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

Abstract

The study was carried during 2017-18 to assess the impact of Cluster Front Line Demonstrations (CFLDs) on production and productivity enhancement of mustard crop. RVSKVV, Krishi Vigyan Kendra, Shivpuri were 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 management. The average yield of improved technology demonstrations and farmers practices were recorded as 17.80 q/ha and 14.40q/ha respectively. On overall, the 19.10 per cent increase in yield was found in demonstration plots over check plots. The average of technology gap, extension gap, technology index and additional return were found as2.20q/ha, 3.40 q/ha, 11 percent and Rs.11420/ha respectively. Average net return ofRs.42140/ha was found in demonstration plots as compared to Rs.30720/ha in farmers practices and 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 of production and productivity in mustard crop cultivation.

***Keywords*:** Mustard, CFLD, gap analysis, technology index, economic performance, B:C ratio

Introduction

India is the 4thlargest producer of oilseeds in world after USA, China & Brazil and accounts for about 20 per cent of the total area under cultivation globally and accounting 10% of global production. Oilseed crops are the second most important determinant of agricultural economy next to cereals. In India, oilseeds account for 3% to the Gross National Products and 10% to the total value of all agricultural commodities. Oilseed production assumes great importance in India because there is the huge gap in demand and supply which was resulted in import of vegetables oil worth millions of rupees per year. Among oilseed crops, rapeseed mustard is the third important group of oilseed crops in the world after soybean and palm oil. In India rapeseed mustard plays a significant role in economy by providing edible oils, vegetables oils, condiments and animal feed. India is the second and third rank in cultivation area and production of mustard crop globally. Mustard seed contains average 34 to 43% oil content and contributes for 32% of total edible oil and total production of this crop in India is 8.08 million tones with a productivity of 1420 kg/ ha (Ghintala *et al.*,2018).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 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.

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 was708 million ha with total production of 920000million tones and average productivity of crop recorded 1300 kg/ha during 2016-17 (https://mpkrishi.mp.gov.in). In Shivpuri district of Madhya Pradesh, farmers are growing mustard after soybean crop. Mustard crop plays a 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). The agriculture development is primarily depending on the application and adoption and extension of the 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 mid-eighties (Ghintala *et al.*, 2018). Under front line demonstrations, introduction and transfer of improved technologies and package practices is the one of the mandate of Krishi Vigyan Kendra. Cluster frontline demonstration is a unique approach to enhance the production and productivity of oilseeds crops. Demonstration 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 increasing their income. The new technologies and package of practice and improved varieties will lead to 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 the Madhya Pradesh. Keeping these factors and the importance of CFLDs, RVSKVV, Krishi Vigan 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.

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 (1999) for the selection of site and farmers. Before conducting cluster demonstration, a list of farmers was prepared from group meeting 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) and finally the extension gap, technology gap and technology index were calculated as formula suggested by Samui *et al.,* (2000) and Yadav *et al.*,(2004) and performance data has been recorded, compiled and compared for interpretation and inference.

Extension gap = Demonstrated yield - Farmer's practice yield

Technology gap= Potential yield - Demonstration yield

Additional return= Demonstration return- Farmer's practice return

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

Results and Discussion

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.

Grain yield

During the period of study, it was found that the average grain yield of cluster demonstrations were recorded as17.80 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 Surywanshi and Prakash (1993), Samui *et al.,* (2000), Hiremath *et al.,*(2007), Mishra *et al.,*(2009), Dhaka *et al.,*(2010), Kumar *et al.,* (2010), Deshmukh *et al.,* (2014), Singh *et al.,*(2014), Singh (2015) and Singh *et al.,* (2017). 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.

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.,*

(2013). 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.*, (2007), Patel *et al.*, (2013) and Singh (2015).

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).These findings are in accordance with the finding of Hirenmath *et al.*, (2007), and Hirenmath and Nagaraju (2009).

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.*, (2010), Lathwal (2010), Patel *et al.*, (2013) and Singh *et al.*, (2012).

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 the production and productivity of mustard crop increased through cluster demonstrations approach by motivating the farmers for the adoption of improved production technologies.

