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*RESEARCH PAPER*

# Exploring livelihood security through enhancement of soybean production on farmer's field of Dhar district of M.P.

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**Abstract :** Frontline demonstration (FLD) programme is an effective technology transfer tool for better technology adoption that bridges the yield gaps. Keeping in view of an effective extension approach of FLDs for dissemination of soybean technology were studied for 3 years during *Kharif* 2012 -13 to 2014 -15 by the KVK, Dhar district of Madhya Pradesh. An impact evaluation was based on the comparison of beneficiary and non-beneficiary respondents with reference to increase in knowledge level, extent of adoption of improved soybean production technologies, the yield gap analysis and economics were also measured. It was found that the level of knowledge of beneficiary farmers regarding different improved soybean production technologies was higher than non-beneficiary ranging from 2.00 MPS in field preparation to 30.00 MPS in seed inoculation with cultures. The overall significant difference was found in knowledge level of beneficiary and non-beneficiary farmers. The adoption level of beneficiary farmers observed 58 per cent and only 28 per cent have accepted but not adopted the technology due to some situational constraints. It is also revealing that there was a wide yield gap between potential and demonstration yields due to technology and extension yield gaps. Extension yield gaps varied to the extent of 4.10 to 9.42q $ha^{-1}$ while technology gap ranged from 3.98 to 7.81q $ha^{-1}$. Improved technologies gave higher mean net return of Rs. 46802/- $ha^{-1}$ with a benefit cost ratio 3.34 as compared to farmers practice (Rs. 27066/- $ha^{-1}$ and benefit cost ratio 2.59). On an average technology index was observed 24.03 per cent, which shows good performance of technical interventions.

**Key Words :** Front line demonstration, Yield, B:C, Economics, Extension gap, Technological gap, Technology index, Rain fed agro-ecosystem

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## INTRODUCTION

Soybean is an important oilseed crop which ranks third in oilseed after groundnut and rapeseed/ mustard in India. After palm oil, soybean oil in its crude form is the most traded oil in international market. Soybean cultivation in India was negligible until 1970, but it grew rapidly, thereafter, crossing over 10.60 million with a national productivity of 1.2 t /$ha^{-1}$ during 2012-13. This has made India the fifth largest producer of soybean in the world. Production of soybean in India at the present

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time is restricted mainly to Madhya Pradesh, Uttar Pradesh, Maharashtra, Rzajasthan, Chhattisgarh, Andhra Pradesh and Karnataka (Mankar *et al.,* 2014). The studies conducted in the past (Ahirwar *et al.,* 2007; Dixit *et al.,* 2009 and Meena *et al.,* 2012) have indicated that the adoption of recommended soybean cultivation practices gives high yields and additional income to the farmers. Soybean productivity achieved by the farmers at present, is far below the potential yield. It has largely been responsible in uplifting farmer's economic status in many districts of the Madhya Pradesh. It usually fetches higher income to the farmers owing to the huge export market for soybean de-oiled cake. Raghuwanshi *et al.* (2014) concluded that major constraints reported by the soybean growers in adoption of improved soybean production technology were electricity problem (100%), irregular visits of RAEOs (100%) and lack of availability of technical information from extension personnel (100%), lack of training regarding production technology (82.5%), high cost of seed, fertilizers, insecticides and lack of soil testing facilities (100%). Singh *et al.* (2015) reported that assessment of the overall adoption level of recommended soybean production practices by the respondents revealed that most of the respondents had medium level of adoption (45 %) followed by low (37 %) and high (18 %). Of the twelve improved production practices, adoption level was satisfactory only in chemical pest control (90 %), use of recommended herbicides (70 %), timely sowing (82 %) and seed treatment with fungicides (60 %). Other better adopted practices were line sowing (45 %), inter cropping (32 %) and manual weed management (25 %). Very low priority was given by the farmers on use of optimum seed rate (11 %), balanced use of fertilizers (8 %), need based irrigation and provision of proper drainage (2 %) and integrated pest management (2 %).

The average productivity of soybean is less in India as compared to 2.3-3.8 tonnes per hectare in other countries like United States, Brazil and Argentina.It has great potential as a *Kharif* oilseed and has emerged as an important commercial oilseed in Madhya Pradesh in rain-fed agro-ecosystem.Madhya Pradesh occupies 0.318 million ha of area under soybean with 0.232 million tonnes production with the average productivity of 775 kg per ha (SOPA, 2013).

