Research Article

Soybean Productivity Enhancement through Cluster Front Line Demonstrations

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Abstract

Soybean is an important rain-fed oilseed crop grown in *Vertilsols* during *kharif* season. Cluster Front Line Demonstration (CFLDs) is an appropriate means for demonstration as well as transfer of improved agricultural innovations to the farming community. Krishi Vigyan Kendra, Rudrur, Nizamabad district has been conducted front line demonstrations in farmers fields from 2017-18 to 2019-20 during *kharif* seasons in a total of 132 demonstrations by covering an area of 53 ha under National Mission on Oilseeds and Oil Palm (NMOOP) scheme. The results revealed that the Basar (ASb-22) variety with improved technology was performed better with an average increase of 36.16 per cent in soybean yield (2263 kg ha^{-1}) over the farmers practice (1662 kg ha^{-1}). The average extension gap, technology gap and technology index value were calculated as 601 kg ha^{-1}, 862 kg ha^{-1} and 27.58 %, respectively. CFLDs gave higher mean gross returns (Rs. 76,224/- ha) and net returns (Rs. 51,149/-ha) with a higher B: C ratio (3.11:1) as compared to farmers practice. Thus, the productivity of soybean could be increased with the adoption of recommended improved package of practices with this variety. The result has given good impact on higher productivity and returns by convincing the farming community of Northern Telangana Zone.

Keywords: Soybean, Cluster front line demonstration, yield, economics, Telangana

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Introduction

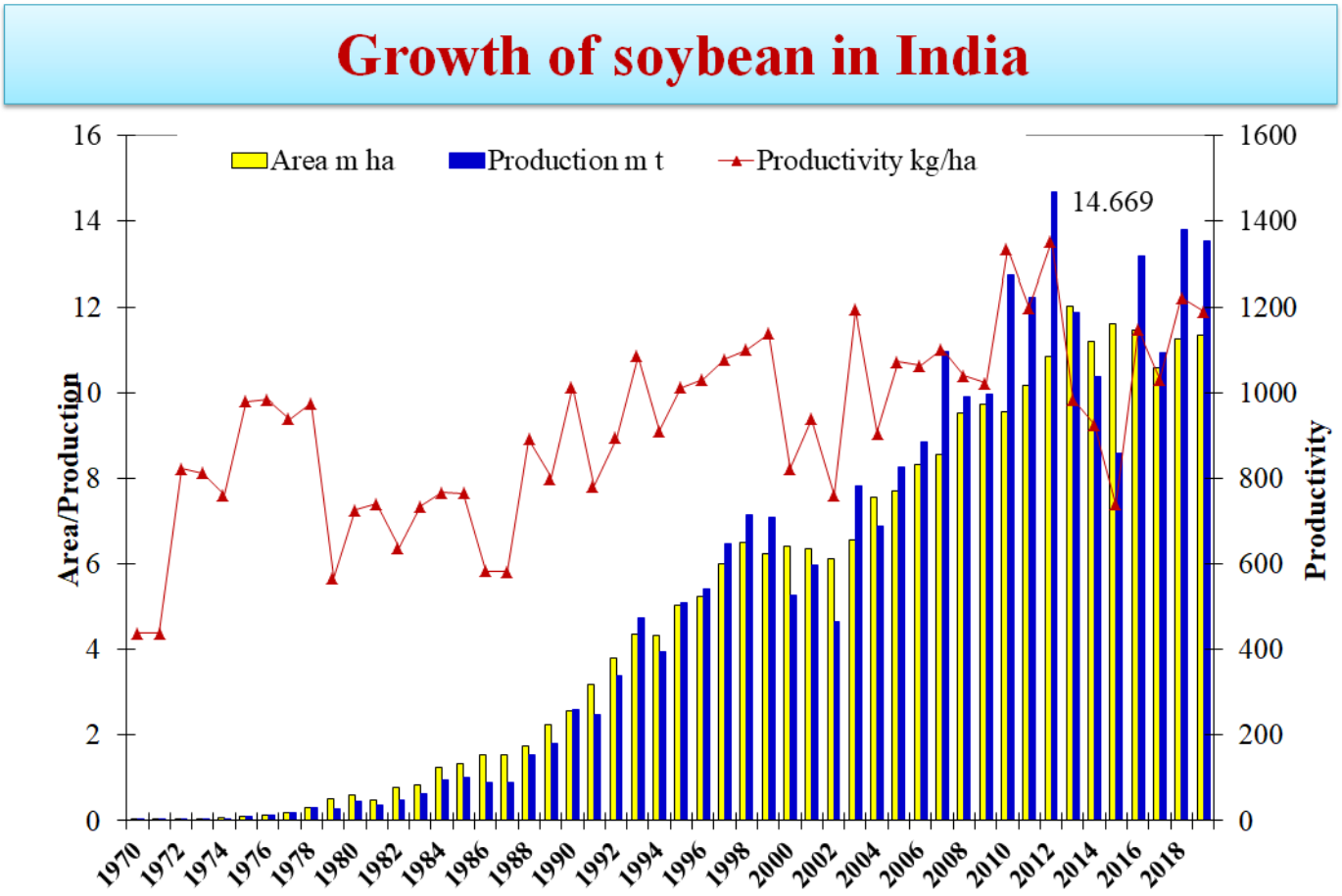
Soybean (*Glycine max* (L.)) belongs to the legume family grown as rain-fed crop during rainy seasons in *Vertisols* and associated soils. It is having high nutritive value and used as feed, oil and soy food products. It is rich in oil (18-22%) and protein (38-42%). Soya oil contains 85% unsaturated fatty acids that include high content of essential fatty acids such as linolic acid and linolenic acid. As it is a most resilient crop by providing subsistence to small and marginal farmers under erratic monsoon rainfall with improvement of farmer's livelihood in India. As a cheapest source of high quality protein, it has a potential to remove protein mal nutrition in humans and also important for sustainable agriculture enriching the soil through biological nitrogen fixation and fit well in the various cropping systems without disturbing the main cereal crops.

