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Impact of Frontline Demonstrations on Mustard in Sahibganj District of Jharkhand

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ABSTRACT

Cluster Frontline Demonstrations (CFLDs) on mustard were conducted during 2016-17 to 2019-20 in ten villages of Sahibganj district of Jharkhand covering 641 farmers and 250 ha area to evaluate the impact of scientific production techniques on productivity and profitability. Performance of mustard varieties Pusa Mahek and Pusa Mustard 26 in 641 locations along with improved cultivation practices were evaluated during demonstrations. It was observed that the yield of mustard in CFLD under irrigated conditions ranged from 10.82 q to 12.36 q ha^{-1} whereas in Farmer's Practice (FP) it ranged between 7.3 to 8.5 q ha^{-1}. The per cent increase in yield was recorded in the range of 45.06 to 48.21. The extension gap and technological index ranged between 3.52 to 3.86 q ha^{-1} and 27.29 to 36.35 per cent, respectively. The trend of technology gap reflected the farmer's cooperation in carrying out demonstrations with encouraging results in subsequent years. Maximum gross return (Rs 51,912 ha^{-1}) and net return (Rs 25,912 ha^{-1}) was fetched during four observation years. The benefit cost ratio varied from 1.71 to 2.05 under demonstration, while it was 1.39 to 1.70 under farmer's practice. Therefore, the results clearly indicate that the use of improved variety and package of practice with scientific intervention under cluster frontline demonstration programme contribute to increase the productivity and profitability of mustard.

INTRODUCTION

India holds a significant share in world oilseed production. It is the third largest producer of rapeseed after China and Canada. The area under major oilseeds viz., rapeseed and mustard, groundnut, sesamum, linseed, castor, soyabean, cottonseed, sunflower, safflower and niger seed occupied 20 per cent of net area sown. It must, however be noted that the production of oilseeds has always fallen short of our demand and there always been a need to import oilseeds or their products. Total oilseeds production in the country during 2016-17 was estimated at 35.40 million tons (MT). The oilseeds account for nearly 3 per cent of the gross national product and 10 per cent of the value of all agricultural products. With limited scope of bringing additional area under oilseeds, an increase in oilseed production will have to come primarily from land saving to technologies highlighting. Further, there is a large-scale regional variation in the area, production and productivity of oilseeds in India.

Mustard is among the oldest recorded spices as seen in Sanskrit records dating back to about 3000 BC (Mehra, 1968) and was one of the first domesticated crops. Originally, it was the condiment that was known as mustard and the word was derived from the Latin "mustum". Apart from its use as a condiment, its medicinal value also was recognized early, as it was mentioned by Pythagoras in 530 BC as a remedy for scorpion bites. In India the mustard-rapeseed is the most important oilseed crop after groundnut accounting around 25 per cent of the total oilseed production. It is one of the important oilseed crops of the Indo-gangetic plains. Indian mustard (Rai) cultivation has occupied about 85-90 per cent of the total area under cultivation of mustard-

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rapeseed. Besides, the use of oil obtained from mustard-rapeseed, the seeds, sprouts, leaves, tender plants are also useful to human health, when they are consumed as spices and vegetables. They contain selenium, calcium, magnesium, iron, phosphorus, zinc, manganese etc. In Jharkhand mustard occupies a major position in terms of area, production and productivity among the oilseeds. Mustard is also an important oilseed crop in Sahibganj district covering over 14,000 ha with an average productivity of 5.3 q/ha which is well below the state average (7.29 q/ha) and national average (12.7 q/ha). Unavailability of improved variety as well as non-adoption of scientific cultivation practices in the district is one of the possible reasons for lower average productivity of mustard in the district. Keeping this in view the present demonstrations were conducted with high yielding varieties viz. Pusa Mahek and Pusa Mustard 26 and improved package and practices to enhance productivity and profitability of mustard in the district.

