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# IMPACT OF FRONT LINE DEMONSTRATION ON PRODUCTIVITY OF SOYBEAN (*GLYCINE MAX* L. MERRIL.) IN FARMER'S FIELDS

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## Abstract

The front line demonstrations of soybean were conducted during the *kharif* season at 20 farmers fields, to demonstrate production potential and economic benefit of improved technologies consisting suitable variety (JS-97-52), integrated nutrient management (20:60:20:20 kg NPKS/ha + *Rhizobium* + PSB @ 5g/kg of seed), integrated pest management (deep ploughing + seed treatment with *Trichoderma viridae* @ 5 g/kg seed + indoxacarb @ 500 ml/ha) at Umaria district of Madhya Pradesh during *kharif* season of 2009-10 and 2010-11. The improved technologies recorded mean yield of 20.8q/ha, which was 32.6 percent higher than that obtained with farmers practice of 15.65q/ha. Improved technologies gave higher mean net return of Rs. 25048/ha with a benefit cost ratio 2.32 as compared to farmers practice (Rs. 15340/ha, benefit cost ratio 1.86).

***Key words :*** Front line demonstration, soybean, JS-97-52, Yield, BC ratio.

## Introduction

Soybean is the major oilseed crop that boosted the economy of the state. It is legume but widely grown for oil purpose. It has great potential as a *kharif* oilseed and has emerged as an important commercial oilseed in Madhya Pradesh. It has substituted the area under upland rice due to better price and performance, It is grown on an area of 9.6 million ha in India with a production of 9.0 million tones and productivity of 942 kg/ha (AICRPS, 2010). Madhya Pradesh ranks first with the contribution of 70% and 64.4% in area (4.4 million ha) and production (4.42 million tones) of soybean in the country.

Umaria district is dominated by tribal people; they are resource poor and not much aware from improved technology of soybean production. It is thus, obvious to enrich farmers with such an alternate technology that can give comparable yield at minimum expenditure. Suitable sowing time, variety and plant population are important non-cash input to achieve synchronous maturity and higher productivity of soybean. Poor agronomic practice such as seed rate, fertilizer management and pest management etc. are responsible for low productivity of soybean in the district. Within the genetic limits, time of sowing is an important agronomic factor affecting the productivity of most of the arable crops, owing to changes in environmental conditions to which phenological stages of crops are exposed. A good genotype under modified environment of different dates of sowing and maintenance of plant population may help in realizing optimum yield level. With the development of new genotypes, it becomes essential to test them at different sowing dates to exploit their full production potential. Genotypes may behave differently due to their plant architecture particularly under late sown conditions because of poor plant growth.

Soybean is grown on 2100 ha area in Umaria district (30% of total *kharif* oilseed; total *kharif* oilseed area is 7006 ha) but productivity is below (1214 kg/ha) than its potential production (2500 kg/ha). Although, soybean is newly introduced in the district (during 2005-06), but due to better price and productivity farmers were well accepted this crop and area is increasing year by year. The reasons of low productivity of soybean in Umaria district are lack of suitable varieties, lack of irrigation facilities (only 25%), low fertilizer consumption (20.25 kg NPK/ha), poor agronomic management (broadcasting method of sowing, higher seed rate and delayed in sowing) and poor plant protection measures are responsible for the low productivity of soybean. Hence, an effort made by the KVK scientists by introducing the recommended technologies of soybean production with HYV JS-97-52 through front line demonstration on farmers field during *kharif* season of 2009-10 and 2010-11.

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## Materials and Methods

The present study is a part of the mandatory programme of Krishi Vigyan Kendra, Umaria, Madhya Pradesh, India. Participatory rural appraisal (PRA), group discussion and transect walk were followed to explore the detail information of study area. In between the technology intervention HRD components (Trainings/ Kisan sangosthi/ Kisan mela/ field day etc.) were also included to excel the farmers understanding and skill about the demonstrated technology on soybean. Field demonstrations were conducted under close supervision of krishi vigyan Kendra, Umaria. Total 20 front line demonstrations under real farming situations were conducted during *kharif* season of 2009-10 and 2010-11 at four different villages namely; Dagdoa, Chotipali, Kuriha and Pinora, respectively under krishi vigyan kendra operational area. The area under each demonstration was 0.4 ha. The soil was sandy clay-loam in texture with moderate water holding capacity, low in organic carbon (0.2-0.41%), low in available nitrogen (97.3-142.3 kg/ ha), low to medium in available phosphorus (8.2-12.9 kg/ ha), low in available potassium (169.7-229.6 kg/ha) and soil pH was slightly acidic to neutral in reaction (6.8-7.2). The treatment comprised of recommended practice (Improved variety JS-97-52, integrated nutrient management-@ 20:60:20:20 kg NPKS/ha + *Rhizobium* + PSB @ 5 g/kg seed, integrated pest management- deep ploughing + seed treatment with *Trichoderma viridae* @ 5 g/kg seed + indoxacarb @ 500 ml/ha etc. *vs.* farmers practice. Deep ploughing was done during the April month. Crop was sown between 25 June to 10 July with a spacing of 45 cm and seed rate was 75 kg/ha. An entire dose of N and P through diammonium phosphate, K through muriate of potash and sulphur through $ZnSO_4$ was applied as basal before sowing. The seeds were treated with *Trichoderma viridae* @5 g/kg seeds then inoculated by *Rhizobium* and phospho-solubilizing bacteria biofertilizers each 5g/kg of seeds. Application of Imazethapyr @100g a.i./ha at 25-30 DAS followed by slight hand weeding at 45 DAS for effective weed management was done; used flat fan nozzle. One spray of Indoxacarb @500 ml/ha with 500 liters of water was given at the time of incidence of stem fly. Fields were irrigated at seed development stage and the crop was harvested between15$^{th}$ October to 25$^{th}$ October during both years of demonstration.

