



Impact of Front Line Demonstrations on Mustard Productivity and Profitability in Shivpuri District of Madhya Pradesh, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The study was carried out during 2017-18 to assess the impact of Cluster Front Line Demonstrations (CFLDs) on production and productivity enhancement of mustard crops. RVS KVV, Krishi Vigyan Kendra, Shivpuri conducted a total of 75 demonstrations in selected clusters with GPS locations over an area of 30 ha in district Shivpuri of Madhya Pradesh. The yield performance data and economics of demonstration and farmer's practice plots were compiled and analyzed for calculation of gap analysis, costs and returns. The critical inputs were identified in existing production technology through personal interaction, group meetings and discussions with farmers and KVK Scientists team. The improved technologies consisting improved variety, soil testing, seed treatment mechanized sowing, integrated nutrient and weed management, and pest and disease

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management. The average yield of improved technology demonstrations and farmers' practices were recorded as 17.80 q/ha and 14.40q/ha respectively. Overall, the 19.10 per cent increase in yield was found in demonstration plots over check plots. The average of the technology gap, extension gap, technology index and additional return were found as 2.20q/ha, 3.40 q/ha, 11 percent and Rs.11420/ha respectively. An average net return of Rs.42140/ha was found in demonstration plots as compared to Rs.30720/ha in farmers' practices and an average B:C ratio of 2.65 and 2.28 were recorded in demonstrated and farmers practices plots respectively. The higher yield and returns in demonstrations indicated that production and productivity of mustard at farmer's fields increased by adopting improved technologies. The results revealed that the CFLDs by interventions of scientific technologies gave positive effects on production and productivity in mustard crop cultivation.

Keywords: Mustard; CFLD; gap analysis; technology index; economic performance; B:C ratio.

1. INTRODUCTION

"India is the 4th largest producer of oilseeds in the world after the USA, China & Brazil and accounts for about 20 per cent of the total area under cultivation globally and accounting for 10% of global production. Oilseed crops are the second most important determinant of the agricultural economy next to cereals. In India, oilseeds account for 3% of the Gross National Products and 10% of the total value of all agricultural commodities. Oilseed production assumes great importance in India because there is a huge gap in demand and supply which resulted in import of vegetable oil worth millions of rupees per year. Among oilseed crops, rapeseed mustard is the third most important group of oilseed crops in the world after soybean and palm oil. In India, rapeseed mustard plays a significant role in the economy by providing edible oils, vegetable oils, condiments and animal feed. India is the second and third rank in cultivation area and production of mustard crops globally. Mustard seed contains an average of 34 to 43% oil content and contributes 32% of total edible oil and the total production of this crop in India is 8.08 million tones with a productivity of 1420 kg/ ha" [1]. "The major rapeseed mustard growing states are Rajasthan, Madhya Pradesh, Uttar Pradesh, Haryana, Punjab, West Bengal, Gujarat, Bihar and Assam occupies approximately 86.5% of the total area which is 5.76 million ha in the country and 91% of total production of 6.82 million tonnes. Mustard crops can be grown in both rainfed as well as irrigated condition and has higher price in market, so increased the rural economy of marginal and small farmers in our country" [1].

"Mustard crop is most important oilseed crop and plays an important role in agriculture economy in Madhya Pradesh and occupied the area under

mustard cultivation was 708 million ha with a total production of 920000 million tonnes and the average productivity of the crop was recorded at 1300 kg/ha during 2016-17" (<https://mpkrishi.mp.gov.in>). "In the Shivpuri district of Madhya Pradesh, farmers are growing mustard after soybean crop. Mustard crop plays an important role in supplementing income for small and marginal farmers of Shivpuri district and this crop was grown in 62 million ha area with production of 72000 million tones and average yield of 1204 kg/ha during 2016-17" (<https://mpkrishi.mp.gov.in>). Agriculture development is primarily depending on the application and adoption and extension of scientific technologies by making the best use of available resources.

