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Meshram Vishal
Senior Scientist & Head, KVK, Mandla, Madhya Pradesh, India

Ahirwar RP
Scientist, KVK, Mandla, Madhya Pradesh, India

Sahare KV
Senior Scientist & Head, KVK, Narsinghpur, Madhya Pradesh, India

Pandre NK
Programme Assistant, KVK, Mandla, Madhya Pradesh, India

Dhumketi Ketki
Programme Assistant, KVK, Mandla, Madhya Pradesh, India

Meshram Minakshi
SRF-NAHEP, COAE JNKVV, Jabalpur, Madhya Pradesh, India

Corresponding Author:
Meshram Vishal
Senior Scientist & Head, KVK, Mandla, Madhya Pradesh, India

Impact of cluster frontline demonstrations (CFLD) oil seeds on yield enhancement of mustard (*Brassica juncea*) in tribal district of Mandla, Madhya Pradesh

Meshram Vishal, Ahirwar RP, Sahare KV, Pandre NK, Dhumketi Ketki and Meshram Minakshi

Abstract
The study was conducted by Krishi Vigyan Mandla district of Madhya Pradesh to find out the yield gaps between scientific package and practices under cluster front line demonstration (CFLD oilseeds) and farmer's practice (FP) of mustard crop. Cluster Front Line Demonstration on mustard were conducted on farmer's fields during *Rabi* season of two sequential years i.e. 2017-2018 and 2018-2019 under National Food Security Mission (NFSM), Govt. of India to demonstrate the impact of enriched agro-techniques on production and economic benefits under rainfed conditions. CFLD's were conducted in 23 ha and 20 ha area for two years with active involvement of 108 farmers and technical staff of Krishi Vigyan Kendra Mandla. According to observed data the highest grain yield was obtained in demonstrated plots with an average of 12.73 q/ha as compared to local check with an average of 6.73 q/ha. An average mean of extension gap, technology gap and technology index were calculated as 5.06 q/ha, 3.27q/ha, 20.47 percent, respectively. In Adoption of improved package of practices in mustard cultivation recorded average higher B:C ratio (3.31) as compared to Farmers Practice (2.79) during the period of study. Thus, the productivity of mustard could be increased with the adoption of recommended scientific package of practices. The study resulted in satisfying the farmers for maximum productivity and returns.

Keywords: mustard, front line demonstration, technology gap, practices, yield, agriculture, production

Introduction
Tribal district of Mandla, Madhya Pradesh in India situated at an elevation of 1,768 feet (539 meters) above sea level an upland plateau at a U- shaped bend in the Narmada River where it is joined by the Banjar River. Mandla district has an area of of 8771 km^2. There are 9 blocks, 4 tehsils and 1214 villages in the district. India is the fourth largest producer of mustard oil cultivation in the world. Central Organization for Oil Industry and Trade (COOIT) has estimated 89.5 lakh tones of mustard seed to be produced in the country in the ongoing *Rabi* season of 2020- 21 against 75 lakh tones recorded last year which brings a growth of about 19% over last year. Mustard seed production is expected to remain at 10 lakh tones in Madhya Pradesh and Chhattisgarh put together in 2020-21 against 6.5 lakh tones in both states clubbed together last year.

Mustard is an important *Rabi* oilseed crop of rainfed season of Mandla district of Madhya Pradesh. The productivity 850 kg/ha of oilseed in the district is low as compared to National average mainly due to poor crop management practices ultimately and inadequate availability of quality seed of improved mustard varieties and other inputs. Mustard is the second most important and most prominent *Rabi* season oilseed crops of India. It belongs to the group of cruciferae with several cousin species cultivated. The small brown or yellow seeds contain up to 45% of the de- oiled cake is used as animal feed. Arpan is bold seeded variety crop duration 120-125 days depending on the environmental conditions. It is recommended for rainfed condition it contains 40% oil. Krishi Vigyan Kendra's are grass root level organizations meant for spreading of technology through refinement, assessment and demonstration of proven production technologies under different micro-farming situations (Das, 2010). The main object of Krishi Vigyan Kendra is to minimize the time lag between generations of technology at the research and its transfer to the farmers for increasing productivity and income from agriculture and allied sectors. The main objective of Cluster Front Line Demonstration under National Food Security Mission was to demonstrate scientific crop production technologies of oilseeds on the farmers field and to popularize the newly notified improved varieties auto technologies for varietal diversification and efficient management of resources the present investigation was undertaken to study the impact of cluster frontline demonstration on yield enhancement of

mustard (*Brassica juncea*) under rainfed condition in Mandla district of Madhya Pradesh with the objective of increasing productivity and executed to narrow down the time lag and insured speedy adoption of technologies in district.