METHODOLOGY

The study was carried out during rabi season from 2016-17 to 2019-20 (4 consecutive years) by the KVK Sahibganj, Jharkhand. The villages covered under CFLDs were Mayurcola (Block – Barharwa), Jobo Nischinta (Block – Taljhari) and Piparjoriya (Block – Borio) in 2016-17, Telo (Block – Borio) and Haripur (Block – Rajmahal) in 2017-18, Batail (Block – Barharwa) and Dumariya (Block – Barhait) in 2018-19 and Dhatapara, Belpahari (Block – Barharwa) and Taljhari (Pathna) in 2019-20 of Sahibganj district of Jharkhand. Number of locations (beneficiaries) during 2016-17, 2017-18, 2018-19 and 2019-20 were 74, 125, 92 and 350, respectively with total of 641. Beneficiaries (farmers/ farmwomen) were identified through their participation and feedback received during the preliminary survey, awareness programmes and interactive meetings. Farmers were trained to follow the package and practices for mustard cultivation as recommended by the Birsa Agricultural University and critical inputs for the technologies like seeds, fungicides, insecticide, were distributed to the farmers however balanced plant nutrients on the basis of soil test value were applied by the farmers from their own resources. Detail of technological interventions are presented in Table 1. Regular field visit, monitoring and need based advisories were provided by the scientists of KVK. All 641 demonstration in 250-hectare area were conducted by the active participation of the farmers with an objective to demonstrate the improved technologies of mustard production potential in different villages. In case of local check, the traditional practices were followed by using existing variety. In demonstration plots, use of quality seeds of improved varieties Pusa Mahek and PM 26 with line sowing, timely application of weedicide and need based pesticide as well as balanced fertilizer were emphasized. In general, the soil of the demonstration plots was sandy loam in texture, acidic in soil reaction (pH 5.7 to 6.3), low to medium in organic carbon (0.40 to 0.64 %), medium status in available nitrogen (315 to 370 kg/ha), low to medium in available phosphorus (8.1 to 12.8 kg/ha) and also low to medium in available potassium (110 to 135 kg/ha). The farmers under the programme were facilitated by KVK scientists in performing field operations like sowing, spraying, weedicide application, harvesting etc. Finally, field day was conducted involving demonstration holding farmers, other farmers in the village, scientist from KVK, officials from Department of Agriculture, local extension functionaries to demonstrate the superiority of technology. The basic information was recorded from the demonstration and control plots and analyzed for comparative performance of the cluster frontline demonstrations (CFLDs) and farmer's practice. The yield data were collected both from the demonstration and farmers practice by random crop cutting method and analyzed by using simple statistical tools. The technology gap and technological index (Yadav *et al.*, 2004) along with the benefit cost ratio (Samui *et al.*, 2000) were calculated by using following formula as given below.

Extension Gap = Demonstration Yield-Farmer's Practice Yield

Technology Gap = Potential Yield - Demonstration Yield

Additional Return = Demonstration Return-Farmer's Practice Return

$$\text{Technology Index} = \frac{\text{Potential Yield-Demonstration Yield}}{\text{Potential Yield}} \times 100$$

$$\text{\% increase in yield} = \frac{\text{Demonstration Yield-Farmer's Practice Yield}}{\text{Farmer's Practice Yield}} \times 100$$

RESULTS AND DISCUSSION

Technological interventions of the demonstrations, farmer's practice (FP) and gap between demonstrations and FP has been

Table 1. Difference between technological intervention and farmer's practices under CFLDs on Mustard

Particulars	Technological intervention in CFLDs	Farmers practices	Gap
Farming situation	Irrigated medium land	Irrigated medium land	No gap
Variety	Pusa Mahek and Pusa Mustard 26	Local/own seed	Full gap
Seed rate	5 kg/ha	10 kg/ha	High seed rate
Sowing method/ spacing	Line sowing	Broadcasting, uneven plant population	Partial gap
Time of sowing	15 October to 30 November	20 November to 10 December	Partial gap
Seed Treatment	Seed treatment was done with 2.5 gm of carbendazim per kg seed	No seed treatment	Full gap
Fertilizer	Balanced fertilizer application as per soil test values 60 kg N, 40 kg P_2O_5, 40 kg K_2O, 30 kg Sulphur	Imbalanced use of fertilizer 50 kg urea as top dressing and 50 kg of DAP as basal dose/ha	Full gap
Weed management	Application of Pendimethalin @ 300g a.i ha^{-1} as pre-emergence and one hand weeding at 25-30 DAS	Manual weeding at 40 DAS	Full gap
Plant Protection	Need based timely spraying of Carbendazim 12%+ Mancozeb 63% WP for fungal disease and Imidacloprid 17.8 SL to protect the crop against aphid	Injudicious use of insecticides and fungicides based on advice of input dealers	Partial gap with high cost

