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Impact of Front Line Demonstration on Yield and Economics of Soybean under Rainfed Condition in Beed District of Maharashtra, India

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Abstract: The frontline demonstrations of soybean were conducted by Krishi Vigyan Kendra, Khamgaon of Beed District, Maharashtra State. Frontline demonstration of soybean variety MAUS 158 were conducted during 2020-21, 2021-22 and 2022-23 on 4.0 ha area in 10 number of demonstration each year. Soybean variety MAUS 158 which is released by Vasantarao Naik Marathada Krishi Vidyapeeth which is high yielding stem-fly tolerant and suitable for marathwada region of Maharashtra. Improved cultivation practices were demonstrated in farmer's field for three consecutive years. The result of the demonstrations showed higher yields compared to farmers' practices followed for soybean cultivation. The average increased per cent seed yield is 31.02 over the years from frontline demonstrations compared to check plots. However, during the year 2021-22, the per cent increase in seed yield was 38.15. The huge variation in farmers practices adopted in the villages. The other parameters like extension gap, technological gap and technology index were derived for assessment of technology adoption rate. The average technology gap and technology index were 1264 and 48.61 per cent, respectively. The improved technology recorded higher average seed yield 1336 kg/ha over farmers practice 1030 kg/ha in rainfed condition. The improved technology gave higher average gross return (54502 Rs./ha.) average net return (26468 Rs./ha.) with higher benefit cost ratio (1.92) as compared to farmers practices. The results clearly indicated that the beneficial impact of front line demonstrations over the farmers practices towards enhancing the productivity of soybean cultivation under rainfed condition in Beed district of Maharashtra state, India. Demonstrated technologies proved more remunerative and economically feasible compared to farmers traditional practices in soybean cultivation.

Keywords: Soybean, FLD, Variety, Yield, Economics.

INTRODUCTION

Soybean (Glycine max (L.) Merril) is globally cultivated leading oilseed crop known as golden bean for its various nutritional qualities. The major soybean producing countries are Brazil, Canada, China, India and USA. Globally India stands in fourth position with the cultivable area of 11.40 m ha and fifth with a production capacity of 13.78 million tons (FAO STAT, 2018) from an area of 12.12 million ha and a productivity of 1125 kg/ha. The soybean seed contains about 38 to 44 per cent protein and 18-22 per cent oil. Moreover, it contains vitamin B, fibre, iron, calcium, zinc and is flavones such as genistein and daidzein (Rizzo and Baroni, 2018). In India, soybean is a major oilseed crop in terms of area, production and economic value. It is mostly grown for the source of edible vegetable oil for human consumption, defatted soy protein products or soy protein extracts (concentrates or isolates) are an important ingredient for several processed foods and protein meal for animal feeds (Xiaoyu et al., 2011). Because of its lucrative nature and numerous benefits, the crop is the first and foremost option of millions of small and marginal farmers, and it plays an important role in the farming community's socio-economic transformation. (Dupare *et al.*,

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2009). It is also known as Poor man's meat. In consideration of the absence of sugar content, it is consider to very suitable diet for diabetic patients. It has got good industrial importance of used for preparation of bread, biscuits, cakes, chocolates, salad, resin, dyeing oils, paints, varnishes, printing ink, glycerin and explosives. Soybean not only supplies food for humans and animals but it also improves the soil fertility by fixing atmospheric nitrogen. Soybeancake s also rich in protein and mineral oil.

Maharashtra state ranks second in area (4.32 m ha) after Madhya Pradesh (5.8 m ha). Area under soybean is increasing in beed district, average productivity of soybean in beed district is 901 Kg/ha. There is huge scope to increase productivity of soybean in beed district. Various factors influences potential yield of the crop such as, faulty sowing practices, lack of knowledge about high yielding, pest and disease resistant varieties. Lack of awareness about seed treatment with biofertilizers *Rhizobium, PSB*, *Trichoderma* viridae. Keeping these in view, front line demonstrations of improved production technology on soybean were conducted to enhance the productivity and economic returns and also convincing the farmers for adoption of improved production technologies in soybean crop.

METHODOLOGY

Frontline demonstration on soybean variety MAUS 158 with improved package of practices were conducted at thirty farmers fields during 2020-21, 2021-22 and 2022-23 in different villages i.e. Belgaon, komalwadi and rewaki dewaki by Krishi Vigyan Kendra, Khamgaon, Beed district of Maharashtra. The total 10 number of demonstarion was conducted on 4.0 ha area each year. Each demonstration was conducted on an area of 0.40 ha. FLD plots were kept for assigning farmers practices. Prior to conducting FLDs, group meeting and specific skill training was given to the selected farmers regarding package of practices of soybean crop (Bhargava *et al.,* 2015). In general soil of the area under study was medium to heavy and medium fertility status. The component demonstration technology in soybean was comprised i.e. university recommended improved variety MAUS 158 which was high yielding stem-fly tolerant and suitable for marathwada region of Maharashtra.

To popularize the improved soybean agro-techniques for enhancing the production constraints in soybean were identified through participatory approach. The soybean crop was sown at 45 cm row-row apart using broad bed furrow (BBF) and seed rate of 65 kg/ha. The demonstration were conducted to study the technology gap between the potential yield and demonstrated yield, extension gap between demonstrated yield and yield under existing practice and technology index. The yield data were collected from both the demonstration and farmers practice by random crop cutting method and analyzed by using simple statistical tools. The percent increase yield, technology gap, extension gap and technology index were calculated by using following formula as per *Samui et al.,* (2000), as given below-

$$Percent\ increase\ in\ yield = \frac{Demonstration\ yield - farmers\ practice\ yield}{farmers\ practice\ yield} \times 100$$

Technology gap = Potential yield - Demonstration yield

Extension gap = Demonstration yield – farmers practice plot yield

$$Technology\ index(\%) = \frac{Technology\ gap}{potential\ yield} \times 100$$

The economic analysis was done by working out cost of cultivation utilizing the inputs and output prices of commodities which prevailed during three years of demonstration, gross and net returns and benefit cost ratio.