Materials and methods

Cluster Frontline Demonstrations (CFLDs) on improved farm technology (Table 1) were conducted by Krishi Vigyan Kendra Mandla of JNKVV Jabalpur in mustard (Arpan) during *Rabi* 2017-2018 and *Rabi* 2018-2019 under rainfed conditions on 43 ha area of Mandla district covering 108 farmers. The soil of CFLDs was Sandy loam to Sandy clay loam and the pH of soil is near about 6.18 to 7.11. the scientific technology such as improved varieties seed (Arpan) method of line sowing with Nari plough seed treatment with thirum and bio control agents weed management and integrated pest management practices was maintained during period of study seed treatment was done with thirum 3 gm/kg seed trichoderma at @ 5 gm/kg and PSB @ 5 gm/kg of seed before sowing to protect the crop against fungal diseases up to 15 - 20 days after sowing the seed rate of mustard was kept 5 kg/ha in demonstrations plot the sowing of mustard was done during 5th November to 13 th November during the study period the spacing between row to row and plant to plant was kept 30x20 for the Cluster Frontline Demonstrations. The fertilizers were also given in the ratio of 160:60:40:25 kg/ha as basal dose spraying of chloropyriphos+ cypermethrin for controlling of insect and pests like aphids and jasids mustard sawfly @1250 gm/ha. The data were collected from beneficiary farmers through personal interviews and after that data was tabulated and analysed to find out the findings and conclusions. The yield increase in demonstrations over farmers practice was calculated by using following formula.

$$\% \text{ Yield increase over farmer's} = \frac{\text{Demonstration average plot yield} - \text{Famer's average plot yield}}{\text{Farmer's average plot yield}}$$

Estimation of technology gap, extension gap and technology index

Extension gap means adoption of improved transfer technology in demonstrations practices resulted in maximum grain yield than traditional farmer's practices. The related observations were also obtained in black gram crop by Mahalingam *et al*., (2018) Bairwa *et al*., (2013) [2], Hiremath and Nagarju (2010) [5] and also Jamwal Anamika *et al.* (2020). The estimation of technology gap, extension gap and the technology index were worked out by using following formula (Kadian *et al*., (1997) [6] Samui *et al*., 2000) [9].

- Technology yield gap = Potential yield – Demonstration plot average yield
- Extension yield gap = Demonstration plot average yield Farmer's plot average yield
- $\text{Technology index} = \frac{\text{Technology yield gap}}{\text{Potential Yield}} \times 100$

Results and Discussion

The findings of the study as well as relevant discussion have been conferred under following points

Grain Yield

Data presented in Table 2 revealed that transfer of improved technology under Cluster Frontline Demonstrations in mustard resulted in higher yield as compared to farmer's practice. The maximum yield in demonstration plot was due to improved variety of seed, seed treatment with bio control agent, integrated pest management practices. The average seed yield of demonstration plots was 12.73 q/ha (Table 2) which was higher as compared to farmers practice 7.67 q/ha. The increased yield percentage over control was 65.97% in Cluster Frontline Demonstration over local check. However the seed yield of 12.73 q/ha in CFLD's was low as compared to potential yield 16 quintal per hectare of mustard variety Arpan due to attack of aphids and mustard sawfly. The yield enhancement through adoption of improved technology has also been reported in earlier studies of FLD's (Kothyari *et al*. 2018 and Kumar *et al*. 2019 and Jamwal Anamika *et al*. 2020) [7, 8]. Yield of the Frontline Demonstration trials and potential yield of the crop was compared to estimate the yield gaps which were further classified into technology and extension gaps (Hiremath & Nagarju; 2009 and Jamwal Anamika *et al*. 2020) [5].

