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Research Article

YIELD PERFORMANCE OF SOYBEAN (*Glycine max* L) IN BANSWARA DISTRICT OF RAJASTHAN

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Abstract: Front line demonstrations are the best powerful tool of extension to motivate the farmer for adoption of an innovation. 450 FLDs on Soybean were organized for three years in kharif season of 2014-15 to 2016-17 in 19 adopted villages by Krishi Vigyan Kendra, Banswara in Rajasthan. The improved technologies consist, use of high yielding short duration variety JS 95-60, proper seed rate, seed inoculation with rhizobium and PSB culture, integrated nutrient management and integrated pest management. Average higher yield (10.66q/ha) was obtained in the demonstration plot over local check (7.00 q/ha) and an additional yield of 52.62 percent was obtained in demonstration plot. In spite of increase in yield of soybean, technology gap, extension gap and technology index existed. The improved technology gave higher gross return, net return with higher benefit cost ratio (2.12) as farmer's practice (1.52). An average additional investment of Rs. 2200 per ha coupled with scientific monitoring of front line demonstration and non monitoring factors were resulted in additional return of Rs. 11457 per ha.

Keywords: *Front line demonstration, Soybean, Technology, Yield, Oil seed*

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Introduction

Soybean (*Glycine max* L. Merrill) is generally referred to as golden as well as wonder bean because seeds are rich in oil (20%) and proteins (40-44%), amino acids, lysine(5%), which is deficient in most of the cereals. Good quality of protein provided by soybean is capable of alleviating the wide-spread protein malnutrition in the country. The soybean oil is highly digestible and devoid of cholesterol. Soybean is a legume that grows in tropical, sub-tropical and temperate climates. Soybean oil is used for manufacturing of vanaspati ghee and several other industrial products. It maintains the soil fertility by fixing large amounts of atmospheric nitrogen through the root nodules and also through leaf fall on the ground at maturity. Soybean cultivation in India was negligible until 1970, but it grew rapidly thereafter, crossing 11.6 million hectares in 2015-16 [1]. Production of soybean in India at the present time is restricted mainly to Madhya Pradesh, Uttar Pradesh, Maharashtra and Rajasthan. In Rajasthan State, Soybean crop is grown on an area of 1055610 hectares with total production of 1131811 tonnes with average productivity of 1072 kg/ha Anonymous [2]. Soybean is a major kharif crop in Banswara district which is grown over 61824 hectares area with the production of 84552 tonnes and productivity of 1368 kg/ha during (2016-17). Front line demonstration (FLD) is the one of the mandate of Krishi Vigyan Kendra (Farm Science Centre). It is a long term education activities conducted in a systematic manner in farmer's field to worth of a new practice/technology. Farmer's in India are still based on the knowledge transmitted to them by their fore fathers leading to a grossly unscientific agronomic, nutrient management and pest management practices. Hence, Krishi Vigyan Kendra, Banswara has conducted front line demonstration on recommended practices of soybean in kharif season during 2014-15 to 2016-17 (3 years).

The objectives were kept under the study.

1. To assess the response of yield of soybean
2. To investigate the technology gap, extension gap and technology index of soybean crop in Banswara
3. To evaluate the economics of the soybean.

