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A Tarajit Singh
Krishi Vigyan Kendra, Bishnupur district, Utlou, Manipur, India

Sakhen Sorokhaibam
Krishi Vigyan Kendra, Bishnupur district, Utlou, Manipur, India

RK Imotomba Singh
Krishi Vigyan Kendra, Bishnupur district, Utlou, Manipur, India

Senjam Jinus S
School of Horticulture, Pandit Deen Dayal Upadhyay Institute of Agricultural Sciences, Utlou, Bishnupur, Utlou, Manipur, India

Thiyam Jefferson Singh
ICAR, Research Complex for NEH Region, Manipur Centre Lamphelpat, Imphal Manipur, India

Correspondence
A Tarajit Singh
Krishi Vigyan Kendra, Bishnupur district, Utlou, Manipur, India

Productivity enhancement and popularization of improved production technologies in soybean var. dsb-19 through front line demonstration in Bishnupur district, Manipur, India

A Tarajit Singh, Sakhen Sorokhaibam, RK Imotomba Singh, Senjam Jinus S and Thiyam Jefferson Singh

Abstract
There is a wide gap existed in the potential yield and farmers yield on soybean crop of Bishnupur district. The study was carried out to demonstrate the production and economic benefit of adopting improved technologies. The improved technologies consisting use of modern variety, seed treatment with Carbendazim 50% and Mancozeb 50% @ 2g/kg seed, *Rhizobium japonicum* @ 10g/kg seed, balanced fertilizer application (NPKS@20:40:20:20 kg/ha) and integrated pest management. Impact assessment recorded higher yield as well as higher economic return as compared to the farmer's local practices. The demonstration of technologies gave higher yield of 9.14 Qt/ha in an average with 70.99% increase in average yield over farmer's local practices. The study also registered improved technology gives higher gross return (Rs. 59410/ha.), net return (Rs. 28410/ha.) with higher benefit cost ratio (1.92:1) as compared to farmer's local practices. The results indicated that the front line demonstrations have given a good impact over the farming community of Bishnupur district.

Keywords: Enhancement, popularization, improved production technologies, soybean var., dsb-19 through, front line demonstration

Introduction
Pulses contribute significantly to the nutritional security of the country and also considered as "Poor man's meat" and "rich men vegetable" (Singh *et al.,* 2015). From an area of about 25.2 million hectare India has achieved 19.25 million tonnes of pulse production during the year 2013-14 (Roy *et al.,* 2017) [14]. Pulse productivity which was 441 kg/ha in 1950 increased up to 689 kg/ha during 2011, registering 0.56% annual growth rate (Singh *et al.,* 2015) [17].
In the North Eastern Region pulses are also mainly grown as important food crops. In 2013-14, from an area of 252.8 thousand hectare, Northeast India produced 209.3 thousand tonnes of pulses with an average productivity of 828 Kg/ ha. As per ICMR recommendation, the NE region of India is almost 82% deficit in pulse production against its requirements (Roy *et al.,* 2017) [17]. Of all the major pulses, Soybean is an important oilseed and cash crop, which has a vital role in Indian agriculture, industry and export trade. Soybean possesses a very high nutritional value along with high yield potential. It contains about 40% high quality protein and 20% oil (Verma *et al.,* 2013, Singh, 2018) [19]. The planted area under soybean in India is above 6.50 million ha, which produces above 7.00 million tonnes of soybean with an average productivity 1,070 kg. ha^{-1} (Patil *et al.,* 2010) [9]. Soybean ranked first in the world in oil production (57%) (Raj *et al.,* 2014) and in the international trade markets (Meena *et al.,* 2012) [6]. Soybean is the also major oilseed crop of Manipur that boosted the economy of the state (Raj *et al.,* 2014) [13]. Traditionally, it is consumed as fermented alkaline food "*Hawaijar".* Small-seeded local variety soybean grown in the hilly terraces of Manipur is used to prepare *Hawaijar* (Tamang, 2015) [20]. Fermented soybean products have been reported to be used extensively in almost all the states of north-east India and bears resemblance to *tou-shi, Hamanto, chiang-yu, shi-tche, chiang* and *tofu* of China, *tempekedele, kecap* and *taoco* of Indonesia, *shoyu* and *miso* of Japan (Wang and Fang 1986) [22]. Besides being a rich source of protein, they are also important for sustainable agriculture enriching the soil through biological nitrogen fixation. These crops fit well in the various cropping systems without disturbing the main cereal crops. Hence, it is need of the day that we concentrate in developing high yield

Varieties with matching production technologies and in development of strategies or transfer of appropriate technologies (Raj *et al.,* 2014) [13]. Even though, a wide gap existed in the potential yield and farmers yield on soybean crop of Bishnupur district. In view of this, the scientist of Krishi Vigyan Kendra, Bishnupur conducted the front line demonstrations (FLD) on soybean crop to know the yield gaps between FLD's and farmer's field, extent of technology adoption. The area under soybean was very limited in this region due to continuous use of old varieties, imbalance use of chemical fertilizer, poor agronomic practice such as higher seed rate, no seed treatment, irregular sowing time, defective method of sowing, no weed management and no plant protection measures are responsible for low productivity of soybean in the district. The main aims of organizing these FLDs in farmer's field to bridge wide gap between demonstration field yield and farmer field yield and popularizing the cultivation of soybean in large area of Bishnupur district of Manipur with such an alternate technology that can give comparable yield at minimum expenditure.