presented in Table 1. Data presented in table indicates that full gap observed between demonstration package and FP were use of improved variety, seed treatment, nutrient management and weed management, however partial gap was observed in case of seed rate, sowing method, sowing time and plant protection measures.

Results revealed that the technological interventions of CFLDs had positive influence on grain yield of mustard over FP during four years of demonstrations (Table 2). The average grain yield of mustard under CFLDs ranged from 10.82 to 12.36 q ha^{-1} as compared to 7.3 to 8.5 q ha^{-1} in case of FP during 2016-17 to 2019-20. As far as per cent increase in demonstration yield over yield obtained under FP is concern, an average of 46.36 per cent increase was found during the demonstration period. The observed increase in grain yield of mustard under CFLDs over FP may be attributed to the use of improved variety, proper seed rate, nutrient management and weed management. Similar yield enhancement in different crops in cluster frontline demonstrations were reported by Kumar et al., (2010) in bajra; Singh et al., (2018) in black gram; Kalita et al., (2019) in mustard; Jha et al., (2020) in black gram, pigeonpea and chickpea; and Sangwan et al., (2021) in mustard. However, the yield obtained in demonstration plots over the year were still lower than potential yield which may be attributed to climatic conditions of the areas during the maturity period. Data presented in Table 2 also indicates that the yield of mustard fluctuate little over the years in demonstration plots. The per cent increase in mustard yield ranged from 45.06 to 48.21 during the four years.

Table 2. Effect of technological interventions on grain yield of mustard

Year	Sample Area (ha)	Sampled farmers	Average yield (Q/ha)			% increase over FP
			Potential	CFLD	FP	
2016-17	10	27	17	10.82	7.3	48.21
2017-18	10	32	17	11.45	7.8	46.79
2018-19	10	30	17	11.75	8.1	45.06
2019-20	10	30	17	12.36	8.5	45.41
Average	-	-	17	11.59	7.92	46.36

Table 3. Gap analysis of cluster frontline demonstration on mustard

Year	Sample Area (ha)	Sample No. of farmers	Technology gap (q/ha)	Extension gap (q/ha)	Technology Index (%) CFLD
2016-17	10	27	6.18	3.52	36.35
2017-18	10	32	5.55	3.65	32.64
2018-19	10	30	5.25	3.65	30.88
2019-20	10	30	4.64	3.86	27.29
Average	-	-	5.40	3.67	31.79

The results are in conformity with the findings of Meena et al., (2012); Saikia et al., (2018) and Jha et al., (2020).

Data presented in Table 3 indicates the effect of technological interventions of CFLDs on extension gap, technology gap and technology index during the four years of demonstration. The extension gap ranging from 3.52 to 3.86 q ha^{-1} over the years of study emphasizes the need to educate the farmers through various means for adoption of improved agriculture practices to reverse the trend of wide extension gap. The trend of technology gap ranging between 4.64 to 6.18 q ha^{-1} reflects the farmers cooperation in carrying out demonstrations with encouraging result in subsequent years. The results are in conformity with Katare et al., (2011) in oilseeds; Meena et al., (2012); Saikia et al., (2018) and Jha et al., (2020) in black gram, pigeonpea and chickpea. The technology gap over the years of study may be attributed to dissimilarity in soil fertility status, rainfall distribution, pest infestation, weed intensity and change in locations of cluster frontline demonstration sites. However, the result observed is an evidence of the better performance in varied environmental condition over farmer's practice. The technology index showed the feasibility of the evolved technology at the farmer's field. The technology index ranging from 27.29 to 36.35 per cent during the years of study exhibited a decreasing trend over the years with low fluctuation which may be attributed to the dissimilarity in weather condition, soil fertility status and non-availability of water in the crop. The lower the value of technology index the more is the feasibility of the improved technology. On an average Technology Index was 31.79 per cent during four years (2106-17 to 2019-20) which showed the efficacy of good performance of technical interventions. This may accelerate the adoption of demonstrated technical interventions to increase the yield performance of mustard.