Farmer's practice constituted there were no deep ploughing was done during summer, old seed of variety JS-335 was used, crop was sown on the same time of demonstration, broadcasting method of sowing, higher seed rate (100 kg/ha) sown, imbalance dose of fertilizers applied (15:40:0 kg NPK/ha), no seed treatment, no biofertilizers, no plant protection measures and one hand weeding at 30-35 DAS were adopted. Crop was harvested on the same time of harvesting of demonstration plots. Harvesting and threshing operations done manually; 5mx3m plot harvested in 3 locations in each demonstration and average grain weight taken at 14% moisture. Similar procedure adopted on FP plots under each demonstration then grain weight converted into quintal per hectare (q/ ha).

Before conduct the demonstration training to farmers of respective villages was imparted with respect to envisaged technological interventions. All other steps like site selection, farmers selection, layout of demonstration, farmers participation etc. were followed as suggested by Choudhary (1999). Visits of farmers and extension functionaries were organized at demonstration plots to disseminate the technology at large scale. Yield data was collected from farmers practice and demonstration plots. The grass returns, cost of cultivation, net returns and benefit cost ratio (B:C ratio) were calculated by using prevailing prices of inputs and outputs and finally the extension gap, technology gap and technology index were worked out. To estimate the technology gap, extension gap and technology index, following formulae given by Kadian *et al.* (1997) have been used.

$$\text{Technology Index} = \frac{(Pi - Di)}{Pi} \times 100$$

Where,

Pi- Potential yield of i$^{th}$ crop

Di- Demonstration yield of i$^{th}$ crop

## Results and Discussion

### Yield attributing parameters

The yields attributing parameters like number of pods/ plant and harvest index (%) of soybean obtained over the years under recommended practice as well as farmers practice are presented in table 1. The Number of pods/ plant of soybean ranged from 52.5 to 53.9 with mean of 53.2 under recommended practice on farmers field as against a ranged from 46.5 to 47.4 with a mean of 46.9 recorded under farmers practice. Similarly higher harvest index was recorded under recommended practice (31.3-32.9% mean value of 32.1%) as compared to farmers practice (ranged between 28.5-29.6%, mean of 29%).The higher values of number of pods/plant and harvest index following recommended practice as well as farmers practice was due to the use of latest high yielding variety, integrated nutrient management and integrated pest

**Table 1 :** Productivity, Yield parameters, Harvest index, Technology gap, Extension gap and Technology index of soybean (JS-97-52) as affected by recommended practices as well as farmer's practices.

| Year | Area (ha) | No. of farmers | No. of pods/ plant | | Grain yield (q/ha) | | | % increase over FP | Biological yield (q/ha) | | Harvest index (%) | | Technology gap (q/ha) | Extension gap (q/ha) | Technology index (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | RP | FP | Potential | RP | FP | | RP | FP | RP | FP | | | |
| 2009-10 | 5.6 | 14 | 53.9 | 47.4 | 25 | 22.4 | 16.51 | 35.6 | 45.5 | 39.2 | 32.9 | 29.6 | 2.6 | 5.89 | 10.4 |
| 2010-11 | 2.4 | 06 | 52.5 | 46.5 | 25 | 19.2 | 14.80 | 29.72 | 42.0 | 37.0 | 31.3 | 28.5 | 5.8 | 4.40 | 23.2 |
| **Total/mean** | **8.0** | **20** | **53.20** | **46.9** | **25** | **20.8** | **15.65** | **32.66** | **43.7** | **38.1** | **32.1** | **29.0** | **4.2** | **5.14** | **16.8** |

**Table 2 :** Economics of Front Line Demonstration of soybean (JS-97-52) as affected by recommended practices as well as farmer's practices.

