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Impact on Cluster Frontline Demonstrations on the Productivity of Mustard (*Brassica juncea*)

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Abstract

Cluster frontline demonstrations (CFLDs) are the long-term educational activity conducted in a logical method on partner farmer's field to show the worth of new technology under micro farming. The present investigation was carried out during the *Rabi* season (October to March) of respective year 2016-17 to 2019-20 under the National Food Security Mission, Government of India. Four hundred thirteen CFLDs were conducted in 165.2 ha area with the farmers and scientists of KVK. The CFLDs were conducted at adopted fifteen villages of Dholpur district. Cultivation technology was applied under CFLDs included scientific intervention. The highest yield was obtained in demonstrated practices (DP) with an average of 2272.00 kg ha^{-1} as compared to farmer practice (FP) with an average of 1829.00 kg ha^{-1}. Further, an average additional return (₹ 16,063.6), effective gain (₹ 14,335.8), net return (₹ 64,512.1 ha^{-1}) and benefit-cos ratio (3.49) were found in the DP as compared to farmer practice. An average occurrence of Alternaria blight, white rust, stem rot, aphid were recorded 27.44, 5.93 and 14.85 and 25.05, respectively showed in DP as compared to farmer practice. An average extension gap, technology gap and technology index between and was noted 443.0 kg ha^{-1}, 234.75 kg ha^{-1} and 10.39%, respectively. The results indicate that the use of scientific intervention under CFLDs to increase the production and profitability of Mustard.

Keywords: CFLDs, oilseeds, production, yield, gap, adoption, mustard

1. Introduction

Major oilseed producing countries in the world, which are China, Canada, India, the USA, Brazil and Argentina account for 82% of oilseed production in the world (Reddy and Emmanuel, 2017). The oilseeds account for one-third of the oil produced in India. Suitable agro-climatic conditions favour cultivation of all nine major oilseed crops (seven edible oils are Sunflower, Rape seed and Mustard, Groundnut, Sesamum, Soybean, Safflower, Niger and two are non-edible, Castor and Linseed). The limited scope of bringing additional area under oilseeds an increased in production will have to income primarily from land saving to technology lighting (Choudhary and Suri, 2014). Among oilseed crops, mustard (*Brassica juncea*) is the third

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(28.6%) important groups of oilseed crops in the world after soybean and palm oil (Singh et al., 2020). In India, Mustard accounts for 24.43% of the acreage and 28.95% of the production. Mustard grown in 6.23 Mha with production of 9.34 MT with average productivity of 1499 kg ha^{-1} (Anonymous, 2020). Major states contribute in area are Rajasthan, MP, UP, WB and production are Rajasthan, Haryana, UP and MP (Anonymous, 2020). In Rajasthan, the Mustard crop is mostly cultivated in Alwar, Bharatpur, Sriganganagar, Tonk, Sawai Madhopur, Baran, Bikaner and Dholpur districts. Dholpur, the eastern district of Rajasthan is the largest Mustard growing division covering about 10.48 percent of the total production of the state. The area under Mustard in Dholpur is 69,195 ha, production 1,36,652 tonnes with productivity of 2245.0 kg ha^{-1} (Anonymous, 2020a). An average productivity of Mustard in Dholpur district was noticed lower side (2245 kg ha^{-1}) than the average potential yield (2605 kg ha^{-1}). Oilseeds crops require more Sulphur for their oil and protein synthesis, which is indicated considerable increases in the yield and its quality (Chauhan et al., 2002). Major factors responsible for the decrease of the yield potential of Mustard in the district includes improper nutrient management, use of high seed rate, inadequate plant protection measure, small and marginal holding, poor adoption of improved POP (Kumari et al., 2019; Ray et al., 2019). The department of agriculture, Cooperation and Farmer welfare had sanctioned the project "cluster frontline demonstrations on oilseeds" to ICAR- ATARI, Jodhpur under National Food Security Mission, a scheme sponsored by Government of India and implemented by KVKs with the main purposes to increase oilseed production (Shivran et al., 2020). The scheme purposes to target the adopted village by making available the improved technologies upgrade and spread likewise improved seeds, Integrated Nutrient Management, Sulphur, bio fertilizers, weed management, Integrated Pest Disease Management, extension activities like training and mass media campaign (Singh et al., 2019). The aims of CFLDs was to demonstrate the improved technologies among the farmers recommended technology by the Research Institutes and SAUs, so that it would improve the productivity of oilseed crops.