RESULT AND DISCUSSION

Soybean yield

Frontline demonstrations studies were carried out in Beed district of Maharashtra state in Kharif season from 2020-21 to 2022-23. During three years of technologies results obtained are presented in Table 1. The results revealed that the demonstration on soybean an average seed yield recorded 1336 kg/ha under demonstrated plots as compare to farmers practice 1030 kg/ha. The highest seed yield in the demonstration plot

was 1500 kg/ha during 2020-21. The average yield of pigeonpea increased 31.02 per cent (Table 1). These results clearly indicated that the higher average seed yield in demonstration plots over the compare to farmers practice due to integrated crop management practices and use of university recommended improved variety of soybean. Adoption of scientific package of practices like seed treatment with fungicide, bio-fertilizers and need based right plant protection practices resulted in higher yields. The above findings are similar in lines with Badaya *et al.,* 2017, Singh *et al.* Raju *et al.,* 2015. and Khedkar *et al.,* 2020.

Extension gap

Based on observation made, extension gap, technology gap and technology index were worked out. The extension gap observed during different years was 250, 290 and 378 kg/ha during 2020-21, 2021-22 and 2022-23 respectively. On an average extension gap observed in three years under FLD implemented villages was 306 kg/ha. The highest extension gap 378 kg/ha was recorded in 2022-23 followed by 290 kg/ha (2021-22) and 250 kg/ha (2020-21). The above findings are similar in lines with Keshavreddy G *et al*., 2018, Kishor Zade *et al.,* and Singh S B 2018.

Technology gap

Technology gap is the difference between potential yield and demonstrated plot yield. The technology gap observed during different years was 1100, 1550 and 1140 kg/ha during 2020-21, 2021-22 and 2022-23 respectively. On an average technology gap observed in three years under FLD implemented villages was 1264 kg/ha. The highest technology gap 1550 kg/ha was recorded in 2021-22 followed by 1140 kg/ha (2022-23) and 1100 kg/ha (2020-21) (Table 1). The above findings are similar in lines with Keshavreddy G *et al*., 2018, Garud *et al*., 2022 and Meena *et al*., 2022.

Technology index

On an average technology index observed was 48.61% for three years where front line demonstrations were conducted. This shows the efficiency and effectiveness of the improved technologies as a result of successful technical interventions to increase the yield performance of soybean.

Economic analysis

Economic returns related to input and output prices of commodities prevailed during the study period, were recorded. The cultivation of soybean under improved technologies FLD gave higher net returns of Rs.31250, Rs. 15475 and Rs. 32680 per hectare as against to farmers practices i.e., Rs. 23375, Rs. 5000 and Rs 18326 per hectare during the years 2020-21, 2021-22 and 2022-23 respectively (Table 2) Similar results were observed with Singh *et al.,* 2014 and Raj *et.al.,* 2013 findings.

Table 1: Yield, technology gap, extension gap and technology index in soybean under FLDs during 2020-21, 2021-22 and 2022-23

Year	*Potential Yield (Kg/ha)*	*Average seed yield (Kg/ha)*		*Percent increase*	*Technology gap (Kg/ha)*	*Extension gap (Kg/ha)*	*Technology index (%)*
		Demo	*Farmers Practice*				
2020-21	2600	1500	1250	20.00	1100	250	42.30
2021-22	2600	1050	760	38.15	1550	290	59.61
2022-23	2600	1460	1082	34.93	1140	378	43.84
Average	2600	1336	1030	31.02	1264	306	48.61

Table 2: Economic impact of soybean cultivated under FLD and farmers practice during 2020-21, 2021-22 and 2022-23

Year	*No. of Demo*	*Area (ha)*	*Gross Income Rs./ha.*		*Net Income Rs./ha.*		*B: C Ratio*	
			Demo	*Farmers Practice*	*Demo*	*Farmers Practice*	*Demo*	*Farmers Practice*
2020-21	10	4.0	59250	49375	31250	23375	2.11	1.89
2021-22	10	4.0	41475	30020	15475	5000	1.59	1.20
2022-23	10	4.0	62780	46526	32680	18326	2.08	1.64
Average	10	4.0	54502	41974	26468	15567	1.92	1.57

The Benefit: cost ratio of soybean observed during different years 2020-21, 2021-22 and 2022-23 under improved cultivation practices were 2.11, 1.59 and 2.08 respectively while it was 1.89, 1.20 and 1.64 under farmers practice for the respective years. The highest Benefit : cost ratio in demo plots is because of higher yields obtained under improved technologies compared to farmers practices during all the three years (Table 2). Similar results were observed with Raju. G. T *et. al.,* 2015.

CONCLUSION

The frontline demonstration conducted on soybean at the farmer's field revealed that the adoption of improved technologies significantly increased the yield as well as net returns to the farmers. Hence there is need to disseminate the improved technologies among the farmers with effective extension activities like trainings and field demonstrations. The farmers should be encouraged to adopt the recommended package of practices realizing for higher returns. The beneficiary farmers of demonstrations also play an important role s source of information and quality seed for wider dissemination of the high yielding variety of soybean for nearby farmers. The results indicated that the frontline demonstration gave higher seed yield, gross monetary returns, net monetary returns and B: C ratio under rainfed condition over farmers practice.

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