Economic performance of mustard under cluster frontline demonstration is presented in Table 4. Results of economic analysis parameter revealed that the mustard recorded higher total return of Rs. 36,247/-, Rs. 38,358/-, Rs. 49,350/- and Rs. 51,912/- per ha during 2016-17, 2017-18, 2018-19 and 2019-20, respectively under CFLDs as compared to Rs. 24,455/-, Rs. 26,130/-, Rs. 34,020/- and Rs. 35,700/- per ha, respectively under FP. Technologies demonstrated under CFLDs also had positive influence on net return and thereby benefit cost ratio (B:C ration) over FP. The net return ranged from Rs. 15,247/- to Rs. 25,912/- per ha under recommended practice as compared to Rs. 6,955/- to Rs. 14,200/- per ha in FP. It was observed that the additional returns ranged from Rs. 11,792/- to Rs. 16,212/- per ha under recommended practices during the years. The higher benefit cost ratio was also recorded under

Table 4. Economic analysis of the cluster frontline demonstrations on mustard

Year	Total return (Rs per ha)		Input cost (Rs per ha)		Net return (Rs per ha)		Additional return (Rs per ha)	B:C ratio	
	CFLDs	FP	CFLDs	FP	CFLDs	FP	CFLD	CFLDs	FP
2016-17	36,247	24,455	21,000	17,500	15,247	6,955	11,792	1.72	1.39
2017-18	38,358	26,130	22,400	18,600	15,958	7,530	12,228	1.71	1.40
2018-19	49,350	34,020	24,000	20,000	25,350	14,020	15,330	2.05	1.70
2019-20	51,912	35,700	26,000	21,500	25,912	14,200	16,212	1.99	1.66
Average	43,967	30,076	23,350	19,400	20,617	10,676	13,891	1.86	1.53

Note: Price of Mustard @ Rs. 3350.00 qt^{-1} in 2016-17, Rs. 3350.00 q^{-1} in 2017-18, Rs. 4200.00 qt^{-1} in 2018-19 and Rs. 4200.00 qt^{-1} in 2019-20

recommended practices and the observed B:C ratio was 1.72, 1.71, 2.05 and 1.99 during 2016-17, 2017-18, 2018-19 and 2019-20, respectively as compared to 1.39, 1.40, 1.70 and 1.66, respectively under FP. These results are in accordance with the findings of Singh et al., (2014), Kumbhare et al., (2014); Jayalakshmi et al., (2018); Jha et al., (2020) and Sangwan et al., (2021).

CONCLUSION

The cluster frontline line demonstrations (CFLDs) conducted by KVK had enhanced the yield of mustard vertically and ensured rapid spread of recommended technologies of mustard production horizontally by implementation of various extension activities like training programmes, field days, exposure visits etc. organized under CFLD programmes in farmer's field. The CFLDs made a positive impact on yield of mustard by 46.36 %. It was observed that the potential yield of mustard varieties Pusa Mahek and Pusa Mustard 26 can be achieved by imparting scientific knowledge to the farmers, providing the need-based quality inputs and their proper utilization. The demonstration trails also enhanced the relationship and confidence between farmers and KVK scientists. The recipient farmers of CFLD also played an important role as source of information and quality seeds for wider dissemination of the improved varieties of mustard for nearby farmers. Therefore, it is suggested that policy maker may provide adequate financial support to frontline extension system for organizing CFLD under the close supervision of agricultural scientists and extension professionals.

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