The main aim of KVK is to reduce the time lag between the generation of technology and its transfer to the farmers for increasing productivity and income from the agriculture and allied sectors on a constant basis (Kushawah et al., 2016). CFLDs are a long-term educational activity conducted in a logical manner at farmers' fields to show the value of a new technology (Rana et al., 2017; Singh et al., 2018). Which is unmoving increasing due to an increase in population, increase in per capita consumption and unhurried increase in the local production of oilseed crops (Shengwu et al., 2003). Therefore, keeping in view the above fact, efforts have been made through CFLDs to introduce innovative recommended POP of Mustard with a view to increasing its productivity in the district Dholpur.

2. Materials and Methods

The Cluster frontline demonstrations (CFLDs) were conducted by Krishi Vigyan Kendra under the NFSM-Oilseeds scheme during *rabi* seasons (October to March) of respective year 2016–17 to 2019–20, to study the performance of recommended package of practices (POP) on production, productivity and profitability of Mustard in Dholpur district, Rajasthan, India. The study area is traditionally oilseed-producing area located in 26.7195°N Latitude; 77.8871°E longitude and 178 m above mean sea level that falls under Agro-climatic Zone III b (Flood Prone Eastern Plain) of Rajasthan state, India. The CFLDs had organized on partner farmer's field according to the POP recommended by home SKN Agriculture University, Jobner was adopted. Before organized actual baseline information collected from the adopted village. Interested partner farmers (farmers/farm women) were identified with the help of the Participatory Rural Appraisal (PRA) technique. Finally, the primary selection of partner farmers and their fields for the demonstration was based on the active participation of partner farmers and KVK scientists. Assessment of gap in adoption of recommended technology by the partner farmers was taken before laid out the CFLDs through personal discussion with selected partner farmers list was ready. The geo-mapping of the selected partner farmer's field for conducting the CFLDs was done (Table 1). The adopted villages were Kansotikhera (Bari Block), Ekta, Kankrat (Baseri Block), Dagarpur, Odi Ka Pura, Sanda, Sarkankhera, Beelpur (Dholpur Block), Dihauli and Dhondkapura (Rajakhera Block), Basai Nawab, Behrawti,

Table 1: The geo-mapping of selected farmer's field for conducting the CFLDs

Sl. No.	Village	Block	Longitude	Latitude
1.	Chaurakhera	Saipau	77.8010	26.7930
2.	Behrawti	Saipau	77.8283	26.8362
3.	Dhondkapura	Rajakhera	77.9923	26.8376
4.	Kankrat	Baseri	77.4380	26.5820
5.	Odi kapura	Dholpur	77.9797	26.8398
6.	Ekta	Baseri	77.6360	26.8092
7.	Basai Nawab	Saipau	77.7811	26.9030
8.	Sanda	Dholpur	77.9065	26.7268
9.	Dihauli	Rajakhera	78.0160	26.7831
10.	Naurangabad	Saipau	77.8116	26.8024
11.	Moosalpur	Saipau	77.2320	26.6330
12.	Sharkhankhera	Dholpur	77.8920	26.7554
13.	Kansoti khera	Bari	77.6260	26.5790
14.	Beelpur	Dholpur	77.8988	26.7846
15.	Dagarpur	Dholpur	77.9490	26.7460

