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Comparative yield gaps, economic analysis and constraints in frontline demonstrations of black Soybean (*Glycine max* L. Merril) under Rainfed Conditions in Uttarakhand hills

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Abstract
Soybean is an important kharif crop which play a vital role in nutritional and livelihood security in Uttarakhand hills. Considering the scope of improvement in productivity through the improved varieties and recommended production technologies, front line demonstrations were conducted by by Krishi Vigyan Kendra, Matela, Almora to know the yield gaps between improved package and practices under front line demonstration (FLD) and farmer's practice (FP) of soybean crop under rainfed conditions. Front line demonstrations (FLDs) were conducted on farmers' fields to demonstrate the impact of improved agro-techniques on production and economic benefits under rainfed conditions of Uttarakhand in Almora district during k*harif* season of two consecutive years i.e. 2016 and 2017. The technologies demonstrated in FLDs recorded additional yield over farmer's practice. Under FLDs the grain yield of Soybean was increased by 42.72 per cent over FP. The extension gap, technology gap and technology index were calculated as 3.38 q/ha, 18.87 q/ha and 62.9 % respectively. Adoption of improved package of practices in Soybean cultivation recorded higher B: C ratio (1.96) as compared to FP (1.60). Yield enhancement and higher net returns wa sobserved under FLDs of improved technologies in soybean. Thus, the productivity of Soybean could be increased with the adoption of recommended improved package of practices. The study was very convincing to the farming community for higher productivity and returns.

Keywords: Soybean yield, Economics, Extension gap, FLD, Technology gap, Technology index

Introduction

Soybean (*Glycine max* L. Merril) is recognized as golden or miracle bean due to its high nutritive value and various usage viz., for feed, oil and soy food products. It is known to have high protein content (about 35-40%) and lipids (15-20%), particularly polyunsaturated fatty acids (PUFA) (Arnoldi, 2013) [2]. Soybean belongs to genus Glycine and originated in the Chinese-Japanese centre of origin (Mikic *et al*., 2013) [10]. Soybean is the world's most important seed legume, which contributes 25% of the global edible oil, about two-thirds of the world's protein concentrate for livestock feeding (Agarwal *et al*., 2013) [1] and presently, ranks first among oilseeds both at national and global level. Soybean ranked first in the world in oil production (57%) and in the international trade markets (Meena *et al.*, 2012) [8]. Soybean continues to be number one oilseed crop in India occupying 11.67 million ha area with production of 8.59 million tonnes and productivity 737 Kg/ha (GOI, 2016) [3].

It is a traditional food crop in Uttarakhand hills. It is locally known as Bhat/Bhatmash and grown in Kumaon region and in its bordering states and countries in the Himalayas (Shah, 2006) [12]. Both yellow and black seeded soybean are widely grown but in terms of food value small seeded black soybean is well accepted and preferred among local inhabitants in Uttarakhand hills. It is part of traditional cuisine and used in preparation of various local recipes like roasted black soybean (Bhuti bhat), chutney (Bhat ke chutney) and gravies (Dubka, Chutkani, Ras, Ginjada, Joula/Bhatia and Churkwani/ bhatwari) (Mehta *et al*., 2010; Bungla *et al*., 2012) [9]. Black soybean is more treated as pulse rather than an oilseed crop and plays an important role in nutritional security of rural populace in hills. It occupies an integral part in hill agriculture as well as food habits of local communities of this region.

There are several constraints of low productivity of Soybean in India. Improper agronomic practices such as higher seed rate, unsuitable varieties, imbalance fertilizer use well as negligence of plant protection measures of crop from insect-pest and wild animals are different constraints for its low productivity. Like other hilly areas, villages in Almora, farmers grow traditional local varieties of black soybean in rainfed condition following traditional methods.

Therefore, the yield obtained by this crop is very low due to use of traditional seed, use of undecomposed FYM, negligible use of chemical fertilizers and non-adoption of weed control and plant protection measures. Keeping these in view, FLDs of improved production technology on soybean were conducted to enhance the productivity and economic returns.

Materials and Methods

The present Front-line demonstration with improved package of practices on Soybean were conducted at five and eight farmer's fields during *kharif* season of 2016 and 2017, respectively in two villages i.e. Tunakot shera and Tipola, in Bhujan-Richi Road, in Tarikhet block which is about 63 km from KVK, Almora. The black soybean variety i.e.VL Bhatt 65, was sown at 45 cm (row-row) apart in line using seed rate of 75 kg/ha in month of May and June during both the years (Table 1). The average yield of FLD and farmer practice has been taken in both the years for interpretation of the results. The extension gap, technology gap and technology index were calculated using the following formula as suggested by Samui *et al.,* (2000) [11].

