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Impact of FLD Intervention on Yield, Adoption and Horizontal Spread of Oilseed Crops in Pali District of Rajasthan, India

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Abstract: In arid zone old varieties and poor management practices leads to the failure of oilseed crops facing heavy losses to the farmers. Introduction of better varieties with the adoption of scientific cultivation can help to solve this problem. To prove this theory frontline demonstrations (FLDs) were conducted in Pali district for sesame and mustard crop during 2017-2020 on farmer's field according to package of practices recommended for this zone, farmers practice also taken as control to evaluate the performance of FLDs in cluster. The results revealed that there was a significant raise in yield of mustard over the control by 47.00% and sesame by 46.00% respectively. Front line demonstrations recorded higher mean net return (Rs. 39762.50 ha^{-1}) with higher benefit ratio (2.86) under improved technologies of mustard as compared to local checks. In sesame also higher mean net return (Rs. 18655.73 ha^{-1}) with higher benefit ratio (2.06) under improved technologies was recorded as compared to local checks. Therefore, the stakeholders who are engaged in transfer of agriculture technologies on farmer's field should pay more attention conducting frontline demonstrations (FLDs) extensively in cluster approach for enhancing productivity potential of and to make rapid spread of flagship technologies.

Key words : Adoption, horizontal spread, varietal replacement, yield, FLD.

Rapeseed-Mustard (family: Cruciferae) and sesame (family: Pedaliaceae) both are climate resilient crops and suitable to grow under diverse range of agro-climatic conditions in arid and semi-arid areas of the country.Higher net return and lower input cost are an important feature of these crops amd have become an important part ofstrategies to increase domestic oilseed production and secure the livelihood of small and marginal farmers. In India, oilseed crops are the second largest agricultural commodity contributing 33.42 MT production from an area of 27.04 million hectare with an average productivity of 1236 kg ha^{-1} during 2019-20. Rajasthan is the third largest oilseed producing state in India with a share of 20.30% by producing 6.79 MT from an area of 5.29 million hectare with 19.58% area share in the country. Rajasthan claims first position in the production of rapeseed-mustard in India with the production of 4.22 MT (46.28% of the country) from 2.95 million hectares area, with an average productivity of 1431 kg ha^{-1} (Anonymous, 2020). Sesame also is an important oilseed crop for Rajasthan, state holds third position with 13.8% share in the total sesame production of the country. The area under oilseed at the district level in Rajasthan has been instable as district wise rainfall has been uneven and uncertainty affecting the irrigation available and the sowing area under the crop. These are highly paying crops of the dry regions. At the national level, the domestic achievements in oilseeds production are unparallel with six times increase in oilseeds production during the period of 1950-2011 achieved under predominantly rainfed (72%) agroecological conditions, which is even higher than the production increase in total food grains during the corresponding period (Hegde, 2012). Despite the impressive growth in the country's oilseed area and production, there is still a huge gap between deamand and supply of oilseeds and vegetable oils in the country.

Given the competing demands on agricultural land from various crops, the production of oilseeds can be maximized only if productivity is improved significantly and farmers will receive remunerative and attractive prices. The major constraints were technological (non-availability of suitable varieties, poor crop germination, lack of irrigation facilities, weed infestation etc.), agro-climatic factors (drought at critical stages of crop growth, excessive rains, extreme variations in temperature, etc.), economic and institutional (high-input cost on diesel, fertilizers, agrochemicals, shortage

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of human labor, low and fluctuating prices, problem of timely availability of seed, non-availability of other inputs, lack/poor extension services etc.), and post-harvest, marketing and value addition. Since there is limited scope to bring additional area exclusively under oilseeds as the demand for land for other purposes and for producing other remunerative crops will continue to rise due to population increase and rising living standards, it is crucial to search for newer approaches to expand their cultivation under different cropping/farming situations.

Frontline demonstration are one of the important and powerful tool of extension because, in general farmers are driven by the perception that 'learning by doing' and 'Seeing is believing'. The main objective of frontline demonstrations is to demonstrate improved production technologies comprising high yielding varieties and its management practices in the farmer's field under different agro-climatic regions and farming situations. Realizing the importance of FLDs in transfer of the latest technologies, KVK, Pali conducted FLDs and studied the impact of frontline demonstration on oilseeds at farmer's field.