Extension Yield gap

An average extension gap between demonstrated practices and farmers practices was recorded 5.06 q/ha (Table2). Higher extension gap in present study suggested that there is a need to motivate and aware the farmers for adoption of improved technologies in mustard over existing local farm practices. The similar results were also reported by Bairwa *et al*. 2013 [2] Gangadevi *et al*. 2018 Jamwal Anamika *et al*. 2020

Technology Yield gap and Technology Index

The technological gaps generally appear even if the CFLD'S were conducted under the strict direction of farm scientists on the farmers field the data presented in table 2 showed that the value of technological gap was higher 3.05 to till per hectare during the year 2018-19 while during 2017-18 the technological gap was 3.52 per ha the technology gap observed may be attributed to the decimal dissimilarity in soil status, lake of irrigation facilities non congenial weather conditions, disease and pest attacks and change in the position of demonstrations plots every year. Technology index specified the feasibility of the generated Technology at the farmer's fields under existing agro climatic conditions (Vedna *et al*. 2007) [12]. The results of table 2 revealed that value of technology index was 21.88% and 19.06% during 2017-2018 and 2018-19 respectively. Where as the average value of technology index was recorded 20.47%. Lower the value of the technology index more is the feasibility and applicability of the tested technology. This showed that a gap existed between technology involved and technology adopted at farmer's field. The similar results were also recorded by Gangadevi *et al*. 2018, Chaudhari *et al*. 2019 and Jamwal Anamika *et al*. 2020.

Table 1: Technology demonstrated in CFLD's and Farmer's practices

S/No.	Intervention	Demonstrated Intervention	Farmers intervention
1	Field preparation	2 ploughings	Single plough
2	Seed sowing	Line sowing by seeddrill & Nari	Broad casting
3	Seed Variety	Arpan	Local Lotini Rai
4	Seed treatment	Thirum @ 2,5 gm/kg seed, PSB & Trichoderma @ 5gm/kg seed	Not treated
5	Seed rate	5kg/ha	10-15 kg/ha
6	Manures and fertilizers	PSB 500ml, Rhizobium 500gm with 100kg vermicompost and sulphor 100:60:40:25	Nil
7	Weed management	Pendimethaline @ 2,5-3.5 lit/ha	No pre emergence used
8	IPM measures	spray of Neem oil and pheromone traps, yellow sticky traps	Imbalance use of pesticides
9	Technical guidance	Time to time	Nil

Table 2: Year wise productivity, extension gap, technology gap and technology index of mustard under Demonstration and farmer's practices.

Year	Yield q/ha		Increase yield % over Control	Extension gap (q/ha)	Technology gap (q/ha)	Technology Index %
	Demo	Farmer's Practice				
2017-18	12.5	7.60	64.47%	4.9	3.5	21.88
2018-19	12.95	7.75	67.09%	5.2	3.05	19.06
Mean	12.73	7.67	65.97%	5.06	3.27	20.47

Table 3: Cost of cultivation, Gross return and B:C ratio of mustard under Demonstration and farmer's practices.

Year	Cost of Cultivation (Rs/ha)		Gross Return (Rs/ha)		Net Return (Rs/ha)		B:C Ratio	
	Demo	Farmer's Practice	Demo	Farmer's Practice	Demo	Farmer's Practice	Demo	Farmer's Practice
2017-18	15275	10500	50000	30400	34725	19900	3.27	2.89
2018-19	15500	11500	51800	31000	36300	19500	3.34	2.69
Mean	15388	11000	50900	30700	35513	19700	3.31	2.79

Economic analysis of Cluster Front Line Demonstrations

Average cultivation cost of demonstration plot (Rs15388/ha) is more as compared to Farmer's practice (Rs 11000/ha). The data in table 3 clearly clarified the implication of Cluster Frontline Demonstration at Farmer's field during the period of investigation in which higher average net return rupees 35513 were acquired under Demonstration plots as compared to farmer's practice (Rs 19700/ha). Benefit cost ratio recorded was also higher in demonstration plots (3.31)as compared to farmer's practice (2.79) increased monetary returns as well as Benefit cost (B:C) ratio through improved farm technology have also been reported by various scientists (Vedna *et al*. 2007, Bairwa *et al*. 2013 and Jamwal Anamika *et al*. 2020) [12, 2].

Conclusion

This study indicated that the incorporation of scientific farm technology practices along with active participation of farmer's of the area has positive effect on increasing the yield and economic return of mustard in Mandla district the economic viability of suitable technology for increasing the productivity of mustard motivated the farmers towards adoption of technologies demonstrated at farmer's field.

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