Chaurakhera, Naurangabad and Moosalpur (Saipau Block) of Dholpur district in reporting year on the selected partner farmers' fields. Four hundred thirteen CFLDs on Mustard were laid out covering the total area of 165.2 ha with demonstration practices (DP) ranging from 0.40 ha (one acre) to 0.80 ha area. POP oriented training to be informed to the selected partner farmers (Venkattakumar et al., 2010). During the meeting, receptive and innovative partner farmers were selected for technological intervention. Critical input likewise improved seed, fungicides, insecticides, bio-fertilizer, Sulphur was provided to the partner farmer, however, applied based on soil test value by the partner farmer's fertilizer from their own cost. Which was comprised of soil test based fertilizers tailoring (40:20: 0:20 kg NPKS ha^{-1}), seed treatment (Apron 7 g kg^{-1} seed, imidachloropid 7 ml kg^{-1} seed), soils treatment (*Trichoderma* culture @ 03 kg ha^{-1}), improved variety DRMRIJ 31 (Giriraj) and RH-406, seed (@ 4 kg ha^{-1}), sowing time (first fort-night of October), sowing by seed cum fertilizer drill, sowing distance (30 cm R to R), weed management, Dimethoate 30 EC 1.0 l ha^{-1}, harvesting (between the first week of March to last week of March). The performance of DP was compared with FP in the same villages. Seed treatment was done under the critical supervision of KVK Scientist. Partner farmers were facelifted by KVK scientists under the program for performing field operations likewise sowing, spraying, weed management, harvesting, etc. The gap between DP and FP is cited in Table 2. The FP was considered as a control plot (local check), which was maintained by the farmers according to their own traditional cultivation practices with old varieties. A training programme was organized for partner farmers on improved technology of oilseeds production including high yielding variety, seed treatment, recommended chemicals (weedicides, fungicides and pesticides), literature and regular visit, monitoring of pest and disease, agro advisory services management by the KVK scientist as a separate unit is running. Partner farmers were also recommended for efficient use of fertilizers by drilling in furrows, need based weed management and thinning at 15–20 DAS and irrigation at a critical stage. Finally, field day and crop cutting experiments were conducted involving beneficiaries partner and other farmers in the village, Scientists from SKNAU, Jobner and ATARI, Jodhpur officials from local extension functionaries, Department of Agriculture to demonstrate the dominance of the DP. To study the yield aspects, 25 plants were designated by randomly placing of quadrate at five places in DP as well as in FPs and five plants selected from separately quadrate. Basic information from DP and FPs' was collected after harvesting the crop. Seeds were taken and weighed. The economical assessment was done as per prevailing minimum support prices decided by Government. Data were collected from both DP as well as FP and analyzed for the technology gap, extension gap and technology index (Yadav et al., 2004) along with benefit cost ratio, percent increase yield and effective gain (Samui et al., 2003).

Table 2: Gap analysis among recommended practice and farmers' practice Mustard growers

Technology	Farmer practices	Recommended practices	Gap (%)
Variety	Laxmi, Rohini, Private company seeds	Variety DRMR IJ-31 (Giriraj), RH-406	22
Seed rate	Seed rate 6–7 kg ha^{-1}	Seed rate 4–5 kg ha^{-1}	58
Seed treatment	No proper seed treatment	Seed treatment with apron @ 6 g and Imidacloprid 17.8 SL @ 7.0 ml kg^{-1} seeds	68
Soil treatment	No soil treatment	Soil treatment with Trichoderma @ 2.5 kg ha^{-1}.	92
Row spacing	Sowing crops in 30 cm rows.	Sowing crops in 30 cm rows and thinning as per need at 15-20 DAS	35
Fertilizer use	Non-judicious use of fertilizers, No use of Zn and S	NP @ 80:40 kg ha^{-1} in irrigated and 40:20 in rainfed, respectively. Soil application of Zn So_4 @ 25 kg and Sulphur 90% WG @ 25 kg ha^{-1}	43
Weed management	No practice of hand weeding	Pre-emergence application of Pendamethalin @ 1.0 kg a.i ha^{-1}. Hand weeding at 15–20 DAS	80
Irrigation management	2–4 Irrigation	2 Irrigation	40
Pest and disease management	Improper use of insecticides	Spray of Dimethoate 30 EC @ 1.0 l ha^{-1} for aphid management	70