Extension gap (q/ha) = Demonstration yield (q/ha) – Yield of local check (q/ha).
Technology gap (q/ha) = Potential yield (q/ha) – Demonstration yield (q/ha).
Technology index (%) = [(Potential yield – Demonstration yield) / Potential yield] x 100

Results and Discussion

Soybean yield: The data on Soybean yield (Table 2) indicates that the FLDs gave better impact on the farming community of Almora district as the high yielding variety of Black Soybean performed better than their local cultivars, thereby increasing their profits as a result of which they were motivated by the new agricultural technologies adopted in the demonstrations. Average soybean yield under front line demonstrations was observed as 11.13 q/ha which was higher by 42.72 % over the prevailing farmers practice (7.75 q/ha). The results clearly indicated that the yield of soybean could be increased over the yield obtained under farmer's practices by the adoption of recommended production technology. Dixit and Singh (2003), Singh *et al.,* (2014) [15] and Sharma *et al.,* (2016) [14] also found similar findings.

Extension and technology gap

The extension and technology gap are 3.38 q/ha and 18.87 q/ha respectively (Table 2) during the period of study in the farmers' fields, emphasized that there is need to educate the farmers through various means i.e. interaction, trainings, demonstrations, field visits etc. for the adoption of improved agricultural production technologies to reverse this trend of wide extension gap. After adoption of new scientific production technologies there will be the subsequent change in this alarming trend of extension gap.

The new agro-techniques will eventually results the replacement of old varieties with the new high yielding variety by the farmers. The technology gap observed may be attributed to the dissimilarity in the soil fertility status and weather conditions. Hence, variety wise location specific recommendation appears to be necessary to minimize the technology gap for yield level in different situations. Singh *et al.,* (2014) [15] was also found similar findings.

Technology index: The technology index as shown in Table 2, indicates the feasibility of the evolved technology at the farmer's fields. The lower the value of technology index more is the feasibility of the technology. The data (Table 2) showed that technology index value 69.83 % was noticed in the year 2016 while in the year 2017 the value was 56 %, whereas the average value of technology index was recorded 62.9 %, it may be due to uneven and erratic rainfall and weather conditions of the area. Similar results were also recorded by Hiremath and Nagaraju (2009) [5], Dhaka *et al.,* (2010) [4], Singh *et al.,* (2014) [15] and Sagar and Chandra (2004) [13].

Economic analysis

The present study concludes that there was higher cost of cultivation i.e Rs.1,9300 in FLDs as compared to Rs.16,500 under Farmers practice (Table 3). The FLDs plots resulted in higher mean gross returns (Rs.30,590 /ha) and net returns (Rs.18,452.50 /ha) with higher benefit: cost ratio (1.96) as compared to (gross returns Rs.26,400), (net returns Rs.9900) and (benefit: cost ratio 1.60) with farmers practice. Hiremath and Nagaraju (2009) [5], Sreelakshmi *et al.,* (2012) [16] and Joshi *et al.,* (2014) [6] also reported higher net returns and B: C ratio in the FLDs on improved technologies compared to the farmers practices and are at par with results of the present study which also resulted in higher net returns through FLDs on improved technologies.

Additional cost of cultivation and returns

Further, data (Table 3) revealed that the average additional cost of cultivation (Rs.2800/ha) under integrated crop management demonstrations and has yielded additional net returns of Rs. 8552.50 / ha. Hence, these results imply the higher profitability and economic viability of Soybean demonstrations under local agro-ecological situation.

Therefore, from these findings, it may be concluded that the yields and returns in soybean crop increased substantially with the improved production technologies. However, the yields under FLDs was higher than the farmer practice and performance of these varieties could be further improved by adopting recommended production technologies. So, it is necessary to disseminate the new scientific technologies among the farmers with effective extension methods like trainings, interaction and field demonstrations. The farmers should be encouraged to adopt the recommended agro-techniques for getting maximum returns in specific locations. The results indicated that the frontline demonstration has given a good impact on the farming community of the districts as they were motivated by the new agricultural technology applied in the FLD plots. Similar findings were reported by Kirar *et al.,* (2006) [7].

