

Original Research Article

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Impact Analysis of Front Line Demonstrations on Yield and Economics of Mustard Crop in Banda District of Bundelkhand, Uttar Pradesh, India

B. K. Gupta*, Vivek Singh, B. K. Singh, Narendra Singh and B. P. Mishra

Agricultural Extension, Banda University of Agriculture and Technology, Banda, U.P., India

*Corresponding author

ABSTRACT

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Rapeseed is grown in irrigated and non-irrigated condition as a rain fed crop. Production of rapeseed is also limited owing to non adoption of recommended agronomic which reduce the yield to a greater extent. The present study was carried out in 23 villages of Banda district of Bundelkhand, Uttar Pradesh, to know the impact and yield gaps between improved package of practices (IP) under Front Line Demonstration (FLD) and existing farmer's practice (FP) of mustard crops. Yield attributes of both demonstration and farmers' practice were recorded and their yield gap, technology gap, extension gap and technology index were analysed. The study shows that the yield of rapeseed –mustard in IP ranged from 11.75 qha⁻¹ to 13.75 qha⁻¹ whereas in FP it ranged between 08.55 qha⁻¹ to 10.45 qha⁻¹. The per cent increase in yield with IP over FP was recorded in the range of 29.19 to 44.23 percent. The technological gap and extension gap were ranging between 1.50–3.25 qha⁻¹ and 3.05–3.68 qha⁻¹, respectively and the technological index 10.00 to 21.67 percent was recorded. The benefits cost ratio was 1.8- 3.5 under demonstration, while it was 1.4 to 2.2 under farmers practice. The result convincingly brought out that the yield of oil seed can be increase with the intervention on recommended package of practices. This also improved linkages between farmers and scientists, and built confidence for adoption of the improved technology.

Introduction

Rapeseed – mustard crops in India are grown in diverse agro climatic conditions ranging from north-eastern /north –western hills to down south under irrigated /rain fed timely/late sown, saline and mixed cropping. Indian mustard account for about 75-80% of the 6.07m ha under this crops in the country during 2016-2017 crop season. India is the third largest rapeseed and mustard growing countries in the world after Canada and

China. Globally, India accounts for 19.8 % of the total acreage and 09.8 % per cent of the total production of the world (USDA 2016-17).

Rapeseed and mustard have caught the infatuation of farmers in Bundelkhand region is more particular area where the major crops are grown in rabi session only. Soybean, rapeseed-mustard and groundnut are the major oilseed crops in India contributing nearly 84% to 88% to its total acreage and

production. Due to various factors the productivity of the crop is poor and it varies from year to year and place to place.

The mustard growing areas in India are experiencing the vast diversity in the agroclimatic conditions and different species of rapeseed-mustard are grown in some or other parts of the country (Shekhawat *et al.*, 2012). Mustard/ rapeseed belong to the family Brassicaceae (Cruciferae). Two species of mustard and rapeseed are *Brassica campestris* and *Brassica juncea*. Oil content in the seed of toria is about 35 to 40%. Its seed and oil is widely used in the preparation of different recipes like, vegetables, curries, pickles, medicines, hair oil and manufacture of greases. The oil cake is used as feed of cattle and manures for the plants. Oil cake is very useful for increase milk in milch cattle's. The leaves of young plants are used as green leafy vegetables and whole green plant is used as green fodder for animals.

In Bundelkhand region of Uttar Pradesh generally mustard are shown in month of September to mid of November and more are less in Banda district also. But most feasible and suitable time as per the farmers convenient during mid September to mid October when Kharif crops are harvested if any. In Bundelkhand mono cropping system is popular among the farming community due to the lack of assured irrigation facilities and other important factors farmers have to utilize the soil moisture as soon as possible, so preferably they shown the crop in month of last week of September to first week of October. Harvesting of kharif crop is done in the month of September to October. In Uttar Pradesh, Rai/mustard and toria is major oilseed crop of rabi season. It is grown in 0.68 million hectare area with total production of 0.95 million ton having productivity of 13.92 qha⁻¹. In district Banda, total area is 7562 ha. with a production of 6517 MT having