Materials and Methods

In total, 436 frontline demonstrations were conducted at farmers' fields in fifteen villages to demonstrate the production potential and economic benefits of improved technologies in the Pali district of Rajasthan state during rabi, 2017-18 to 2020-21 under a rainfed farming situation. For the FLDs, varieties suiting the agroclimatic conditions were selected, i.e NRCDR 2 for mustard and RT 351 for sesame, as these are salinity tolerant and well adapted to rainfed conditions. e utilised a systematic approach to allocate treatments to plots within fields. Pringle *et al*. (2004), claim the interpolated yield maps were made for various farmer fields and utilised to calculate continuous quantities of controlled input. During data collection, a global positioning system was employed to pinpoint the exact location of several experimental plots in the farmer's field. Furthermore, soil moisture conditions were evaluated using a digital moisture metre at a depth of 15 cm before planting and after crop harvesting. All the packages and practices recommended by the state agriculture department were adopted during the trials from sowing to harvesting. The yield and economic performance of frontline demonstrations were collected from FLDs as well as local plots and finally the grain yield, average extension gap, technology gap, technology index, cost of cultivation, net returns with the benefit cost ratio were worked out. For the purpose of investigation, fifteen villages in Pali district, where FLDs were conducted during the preceding four years ,were selected. A sample of 100 respondents was taken, comprising 50 beneficiary and 50 non-beneficiary farmers. For the selection of beneficiary farmers, a list of farmers where FLDs on oilseeds were conducted was prepared and, taking equal representation, farmers from each of the selected villages were selected randomly. For the other half of the samples (50 non-beneficiary farmers), were selected randomly from the locality adjacent to KVK, where FLDs were not conducted by any institute or organizations. The data was collected through personal contacts with the help of a well-structured interview schedule. In light of the study's objectives, the collected data were processed, tabulated, classified, and analysed in terms of mean per cent score and rank. A difference of more than 10% between beneficiary and non-beneficiary farmers was considered significant. During the demonstration, Farmers were educated on the value of new technologies for sesame and mustard, as well as how to correctly apply these technologies for improved crop performance under current soil and agro-climatic conditions. Grain yield from the demonstration plots was statistically verified and reported as a mean score. Different parameters as suggested by Yadav *et al*. (2004) were used for calculating gap analysis, costs and returns. The details of the different parameters are as follows:

Extension gap = Demonstration-Farmers practice yield

Technology gap = Potential yield-Demonstration yield

Additional return = Demonstration return-Farmer practice return

B:C ratio = (Gross return)/(Gross cost)

Technology index (%) = (Potential yield - Demonstration yield)/(Potential yield) x 100

The collected data was tabulated and statistically analysed in order to interpret the FLDs results.

Results and Discussion

Performance of FLD

A comparison of productivity levels between demonstrated varieties and local checks is shown in Table 1. During the period under study, it was observed that the productivity of mustard in Pali district under improved production technologies ranged between 14.42 to 20.25 q ha^{-1} with a mean yield of 17.48 q ha^{-1}, as against the yield range between 11.45 to 12.30 with a mean of 11.90 q ha^{-1} under farmers local practices. The additional yield of demonstrated varieties under improved production technologies over local practises ranged from 5.09 to 5.98 q ha^{-1} with a mean of 5.58 q ha^{-1} in comparison to local varieties. In the case of sesame, the productivity varied from 4.75 to 7.92 in the case of demonstration as compared to 4.0 to 4.5 q ha^{-1} in the case of local cultivars. Thus, there was an additional yield advantage of 5.58 q ha^{-1} in case of mustard and an advantage of 1.96 q ha^{-1} in case of sesame over the local cultivars grown at farmers' fields from traditions. This increased grain yield with improved production technologies was mainly because of high potential yielding varieties and its moisture availability, rainfall and weather condition, disease and pest control, as well as the change in the locations of demonstration plots every year. This variation in productivity also caused an unusual delay in sowing in some of the farmer's fields. The late-sown crop was subjected to a relatively shoter time span available for plant growth and development. Mitra and Samajdar, 2010 in the Tarai zone of West Bengal; Naagar *et al*., 2017 in Bhilwara district of Rajasthan; Kalita *et al*., 2019 in Tirap district of Arunachal Pradesh; Meena *et al*., 2020 in Sri Ganganagar district of Rajasthan; and Sangwan *et al*. (2021) in Rohtak district of Haryana have all documented similar results of yield enhancement in rapeseed-mustard crop in front line demonstrations. The results are also in conformity with the findings of Singh *et al.* (2007), Singh *et al.,* 2011; Katare *et al.,* 2011 and Dayanand and Mehta, 2012. The results also indicated that the improved varieties were found to be better than the local check under local conditions, and Front-Line Demonstrations had a good impact on the farming community of this district as they were motivated by the improved agricultural technologies used. On farm expérimentation (OFE) brings together scientific methodologies and farmers' actual needs to generate acceptable, effective, and thoroughly tested location-specific agricultural solutions. The synergy of scientists and farmers working together to plan, implement, and evaluate research is the strength of OFE (Wuest *et al.,* 1999). The yield of the front demonstration trials and the potential yield of the different varieties of crop -were compared to estimate the yield gaps which were further categorized into technology indexs. The technology gap shows the gap in the demonstration yield over potential yield and it was 4.66 q ha^{-1} (mustard) and 3.78 q ha^{-1} (sesame). The observed technology gap may be attributed to dissimilarities in soil fertility, salinity, erratic rainfall and other vagaries of weather conditions in the area. Hence, to narrow down the gap between the yields of different varieties, location specific recommendations appear to be necessary. These findings are consistent with the findings of Pringle *et al.,* 2004 and Panten *et al.,* 2010, who stated that farmers and researchers learn from such experiments incrementally. In order to more accurately estimate response functions, the farmer must balance the benefit from OFE with the potential economic loss from including extreme (far from optimal) treatments. The technology index indicate the viability of a variety in the farmer's