References

1. Ghintala Akshaya, Bheiru Singh and Mukesh Kumar Verma (2018). Impact of front line demonstrations on mustard productivity in Hanumangarh District of Rajasthan, India. *Int.J.Curr.Microbiol.App.Sci.* 7(09): 1942-1946.
2. Choudhary, B.N.(1999). Krishi Vigyan Kendra- a guide for KVK mangers. Pub. Division of Agricultural Extension, ICAR; pp. 73-78.
3. Dhaka, B. L., Meena, B. S. and Suwalka, R. L. (2010).Popularization of Improved Maize production technology through frontline demonstrations in south-eastern Rajasthan. *Journal of Agri. Sci.,* 1(1):39-42.
4. Deshmukh G, Patel H.B., and Patel. M.R. (2014). Frontline Demonstration Influences on Knowledge and Adoption of Mustard Growers. Guj. J. Ext. Edu.: 25 (1): 27-30.
5. Hiremath, S. M., Nagaraju, M. V. and Shashidhar, K. K. (2007). Impact of frontline demonstration on onion productivity in farmers field. *Nation. Sem. Appropriate Extn. Strat. Manag. Rural Resources, Univ. agric. Sci. Dharward.* December 18-20:100.

6. Hiremath, S. M. and Nagaraju, M. V. (2009). Evaluation of frontline demonstration trails on onion in Haveri district of Karnataka. *Karnataka j. of agric. Sci.*, 22(5): 1092-1093.
7. https://mpkrishi.mp.gov.in
8. Kumar, A., Kumar, R., Yadav, V.P.S. and Kumar, R. (2010). Impact Assessment of Frontline Demonstrations of Bajara in Haryana State. *Indian Res. J. Ext. Edu*. 10 (1): 105-108.
9. Lathwal, O.P. (2010). Evaluation of frontline demonstrations on black gram in irrigated agro ecosystem. Annals of Agril. Res. 31(1&2): 24-27.
10. Mishra, D.K., Paliwal, D.K., Tailor, R.S. and Deshwal A.K. (2009). Impact of Front line Demonstrations on yield enhancement of Potato. *Indian Res. J. Ext. Edu.* 9(3)26-28.
11. Patel, M. M., Jhajharia, A. K., Khadda, B. S. and Patil, L. M. (2013). Frontline demonstration: An effective communication approach for dissemination of sustainable cotton production technology. *Ind. J. Extn. Edu. & R.D.*, 21: 60-62.
12. Samuei, S. K., Miha, S., Roy, D. K., Mandal, A. K. and Saha, D. (2000). Evaluation of Frontline demonstration on groundnut. Journal of Indian Society Coastal Agril. Res., 18:180-183.
13. Singh, D. K. Gautam, U. S. and Singh R. K. (2007). Study on yield gap and level of demonstrated crop production technology in Sagar district. *Ind. Res. J. Extn. Edu.*, 7(2&3):94-95.
14. Singh Jagmohan, Dhillon B.S., Asthaand Parvinder Singh (2012). Front line demonstration – An effective tool for increasing the productivity of summer moong in Amritsar district of Punjab. Asian Journal of Soil Science, 7(2): 315-318.
15. Singh SRK, Mishra A, Gautam US, Dwivedi AP, Prem Chand (2014).Scouting technological vis-à-vis extension gaps in soybean production in Madhya Pradesh. Ind. Res. J. of Ext. Edu.:14(2):41-45.
16. Singh, D. (2015). Impact of front line demonstrations on productivity of Carrot in Dholpur district of Eastern Rajasthan. *Ind. J. Extn. Edu. &R.D.*, 7(2&3):94-95.
17. Singh, R. K., Jaiswal, R. K., Kirar, B. S., & Mishra, P. K. (2017). Performance of improved varieties of pulse crops at farmers'field in Kymore plateau and Satpura hills zone of Madhya Pradesh. Indian Journal of Extension Education, 53(4), 136-139.

18. Suryawanshi, S.D. and Prakash, M. (1993). Impact of viable technology of promoting oil seeds. *Maharastra Indian Journal of Agricultural Economics* 48: 420. 94-95.

19. Yadav, D.B., Kamboj, B.K. and Garg, R.B. (2004). Increasing the productivity and profitability of sunflower through front line demonstrations in irrigated agro-ecosystem of eastern Haryana. Journal of Agronomy, 20:33-35.

Fig 1 : Field experiment

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	*Trichodarma* virdi 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