"Frontline demonstration is the new concept of field demonstration evolved by the ICAR with the inception of the technology mission on oilseed crops during the mid-eighties" [1]. Under front line demonstrations, the introduction and transfer of improved technologies and package practices is one of the mandate of Krishi Vigyan Kendra. Cluster frontline demonstration is a unique approach to enhance the production and productivity of oilseeds crops. Demonstrations on farmer's field help to identify the constraints and potential of the crop in specific area as well as it help in socio-economic aspects of farmers. The main objective of the front line demonstrations is to transfer of scientific technology to the farmers to increase their income. The new technologies and package of practice and improved varieties will lead to the replacement the old technologies/varieties and narrow down technological gap with the adoption of newer technologies by the farmers.

Cluster frontline demonstration is a unique and powerful approach for transfer of technology and

to enhance the production and productivity of oilseeds crops. Since, mustard is the most important oilseed crop in central region of Madhya Pradesh. Keeping these factors and the importance of CFLDs, RVS KVV, Krishi Vigyan Kendra, Shivpuri (M.P.) conducted the demonstrations of improved variety with technology and package of practice under CFLD programme to enhance the production and productivity of the mustard during Rabi 2017-18, funded by ICAR-ATARI, Zone-IX, and Jabalpur. Demonstrations were conducted under the supervision of KVKS Scientists to disseminate the technologies among the farmers and to get their feedback about the demonstrated technologies.

2. METHODOLOGY

A total of 75 farmers were selected from different clusters and blocks of Shivpuri district to conduct the 75 Cluster Frontline Demonstrations (CFLDs) on farmers field with GPS locations which covered an area of 30 ha with plot size 0.4 ha. Cluster frontline demonstrations were conducted during Rabi 2017-18 to evaluate the performance of RVM-2 improved variety of mustard procured from ZARS, Morena (M.P.). Layout of demonstrations was followed as suggested by Chaudhary [2] for the selection of site and farmers. Before conducting cluster demonstration, a list of farmers was prepared from group meetings and specific skill training was conducted for the selected farmers regarding detail package of practices of mustard crop. Krishi Vigyan Kendra Shivpuri facilitated the farmers to conduct effective demonstrations and extension, monitoring and visit time to time on fields. All the technological interventions were taken as per prescribed package of practices for improved variety of mustard (Table 1). The grain yield, technology and extension gap analysis, net return and additional return, B:C ratio parameters were recorded (Table 2& Table 3). Assessment of gap in adoption of recommended/demonstrated technology before laying out the CFLDs through personal discussion with selected farmers. The feedback from the farmers were also recorded for further improvement in extension programmes. The extension activities i.e., trainings, Scientist's field visits and crop field days were organized at the CFLDs locations. Demonstration base line survey were carried out to find out the problem under mustard cultivation area and it was observed that lower crop yield was mainly due to

use of poor quality seed, local variety, no seed treatment, no soil testing, improper method of sowing and indiscriminate use of inorganic fertilizer. The proven technology and package of practices included high-yielding and new varieties, soil testing, seed rate, seed treatment, timely sowing, line sowing, maintenance of optimum plant population, fertilizer management, plant protection measures etc. The information of basic data and output were collected from both cluster demonstrations as well as farmer's practice plots (control). In the study, technology index was operationally defined as the technical feasibility obtained due to implementation of demonstration in mustard (Ghintala et al., 2018) [1] and finally the extension gap, technology gap and technology index were calculated as formula suggested by Samui et al., [3,4] and performance data has been recorded, compiled and compared for interpretation and inference.

$$\text{Extension gap} = \text{Demonstrated yield} - \text{Farmer's practice yield}$$

$$\text{Technology gap} = \text{Potential yield} - \text{Demonstration yield}$$

$$\text{Additional return} = \text{Demonstration return} - \text{Farmer's practice return}$$

$$\text{Technology index (\%)} = (\text{Potential yield} - \text{Demonstration yield}) / \text{Potential yield} \times 100$$

3. RESULTS AND DISCUSSION

3.1 Technological Intervention on Cluster Demonstrations

Krishi Vigyan Kendra Scientists and farmers made efforts in collaborative manner for making difference in higher production and productivity of mustard in the Shivpuri district of Madhya Pradesh. The recommended/demonstrated packages of practices were followed to conduct CFLDs at the farmer's field in different clusters. The major differences were observed between demonstration package and farmer's practices are regarding recommended varieties, seed rate, seed treatment, soil testing, and fertilizer dose, method of fertilizer application and plant protection measures. Details of demonstration package and existing practices (farmer's practice) under mustard crop cultivation are given in Table 1.