Percent increase yield=Demonstration yield-Farmers yield÷Farmers yield×100

Extension gap=Demonstrated yield-Farmer's practice yield

Technology gap=Potential yield- Demonstration yield

Additional return=Demonstration practices return-Farmer's practice return

Technology index=Potential yield-Demonstration yield÷

Potential yield ×100

Effective gain (₹ ha^{-1})=Additional returns of DP (₹ ha^{-1})-Additional cost of DP (₹ ha^{-1}) Benefit cost ratio (BCR)=Gross return (₹ ha^{-1})÷Gross expenditure (₹ ha^{-1})

To assess the percent disease incidence and percent disease intensity each DP and FP field were observed in CFLDs. The average incidence and intensity of the disease in CFLDs were calculated. In each field, marked randomly, diseased and healthy plants were calculated in one square meter area, in a field, four such spots were randomly selected and average disease incidence and disease intensity of field were calculated. The percent disease incidence (PDI) was calculated as per the formula given below.

Percent disease incidence=No. of infected plant÷Total No. of plant observed×100
Percent disease intensity=Sum of all disease rating÷Total No. of rating×Maximum disease rating×100

The population of mustard aphid was noted from 10 cm top portion of the terminal shoot of 10 randomly designated and tagged plants from each field. Pre-treatment calculations of the aphids were made 24 hours prior to insecticide application, while post-treatment counts were finished 10 days after the spraying application of Dimethoate 30 EC @ 1.0 l ha^{-1}. Percent aphid mortality after the spray was calculated.

To measure the extent of adoption of mustard DP by the partner farmers an adoption test was developed. Eleven major practices of Mustard DP were included in the test. Each selected practice was further divided into several sub sections. The response under each sub-item was taken on a three point continuum *viz*., "always", "sometimes" and "never" which were assigned 2, 1 and 0 score, respectively. The minimum and maximum scores, which a respondent could obtain on this scale, were 0 and 46, respectively.

3. Results and Discussion

3.1. Gap analysis

The gap analysis between the DP and prevailing FP under mustard is obtainable in Table 2. The highest gap (92%) was recorded in the case of use soil treatment followed by weed management, pest and disease management, seed treatment, application of sulphur and use of variety with 80, 70, 68 and 58%, respectively. Sulphur is not in reach of partner farmers. Partner farmer are not aware of soil and seed treatment and having no knowledge about stem rot, Alternaria Blight and white rust diseases management. Soil treatment to manage soil borne pests and diseases was not in practice by the partner farmers although some partner farmers were started summer ploughing. Weed management by labour is very expensive and chemical weed management was not common. The reason overdue higher gap is less extension workers are there in the district Dholpur. Partner farmers are dependent on the advice of retail agri-input dealers who are less educated and having no knowledge about agriculture practices (Singh et al., 2019, Kalita et al., 2019 and Shivran et al., 2020).

3.2. Yield performance

The implementation of year-wise details of DP conducted by KVK, Dholpur in the adopted villages are presented in table 3. In each CFLDs, improved varieties of Mustard namely; RH-406 and Giriraj were considered along with their recommended POP. A total number of 413 demonstrations covering 165.2 ha were accompanied by the KVKs at partner farmers' field during *Rabi* season 2016–17 to 2019–20.

The data revealed on yield parameters of Mustard are obtainable in Table 3 showing that the maximum seed yield of Mustard was obtained under DP 23.46 q ha^{-1} during 2018–19 followed by 22.87 q ha^{-1} (2017–18), 22.50 q ha^{-1} (2016–17) and 22.05 q ha^{-1} (2019–20), respectively with an average of 22.72 q ha^{-1} as compare to prevailing FP 19.17 q ha^{-1} during 2018–19 followed by 18.50 q ha^{-1} (2016–17), 17.86 q ha^{-1} (2019–20) and 17.63 q ha^{-1} (2017–18) respectively with an average of 18.29 q ha^{-1}. Which was increased with an average value of 19.84 percent for mustard production. Although yield obtained under DP was lower than the potential yield of varieties. It may be due to the cumulative effect of several biotic and abiotic factors in microclimatic conditions that varying year to year. Yield enhancement under DP might be due to the balanced nutrition as per soil test value integrated approach, involving insects and diseases management and Sulphur application. Likewise, crop yields were varied recorded due to soil type, moisture availability, rainfall and weather condition, disease and pest attacks as well as the change in the locations of DP

