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Impact of IPM Front Line Demonstrations (FLDS) on soybean growers

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Abstract
Front Line Demonstration (FLDs) is a popular extension asset of agricultural technology transfer. Keeping in view of an effective extension approach of FLDs for dissemination of soybean IPM technology, an impact of FLDs conducted by KVK, Buldhana. Soybean was originated in China and was introduced to India centuries. Soybean is an important oilseed crop which ranks third in oilseed after groundnut and mustard in India.

An impact assessment was based on the comparison of beneficiary and non-beneficiary respondents. The objective of the study to demonstrate the IPM practices to reduce losses due to pest particularly Stem fly and Girdle beetle and to increase the yield and C: B ratio. A total sample of 52 respondents was taken comprising 26 beneficiary and 26 non-beneficiary farmers. For selection of beneficiary farmers, a list of farmers where FLDs on soybean were conducted during 2022-23 & 2023-24 was prepared and taking equal representation, 13 beneficiary farmers from each selected villages making 26 respondents were selected. For the other half of samples (26 non-beneficiary farmers) were selected randomly from the same villages. The data were collected through personal contact with the help of well-structured interview schedule. The demonstration results in 23.97 per cent and 20.93 per cent reduction of stem fly infestation and 45.01 per cent and 51.74 per cent reduction of girdle beetle infestation over non beneficiary farmers in 2022 and 2023 similarly there is 16.15 percent increase in yield of beneficiary farmers over non beneficiary farmers. Beneficiary farmers produced 23.15 q/ha yield of soybean over non IPM (non-beneficiary farmers) practice *i.e.* 19.41 q/ha. The study revealed that use of different IPM technologies in soybean production by beneficiary farmers was yielded higher, found reduced percent stem fly and girdle beetle infestation and higher benefit cost ratio over non beneficiary soybean growers.

Keywords: Soybean, IPM technology, Beneficiary farmers, non-beneficiary farmers

Introduction
Amaranth or pigweed belongs to the family Amaranthaceae. It is believed to have originated from Central and South America. The genus *Amaranthus* consists of up to 70 species (in the form of cosmopolitan weed or cultivated plant) and are widely spread in all tropical and subtropical regions of the world and they are cultivated as leaf vegetables, grains or ornamental plants, while, others are weeds. Grain amaranth produce significant edible cereals grain but known as “pseudocereals” to distinguish it from other cereal producing crops. In India, presently amaranth is commonly grown in Himachal Pradesh and on hills of Uttar Pradesh and Uttaranchal for both grain and leafy vegetable purpose, however, the Himalayan region is mainly known as the amaranth ‘centre for diversity’ for the number of varieties that are been cultivated. While, it is mainly grown for grain especially in Uttarakhand, Maharashtra and in some parts of Gujarat. Grain amaranth commonly called as *Chaulai, Batu, Bhabhri, Ganhar, Harave, Keere, Maarsu, Marsha, Pung-keerai, Rajakeera, Sawal, Sil* or *Ram Dana*. However, in parts of Maharashtra and Gujarat, it is known as *Rajgirah* “King seed” (Patel *at el*., 2022) [18].

Soybean was originated in China and was introduced to India centuries. Soybean is an important oilseed crop which ranks third in oilseed after groundnut and mustard in India. In International market after palm oil, soybean oil in its crude form is the most traded oil. Soybean oil is basically used as edible oil. Soybean contains about 20 per cent oil and 40 per cent protein. In addition to this it contains a good amount of minerals, salts and vitamins and its sprouting grains contain a considerable amount of vitamin ‘C’ and ‘A’ in the form of precursor carotene, which is converted into vitamin ‘A’ in the intestine.

Soybean is useful for maintaining the soil fertility by fixing 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. According to Ministry of Agriculture, Govt. of India area under soybean was at 12.2 million hectares in 2021-22.

This has made India the fifth largest producer of soybean in the world today. If considered worlds soybean production scenario Brazil ranks first with 114.27 million tones followed by United States of America with 96.79 million tones, Argentina 55.26 million, China 15.73 million and India 13.27 million accounting for 34.25, 29.01, 16.56, 4.00 and 3.98 percent of world production respectively. Production of soybean in India at the present time is restricted mainly to Madhya Pradesh, Uttar Pradesh, Maharashtra and Rajasthan.

The average yield of soybean is less in India as compare to other countries, which is about 1 tons per hectare as compared to 2.3-3.8 per hectare in other countries. Area under soybean cultivation in Maharashtra is 43.21 lacs hectares and ranks second in area in India.

Soybean is a major Khari crop in Buldhana district of Maharashtra, which is grown over 3.99 lacs hectares area with the production of 3.39 lacs with productivity of 8.5 quintal per hectares during 2021-22. (*Source*: DSAO, Buldhana).