Table 1. Details of demonstration package and existing practices (farmer's practice) under mustard crop cultivation

| Intervention | Farmer's Practices | Demonstrated/recommended practices (CFLD) | Gap |
|---------------------------|---|--|----------------|
| Farming situation | Irrigated | Irrigated | - |
| Cropping system | Soybean-Mustard | Soybean-Mustard | - |
| Summer deep ploughing | No | Summer deep ploughing | Fully gap |
| Soil treatment | No soil treatment | <i>Trichodarma virdi</i> 5 kg/ha with 20 kg rotten Cow dung (FYM) | Fully gap |
| Variety | Local | Improved variety RVM-2 | Fully gap |
| Seed rate (kg/ha) | 6-8 | 5 | More seed rate |
| Seed treatment | No application | Seed treatment with Carbendazim @ 3 g/kg seed, and imidachloprid @ 4 ml/kg seed | Fully gap |
| Spacing | Un uniform plant population | Plant to plant 10-15 cm Row to row 30 | Partially gap |
| Method of sowing | Line sowing by seed drill with mixing of seed and fertilizer | Line sowing with seed cum fertilizer drill | Partially gap |
| Nutrient management | Indiscriminate and imbalance fertilizer (NPK: 60:30:00) | Balance dose of fertilizer based on soil testing (NPKS: 80:40:20:30) | Fully gap |
| Irrigations | Irrigation not taken in explanation of critical stages | Needs 2 irrigations, first at branching stage (30 DAS) and the second at pod formation stage (60-65 DAS) | Fully gap |
| Thinning | No thinning practice | 25-25 DAS | Fully gap |
| Weed management | No hand weeding | Hand weeding | Fully gap |
| Plant protection measures | Indiscriminate use of pesticides and fungicides | Integrated pest and disease management practice for the management of pest and diseases. | Fully gap |
| Harvesting and threshing | Harvested of over-matured crops causes shattering and losses of grains. Not considered of seed moisture content at harvesting and storage time. | Harvested as the pods turn yellowish and moisture content of the seed is about 40%. Storage of mustard seed at 8 % moisture content. | Partially gap |

Table 2. Gain yield performance and gap analysis of mustard under farmer's practice and cluster front line demonstration

| Particulars | Grain yield (q/ha) | % increased yield over FP | Technology gap (q/ha) | Extension gap (q/ha) | Technology index (%) |
|--------------------------------|-----------------------|------------------------------|--------------------------|-------------------------|-------------------------|
| Farmer's plot (Local check) | 14.40 | - | - | - | - |
| Demonstration plot | 17.80 | 19.10 | 2.20 | 3.40 | 11.00 |

Table 3. Economic performance of mustard crop under farmer's practice and cluster front line demonstration

| Particulars | Cost of cultivation (Rs./ha) | Gross Return (Rs./ha) | Net Return (Rs/ha) | B:C Ratio |
|-----------------------------|---------------------------------|--------------------------|-----------------------|-----------|
| Farmer's plot (local check) | 24000 | 54720 | 30720 | 2.28 |
| Demonstration plot | 25500 | 67640 | 42140 | 2.65 |
| Additional in demonstration | 1500 | 12920 | 11420 | 8.61* |

