Technology Intervention Through Cluster Frontline Demonstrationin Indian Mustard (*Brassica juncea*) in Arid Region of Western Rajasthan

ABSTRACT

The study aimed to analyze the performance and promote cluster front-line demonstrations in mustard production and assessing CFLDs contributionin yields and the adoption of improved technologies and enhance the profitability of mustard growers, the improved mustard production technologies were showcased through cluster frontline demonstrations. In total-188 no. of on-farm demonstrations were conducted on 140 ha area in Kolhu, Unthwalia, Dayakor, Palli-1, Gajja,Vijaynagar and Siyo ka baas (seven Villages) of Jodhpur district of Rajasthan during 2019-20 and 2020-21 and these were compared with existing farmer's practices of mustard cultivation. The improved production technologies consisting high yielding varieties (DRMRIJ-31 (Giriraj) and RH-0749,sowing method, nutrient management, chemical weed management and use of plant protection measures were included in the demonstrations. The findings of the study revealed that the package of improved production technologies recorded a mean yield of 18.44 q/ha which was 27.92 % higher than the farmers practices (14.41 q/ha). Comparatively average higher net returns (₹ 71533/ha) and with a B:C ratio of (4.93) were recorded with improved technologies as compared to farmers practices (₹ 51210). Adoption of improved technologies significantly increased the yield as well as yield attributing traits of the mustard than the farmers practices. So, there is a need to disseminate the improved technologies among the farmers with effective extension methods like training and demonstrations. The farmers should be encouraged to adopt the improved crop production technologies as discussed in this paper. So the higher productivity and economic returns from mustard cultivation could be realized.Overall, the study

highlights the positive impact of implementing demonstrated agricultural technologies in mustard cultivation. These results indicate that the adoption of improved practices can lead to higher yields, better economic returns, and improved cost-benefit ratios compared to traditional practices.

Key words:*Cluster front line demonstration, Mustard, Productivity, profitability*

INTRODUCTION

Indian mustard is an important oilseed crop and determinant of oilseed-based agricultural economy of the country. However, productivity is low due to lack of awareness in farming community regarding improved package and practices of oilseed crops. Clusterfrontline demonstrations are important dissemination process for transfer of technology and to establish its production potentials on the farmer's fields. Rapeseed-mustard is the second most important edible oilseed crop in India, next only to groundnut and accounts for nearly 30 per cent of the total oilseeds produced in the country (Shivani and Kumar, 2002). India is one of the largest rapeseed-mustard growing country in the world, occupying the first position in area and second position in production after China (Thakur and Sohal, 2014). India is the largest producer of oilseeds in the world and accounts for about 14 per cent of the global oilseeds area, 7 per cent of the total vegetable oil production and 10 per cent of the total edible oil consumption. Indian mustard is an important oilseed crop of Indian subcontinent contributes more than 80 per cent of the total rapeseed-mustard production in India (Meena *et al.*, 2014; Meena *et al.*, 2015). The rapeseed-mustard production among *rabi* oilseed was 6.29 million tonnes from an area of 4.00 million hectares with a productivity of 1573 kg/ha in Rajasthan.In the Phalodi district, the mustard crop is grown in an area of 106526 ha with an annual production of over 102691million tons with a productivity of 964 kg/ha (GOR, 2023-24). This group of oilseed crops offers higher

return with low cost of production and low water requirement, so it has greater potential to increase the availability of edible oil from the domestic production. Inspite the high quality of oil and also its wide adaptability for varied agro-climatic conditions, the area, production and yield of rapeseed-mustard have been fluctuating due to various biotic and abiotic stresses together with domestic price support programme. High yielding new varieties are also imperative to meet potential edible oil requirement of the country which is still increasing due to increase in population, increase in per capita consumption and slow increase in local production of oilseed crops (Shengwu*et al.*, 2003). Thus, there is a need to disseminate the improved production technologies of mustard cultivation among the farmers to enhance the productivity and profitability. Accordingly, the present investigation was undertaken to bridge the extension gap.