Soybean is grown on 2.60 lakh $ha^{-1}$ area in Dhar district (50% of total *Kharif* cultivated area) but productivity is below (1214 kg/ $ha^{-1}$) than it's an average potential production (2500 kg/ $ha^{-1}$). Although soybean is predominantly grown on Vertisols and associated soils in the district due to better price and productivity, farmers are well accepted this crop. But since few years the area and the productivity is decreasing due to non-congenial climate for better crop growth, lack of seed of suitable varieties, lack of knowledge about fertilizer management, poor agronomic management and indiscriminate use of pesticide in the district. To combat the situation KVK, Dhar had done intensive efforts on trainings about scientific cultivation, demonstration on adoption of new varieties, land configuration and production technology since last three year, total number of beneficiaries of FLD was 124 covering five villages of the district involving two tribal blocks namely Tirla and Nalcha to find out the level of knowledge, adoption, impact, yield gap and economics.

## MATERIAL AND METHODS

Frontline demonstration (FLD) is one of the most important and powerful tools for transfer of technology. Keeping in view of an effective extension approach, FLDs on oilseed crops are being conducted by KVKs from several years. An effort made by the scientists of KVK, Dhar by introducing the recommended technologies of soybean production with HYV JS-9305 and JS-9560 during *Kharif* season of 2012-13 to 2014 - 15. For the purpose of study, five villages of Dhar district, where FLDs on soybean were conducted and a sample of 100 respondents was taken comprising 50 beneficiary and 50 non- beneficiary farmers. For selection of beneficiary farmers, a list of farmers where FLDs on soybean were conducted during 2012-13-2014-15 was prepared and taking equal representation of ten beneficiary farmers from each of the selected villages making fifty respondents was selected randomly. On the other hand, 50 samples of non- beneficiary farmers were selected randomly from the same villages who were not involved in any programme. Efforts were also made to assess the knowledge level of beneficiary as well as non-beneficiary farmers regarding soybean production technologies. The knowledge of the respondents was measured in terms of mean percent scores (MPS). Ten and more than 10 per cent difference between beneficiary and non- beneficiary farmers were considered as significant difference as suggested by Meena (2011). Total twelve practices were included to assess the knowledge as given in Table 1. Simultaneously, it was

also planned to study the impact of FLDs on adoption of technology by the selected 50 beneficiaries who was measured with the simple statements given below in terms of Adoption or Rejection of technology by the beneficiary farmers followed continuously as it was demonstrated (Adopted).

- Followed some part only (Partial Adoption)
- Followed with some modification (Reinvention)
- Not followed (Rejected)
- Very much like to use but not followed due to constraints (Accepted/adoptable).

The data were collected through personal contact with the help of well-structured interview schedule. The gathered data were processed, tabulated, classified and analysed in terms of mean per cent score, ranks, yield gap analysis and economics, as suggested by (Samui *et al.*, 2000), were calculated by using formulae in the light of objectives of the study.

## RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

### Knowledge level of respondents :

It is assumed that the knowledge of a farmer to large degree depends upon the extent of exposure given to him about the technology through trainings, exposure visits and means of communications. The FLDs conducted on soybean by KVK, Dhar might improve the knowledge of farmers about soybean production technology. Therefore, efforts were made to assess the knowledge level of beneficiary as well as non-beneficiary farmers. The data indicated in the Table1 depict that both type of respondents possessed maximum knowledge regarding time of sowing, high yielding varieties and field preparation of soybean crop.

The mean per cent scores of knowledge of the beneficiary farmers varied from 84.57 to 98.67, while in case of non-beneficiary farmers, the mean per cent scores varied from 69.11 to 98.33. The data further revealed that knowledge of the beneficiary farmers regarding practices like insect pest management, irrigation management, fertilizer management, disease management, harvesting and post-harvest, weed management, seed rate and spacing, seed treatment and seed inoculation with cultures was found to be 95.11, 94.80, 94.53, 93.78, 93.60, 93.20, 91.14, 85.14 and 84.57 mean per cent score, respectively. In case of non-beneficiary farmers, the knowledge regarding irrigation management, harvesting and post-harvest, weed management, insect pest management, disease management, seed rate and spacing, fertilizer management, seed treatment and seed inoculation by the use of cultures was found to be 89.20, 89.20, 84.60, 70.44, 69.11, 68.29, 67.07, 55.43 and 54.57 mean per cent score, respectively.