Table 3: Performance of technological intervention (CFLDs) on yield and yield attributes of mustard

Year	Variety	Potential yield (kg ha^{-1})	Area (ha)	Demo	Plant population (No. m^{-2})		Seed yield (kg ha^{-1})		Percent increase over control (FP)
					DP	FP	DP	FP	
2016–17	RH-406	2700.0	20	50.0	12.97	18.51	2250	1850	17.60
2017–18	RH-406	2700.0	50	125.0	12.94	19.16	2287	1763	29.77
2018–19	RH-406	2700.0	30	75.0	12.91	18.95	2346	1917	17.95
2019–20	DRMR IJ 31	2509.0	65.2	163.0	12.84	17.71	2205	1786	23.46
Average		2652.25	165.2	413	12.92	18.58	2272	1829	19.84

every year. In general, in all the years' grain yield of CFLDs plots was higher as compared to prevailing FP. Which was due to improved variety, seed treatment, recommended fertilizer doses, plant protection measures was followed by the partner farmer and scientists in the DP. Kumar and Yadav (2007), Singh et al. (2016), Mamgai et al. (2017), Singh et al. (2018), Kalita et al. (2019), Ray et al. (2019), Singh et al. (2019), Kumar et al. (2020), Shivran et al. (2020), Singh et al. (2020); Puniya et al. (2021) have also observed the similar findings.

3.3. Economic performance

The data revealed on the economic performance of CFLDs are obtainable in Table 4. The maximum net return of CFLD's was obtained ₹ 72,032.00 ha^{-1} during 2018-19 followed by ₹ 70,786.30 ha^{-1} (2019-20), ₹ 65,480.00 ha^{-1} (2017-18) and ₹ 49,750.00 ha^{-1} (2016-17), respectively with an average of ₹ 64,512.1 ha^{-1} as compared to FP ₹ 55,714.0 ha^{-1} during 2018-19 followed by ₹ 53,410.0 ha^{-1} (2019-20), ₹ 46,420.0 ha^{-1} (2017-18) and ₹ 38,250.00 ha^{-1} (2016-17), respectively with an average of ₹ 48,448.50 ha^{-1}. The data denoted on the gross cost of cultivation was more under DP with an average of ₹ 25,946.25 ha^{-1} as compare to prevailing FP ₹ 24,218.5 ha^{-1}. Use of costly improved seeds, line sowing, seed treatment, Sulphur, use of fertilizers, integrated pest and disease management etc. are the main factors for increase in cost of cultivation under DP as compared to prevailing FP. The data depicted on higher average gross returns (₹ 90,458.3 ha^{-1}) were obtained under DP as compare to prevailing FP (Rs. 72667.0 ha^{-1}). The most important factor B:C ratio shows that whether CFLDs technology is profitable or not. The average benefit cost ratio was recorded higher under CFLDs 3.49 as compared to FP 3.00 during the period of investigation. The higher net returns and B: C ratio in Mustard DP might be due to the higher grain yield and better pricing of the produce in the market. Choudhary and Suri (2014), Kalita et al. (2019), Meena and Singh (2019), Singh et al., (2018), Ray et al. (2019), Singh et al. (2019), Kumar et al. (2020), Shivran et al. (2020), Singh et al. (2020); Puniya et al. (2021) have also observed the similar findings.