MATERIALS AND METHODS

Present study was conducted on CFLD mustard in irrigated condition in Jodhpur district of Rajasthan.In total 188 frontline demonstrations were conducted on farmers' field in villages of Kolhu, Unthwalia, Dayakor, Palli-1, Gajja,Vijaynagar and Siyo ka baas (seven Villages) of Jodhpur district of Rajasthan during 2019-20 and 2020-21. Each demonstration was conducted on an area of 0.4 and 0.8 ha, adjacent-to the demonstration plot was kept as farmers' practices. The package of improved technologies like line sowing, nutrient management, seed treatment and whole package were used in the demonstrations. The mustard variety DRMRIJ-31 (Giriraj) developed by the ICAR-DRMR, Bharatpur (Rajasthan) and RH-0749 developed by the CCSHAU, Hisar (Haryana) were included in demonstrations methods used for the present study with respect to CFLDs and farmers' practices are given in Table 1. In case of local check plots, existing practices being used by farmers were followed. In general, soils of the area under study were loamy fine to coarse and medium to low in fertility status. The spacing was 30 cm between

rows and 10 cm between plants in the rows. The thinning and weeding were done invariably 20-25 days after sowing to ensure recommended plant spacing (10 cm) within a row (30 cm) because excess population adversely affects growth and yield of crop. Seed sowing was done in the mid to last week of October, with a seed rate of 3-4 kg/ha. Other management practices were applied as per the package of practices for *rabi* crops by Department of Agriculture, Agro-climatic Zone Ia-Arid Western Plains Zone (DOA, 2020). Data with respect to seed yield from FLD plots and from farmer's fields cultivated following local practices adopted by the farmers of the area were collected and evaluated. Different parameters as suggested by Yadav *et al.* (2004) was used for gap analysis, technology index and calculating the economics parameters of mustard.

Estimation of technology and extension gaps and technology index

The estimation of technology and extension gaps, technology index and other economic analysis was done using formula by Kadian, 1997: Samui *etal.* (2000)

Extension gap = Average demonstration plot yield – Farmer’s averageplot yield

Technology gap = Potential yield –Average demonstration plot yield

Technology index = Potential yield -–Average demonstration plot yield /Potential yield × 100

Additional cost (₹) = Demonstration cost (₹) – Farmers' practice cost (₹)

Effective gain = Additional returns (₹)–Additional cost (₹)

Additional returns = Demonstration returns (₹)–Farmers' practice returns (₹)

B: C ratio =Gross returns/ total costs

Incremental B: C ratio=Additional returns /Additionalcosts

RESULTS AND DISCUSSION

Improved technology v/s farmer's practices:

Before the commencement of CFLDs at the farmer's field, the participatory rural appraisal was undertaken. Based on this, the gap between farmers' practices and improved technology of mustardcultivation in the Jodhpur district of Rajasthan was worked out (Table 1). Among varying technology interventions, no gap was observed under the farming situation, whereas a full gap was observed under soiltreatment, seed treatment, Spacingand variety. However, a partial gap was observed for the particulars viz.: Seed rate, Time of sowing, fertilizer and weed management, and Plant protection. These gaps noticed in the farmer's field are ascribed to the slow pace of extension machinery, coupled with unreached public extension systems or improved technologies, especially among smallholder farmers and other vulnerable groups Das and Willey 1991: Badhala and Bareth 2013. Further farmers used local cultivars of mustardshowing low yield potential instead of newly released varieties with appropriate adoption of an improved package of recommended technologies.The improved package and practices are more important with technological intervention for productivity and profitability of oilseeds. Detailed package and practices with technological intervention for recommended practice has been presented in (Table 1). Sulphur is an important supplement for oilseed crops and it is recommended that farmer'sshould apply single super phosphate fertilizers to meet the requirement of both phosphorus and sulphur in mustard. It was also observed that farmer's use injudicious and non-recommended insecticides and most of the farmer's didn't use fungicides. Similar observations were reported by Singh *et al.*,2011.