Soybean is an exceptional crop among oilseeds, it is attaining an unparallel glory of horizontal expansion in very short span of nearly four decades [1]. It continues to be number one oilseed crop in India, currently occupying 11.33 million ha with an estimated production of 13.79 million tonnes and productivity of 1217 kg ha^{-1}.

Productivity of Soybean in Telangana State is very low, nearly 1-1.5 t ha^{-1}. Therefore concerted efforts are required to enhance its productivity. Improved agricultural technologies are the products of modern science which lead to ultimate sustainable production. In spite of availability of improved crop production technologies; the adoption of recommended production technologies among farmers is not very encouraging. The average productivity of soybean in the state is very low as compared to potential yield. The reason may be that most of the technologies have not yet reached to the farmer's field. Hence, to percolate the scientific know how amongst soybean growers and to have direct interaction with farmers, ICAR proposed to undertake a project on frontline demonstration through NMOOP in a mode of cluster approach.

The main objective of cluster frontline demonstration (CFLD) on Oilseeds under NMOOP through extension centres like KVKs and State Agricultural departments is to demonstrate the productivity potentials and profitability of the latest and improved soybean production technology under real farm conditions. Keeping this in view, cluster front

line demonstrations (CFLDs) on oilseeds were conducted under NMOOP scheme on soybean to enhance the area, production and productivity of soybean with improved technology in Nizamabad district.



Source: ICAR- IISR, Indore

Material and Methods

Cluster Frontline demonstrations (CFLDs) in soybean crop under NMOOP scheme were conducted by the Krishi Vigyan Kendra, Rudrur during *kharif* seasons in the farmer's fields of Nizamabad district from 2017-18 to 2019-20 for three years by the active participation of farmers with an objective to demonstrate the improved technologies of oilseeds production in different villages of Nizamabad district with a improved high yielding variety Basar (ASb-22) developed by the Agricultural Research Station, Adilabad, PJTSAU. KVK was provided this truthfully labeled seed to the farmers of the district for increasing the area and its productivity.