Table 1. Yield of mustard as influenced by high yielding varieties over local practices in farmer's fields (2017 to 2020)

Year	Variety	Area (ha)	Demo Nos.	Yield (q ha^{-1})				Add. Yield over local (q ha^{-1})	Increase in yield over local (%)	Ext. gap (q ha^{-1})	Tech. gap (q ha^{-1})	Tech. index (%)
				Max.	Min.	Mean	Local					
2017-18	NRCDR-2	15	30	19.92	15.10	17.51	12.03	5.48	45.6	5.48	4.62	20.9
2018-19	NRCDR-2	10	20	19.35	14.42	16.89	11.80	5.09	43.1	5.09	5.25	23.7
2019-20	NRCDR-2	28	56	19.56	15.30	17.43	11.45	5.98	52.2	5.98	4.70	21.2
2020-21	NRCDR-2	15	30	20.25	15.90	18.08	12.30	5.78	47.0	5.78	4.06	18.3
Mean				19.77	15.18	17.48	11.90	5.58	47.0	5.58	4.66	21.0

Table 2. Yield of sesame as influenced by high yielding varieties over local practices in farmer's fields (2017 to 2020)

Year	Variety	Area (ha)	Demo Nos.	Yield (q ha^{-1})				Add. Yield over local (q ha^{-1})	Increase in yield over local (%)	Ext. gap (q ha^{-1})	Tech. gap (q ha^{-1})	Tech. index (%)
				Max.	Min.	Mean	Local					
2017	RT 351	20	50	7.50	4.75	6.13	4.32	1.81	41.8	1.81	3.88	38.8
2018	RT 351	20	50	7.25	4.68	5.97	4.00	1.97	49.1	1.97	4.04	40.4
2019	RT 351	20	50	7.92	5.06	6.49	4.25	2.24	52.7	2.24	3.51	35.1
2020	RT 351	20	50	7.20	5.42	6.31	4.50	1.81	40.2	1.81	3.69	36.9
Mean				7.47	4.98	6.22	4.27	1.96	46.0	1.96	3.78	37.8

field. Table 1 revealed that the technology index value was 21.0 in the case of mustard and 37.8 in the case of sesame, showing the feasibility of the technology demonstrated. The findings of the present study are in line with the findings of Sagar and Chandra (2004); Mitra and Samajdar, 2010; Katare *et al.*, 2011; Chaudhary *et al.*, 2018 and Sangwan *et al.*, 2021. Because farmers like to acquire first-hand knowledge while selecting whether to implement a new technique, demonstration plots under typical local circumstances are important in FFS. As Sones *et al.*, 2003 concluded, demonstration plots may give this practical knowledge to aid farmers in the seamless adoption of new technologies.

Economic performance

The economic feasibility of improved technologies over traditional farmer's practices was calculated depending on the prevailing prices of inputs and output costs (Table 2). It was found that the average cost of production of mustard under improved technologies was Rs. 21,400 ha^{-1} with an average of Rs. 16,450 ha^{-1} in local practice, whereas for sesame it was Rs. 17,665 ha^{-1} with an average of Rs. 14,880 ha^{-1} in local practice. The increased cost of improved technologies was mainly due to the higher costs involved in the cost of improved seed alone. Front line demonstrations recorded a higher mean net return (Rs. 39762.50 ha^{-1}) with higher benefit ratio (2.86) under improved technologies of mustard as compared to local checks. In sesame,a a higher mean net return (Rs. 18655.73 ha^{-1}) with a higher benefit ratio (2.06) under improved technologies was recorded as compared to local checks. These results are in line with the findings of Choudhary *et al.*, 2013 on Cumin; Singh *et al.*, 2019; Sangwan *et al.*, 2021 on mustard and Rohit and Singh, 2019 on sesame. The results from the present study clearly brought out the potential of improved production technologies in enhancing oilseed production and economic gains in rainfed farming conditions of this region of Rajasthan. Hence, oilseed production technologies have broad scope for increasing the area and productivity at each and every level.