| Year | No. of demonstration | Yield (q/ha) | | % increase over FP | Gross expenditure (Rs/ha) | | Gross returns (Rs/ha) | | Net returns (Rs/ha) | | Additional net return (Rs/ha) | B:C ratio | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RP | FP | | RP | FP | RP | FP | RP | FP | | RP | FP |
| 2009-10 | 14 | 11.59 | 9.16 | 35.6 | 19292 | 18621 | 49280 | 36322 | 29988 | 17701 | 12287 | 2.55 | 1.95 |
| 2010-11 | 06 | 11.95 | 8.50 | 29.72 | 18292 | 16621 | 38400 | 29600 | 20108 | 12979 | 7129 | 2.09 | 1.78 |
| Total/mean | **20** | **11.77** | **8.83** | **32.66** | **18792** | **17621** | **43840** | **32961** | **25048** | **15340** | **9708** | **2.32** | **1.86** |

management on soybean during both the years of demonstration. Similar results have been reported earlier by Prasad (2005).

### Seed yield

The yields of soybean obtained over the years under recommended practice as well as farmers practice are presented in table 1. The productivity of soybean ranged from 19.2 to 22.4 q/ha with mean yield of 20.8 q/ha under recommended practice on farmers field as against a yield ranged from 14.8 to 16.51 q/ha with a mean of 15.65 q/ha recorded under farmers practice. The higher productivity following recommended practice as well as farmers practice was during the year 2009-10 which might be due to congenial climate for better growth of crop. In comparison to farmers practice there was an increase of 35.6 and 29.72% higher productivity, respectively during 2009-10 and 2010-11 following recommended practices. The higher yield of soybean under recommended practices was due to the use of latest high yielding variety, integrated weed management, integrated nutrient management and integrated pest management. Similar results have been reported earlier by Jain and Dubey (1998).

### Economics

The inputs and outputs prices of commodities prevailed during both the year of demonstrations were taken for calculating cost of cultivation, net returns and benefit cost ratio (table 2). The investment on production by adopting recommended practices ranged from Rs. 18292 to 19292/ha with a mean value of Rs. 18792/ha against farmers practice where the variation in cost of production was Rs. 16621-Rs. 18621/ha, mean of Rs. 17621/ha. Cultivation of soybean under recommended practices gave higher net return of Rs. 29988 and Rs. 20108/ha compared to Rs.17701 and Rs.12979/ha under farmers practice during 2009-10 and 2010-11, respectively. The additional net income ranged from Rs. 7129 to Rs. 12287/ha with a mean value of Rs. 9708/ha over farmers practice. The average benefit cost ratio of recommended practices was 2.32, varying from 2.55 to 2.09 and that of farmers practice was 1.86, varying from 1.95 to 1.78. This may be due to higher yields obtained under recommended practices compared to farmers practice. Similar results have been reported earlier on chickpea by Tomar *et al.* (1999) and Tomar (2010).

### Extension and technology gap

The extension gap ranging between 4.4-5.89 q/ha during the period of study emphasized the need to

**Table 3 :** HRD component: Cumulative data of 2009-10 & 2010-11.

| S.no. | HRD components | Frequency | Beneficiaries |
|---|---|---|---|
| 1. | Trainings on soybean production | 10 | 339 |
| 2. | Radio talk | 1 | Mass |
| 3. | CD shows | 3 | Mass |
| 4. | Kisan mela | 2 | 965 |
| 5. | Kisan sangosthi | 5 | 83 |
| 6. | Field day | 1 | 45 |
| 7. | News paper coverage | 4 | Mass |
| 8. | Folders | 2 | 1500 |

educate the farmers through various means for the adoption of improved agricultural production to reverse the trend of wide extension gap (table 1). The trend of technology gap ranging between 2.6 - 5.8 q/ha reflected the farmer's cooperation in carrying out such demonstration with encouraging results in both the years. The technology gap observed may be attributed to the dissimilarity in weather conditions. The technology index showed the feasibility of the evolved technology at the farmer's field. The lower the value of technology index, the more is the feasibility of the technology. As such, the reduction in technology index from 10.04% during 2009-10 to 23.2% during 2010-11 exhibited the feasibility of the demonstrated technology in this region.

### HRD components

During the study period, Human Resources Development Components *i.e.* training, radio talk, field day, CD shows, popular articles, Kisan Mela and Kisan Sangosthi were also taken to increase the farmers understanding and skill about the recommended practice on soybean production (table 3).

## Conclusion

The result of front line demonstration convincingly brought out that the yield of soybean could be increased higher with the intervention on varietal replacement *i.e.* JS-97-52, integrated weed management, integrated nutrient management and integrated pest management in soybean production in the Umaria district. To safeguard and sustain the food security in India, it is quite important to increase the productivity of soybean under limited resources. Favorable benefit cost ratio is self explanatory of economic viability of the demonstration and convinced the farmers for adoption of improved technology of soybean production. The technology suitable for enhancing the productivity of soybean and calls for conduct of such demonstration under the transfer of technology programme by KVKs.

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