**Incremental benefit cost ratio*



Fig. 1. Field experiment

3.1.1 Grain yield

During the period of study, it was found that the average grain yield of cluster demonstrations were recorded as 17.80 q/ha as compared to average local check (farmer's plots) yield of 14.40 q/ha and the percentage increase in the demonstration yield over local check was recorded as 19.10. Similar yield enhancement results in different crops under demonstration were documented by Suryawanshi and Prakash [5] Samui et al., [3] Hiremath et al., [6] Mishra et al., [7] Dhaka et al., [8] Kumar et al., [9] Deshmukh et al., [10] Singh et al., [11] Singh [12] and Singh et al., [13]. Gain yield performance and gap analysis of mustard under farmer's practice and CFLD plots are given in Table 2. From these results it is evident that the performance of improved variety was found better than the farmer's practice (local check) under same agro-ecological conditions. Farmers were motivated by performance technological interventions in the CFLDs and it is expected that they would adopt and extension these package and practice technologies in the next years.

3.2 Technology Gap, Extension Gap and Technology Index

Gap analysis of mustard cultivation under farmer's practice and CFLDs are presented in Table 2. Yield of the CFLDs and potential yield of the crop was compared to evaluate the yield gap/technology gap which was further categorized into technology index. The technology gap presents the gap in the demonstration yield over potential yield or there is a gap between the potential yield and demonstration yield and it was found 2.20 q/ha. This may be attributed to dissimilarities in soil fertility, salinity, environmental/climatic and weather situations, varietal suitability and

adoption of technological practices. Similar results were reported by Patel et al., [14]. Hence, location specific recommendations may become necessary to narrow down the technology gap.

The extension gap indicating the need to educate and enhance the skills of the farmers through proper various extension approaches for the adoption of improved variety and technology, package and practices. The lower value of technology index indicated the feasibility of the demonstrated mustard crop production technology. More and more adoption of latest production technologies with high yielding variety will subsequently change this alarming trend of galloping extension gap.

Technology Index shows the feasibility of the technology and improved variety at the farmer's field. The lower the value of the technology index more is the feasibility of the particular technology and variety. The value of technology index was found as 11% (Table 2). These results are in consonance with the findings of Singh et al., [15] Patel et al., [14] and Singh [12].

3.3 Economic Analysis of Mustard Cultivation

The economics performance of mustard production in gird agro-climatic zoneunder CFLDs were evaluated and results are presented in Table 3. The overall average net returns and B:C ratio of demonstration was Rs. 42140 per ha and 2.65whereas for farmer' practice (control check)was Rs.30720 per ha and 2.28, respectively (Table 3). This improvement in yield of demonstration plots might be due to the application of seed treatment, balance dose of fertilizers, timely sowing, mechanical sowing method, proper and timely weed management and integrated pest and diseases management practices. The results revealed that the CFLDs

gave good impact over the farmers practice (control check)". Hirenmath et al., (2007), and Hirenmath and Nagaraju [16].

Further, additional cost of Rs.1500 per ha in demonstration was increased additional net returns Rs.11420 per ha with incremental B:C ratio 8.28 suggesting it has higher profitability and economic viability of the demonstration. The higher additional returns obtained under demonstrations could be due to improved production technology and regular scientific monitoring of Scientists of Krishi Vigyan Kendra. More and less similar results were also reported by Hirenmath et al., (2007) Dhaka et al., [8] Lathwal [17] Patel et al., [10] and Singh et al., [18].

4. CONCLUSION

The average yield of demonstrations and farmers practices were recorded as 17.80 q/ha and 14.40 respectively. The average of technology gap, extension gap, technology index and additional return were found as 2.20q/ha, 3.40 q/ha, 11 percent and Rs.11420/ha respectively. Average net return of Rs.42140/ha was found in demonstrations plots over farmers practices as Rs.30720/ha and average B:C ratio of 2.65 and 2.28 were recorded in demonstrated plots and farmers practices respectively. Cluster front line demonstrations gave higher yield and net returns with improved production technologies than the existing farmer's practice. The higher yields and returns in demonstrations showed that production and productivity of mustard crop at farmer's fields increased by adopting improved variety and technologies. Therefore, the results advocated that the cluster front line demonstrations by intervention of improved variety and technology gave positive effects of production and productivity of mustard crop. It can be concluded that cluster demonstrations increased mustard crop production and productivity by inspiring farmers to adopt new production technology.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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