A total of 132 demonstrations (50, 32 and 50 demonstrations each year, respectively) by covering 53 ha from 2017-18 to 2019-20 and demonstrated the improved technologies of soybean, so as to establish production potentials and expand the area under the crop with this variety, as it is suitable for the district along with farmers practice (JS-335) as check plot. Pre-sowing trainings were organized by involving the selected farmers on soybean crop management practices. Critical inputs along with technology to be demonstrated at every stage of the crop were delivered with an appropriate training. The technology demonstrated in CFLDs and existing farmers practice was given in **Table 1**.

The crop was harvested at perfect maturity stage with suitable methods. The yield data were collected from both the demonstration and farmers practice by random crop cutting method and analyzed the results by using simple statistical tools. The extension gap, technology gap and technology index [2] were calculated by using following formula as given below.

$$\text{Extension gap (kg ha}^{-1}\text{)} = \text{Demonstration yield} - \text{Farmers yield}$$

$$\text{Technology gap (kg ha}^{-1}\text{)} = \text{Potential yield} - \text{Demonstration yield}$$

$$\text{Technology Index (\%)} = \left\{\frac{\text{Potential Yield} - \text{Demonstration yield}}{\text{Potential yield}}\right\} \text{x } 100$$

$$\text{Per cent increase in yield} = \left\{\frac{\text{Demonstration yield} - \text{farmers practice yield}}{\text{Farmers practice yield}}\right\} \text{x } 100$$

The economic details like gross cost, gross returns, net returns and B: C ratio was worked out on the basis of prevailing market prices of inputs and minimum support price of soybean seed.

Table 1 Comparison of technologies followed in CFLDs and existing farmers practice for soybean in Nizamabad district

Practice	Demo technology	Farmers practice
Variety	Basar (ASb-22)	JS-335
Duration (Days)	110-115	95-100
Sowing time	3rd week of June to 1st week of July	3rd week of June to 1st week of July
Seed rate (kg/ha)	75	100
Sowing method	Seed drill	Seed drill
Spacing	45 X 5 cm	30 X 10 cm
Seed treatment	Fungicide- Carbendazim +Thiram @ 3 g/kg of seed Insecticide- Imidacloprid 48 FS@ 1.25 ml/kg seed Bio-fertilizer- *Rhizobium japonicum* @ 5 g/kg seed	Fungicide- Carbendazim +Thiram @ 3 g/kg of seed
Fertilizers	22.5-57.5-0.0 kg NPK/ha	22.5-57.5-0.0 kg NPK/ha
Weed control	Pre emergence-Diclosulam 84 WDG @ 26 g/ha Post emergence- Quizalofop ethyl 5 EC @ 1 l/ha	Pre emergence -Pendimethalin 30 EC @ 3.25 l/ha
Pest control	Application of Carbofuran 3G granules @ 8 kg/acre against stem fly at 15-20 DAS. Spraying of Acephate @1.5 g/L for Stem girdler & *Spodoptera* at 35-45 DAS, in severe incidence spraying of Chlorantraniliprole @ 0.3 ml/L at 55 DAS	Application of indiscriminate use of insecticides in an untimely manner.
Disease control	Diseases: Carbendazim+ Mancozeb @ 2.5 g/L	

Results and Discussion

Soybean seed yield

Pooled data (2017-18, 2018-19 and 2019-20) on soybean (Basar variety) yield obtained in CFLDs was observed as 2263 kg ha^{-1}, which was higher by 36.156 % over the existing farmers practice (1662 kg ha^{-1}) with an old variety of JS-335 (**Table 2**). The result revealed that the soybean yield could be increased over the yield obtained under farmer's practices by the adoption of recommended production technology in demonstrations. The Basar variety performed better in Nizamabad district than their local variety with enhancement of productivity; as a result farmers are motivating towards to adopt new technology with new variety through CFLDs. These results are in confirmation with [3] on wheat crop, [4] and [5] on soybean crop.