Table 1 result also reveals that the knowledge of

**Table 1 : Knowledge level of the respondents about improved soybean production technologies**

| Sr. No. | Soybean production technology | Max. score | Beneficiaries (n=50) | | Non- beneficiaries (n=50) | | Difference |
|---|---|---|---|---|---|---|---|
| | | | MPS | Rank | MPS | Rank | |
| 1. | High yielding variety | 15 | 96.13 | II | 93.87 | II | 2.27 |
| 2. | Field preparation | 05 | 95.60 | III | 93.6 | III | 2 |
| 3. | Seed treatment | 07 | 85.14 | XI | 55.43 | XI | 29.70* |
| 4. | Seed inoculation with cultures | 07 | 84.57 | XII | 54.57 | XII | 30* |
| 5. | Time of sowing | 06 | 98.67 | I | 98.33 | I | 0.33 |
| 6. | Seed rate and spacing | 07 | 91.14 | X | 68.29 | IX | 22.90* |
| 7. | Fertilizer management | 15 | 94.53 | VI | 67.07 | X | 27.50* |
| 8. | Irrigation management | 05 | 94.80 | V | 89.20 | IV | 5.60 |
| 9. | Weed management | 10 | 93.20 | IX | 84.60 | VI | 8.60 |
| 10. | Insect and pest management | 09 | 95.11 | IV | 70.44 | VII | 24.70* |
| 11. | Disease management | 09 | 93.78 | VII | 69.11 | VIII | 24.70* |
| 12. | Harvesting and post harvest | 05 | 93.60 | VIII | 89.20 | V | 4.40 |
| | Overall | 100 | 93.02 | - | 77.81 | - | 15.20 |

* Significant difference

beneficiary farmers regarding different improved soybean production technologies was higher than non-beneficiaries ranging from 2.00 MPS in field preparation to 30.00 MPS in seed inoculation with cultures. The significant difference between both the categories of respondents was found in knowledge of seed treatment; (MPS 29.70) followed by fertilizer management (27.50 MPS), Insect pest management (24.70 MPS), disease management (24.70 MPS) and seed rate and spacing (22.90 MPS). The overall difference in knowledge level of beneficiary and non-beneficiary farmers was 15.20 MPS which was significant. The findings are in line with the findings of Kumawat (2008) who also reported that the average knowledge level of beneficiary was higher than the non-beneficiary. This might be due the fact that some of the non- beneficiary farmers are marginal and they were not taking part in some extension education programmes which are organised by different organisations resulting little increase of knowledge then the beneficiary.

**Adoption level of beneficiaries :**

It could be observed from Table 2 that 54.00 per cent beneficiaries have adopted the technology of soybean production. In such cases techno- effectiveness and combine effect of the inputs was gained by the farmers. It is also observed that no one has made reinvention in the technology. It is also encouraging that no one has rejected the technology; almost all the farmers have accepted the technology. Very few have partially adopted (8.0%) and others (38.00%) have accepted but not adopted the technology due to some situational constraints.

**Yield analysis :**

Results of 124 FLDs conducted during 2012-13 to 2014-15 in 50.0 $ha^{-1}$ area of farmer's field on five villages of Dhar district indicated that the production technology of soybean comprised under FLD *viz.,* use of improved variety recommended under rain conditions, seed treatment with carboxin + thirum followed by inoculation with *Rhizobium* and PSM culture, balanced application of fertilizers (20:60:20:20 kg NPKS/ $ha^{-1}$), seed rate and spacing (75kg/ $ha^{-1}$), weed management by herbicide followed one hand weeding at 45 DAS and management of insect pest and disease at economic threshold level, produced on an average 51.01 per cent more yield of soybean as compared to farmers practices (12.57 q $ha^{-1}$). The data of Table 3 revealed that the yield of soybean fluctuated successively over the year in demonstration plots. The maximum yield was recorded by JS-9305 (20.90 q $ha^{-1}$) during 2014-15 and minimum yield was recorded in year 2012-13 (15.58q $ha^{-1}$) and the average yield of three years study period was recorded 18.99q $ha^{-1}$ over farmer's practices (8.75 q $ha^{-1}$). The increase in per cent of yield was ranged from 34.31 to 59.66 during study period. The results clearly indicates that the interventions has given a good impact

**Table 2 : Distribution of respondents according to their adoption or rejection of soybean production technology** **(n=50)**

| Variable | Dimensions | No. | % |
|---|---|---|---|
| Impact | Adoption | 27 | 54 |
| | Partial adoption | 4 | 08 |
| | Reinvention | - | - |
| | Rejection | - | - |
| | Accepted | 19 | 38 |

**Table 3 : Yield and gap analysis of soybean in Dhar district, Madhya Pradesh**

| Year | Variety | Area ($ha^{-1}$) | No. of Demo. | Potential yield (q $ha^{-1}$) | Yield (q/ $ha^{-1}$) | | % increase in yield over FP | Extension gap (q $ha^{-1}$) | Technology gap (q $ha^{-1}$) | Technology index |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | DP | FP | | | | |
| 2012 | JS-9305 | 5.0 | 12 | 25 | 15.58 | 11.60 | 34.31 | 9.42 | 3.98 | 37.68 |
| 2013 | JS-9560 | 17 | 42 | 25 | 19.56 | 13.75 | 42.25 | 5.44 | 5.81 | 21.76 |
| | JS-9305 | 8 | 20 | 25 | 18.90 | 11.76 | 60.71 | 6.10 | 7.14 | 24.4 |
| 2014 | JS-9560 | 9.60 | 24 | 25 | 20.02 | 12.66 | 58.14 | 4.98 | 7.36 | 19.92 |
| | JS-9305 | 10.40 | 26 | 25 | 20.90 | 13.09 | 59.66 | 4.10 | 7.81 | 16.40 |
| | Total | 50 | 124 | | 18.99 | 12.57 | 51.01 | 6.00 | 6.42 | 24.03 |

on the farming community of this district as they were motivated by the improved agricultural technologies used in the front line demonstrations.