Materials and Methods

Utilizing the information generated during Participatory Rural Appraisal (PRA), the Krishi Vigyan Kendra, Banswara, organized 450 front line demonstrations during 2014-15 to 2016-17 on soil test based nutrient management on farmers'fields in adopted villages *viz*, Kuwania, Amarthun, Senawasa, Ruparel, Umrakhal, Mendiya Katara, Navatapra Heera, Samapada, Vageri Hareng, Tamatiya, Bhojiya Kalan, Junipatan, Naipatan, Hamirpura, Khokharwa, Sangrampura, Garadiya, Baansla and Chokla of Ghatol, Banswara, Abhapura and Bagidora block in Banswara district of Rajasthan. The district has sub humid agro climatic condition with average temperature of the district varies from 21.3-40.6°C in summer and 9.5-34.9°C in winter and annual rainfall is about 900 mm. Soil of the area is medium red loamy soil. The package of improved practices demonstrated included a new short duration high yielding variety JS 95-60, proper seed rate (75 kg/ha), proper RxR spacing (30 cm), integrated nutrient management @ 40:40, N:P, rhizobium culture and PSB culture as seed inoculation (@ 6g/kg of seed), weed management (imazathyper 10 EC @ 1 litre/ha solution in 700 litre water as post emergence between 14 to 24 days after sowing), pest management (for semilooper spray of prophenophos 50 EC @ 1.25 litre/ha, for girdle beetle spray of dimethoate 30 EC @ 1 litre/ha and for spodoptera spray of indoxacarb 15.8 EC @350 ml/ha). Deep ploughing was done during the April and crop was sown between 21June to 12 July. An entire dose of fertilizer was applied as basal before sowing. Simultaneously farmer's practices also carried out as a local check. Farmers practices were involved old variety JS 335, which was sown and harvested simultaneously, without any seed inoculation, higher seed rate (100 kg/ha), broadcasting of DAP at 20-25 days after sowing (DAS) and injudicious use of insecticides and weedicides. Before conducting the demonstrations, trainings to the farmers of respective villages was imparted with respect to envisaged technological interventions. Site selection, farmers' selection, layout of demonstration and farmers participation were considered as suggested by Choudhury [4]. The differences in between demonstrated technology and existing farmers' practices (local check) are mentioned in [Table-1].

Table-1 *Comparison between technological intervention and local check under FLDs*

SN	Particulars	Technological Intervention (Demonstration)	Local Check (Farmers' Practice)	Technological Gap
1	Farming situation	rainfed	Rainfed	No gap
2	Variety	JS 95–60 (new)	JS-335 (old)	Full gap (100%)
3	Land preparation	summer deep ploughing followed by rotavator	No ploughing	Full gap (100%)
4	Time of sowing	last week of June to first week of July	Last week of June to first week of July	No gap
5	Seed inoculation	seed inoculation with rhizobium and PSB@6 g/kg of seed	No seed inoculation	Full gap (100%)
6	Seed rate	75 kg/ha	100 kg/ha	25% more than recommended
7	Method of sowing	line sowing with seed drill RxR 30 cm	Line sowing	No gap
8	Nutrient application	N- 40kg/ha P- 40kg/ha	Broadcasting DAP at 20-25 DAS	Not as per recommendation
9	Weed management	imazethapyr 10 EC@1 ltr/ha as post emergence between 14 to 24 days after sowing followed by hoeing	Only hoeing (no chemical)	Full gap (100%)
10	Plant protection measures	applied prophenophos 50EC @1.25litre/ha, dimethoate 30 EC @ 1 litre/ha and indoxacarb 15.8 EC @ 350 ml/ha	Use of indiscriminate and non recommended pesticides	Full gap (100%)

Table-2 *Productivity, technology gap, extension gap and technology index of soybean under Front line demonstrations on Farmers fields*

Year	Area (ha)	No. of Demo.	Grain yield (q/ha)				Farmers practice	Percent Increase over F.P.	Technology gap (q/ha)	Extension gap (q/ha)	Technology index (%)
			Potential	Recommended Practice							
				Highest	Lowest	Average					
2014-15	40	100	20	13.5	8.5	10.67	7.24	47.37	9.33	3.43	46.65
2015-16	30	150	20	13.14	7.42	10.18	6.87	48.18	9.82	3.31	49.1
2016-17	40	200	20	14.8	8.4	11.2	6.9	62.32	8.8	4.3	44
Mean	110	450	20	13.81	8.11	10.66	7	52.62	9.32	3.68	46.58

Table-3 *Gross return, Cost of cultivation, net return and B:C ratio as affected by improved and local technology under FLDs on farmer's fields*