Table 1: Comparison of recommended production technology capsule followed in the frontline demonstrations (FLDs) and existing farmer's practice (FP) for soybean cultivation in Uttarakhand hills

Input/practices	Production technology capsule (FLD)	Farmer's practice (FP)
Variety	VL Bhatt 65	Local black seeded Bhatt
Planting time	Last week of May to June end	June end/At arrival of monsoon
Planting	45 x 5 cm	Broadcasting
Seed rate	75 kg/ha	125 kg/ha
Seed treatment	Thiram 75 WP + Cabendazim 50 WP (2:1) @ 3 g/kg seed	Nil
Manure and fertilizer	10 t FYM/ha + 20:80:20:20 N:P2O5:K2O:S kg/ha	10-15 t FYM/ha
Weed control	Two hand weedings at 20 and 40 DAS or Pendimethalin @1kg a.i./ha	Nil

Table 2: Yield performance of soybean under FLDs

Year	No. of demo.	Area (ha)	Yield (q/ha)		% yield increase over FP	Extension gap (q/ha)	Techo logy gap (q/ha)	Techno logy index (%)
			FLD	FP				
2016	05	0.60	9.05	6.60	37.12	2.45	20.95	69.83
2017	08	0.80	13.20	8.90	48.31	4.30	16.8	56
Mean		0.70	11.13	7.75	42.72	3.38	18.87	62.9

Table 3: Economics, additional cost and returns in Soybean under frontline demonstrations (FLDs) vs framers practice (FP)

Year	Cost of cultivation (Rs./ha)		Gross returns (Rs./ha)		Net returns (Rs./ha)		Additional cost of cultivation (Rs./ha) in FLD	Additional returns (Rs./ha) in FLD	B: C Ratio	
	FLD	FP	FLD	FP	FLD	FP			FLD	FP
2016	18800	16500	34780	26400	15980	9900	2300	8380	1.85	1.60
2017	19800	16500	40750	26400	20925	9900	3300	14350	2.06	1.60
Mean	19300	16500	30590	26400	18452.50	9900	2800	11365	1.96	1.60

References

1. Agarwal DK, Billore SD, Sharma AN, Dupare BU, Srivastava SK. Soybean: introduction, improvement and utilization in India-problems and prospects. Agricultural Research. 2013; 2:293-300.
2. Arnoldi A. Health benefits of soybean consumption. Legume Perspectives. 2013; 1:25-27.
3. DAC GOI, Agricultural statistics at a glance. 2016. http://agricoop.nic.in/ Agristatistics.htm).
4. Dhaka BL, Meena BS, Suwalka RL. Popularization of improved maize production technology through frontline demonstrations in south-eastern. Rajasthan. J Agril. Sci. 2010; 1(1):39-42.
5. Hiremath SM, Nagaraju MV. Evaluation of front line demonstration trials on onion in Haveri district of Karnataka. Kar. J Agril. Sci. 2009; 22(5):1092-1093.
6. Joshi NS, Bariya MK, Kunjadia BB. Yield gap analysis through front line demonstration in wheat crop. Int. J Scientific and Res. Publications. 2014; 4(9):1-3.
7. Kirar BS, Narshine R, Gupta AK, Mukherjee SC, Demonstration: An effective tool for increasing the productivity of Urd. Ind. Res. J of Ext. Edu. 2006; 6(3):47-48.
8. Meena DS, Ali M, Ram Baldev, Tetarwal JP. Impact of improved technology on soybean productivity in South Eastern Rajasthan. Soybean Research. 2012; 10:99-103.
9. Mehta PS, Negi KS, Ojha SN. Native plant genetic resources and traditional foods of Uttarakhand Himalaya for sustainable food security and livelihood. Indian Journal of Natural Products and Resources. 2010; 1(1):89-96.
10. Mikic Dordevic V, Peric V. Origin of the word soy. Legume Perspectives. 2013; 1:5-6.
11. Samui SK, Maitra S, Roy DK, Mandal AK, Saha D. Evaluation of front line demonstration on groundnut. J Indian Soc. Coastal Agric. Res. 2000; 18:180-183.
12. Shah NC. Black soybean: An ignored nutritious and medicinal food crop from the Kumaon region of India. Asian Agri-History. 2006; 10:33-42.
13. Sagar RL, Ganesh Chandra. Frontline demonstration on sesame in West Bengal. Agril. Ext. Review, 2004; 16(2):7-10.
14. Sharma V, Kumar V, Sharma SC, Singh S. Productivity enhancement and popularization of improved production technologies in wheat through frontline demonstrations. Journal of Applied and Natural Science. 2016; 8(1):423-428.
15. Singh SRK, Mishra A, Gautam US, Dwivedi AP, Chand Prem. Scouting technological vis-a-vis extension gaps in soybean production in Madhya Pradesh. Indian Res. J Ext. Edu. 2014; 14(2).
16. Sreelakshmi CH, Sameer KCV, Shivani D. Productivity enhancement of pigeon pea through improved production technology. Madras Agril. J. 2012; 99(4-6):248-250.