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Yield gap analysis of soybean through front line demonstration in Burhanpur district of Madhya Pradesh

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Abstract
Front Line Demonstration is an appropriate tool to demonstrate recommended technologies among the farmers. Krishi Vigyan Kendra, Burhanpur (M.P.) conducted 50 demonstration on soybean from 2010-11 to 2014-15 in adopted villages. The critical inputs were identified in existing production technologies through bench mark survey. The recommended packages of practices were adopted by the farmers in all the villages. The training program me of different aspects of crop production technologies were organized among beneficiaries and other participating farmers. The average of five years data indicated that an average yield of demonstration plot exhibited 20.49qt./ha. as against local check 15.69qt./ha. with an additional yield of 4.80qt./ha. and increased average soybean productivity by 31.03%. The average technological gap and technological index were found to be 4.51qt./ha. and 18.03%, respectively.

Keywords: FLD, adoption, technological gap, extension gap, technological index

Introduction
Soybean [*Glycine max* (L.) Merill] is one of the important rain fed leguminous oilseed crops of central India. Soybean ranks first amongst oilseed crops in the world as well as in India. India ranks fourth in terms of soybean area in the world and only behind to USA, Brazil and Argentina. Soybean is being grown in 10.18 million hectare producing 12.28 million tonnes with seed yield of 1,207 kg per ha in India (2011-12). In Madhya Pradesh, It is grown in 5.67 million hectare with 6.28 million tons of production and 1,108 kg per ha seed yield (Agricultural Statistics at a Glance, 2012). Owing to its oil and protein profile, this crop has an important role in nutritional security of masses. The yield level in soybean is hovering around 1.2 tons per ha, which is quite low. Yield is a very complex entity influenced by several phonological, physiological, yield traits and environment in soybean as true in other crop also.
At present the area under soybean is mainly spread in latitudinal belt of about 15 to 25^0Ncomprising the states of Madhya Pradesh, Maharashtra, Rajasthan, Chhattisgarh, Andhra Pradesh and Karnataka (Bhatia *et al*., 2008) [1]. Besides improving the socio-economic conditions of small and marginal farmers of the country, the crop contributes 25 % of the total edible oil produced in the country and earns substantial amount of foreign exchange (INR 70000 million) by exporting defatted oil cake (DOC) (Paroda, 1999: Bhatia *et al*., 2011) [7, 2]. Despite the spectacular growth in area and production, the average productivity of the crop (1.2 t /ha) in India is less than half the world average (2.53 t/ha) and one third of its climate potential (3.5 t/ha) (Bhatia *et al*., 2008) [1]. Several biotic, abiotic and socio-economic factors, responsible for low productivity of soybean in India have been identified (Paroda, 1999: Joshi and Bhatia, 2003) [7, 4]. Due to rain fed nature, occurrence of severe drought conditions at one or other stages of crop growth and development is the most important factor limiting soybean productivity in India (Joshi and Bhatia, 2003) [4]. The current climate in terms of drought and temperature are already affecting the productivity of soybean and the problem is expected to further accentuate in future (IPCC, 2007).
The Major problem in soybean production is the stagnant productivity in the country in general and especially Madhya Pradesh in particular (Nahatkar *et al*., 2005) [6] especially when varieties with high yield potentials and improved production technology is available.

In Burhanpur district of MP the poor productivity is because resource poor farmers are very reluctant toward proper scientific management of the crop.

Material and Methods

The study was carried out by Krishi Vigyan Kendra, Burhanpur during Kharif season 2010-11 to 2014-15 (Five consecutive years) in the Farmers field of five adopted villages i.e. Umarda, Harda, Virodha, Loni and Sandas of Burhanpur district (M.P.). The farmers were selected from operational area of KVK, Burhanpur as per the annual action plan and allotment of funds from Zonal Project Directorate (Zone VII). During these five years of study, an area of 20 ha was covered with plot size 0.50 ha under front line demonstration with active participation of 50 farmers. Before conducting FLDs a list of farmers was prepared. Field surveyed and soil sample collected by KVK technical team. The specific skill tanning was imparted to the selected farmers on POP and different aspect of soybean cultivation by the KVK scientist. Besides these, regular visits were done to demonstration field by the KVK scientist in order to ensure day to day guidance to the farmers at different crop growth stages. During crop growth period group meeting and at crop maturity stage field days were also organized at demonstration field to share the experiences and to provide opportunities to other farmers to observe the benefit of demonstration technologies. The critical inputs related to the technology provided by KVK to the farmers. The difference between the demonstration field and existing farmers practices are given in table -1.