Year	Gross expenditure (Rs. / ha)		Gross Return (Rs. / ha)		Net Returns (Rs. / ha)		Additional Net returns (Rs. / ha)	Benefit Cost Ratio	
	RP	FP	RP	FP	RP	FP		RP	FP
2014-15	17500	15000	37345	21720	19845	6720	13125	2.13	1.45
2015-16	17200	15300	35630	24045	18430	8745	9685	2.07	1.57
2016-17	16500	14300	35840	22080	19340	7780	11560	2.17	1.54
Mean	17067	14867	36182	22615	19205	7748	11457	2.12	1.52

The observation yield and economic performance of front line demonstration, the data on output work collected from FLDs as well as local plots from all selected farmers and finally the grain yield, cost of cultivation, net returns and benefit cost ratio were analyzed. The economical assessment was done as per prevailing market prices. In the present study, technology index was operationally defined as the technical feasibility obtained due to implementation of front line demonstrations in soybean. To estimate the technology gap, extension gap and technology index following formula used by Samui *et al*. [9] have been used.

Technology gap = Potential yield – Demonstration yield

Extension gap = Demonstration yield – Farmer's yield

Technology index = Potential yield-Demonstration yield / Potential yield x 100

Results and Discussion

The data [Table-2] revealed that the farmers were not aware about improved package of practices of soybean *i.e.,* short duration high yielding variety, seed rate, sowing method, balance dose of fertilizer, seed treatment, weed management and plant protection measures. The farmers were using old variety and high seed rate. The results revealed that in front line demonstrations seed yield of soybean recorded were 10.67q/ha, 10.18q/ha and 11.20q/ha as compared to farmers practices 7.24q/ha, 6.87q/ha and 6.90q/ha in the year 2014-15, 2015-16 and 2016-17, respectively. In comparison to farmers practices, an increase of 47.37 to 62.32 percent (average 52.62%) in seed yield due to improved practices was recorded. Yield enhancement under recommended practice might be due to balanced nutrition as per soil test value, integrated approach involving fertilizers and bio fertilizers which play a vital role in making availability of plant nutrients. Similar results were observed by Tomar *et al* [11] and Tiwari *et al* [10]. The technology gap was found 9.33q/ha, 9.82q/ha and 8.80q/ha during the year 2014-15, 2015-16 and 2016-17, respectively with an average of 9.32 q/ha. The technology gap observed may be due to dissimilarity in the soil fertility status and local climatic situation. Hence location specific recommendation appears to be necessary to minimize the technology gap for yield level in different situations. The extension gaps which ranged from 3.31q/ha to 4.30q/ha during the period emphasized the need to educate the farmers through various methods or the adoption of improved agricultural production technology to reverse this trend wide extension gap. The technology index shows the feasibility of the evolved technology at the farmers field. On an average technology index was observed 46.58 percent during the three years of FLDs programme which shows the efficiency of good performance of technology interventions. These results are in agreement with the findings of Kumar *et al* [8] and Jain *et al* [7]. Economics of soybean production under front line demonstrations were recorded and the results of the study have been presented in [Table-3]. The result of economic analysis of soybean production revealed that front line demonstration recorded higher gross return range from Rs. 35630 to Rs. 37345 (average Rs. 36182) and net return Rs. 18430 to Rs. 19845 (average Rs. 19205) with higher benefit cost ratio range 2.07 to 2.17 (average 2.12). These results are in accordance with findings of Dhaka *et al* [5] and Hiremath and Nagaraju [6]. In demonstration has increased additional net return Rs. 11457 average per ha. More or less similar results were also reported by Bhowate and Olambe [3].

Conclusion

The front line demonstration produces significant positive results and provided the researcher an opportunity to demonstrate the productivity and profitability of the latest technology (intervention) under real farming situation which they have been advocating for long time.

Application of research: The results convincingly brought out that the yield of soybean can be increased with the intervention on recommended package of practices. These practices may be popularized in this area by the extension agency to bridge the higher extension gaps.

Research Category: Front line demonstration

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