Soybean provides substratum for about 275 species of insect pests in India, out of these only a dozen of species like Girdle beetle, Tobacco caterpillar, Green semilooper, Stem fly and White fly etc. attained the major pest status. About 380 species of insects have been reported on soybean crop from different corner of the world. In Buldhana district the major insect pest reported are Stem fly, Girdle beetle, Tobacco caterpillar *etc*. The present demonstration were conducted in Buldhana district. Masrul village of Buldhana tehsil in 2022 and Muradpur village of Chikhali tahsil in 2023 on thirteen farmers farm for integrated management of stem fly and girdle beetle which are the major threat reducing the yield of soybean

Frontline demonstration is a tool affects perception levels of farmers with the principle of 'learning by doing' and 'seeing is believing'. Keeping in view of an effective extension approach of FLDs for dissemination of soybean IPM technology, and to reduce losses in production of soybean in the district, the present IPM demonstrations were undertaken with the following specific objectives:

1. To study the percent change infestation through IPM technologies in beneficiary farmers over non-beneficiary soybean growers.
2. To study the percent change in adoption of IPM technologies in soybean in beneficiary farmers over non-beneficiary farmers.
3. To assess the extent of yield increase in beneficiary farmers over non-beneficiary farmers.

Research Methodology

The demonstration was organized by KVK in Buldhana district of Maharashtra. For the purpose of investigation, two villages were selected from Buldhana district, where FLDs were conducted during preceding two years. A total sample of 52 respondents was taken comprising 26 beneficiary and 26 non-beneficiary farmers. For selection of beneficiary farmers, a list of farmers where FLDs on soybean were conducted during 2022-23 & 2023-24 was prepared and taking equal representation, 13 beneficiary farmers from each selected villages making 26 respondents were selected. For the other half of samples (26 non-beneficiary farmers) were selected randomly from the same villages. The data were collected through personal contact with the help of well-structured interview schedule. The data collected were processed, tabulated, classified and analyzed in terms of mean percent score in the light of objectives of the study.

Percent stem fly and girdle beetle infestation per meter row length (MRL) were recorded by implementing IPM technology. The demonstrated technology includes 1. Treatment of Thiamethoxam30% F.S. @10 ml /kg of seed, 2. Removal of infested leaves, dried branches in initial stages, 3. 5% NSE spray in early stages i.e. before flowering, 4. ETL based spraying of mixed insecticide namely Thiamethoxam 12.6% + Lambda cyhalothrin 9.5% @2 ml +10 lit of water against soybean stem fly and girdle beetle. Whereas non-beneficiary farmers were selected on the basis of farmers practices where farmers used to only spray 2 or 3 chemical pesticides to control the pests and not followed mentioned IPM practices.

Results and Discussion

It is assumed that the knowledge of a farmer to large degree depends upon the extent of exposure given to him about the IPM technology. The FLDs conducted on soybean crop by KVK, Buldhana helped to get aware farmers about identification of soybean crop pest, proper stage of infestation and when and how to follow IPM practices.

It was observed that after implementation of IPM technology through FLDs there is increased knowledge in terms of proper stage of pest incidence, identification of different pest and proper stage of IPM tactics to overcome.

Table 1: Infestation of stem fly and girdle beetle on soybean during 2022-23 and 2023-24

Particulars	Per cent stem fly infestation per meter row length (MRL)		Girdle beetle infestation per meter row length (MRL)	
	2022-23	2023-24	2022-23	2023-24
Beneficiary farmers	2.60	2.72	1.82	2.08
Non -Beneficiary farmers	3.42	3.44	3.31	4.31
Percent reduced infestation	23.97	20.93	45.01	51.74

The data in the Table1 depicts that there is 23.97 per cent and 20.93 per cent reduction of stem fly infestation in beneficiary farmers over non beneficiary farmers in 2022-23 and 2023-24 respectively. Whereas in case of girdle beetle it was observed that 45.01 per cent and 51.74 per cent reduction was noticed over non beneficiary farmers in 2022-23 and 2023-24 respectively.

The pooled data in the Table 2 portrays that there is 34.22 per cent and 52.01 per cent reduction of stem fly and girdle beetle infestation in beneficiary farmers over non beneficiary farmers in preceding two years respectively.

Table 2: Percent reduction in infestation of stem fly and girdle beetle on soybean

Particulars	Per cent stem fly infestation per meter row length (MRL)	Girdle beetle infestation per meter row length (MRL)
	Pooled	
Beneficiary farmers	2.21	2.40
Non -Beneficiary farmers	3.36	3.87
Percent reduced infestation	34.22	52.01

Table 3: Effect of IPM technologies on soybean yield

Particulars	Yield q/ ha 2022-23	Yield q/ ha 2023-24	Pooled Yield q/ ha	Per cent increase in Yield
Beneficiary farmers	24.5	21.80	23.15	16.15
Non -Beneficiary farmers	20.62	18.20	19.41	

The data in the Table 3 reveals that there is 16.15 percent increase in yield of beneficiary farers over non beneficiary farmers. Beneficiary farmers produced 23.15 q/ha yield of soybean over non IPM (non-beneficiary farmers) practice i.e. 19.41 q/ha.

Table 4: Benefit cost ratio of beneficiary and non-beneficiary soybean growers

Particulars	Beneficiary farmers	Non-Beneficiary farmers
2022-23	3.81	2.08
2023-24	3.51	2.79
Pooled	3.66	2.43

The data in the Table 4 discloses that there is 3.66 benefit cost ratio attained over non beneficiary farmers i.e. 2.43

Conclusion

The study revealed that use of different IPM technologies in soybean production by beneficiary farmers was yielded higher, found reduced percent stem fly and girdle beetle infestation and higher benefit cost ratio over non beneficiary soybean growers. The overall significant difference was noticed in terms of stem fly and girdle beetle infestation, yield and C:B ratio.

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