productivity of 8.62 qha⁻¹ (Directorate of Economics & Statistics, DAC&FW 2018). Banda district of Bundelkhand, U.P has a substantial area under mustard and rapeseed cultivation but the productivity level is quite low. The various reasons for low productivity like different production practices, insufficient knowledge of scientific cultivation, local varieties, location specific production and protection technologies and their management practices at farmer's field. Keeping the above points in view, the FLD's on mustard and rapeseed using improved production technologies was conducted with the following objectives include to showing the production potential and production technologies of new mustard variety under actual farm situation; to compare the yield of FLDs plot and Farmers plot (check plot) and also to find out the technology gap, extension gap, technology index and economic impact of mustard.

Materials and Methods

A study was conducted in Banda district of Bundelkhand, U.P by the group of scientists of Banda University of Agriculture and Technology, Banda in the farmers field of 23 different villages of Banda district an area of 28.8 hectare was covered with plot size one acre under front line demonstration with active participation of farmers selected as respondents by following simple random sampling method. Total of 72 FLDs was conducted during *Rabi* season in three consecutive years (2016-17 - 2018-19). The ten best management practices (BMP) were selected comprised improved and location-specific varieties (NRCHB 101), time of sowing, seed rate (1.5 kg/ acre), seed treatment, sowing method (line sowing), spacing, nutrient management, irrigation, timely weed management and plant protection measures (control of aphid through insecticide). During these three years of

study, before conducting FLDs, a list of farmers of selected villages was prepared from group meeting and specific skill training was imparted to the selected farmers. The FLDs were conducted on farmers' field and monitored by experts.

The yield and economic performance data of demonstrations were collected for study the technology gap between the potential yield and demonstrated yield, extension gap between demonstrated yield and yield under existing practice and work out the technology index. The yield data were collected from both fields of demonstration and farmers practice by random crop cutting method and analyzed by using simple statistical tools. The observation on seed yield, straw yield per ha were recorded. To quantify the technology gap, extension gap and technology index the following formula was used:

Technology Gap (qha^{-1}) = Potential Yield – Demonstration Yield

Extension Gap (qha^{-1}) = Demonstration Yield – Farmers Yield (Check Yield)

Technology Index (%) = Technology Gap / Potential Yield X 100

Results and Discussion

The above study on mustard, the Table 1 indicates the detailed information about package of practices are used in demonstration of mustard crop as well as farmers practice. In the demonstration plot the cultivation practices includes improved and location-specific variety (NRCHB 101), time of sowing, seed rate (1.5 kg/ acre), seed treatment, sowing method (line sowing), spacing, nutrient management, irrigation, timely weed management and plant protection measures.

It is revealed from Table 2 the total 72 Front Line Demonstrations was conducted during three consecutive years (2016-17 to 2018-19) in 28.8 ha area on farmer's fields of 23 different villages of Banda district of Bundelkhand region.

It is revealed from Table 3 yield of mustard in different demonstration plots was recorded and it ranged between 11.75 qha^{-1} to 13.75 qha^{-1} and yield under farmers practice with local non descriptive variety recorded and it ranged between 08.55 qha^{-1} to 10.45 qha^{-1} . during the study period. The demonstrated plot was recorded 29.19 to 44.23 per cent higher yield over farmer's variety. On an average 36.95 per cent increase in yield was recorded in the demonstration plots. Whereas, average farmers yield was recorded only 09.11 qha^{-1} .

The various factors are involved for the poor productivity in farmers practice like use of local non descriptive variety, early or late sowing may be due to owing to early or late vacation of field after harvesting of kharif crops and utilized the soil moisture for better germination of mustard as well as to avoid additional irrigation before sowing etc. During the month of September and October the temperature of this region are comparatively high (36°C to 43°C) so they utilize soil moisture as soon as possible after harvesting of kharif crops. Besides these, farmers are not much serious about other important practices like application of recommended fertilizer doses before or after sowing, excess use of seed rate and low level of agronomic practices in addition to non-utilization of resources in time.