Impact of CFLDs on seed yield: The **(**Table 2) indicated that a average maximum demonstration yield of 20.9 q/ha was recorded in Vijaynagar village, followed by 20.7 q/ha in Gajja village, 20.5 q/ha in Siyo ka baas village, 17.7 q/ha in Kolhu village, 17.5 q/ha Unthwalia village and 17.3 q/ha in Dayakor and Palli-1villages which were found higher over local check 15.69, 16.65, 15.16, 13.52, 13.88, 13.82and 13.18 q/ha, respectively. It is clearly shown that 33.5 percent yield increase over farmer's practice Vijaynagar village, followed by 32.6 percent in Gajjavillage,, 35.3 percent in Siyo ka baas village, 24.89 percent inKolhu village, 21.81 percent in Unthwalia village, 22.6 percent in Dayakorand 24.7 percent in Palli-1 villages,respectively with an additional returns of Rs 25363, 24555, 25942, 17762, 17040, 16430 and 15168 /ha, respectively. The average yield of DRMRIJ-31 (Giriraj)ranged from 17.7 to 17.3 q/ha and as compared to 13.88 to 13.18 q/ha whereas, average yield of RH-0749 ranged from 20.9 to 20.5 q/ha and as compared to 15.7 to 15.16 q/ha of existing variety in all villages indicating suitability of variety in the district due to the use of HYVs, better quality inputs and scientific backup by KVK specialists time to time. The level of yield is considerably low under farmer's practice due to poor adoption of improved practices depending upon the amount of risk involved in terms of cost, skill, and knowledge about the improved practices. These findings conform to the results of a study carried out by Balai *et al.* 2012 in rapeseed and mustard crops and Sharma and Choudhary 2014 in wheat FLDs.

Gap analysis:

The present findings are also in accordance with the findings of Sharma (2014) who found that the yield levels under farmer’s practices were always lower than obtained under frontline demonstration. The results revealed that extension gap ranged from 3.48 to 5.34 q/ha in villages of Jodhpur district and average figure comes out to be 4.43 q/ha, which indicated that

farmers should be awared for adoption of improved production technology in mustard. There is a vast gap between the farmer's yield and improved variety yield as per recommended practice through cluster frontline demonstrations on farmer'sfield. Technology gaps were also recorded of each village and these ranged from 7.1 to 9.7 q/ha and average technology gaps of8.59 q/ha. These gaps may be attributed to the variation in soil fertility status. Similarly, technology index was ranged from 25.36 to 35.93 per cent and average figure comes out to be 31.32 per cent. The program of large scale frontline demonstration could be popularized for other oilseed crops also in order to increase farmer's income and attain self-sufficiency in oilseeds production.

Economics: Different variables like a seed, fertilizers, bio-fertilizers, and pesticides were considered as cash input for the demonstrations as well as farmer's practice, and on average additional investment of ₹ 2360 per ha was made under demonstrations. The economics of improvedtechnology over farmer's practices were calculated depending upon the prevailing market prices of input and output for the particular year. It was observed that the cost of cultivation of mustardvaried from ₹ 17010 to 19310/ha with an average of ₹ 17996/ha under improved technologies. Whereas, the cost of cultivation of mustardvaried from₹ 16250 to 17100/ha with an average of ₹ 16651/ha under farmer's practices.Improved technologyhavealso higher net returns varying from ₹ 54264 to 91460/ha with an average of ₹ 71533/ha under improved technologies. Whereas, the net returns of mustardvaried from ₹ 39096 to 66097/ha with an average of ₹ 51210/ha (Table 4) recorded under farmer's practices. The average additional cost and net returns of ₹ 2360 and 20323/ha, respectively were recorded with the incremental cost-benefit-cost ratio of 8.61 (Fig-1). On average, the benefit-cost ratio (BCR) under improved technologies and farmer's practices were 4.93 and 4.06, respectively. Higher additional returns and effective gains obtained through demonstrations may be attributed to

improved technology, non-monetary factors, timely crop cultivation operations, and scientific monitoring. The higher benefit-cost ratio proved the economic viability of the technology interventions and motivated the farmers to the adoption of improved technologies. These findings corroborate with that reported by Meena and Singh 2016 and Kumawat *et al.* 2017.