In general the soil of demonstration field was black cotton soil in texture with a PH ranging between 7.0-8.0 PH. In demonstration plot, use of quality seeds of Improved varieties i.e. JS 9305, line sowing using ridge & furrow system, timely weeding, need based pesticides application and balanced fertilization (Using micronutrient Sulphur) were emphasized and comparison were made with existing farmers practices (Table- 1).The necessary step for selection of site and farmers, layout of demonstration etc. were followed as suggested by Chowdhary (1999) [3]. The Traditional practices were maintained in case of local checks. The data output were collected from both FLD plots as well as control plots and finally the extension gap, technology gap, technology index along with the benefit cost ratio were worked out (Samui *et al* 2000) [8] as given below:

Technology Gap = Potential Yield-demonstration Yield
Extension Gap = Demonstration Yield-farmer yield
Technology Index = Potential Yield-Demonstration Yield/ Potential yield

Table 1: Comparison between demonstration package and existing practices under Soybean FLD

S. No.	Particulars	Soybean	
		Demonstration	**Farmer Practice**
01	Farming Situation	Rainfed	Rainfed
02	Variety	JS-9305	JS-335
03	Time of Sowing	Onset of monsoon	Onset of monsoon
04	Method of Sowing	Line sowing & Ridges-Furrow	Through local seeding devices
05	Seed Treatment	With fungicide @ 2 gm / kg seeds	Without seed treatment
06	Seed Rate	70 kg/ha.	85-90 kg/ha
07	Fertilizer Dose	20:60:20 kg NPK/ha + Sulphur 20-25 kg/ha.	Without any recommendation
08	Seed Inoculation	Seed inoculation with rhizobium & PSB 5gm/ha of seed	Generally not using
09	Weed Management	Use of weedicide post emergence at 25-30 DAS	Use of local weeding devices
10	Plant Protection	Need based Application	Non judicious use of pesticides
11	Harvesting	Harvesting at physiological maturity of plant i.e. yellowing of pods	Majority Unaware about exact maturity symptoms resulting shattering of grain.

Result and Discussion

The data of table 2 indicate that the yield of soybean fluctuated successively over the years in demonstration plot. The maximum highest yield was recorded 22.33 q/ha during 2014-15 and lowest yield was recorded during 2010-11 and the average yield of five years was recorded 20.49qt/ha. Over local check 15.69 qt/ha. The increase in percent of yield was varied from 21.95 to 40.86 qt/ha during five years of study. On an average 31.03% increase in yield was recorded. The result are in conformity with the finding of Tomar *et al*., (2003) [11], Tiwari and Saxena (2001) [9] and Tiwari *et al*. (2003) [10]. The finding clearly indicate the positive effects of FLDs over the existing practices towards enhancing the yield of soybean with its positive effect on yield attribute. Benefit-cost ratio was recorded to be higher under demonstration against control during all the years of study.

The extension gap showed an increasing trend. The extension gap varied between 4.02-6.11 qt./ha. During the period of study emphasizes the need to educate the farmer through various means for adoption of improved agricultural production to reverse the trend of wide extension gap.

The trend of technology gap varied from 2.67-6.10 qt./ha which reflects the farmers co-operation in carrying out such demonstrations with encouraging results in subsequent years. The technology gap observed may be attributing to the dissimilarity in soil fertility status and weather conditions similar findings was recorded by Katare *et al*. (2011) and Mitra *et al*. (2010) [5].

The technology index data showed technology feasibility at the farmers' field. The lower value of technology index the more is the feasibility of technology. Technology index value varied from 10.68 to 24.40% during the study period may be attributed to the dissimilarity in soil fertility status, weather conditions and insect- pest attack. Similar finding also reported by Katares *et al*. (2011).

Table 2: Productivity, technology gap, extension gap and technology index in soybean under FLD

Year	Area (ha.)	No. of farmers	Seed Yield (qt./ha.)			% increase over control	Technology gap (qt./ha)	Ext. Gap (qt./ha.)	Technology Index (%)	B:C Ratio	
			Potential	Demo	Control					Demo	Check
2010-11	04	10	25	18.90	14.30	32.16	6.10	4.60	24.40	2.35	1.98
2011-12	04	10	25	21.06	14.95	40.86	3.94	6.11	15.76	2.51	1.87
2012-13	04	10	25	19.60	14.89	31.63	5.40	4.71	21.60	3.34	2.66
2013-14	04	10	25	20.57	16.00	28.56	4.43	4.57	17.72	3.45	2.90
2014-15	04	10	25	22.33	18.31	21.95	2.67	4.02	10.68	2.79	3.00

Conclusion

On the basis of results of study it may be concluded that:

- The yield under demonstration plots was higher than the local check fields.
- Farmers can get more income from the cultivation of demonstrated variety instead of local check.
- The use of scientific method of soybean cultivation can reduce the technology gap to a considerable extent thus leading to increased productivity of soybean in the district.
- There is need to provide technical support to the farmers through different educational and extension method by extension agencies to reduce the extension gap.

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