The results clearly depicts that positive effects of FLDs over the existing farmers practices towards enhancing the yield of mustard crops in Banda district with its positive effects on yield. These results are in conformity with the

findings of *Mitra and Samajdar (2010)* in FLD on rapeseed and mustard and of *Rathod et al., (2013)* in soybean produced on an average 38.83% more yield of rapeseed as compared to local practices.

The findings are in similarity with the findings of *Singh (2002)*, *Dhaka et.al. (2015)*, *Lal et al., (2016)* and *Poonia & Pithia (2011)*. The results are also in line with the findings of *Katare et al., (2011)*, *Meena et al., (2012)* and *Tomar et al., (2003)*.

Technology gap

It is revealed from Table 4 the technology gap

in the demonstrated yield over potential yield was recorded 3.25, 3.00 and 1.50 q ha⁻¹. in the year 2016, 2017 and 2018 respectively. It is also depicted from Table 4 that the average technology gap was 2.59 q ha⁻¹ during the period of study. The technology gap ranging between 1.50-3.25 qha⁻¹ reflected that the cooperation from farmer's side is appreciable in conducting FLDs with encouraging results in subsequent years. The variation in technology gap observed may be attributed to variation in soil fertility status and management practices. Similar finding was recorded by *Mitra et al., (2010)* and *Katare et al., (2011)*.

Table1 Parameters and package of practices are used in demonstration of mustard crop as well as farmers practice

Parameters	Demo. package	Farmers' practice
Improved and location-specific varieties	NRCHB101	Local/ non descriptive
Time of sowing	Last Week of October to 1st fortnight of November	First week of October to December
Seed rate	4 kg ha ⁻¹	8-10 kg ha ⁻¹
Seed treatment	Thiram @ 2gm/kg seed	No scheduled
Sowing method	Line sowing	Broadcasting / Traditional
Spacing (cm)	30-45 X10	No specific
Nutrient Management (Ferti. dose in Kg. NPKS)	40:35:15: 10/ ha.	20:20:0:0/ha.
Irrigation	One irrigation of 6 cm depth at 50% flowering stage	No scheduled irrigation
Timely weed management	Two hand weeding @ 25 and 45 days and thinning @ 25 days	No scheduled
Plant Protection measures	Against aphid (<i>Lipaphis erysimi</i>) Foliar spray of 625ml Dimethoate 30EC in 200 liter water per ha.	Nil

Table.2 Year wise detail of front line demonstrations on mustard

Year	Crop	Variety	Total Village	Area (ha)	No. of FLDs
2016-2017	Mustard	NRCHB-101	08	9.6	24
2017-2018	Mustard	NRCHB-101	07	9.6	24
2018-2019	Mustard	NRCHB-101	08	9.6	24
TOTAL			23	28.8	72

Table.3 Yield performance of mustard crop (Pooled data)

Year	Yield (q ha ⁻¹)			Additional Yield over local check (q/ha)	Percent Increase Yield over local check (%)
	Potential Yield (PY)	Check Yield (FP)	Demo Yield (IP)		
2016	15.00	08.55	11.75	03.20	37.43
2017	15.00	08.32	12.00	03.68	44.23
2018	15.00	10.45	13.50	03.05	29.19
Mean	15.00	09.11	12.42	03.31	36.95

Table.4 Analysis of technology gap, extension gap and technology index in mustard crop under FLDs (pooled data)

Year	Technology Gap (q/ha) TG = PY – IP or DP	Extension Gap (q/ha) EG = IP or DP – FP	Technology Index (%) TI = Tech. Gap/PY X 100
2016	03.25	03.20	21.67
2017	03.00	03.68	20.00
2018	01.50	03.05	10.00
MEAN	02.59	03.31	17.23

Table.5 Economic analysis of the demonstrated plot of mustard under FLDs (Pooled data)