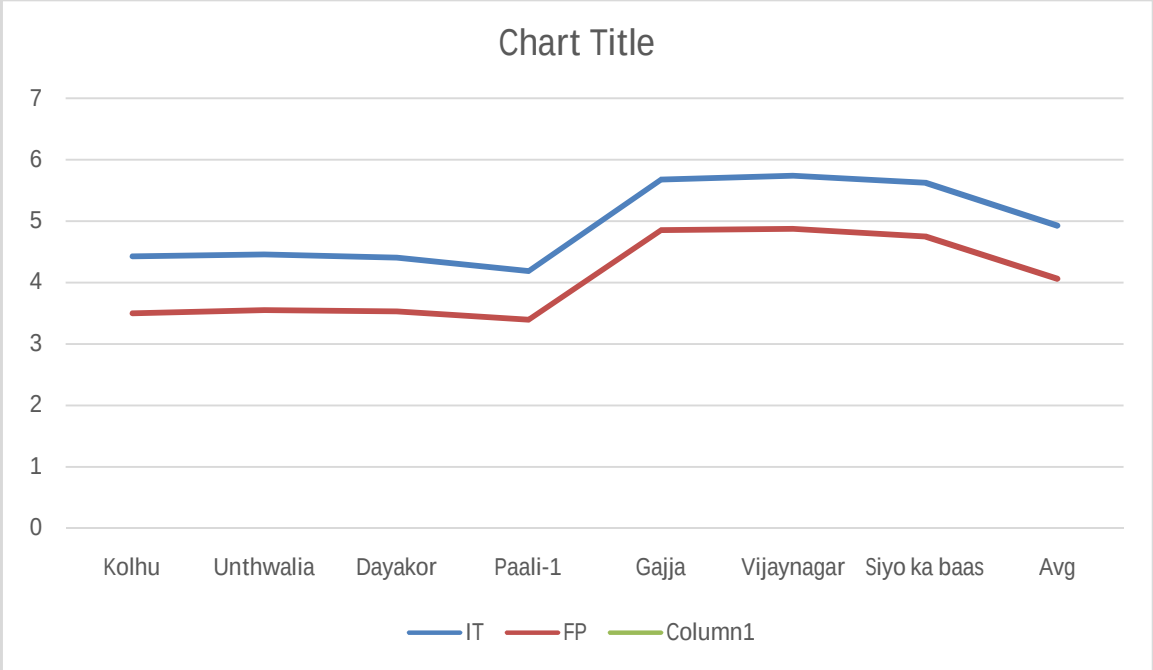

Fig 1. ICBR of mustard demonstrationin Jodhpur districtof Rajasthan

Fig 2. Performance of mustard variety RH-0749 under demonstration in Jodhpur district of Rajasthan

CONCLUSION

It is concluded that CFLDs were effective tools for increasing the productivity of mustard. The demonstrations conducted on mustardat the farmer's field revealed that the adoption of improved technologies significantly increased the yield as well as the net returns to the farmers. On average, gross return (₹ 89529), net returns (₹ 71533), ICBR (8.61), and benefit-cost ratio (4.93) were fetched under improved technologies over farmer's practices. So, there is a need to disseminate the improved technologies among the farmers with effective extension methods like training. Kisan ghosthies, field days, exposure visits, and demonstrations. This created greater curiosity and motivation among other farmers who do not adopt improved practices of mustardcultivation. These demonstrations also strengthened the relationship and trust between farmers and KVK scientists. It was also concluded that besides other practices of weed management, insectpest management, and water stress are to be given due to attention to enhancingmustardproduction in the area. This will subsequently increase the income as well as the livelihood of the farming community of the district.