Extension gap ranged from 4.10 to 9.42q $ha^{-1}$ were observed during the study period.On an average extension gap was observed 6.0q $ha^{-1}$ which still emphasize the need to educate the farmers through trainings, various extension activities *i.e.* field days, Krishak Sanghosthi, front line demonstration for adoption of improved production and protection technologies, to revert the trend of wide extension gap. More and more use of latest production technologies with high yielding varieties will subsequently change this alarming trend of galloping extension gap. It is explicit from the data that the technology gap which is the differences between potential and yield of demonstration plots ranged from 3.98 to 7.81q $ha^{-1}$. On an average technology gap under three year FLD programme was 6.42q $ha^{-1}$. The technology gap observed might be attributing to the dissimilarity in soil fertility status and weather conditions. Similar findings were also recorded by Mitra and Samajdar (2010) and Katare *et al.* (2011).

The technology index shows the feasibility of the demonstrated technology at the farmer's field. The technology index varied from 16.40 to 37.68 per cent (Table 3). On an average technology index was observed 24.03 per cent during the three years of FLD programme, which shows the efficacy of good performance of technical interventions. This will accelerate the adoption of demonstrated technical intervention to increase the yield performance of soybean. The wider gap in technology index during the study period in certain reason may be attributed to the difference in soil fertility status, weather conditions, non-availability of irrigation water and insect-pests attack in the crop. The results confirm the findings of crop technology demonstrations on oilseed and pulse crops by Yadav and Kumar (2007); Lathwal (2010) and Tiwari and Tripathi (2014).

**Economic analysis :**

The inputs and outputs prices of commodities prevailed during the study of demonstration were taken for calculating net return and benefit: cost (Table 4). The economic analysis of the data for the study period for soybean clearly revealed that the gross return, net returns and benefit: cost were higher in FLDs where recommended practices were followed compared to farmers' practice indicating higher profitability. The cultivation of soybean under improved technologies gave on an average higher net return of Rs. 46802/ $ha^{-1}$ as compared to farmers practices (Rs.7066/ $ha^{-1}$). The benefit cost ratio of demonstration plots ranged from 3.10 to 3.60. On an average the benefit cost ratio of soybean cultivation under improved cultivation practices was recorded 3.34 as compared to 2.59 under farmer's practices. This may be due to higher yield obtained through improved technologies compared to farmers practice. This finding is in corroboration with the findings of Mokidue *et al*. (2011) and Kumari *et al*. (2007).

**Conclusion :**

Finding of the study convincingly brought out that the yield of soybean could be increased higher with the intervention on varietal replacement, integrated weed management, integrated nutrient management and integrated pest and disease management in soybean production in the Dhar district. To safeguard and sustain the food security in India, it is quite important to increase the productivity of soybean under limited resources. Significant economic impact, benefit cost ratio is self-explanatory of economic viability of the demonstration and convinced the farmers for adoption of improved technology of soybean production. It is, therefore, recommended to conduct of such demonstrations in large numbers under the transfer of technology programme by KVKs and enhance the active participation of growers in extension activities for rural development.

**Table 4 : Economic analyses of FLDs conducted on soybean in Dhar district of Madhya Pradesh**

| Year | Cost of cultivation (Rs./ $ha^{-1}$) | | Gross return (Rs./ $ha^{-1}$) | | Average net return (Rs./$ha^{-1}$) | | Benefit cost ratio (Gross return / gross cost) | |
|---|---|---|---|---|---|---|---|---|
| | DP | FP | DP | FP | DP | FP | DP | FP |
| 2012 | 16100 | 15400 | 49867 | 36553 | 33767 | 21153 | 3.10 | 2.37 |
| 2013 | 19437 | 17004 | 68440 | 47761 | 49002 | 30757 | 3.52 | 2.81 |
| | 19462 | 15800 | 69930 | 43501 | 50468 | 27701 | 3.60 | 2.75 |
| 2014 | 21218 | 17206 | 73150 | 45823 | 51932 | 28617 | 3.17 | 2.44 |
| | 21218 | 17206 | 70058 | 44310 | 48840 | 27104 | 3.30 | 2.58 |
| Mean | 19487 | 16523 | 66289 | 43589 | 46802 | 27066 | 3.34 | 2.59 |

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