Year	Cost of Cultivation (Rs/ha)		Gross Return (Rs/ha)		Net Return (Rs/ha)		B:C Ratio	
	IP	FP	IP	FP	IP	FP	FP	IP
2016	18000	14500	39645	27089	21645	12589	1.86	2.2
2017	20500	16000	43586	32790	23086	16790	2.04	2.12
2018	22500	17000	46282	34764	23782	17764	2.04	2.05
MEAN	20334	15834	43171	31544	22838	15715	1.99	2.12

Extension gap

The extension gap showed an increasing trend in yield. The highest extension gap of 3.68 q ha⁻¹ was recorded during year 2017-18 followed by 3.20 q ha⁻¹ during the year 2016-17 and the gap was least 3.05 q ha⁻¹. During 2018-19 of study. The table also shows that the average extension gap was recorded 3.31 q ha⁻¹. It is because of the farmers generally not aware about HYV and lost yield potential of the non-descriptive varieties due

to continuous use year after years. Package of practices which is recommended by scientist with best course of action. To minimise the extension gap it need to be find out the some basic cause, educate them and plan the appropriate extension strategies through various means for adoption of improved technologies. The light of hope exists in decreasing trend of the extension gap with the continuity of the study in specific area through demonstration and other appropriate extension methods.

Technology index

The technology index shows the feasibility of the evolved technology at the farmers' fields and the lower the value of technology index more feasibility of the technology. Table 4 shows the technology index and it ranged from 10.00 to 21.67. During the study year 2016-17 the technological index 21.67 percent was recorded followed by 20.00 percent during the year to 2017-18 and the technological index was recorded during the year 2018-19 is 10.00 percent and the average value of technological index during the study year from 2016 to 2018 was 17.23 percent. The table clearly indicate that the values are in decreasing trends which proves the feasibility of the technology demonstrated in farmer's field. These results are line with the earlier findings of Mitra and Samajdar (2010) who indicate that lower the value of technology index, more is the feasibility of the technology demonstrated. Similar findings were also reported by Kirar *et al.*, (2006), Meena *et al.*, (2016), Singh *et al.*, (2014).

Economic analysis of the demonstrated plot

It is revealed from Table 5 that the average cost of cultivation of mustard crop in demonstrated plot is Rs. 20334 /ha and the average cost of cultivation of farmers plot is Rs. 15834 /ha. The gross return of demonstrated plot was recorded Rs. 43171/ha as compare to farmers plot (check plot) Rs 31544/ha and Net return Rs 22838/ha was recorded high in demonstrated plot as compare to farmers plot (check plot) Rs 15715 /ha. The benefit cost ratio (B: C ratio) of demonstrated plot was 2.12 and of 1.99 of farmers plot (check plot). This may be due to higher yield obtained and lower cost of cultivation under improved technologies compared to farmers practice (local check). This finding is in corroboration with the findings of Mokidue *et al.*, (2011), Verma *et*

al., (2016) and Raj *et al.*, (2013). Hence, higher B:C ratios proved economic viability of the interventions made under FLD. Similar findings were also reported by Balai *et al.*, (2012) in rapeseed and mustard and Sharma (2003) in moth bean.

In conclusion front line demonstration (FLDs) play a very important role to disseminate recommended technologies among the farming community and it shows the potential of technology resulting an increased in yield at farmer's level. The result convincingly brought out that the yield of oil seed can be increase with the intervention on recommended package of practices. This also improved linkages between farmers and scientists, and built confidence for adoption of the improved technology. Productivity enhancement under FLDs over farmer practices of pulses cultivation created a greater awareness, and motivated other farmers those who do not growing mustard crops they also adopt improved technologies. These practices may be popularized in this area through different means of transfer of technology by the extension agencies.

Consent

As per international standard farmers written consent has been collected and preserved by the author(s) for conducting demonstration.

Competing interests

Authors have declared that no competing interests exist.

Authors' contributions

The work is carried out by the contribution of all the Authors. Author BKG, designed and conducted the demonstrations at farmer's field. Author VS, BKS and NS supervised and provided necessary support to team for

smooth execution of demonstrations. Author BKG and BPM wrote the first draft of manuscript and statistically analyzed.

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