Table 4: Economical comparison between DP and FP of mustard

Year	Gross cost (₹ ha^{-1})		Gross return (₹ ha^{-1})		Net return (₹ ha^{-1})		Additional return	Effective grain (₹ ha^{-1})	B: C Ratio	
	DP	FP	DP	FP	DP	FP			DP	FP
2016–17	24500.0	22800.0	74250.0	61050.0	49750.0	38250.0	11500.0	9800.0	3.03	2.68
2017–18	26000.0	24100.0	91480.0	70520.0	65480.0	46420.0	19060.0	17160.0	3.52	2.93
2018–19	26500.0	24800.0	98532.0	80514.0	72032.0	55714.0	16318.0	14618.0	3.72	3.25
2019–20	26785.0	25174.0	97571.3	78584.0	70786.3	53410.0	17376.3	15765.3	3.64	3.12
Average	25946.25	24218.5	90458.3	72667.0	64512.1	48448.5	16063.6	14335.8	3.49	3.00

1 US$=₹ 65.93, 65.05, 69.66, 74.53 (Avg. of March, 2017, 2018, 2019, 2020); DP: Demonstration practices; FP: Farmer practices

3.4. Disease incidence

Data noted on plants infested with among diseases white rust (*Albugo candida*), stem rot (*Sclerotinia sclerotiorum*) and alternaria blight (*Alternaria brassicae*) are the major diseases, which was reduced the yield potential of Mustard considerably revealed that, incidence and intensity of disease were lower in DP as compare to prevailing FP (Table 5). It was noted that on white rust, stem rot and Alternaria blight disease occurrence ranged from 6.2, 4.6, 5.6 and 7.3, 11.56; 13.48, 15.89 and 18.47; 28.39, 24.76, 26.17 and 30.43, respectively, observed in DP as compared to 10.44, 9.86, 11.63 and 12.82; 20.11, 22.45, 21.17 and 26.48; 38.42, 35.17, 43.32 and 40.45, respectively in prevailing FP in the reporting year. An average occurrence of white rust, stem rot and alternaria blight disease was recorded at 5.93, 14.85 and 27.44, respectively. Showed

Table 5: Impact of technological intervention on disease and pest infestation of mustard

Year	Disease intensity				Disease incidences		Aphid infestation	
	Alternaria blight		White rust		Stem rot			
	DP	FP	DP	FP	DP	FP	DP	FP
2016–17	28.39	38.42	6.2	10.44	11.56	20.11	18.32	30.33
2017–18	24.76	35.17	4.6	9.86	13.48	22.45	22.45	38.34
2018–19	26.17	34.32	5.6	11.63	15.89	21.17	26.72	45.78
2019–20	30.43	40.45	7.3	12.82	18.47	26.48	32.65	55.26
Average	27.44	37.09	5.93	11.19	14.85	22.55	25.04	42.43

DP:Demonstration practices, FP: Farmer practices disease intensity and incidences symptoms in DP as compared to 11.19, 22.55 and 37.09, respectively in prevailing FP. Year to year crop yield was noted varied due to crop canopy, date of sowing, crop rotation, soil type, moisture availability, rainfall and weather condition as the change in the locations of DP every year. This could be responsible due to seed and soil treatment, spray of fungicides. The findings are in line with the results reported by Meena et al., 2011 and Jain and Sandhu 2019 in Alternaria blight, Rana et al., 2017 in Stem rot and Basavaraj et al. (2020) in white rust of mustard.

3.5. *Insect infestation*

During the investigation, data as noted (Table 5) on the infestation of Aphid (*Lipaphis erysimi*) threatening the crop right from sowing until the end of the crop season. The treatment population of aphid decreased significantly than the untreated check even after the 10th day of spraying. After the application of Dimethoate 30 EC @ 1.0 ml l^{-1}, water at the time of Adult and nymph infected ranged from 18.32, 22.45, 26.72 and 32.65 in DP as compare FP ranged from 30.33, 38.34, 45.78 and 55.26. Average infected found in 25.04 DP as compared to 42.43 found in prevailing FP. Year to year crop yield was varied noted due to crop canopy, date of sowing, moisture availability, rainfall and weather condition as the change in the locations of DP every year. This could be responsible due to seed treatment, spray insecticides. The findings are in line with the results reported by Rohilla et al. (2004).