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Table 1. Details of technology intervention and farmer's practices under CFLDs on Mustard in Jodhpur district of Rajasthan

Technology Component	Improved technology	Farmer's practices	Gap
Farming situation	Irrigated	Irrigated	Nill
Variety	DRMRIJ-31,RH-725, RH-749	Local cultivar (Old variety)	Full
Seed rate (kg/ha)	3-4	5-6	Partial
Soil treatment	Trichoderma @ 2.5 kg/ha cultured with 100 kg FYM	No use	Full
Seed treatment	2.5 gm Mancozeb/kg seed and for white rust Metalexil 35 SD 6 gm/kg seed	No seed treatment	Full
Time of sowing	Mid to last week of October	Last week of October	Partial
Spacing	line sowing 30 cm (row to row) and 10 cm (plant to plant)	No proper spacing	Full
Fertilizer management	60:30-40:40 (NPS kg/ha)	Use of urea 45 kg/ha and DAP 50-60 kg/ha	Partial
Weed management	Pre- emergence application of Pendimethalin 30 EC @1.0 kg a.i./ha and Oxadiargyl @ 90gm/ha	Only use Pendimethalin	Partial
Plant protection	Painted bug and Aphid -Methyl Parathion @ 20 kg/ha White rust- Mancozeb 2 kg/ha	Products suggested by local pesticide dealers	Partial

Table 2. Yield gap analysis of cluster front line demonstrations on mustard crop 2019-2020 to 2020-21

Villages/Block	Variety	Technology gap (q/ha)	Extension gap (q/ha)	Technology index (%)
Kolhu	Giriraj	9.3	4.18	34.44
Unthwaliya	Giriraj	9.5	3.62	35.19

Dayakor	Giriraj	9.7	3.48	35.93
Palli -1	Giriraj	9.7	4.12	35.93
Gajja	RH-0749	7.3	5.05	26.07
Vijay nagar	RH-0749	7.1	5.21	25.36
Siyon ka baas	RH-0749	7.5	5.34	26.79
Avg.		8.59	4.43	31.32

Table 3. Technical impact of mustard crop demonstrations during 2019-2020 to 2020-21 in different blocks

S.N	Crop	Villages/ Block	Variety	Area (ha.)	No. of CFLDs	Potential yield (q/ha)	Average yield under demo.(IT) (q/ha)	Avg. Yield under Farmer practices (q/ha)	Increase in yield (%)
1	Mustard	Kolhu	Giriraj	19.2	24	27.00	17.7	13.52	24.89
2	Mustard	Unthwaliya	Giriraj	10	25	27.00	17.5	13.88	21.81
3	Mustard	Dayakor	Giriraj	20.8	26	27.00	17.3	13.82	22.62
4	Mustard	Palli -1	Giriraj	20	25	27.00	17.3	13.18	24.7
5	Mustard	Gajja	RH-0749	20	25	28.00	20.7	15.65	32.6
6	Mustard	Vijay nagar	RH-0749	30	38	28.00	20.9	15.69	33.5

7	Mustard	Siyon ka baas	RH-0749	20	25	28.00	20.5	15.16	35.3
Total/Avg				140	188	27.43	18.84	14.41	27.92

Table 4. Economic analysis of CFLDs on mustard crop

Village/ Block	Average Cost of Cultivation (₹ /ha)		Additional cost in demo. (₹ /ha)	Average Gross Return (₹ /ha)		Average Net Return (₹ /ha)		Additional returns in demo. (₹ /ha)	Benefit-Cost Ratio	
	IT/ CFLDs plot	FP/ Local check plot	-	IT/ CFLDs plot	FP/Local check plot	IT/ CFLDs plot	FP/Local check plot	-	IT/ CFLDs plot	FP/ Local check plot
Kolhu	17010	16250	760	75306	56784	58296	40534	17762	4.43	3.49
Unthwaliya	17010	16410	600	75936	58296	58926	41886	17040	4.46	3.55
Dayakor	17010	16430	580	75054	58044	58044	41614	16430	4.41	3.53
Palli -1	17010	16360	650	71274	55456	54264	39096	15168	4.19	3.39
Gajja	19310	17100	2210	109710	82945	90400	65845	24555	5.68	4.85
Vijay nagar	19310	17060	2250	110770	83157	91460	66097	25363	5.74	4.87
Siyon ka baas	19310	16950	2360	108650	80348	89340	63398	25942	5.63	4.74

Avg	17996	16651	1344	89529	67861	71533	51210	20323	4.934286	4.06