Extension gap and technology gap

The extension and technology gap are 601 kg ha^{-1} and 862 kg ha^{-1}, respectively in demonstrations emphasized that there is a need to educate the farmers through various means for the adoption of improved agricultural production technologies to remove this extension gap (Table 2). More and more use of latest production technologies with high yielding variety will subsequently change the extension gap.

The new agro-techniques will eventually lead to the farmers to replace old varieties with the new one. The technology gap observed may be attributed to the dissimilarity in the soil fertility status, weather conditions and either lack of irrigation at critical stages in case of drought or lack of drainage facilities in case of excess rainfall during crop growth and harvesting time. More over year to year technology gap was decreased due to adoption of new technology in a prophylactic manner. Hence, variety and technology in respective location specific recommendation appears to be necessary to minimize the technology gap for yield level in different situations. This report was in corroboration with the reports of [4] and [6] on soybean crop.

Table 2 Performance of soybean yield under CFLD demos and farmers practice

Year	No. of Demo	Area (ha)	Yield (kg ha^{-1})		% yield increase over FP	Extension gap (kg ha^{-1})	Technology gap (kg ha^{-1})	Technology index (%)
			Demo	FP				
2017-18	50	20	2063	1575	30.98	488	1062	33.98
2018-19	32	13	2175	1802	20.69	373	950	30.4
2019-20	50	20	2550	1608	58.58	942	575	18.4
Total/ Mean	132	23	2263	1662	36.16	601	862	27.58

Technology Index

The technology index shows the feasibility of the evolved technology at the farmers' fields, as lower the value of technology index more is the feasibility of the technology [7]. The data on technology index value was observed 33.98, 30.40 and 18.40 % in 2017-18, 2018-19 and 2019-20 years, respectively with an average technology index of 27.58 %, it may be due to uneven and erratic rainfall and weather conditions of the area and this decreasing trend clearly indicating that the farmers are motivating towards to adopt recommended technology in their demonstrations (Table 2). Similar findings were also recorded by [8] on sesame, [9] on cluster bean and [10] on black gram.

Economic returns

Under improved technologies, soybean CFLDs gave higher mean gross returns (Rs. 76,224/ha) and net returns (Rs. 51,149/ha) with a higher B: C ratio (3.11:1) as compared to farmers practice (Table 3). This may be due to higher yields obtained with timely operations of crop cultivation and adopting improved technology through scientific monitoring under demonstrations as compared to existing farmers practice. The results were in conformity with the results of [10] in okra, [11] and [12] on soybean .

Table 3 Economics of soybean under CFLD demos and farmers practice

Year	Gross cost (Rs. /ha)		Gross returns (Rs. /ha)		Net returns (Rs. /ha)		B: C ratio	
	Demo	FP	Demo	FP	Demo	FP	Demo	FP
2017-18	28077	29188	62922	48038	34845	18850	2.24	1.65
2018-19	23286	25900	73950	61268	50664	35368	3.18	2.36
2019-20	23363	23284	91800	57888	67937	34604	3.92	2.49
Mean	24909	26124	76224	55731	51149	29607	3.11	2.17

Conclusion

In the CFLDs there was an average increase of 36.16 per cent in soybean yield (2263 kg ha^{-1}) over the farmers practice (1662 kg ha^{-1}). Mean B: C ratio (3.11) was high to motivate the farmers for adoption of the improved technologies in soybean with replacement of high yielding variety, Basar (ASb-22). Under the supervision of extension scientists, these demonstrations should be applied at farmer's fields for speedy and wider dissemination of technologies to the neighboring farmers. Thus, farmers can also do seed multiplication and may be used it year after year, thereby reducing cost incurred on seed purchase. Hence, yield gap can be bridged with quality seed to make the soybean crop more remunerative through the wide publicity of the improved practices by adoption of front line demonstrations with technology backup need to be implemented.

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