3.6. *Extension gap, technology gap, yield index analysis*

The extension gap indicated an increasing style. The extension gap range between 4.0 to 5.24 q ha^{-1} (Table 6) during the period of the study highlight the need to educate the partner farmers through various means for the adoption of improved agriculture production. The trends of extension gap revealed the farmers' co-operation in carrying out such demonstration with encouraging results in the sequent year. The extension gap was may be recognized to the dissimilarity in pest, disease and weed managements and weather conditions. The technology gap was noted from 1.63 to 3.04 q ha^{-1}. The technology index revealed the achievability of the evolved technology at the partner farmer's field. The lower value of technology index more is the feasibility of the DP. The similar findings have been also noted by following researchers such as Dayanand et al. (2012), Choudhary and Suri (2014), Singh et al. (2018), Kalita et al. (2019), Meena and Singh (2019), Singh et al. (2019), Kumar et al. (2020), Shivran et al. (2020), Singh et al. (2020) and Puniya et al. (2021).

Table 6: Impact of CFLDs on extension, technology gap and yield index of mustard

Year	Extension gap (kg ha^{-1})	Technology gap (kg ha^{-1})	Technology index (%)
2016–17	400	250	11.11
2017–18	524	222	9.71
2018–19	429	163	6.95
2019–20	419	304	13.79
Average	443	234.75	10.39

As such, a reduction in technology index from 6.95 to 13.79% noted during the reported year exhibited the feasibility of the DP in the district. Similar findings have been also observed by following researchers such as Dayanand et al. (2012), Choudhary and Suri (2014), Singh et al. (2018), Kalita et al. (2019), Meena and Singh (2019), Singh et al. (2019), Kumar et al. (2020), Shivran et al. (2020), Singh et al. (2020) and Puniya et al. (2021). From the above findings, it can be wind up that use of the scientific method of a Mustard crop can decrease the technology gap to a considerable extent. This will lead to increase the productivity of mustard in the district. Additionally, extension agencies in the district need to provide proper technical support to the farmers through different informative and extension approaches to decrease the extension gap for better oilseeds production. The improved POP is more important with technological intervention for the productivity and profitability of Mustard. Dayanand et al. (2012), Choudhary and Suri (2014), Singh et al. (2018), Kalita et al. (2019), Meena and Singh (2019), Singh et al. (2019), Kumar et al. (2020), Shivran et al. (2020), Singh et al. (2020) and Puniya et al. (2021) have also observed the similar findings.

3.7. *Adoption of mustard production technology*

The level of adoption of Mustard production technology by the partner farmers was measured for eleven important Mustard production practices. The data have been presented in Table 7 shows that the partner farmers had fully adopted high yielding varieties in their fields. It can be also inferred that the mean percent score (MPS) pertaining to practices like irrigation management, seed rate and spacing, soil treatment and field preparation, time of sowing, fertilizer application, harvesting, threshing and storage and seed treatment were 88.25, 86.00, 82.30, 74.62, 65.70, 64.00 and 62.50, respectively.

Table 7: Adoption of mustard production technology by the partner farmers

Sl. No.	Package of practices	Partner farmers	
		Mean percent score	Rank
1.	HYVs	100.00	1
2.	Soil treatment and field preparation	82.30	4
3.	Seed treatment	62.50	8
4.	Time of sowing	74.62	5
5.	Seed rate and spacing	86.00	3
6.	Fertilizer application	65.70	6
7.	Irrigation management	88.25	2
8.	Weed management	39.65	9
9.	Plant protection measures	38.75	10
10.	Physiological aspects	25.50	11
11.	Harvesting, threshing and storage	64.00	7

On the contrary, other practices such as weed management, plant protection measures and physiological aspects were found to be least adopted with 39.65, 38.75 and 25.50 MPS, respectively. The finding is in corroboration with the findings of Kushawah et al. (2016); Deka et al. (2021).

4. Conclusion

Both the selected varieties namely; DRMRIJ 31 (Giriraj) and RH-406 contributed higher yield and net return in DP as compare to prevailing FP in the Dholpur district. Newly demonstrated techniques were also found cost effective, profitable and acceptable among the farming community. There is an extensive yield gap between research station technology and prevailing FP, which has resulted in lower yields in FP. The CFLDs programme is an effective tool for increasing the productivity of mustard.

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