Materials and Methods

The present study was carried out the Front Line Demonstration (FLD) of Participatory Seed Production of Soybean var. DSb-19 by the Krishi Vigyan Kendra, Bishnupur district, Manipur (India) in *kharif* seasons at adopted farmer's field in Bishnupur district during 2017-18. The study was carried out to demonstrate the production and economic benefit of adopting improved technologies through line sowing 45 cm X 15 cm spacing in each of the 20 (Twenty) adopted farmer's field covering an area of 10 ha. The improved technologies consisting use of modern variety, seed treatment with Carbendazim 50% and Mancozeb 50% @ 2g/kg seed, *Rhizobium japonicum* @ 20g/kg seed, balanced fertilizer application, Seed rate 15 kg/ha and integrated pest management. The fertilizers were given as per improved practices as basal dose. Pest and diseases management were done routinely. The crops were harvested at perfect maturity stage with suitable method. In demonstration plots, critical inputs in the form of quality seed and treatment, farm manure, balanced fertilizers and agro-chemicals were provided by KVK, Bishnupur. In the demonstration, one control plot was also kept where farmer practices were carried out. The result was compared with the full package of practices. The intervention *viz*. use of high yielding varieties, proper seed rate, seed treatment, proper sowing time, suitable sowing method, timely irrigation, weed management and plant protection measures were demonstrated at the farmer's field along with control (farmer's practice). For the study, technology gap, extension gap and technology index were calculated as suggested by Samui *et al*., (2000) [15].

Results and Discussion

The demonstration packages on high, low and average yield of Soybean var. DSb-19 were recorded 11.50Qt/ha., 7.20 Qt/ha., and 9.14 Qt/ha., respectively. It was found higher than yield of local checked (5.42 Qt/ha.). The results indicated that the front line demonstrations have given a good impact over the farming community of Bishnupur district as they were motivated by the new agricultural technologies applied in the FLD plots (Table 1). Average soybean yield under front line demonstrations was observed higher (70.99%) over the prevailing farmers practice. This study was in agreement with the findings of Kumar and Yadav (2007) [5], Poonia and Pithia (2011) [10], Singh *et al.,* (2014) [18] and Sharma *et al.,* (2016) [16]. The technology gap in the demonstration yield over potential yield was 10Qt/ha. The technological gap may be attributed to the non-uniformity in the soil fertility status and diverse agro-climatic conditions (Mukharjee, 2003). 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, Rachhoya *et al.,* 2018) [12]. The highest extension gap of 3.72Qt/ha was recorded. This emphasized the need to educate the farmers through various means for the adoption of improved agricultural production technologies to reverse this trend of wide extension gap. More and more use of latest production technologies with high yielding variety will subsequently change this alarming trend of galloping extension gap. The new technologies will eventually lead to the farmers to discontinue the old technology and to adopt new technology (Table 1). This finding was in corroboration with the findings of Hire math and Nagaraju (2010) [1]. The technology index shows the feasibility of the evolved technology at the farmer's fields and the lower the value of technology index more is the feasibility of the technology (Jeengar *et al*., 2006) [2]. The technology index was 45.45 percents; showing that the adopted technology was not that much easily feasible at farmers' level, so there is need to evolve the feasible technology at farmers' level and hence, it may be due to uneven agro-climatic conditions in the region (Rachhoya *et al.,* 2018) [12]. Similar finding was also reported by many co-workers that adoption of improved Soybean production technologies under real farm conditions through frontline demonstrations had resulted in significant improvement in the extent of adoption, productivity and profitability of Soybean. The inputs and outputs prices of commodities prevailed during the study of demonstrations were taken for calculating gross return, cost of cultivation, net return and benefit: cost ratio (Table 1). The cultivation of Soybean var. DSb-19 under improved technologies gave higher net return of Rs. 28410 /ha, as compared to farmers practices Rs. 7230/ha. The benefit cost ratio of Soybean var. DSb-19 under improved technologies was 1.92:1 as compared to 1.23:1 under farmer's practices. This may be due to higher yields obtained under improved technologies compared to local check (farmers practice). The findings of this study were in conformity of Hire math and Nagaraju (2010) [1], Kiresur (2011) [3], Mokidue *et al.,* (2011) [7], Kumar (2015) [4-17].

Conclusion

The important impediments in adoption of soybean production technology were; unavailability of skills and scientific knowledge of soybean production technologies among the farmer in exercising the application of insecticide and other chemicals, high cost of inputs like seed, fertilizer and insufficient high yielding variety. It can be concluded that frontline demonstration exercised under the close supervision of extension workers and scientists is one of the important tool for agricultural extension for rural communities to demonstrate newly released crop production and protection technologies and its management practices in the farmer's field under different agro-climatic regions and farming situations. Hence, yield gap can be bridged to make the soybean crops more remunerative through the wide publicity of the improved practices by adoption of various extensions methodologies, methods including front line demonstrations with technology backup need to be implemented.

Table 1: Front Line Demonstration in Soybean Dsb-19

Crop Enterprise	Technology demonstrated	Demonstration Yield (Qt /Ha)			Yield of local Check	% increase/ change in avg. yield over local	Gross Cost (Rs/ha)/ (Rs./ unit)	Gross Return (Rs/ha) / (Rs./ unit)	Net Return (Rs/ha) / (Rs./ Unit)	B:C Ratio (GR/GC)
		H	L	A	Qt/ha)	%				
Soybean Dsb 19	Spacing:30cmx10cm	11.50	7.20	9.14	5.42	70.99	31000	59410	28410	1.92:1
	Farmer's practice: Direct seeding method						28000	35230	7230	1.23:1

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