Conclusion

It is revealed from the above study that the adoption of improved varieties with production and management technologies through frontline

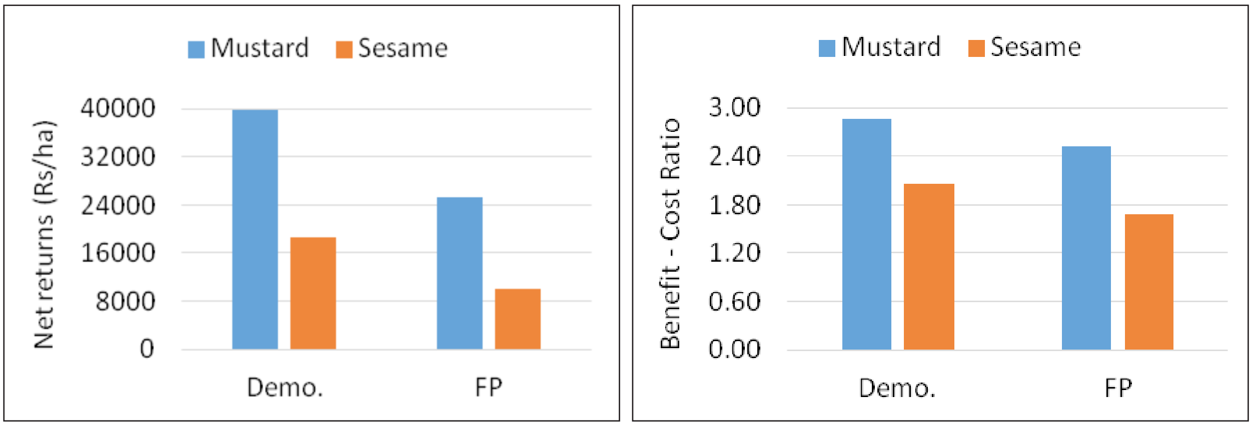

Fig. 1. Net returns (Rs. ha^{-1}) and Benefit: Cost ratio of mustard and sesame as affected by improved production technologies over local practices (2017 to 2020).

demonstration gave 23.53% higher yield and Rs. 7574.22 ha^{-1} more net returns to the growers than local checks. It can be concluded that frontline demonstration conducted under the close supervision of scientists is one of the important tools for extension to demonstrate newly released crop production and protection technologies and their management practices in the farmer's field under different agro-climatic regions and farming situations. FLDs are playing an important role in motivating farmers to adopt of improved varieties, resulting in their increasing their yield and profits. The cultivation of oilseeds involves a higher cost of cultivation and generates higher returns to the farmers compared to the cultivation of cereals and other staple crops. The socio-economic characteristics of the farmers also have an important bearing on the decision to cultivate these cash crops. For example, resource poor farmers normally don't prefer to go for cash crops because of the scarcity of resources. They prefer to cultivate crops, which involve a lower cost of production. On the other hand, large farmers and resourceful farmers usually prefer to cultivate oilseeds as they give better returns, can be maintained at a lower cost, and post-harvest operations are easy.

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References

Anonymous 2020. Agricultural Statistics-2020. Directorate of Economics & Statistics, Department of Agriculture Cooperation & Farmers Welfare, New Delhi.

Chaudhary, R.P., Chaudhary, G.K., Prasad, R., Singh, R. and Chaudhary, A.K. 2018. Impact assessment of frontline demonstrations on mustard crop. *Internation Journal of Current Microbiology and Applied Sciences* 7: 4737-4742.

Choudhary, M.K., Singh, D., Meena, M.L. and Tomar, P.K. 2013. Economic analysis of front line demonstrations on cumin: A case in arid zone of Rajasthan. *Annals of Arid Zone* 52: 137-139.

Dayanand, V.R.K. and Mehta, S.M. 2012. Boosting mustard production through front line demonstrations. *Indian Research Journal of Extension Education* 12(3): 121-123.

Hegde, D.M. 2012. Carrying capacity of Indian agriculture: oilseeds. *Current Science* 102(6): 867-873.

Kalita, S.K., Chhonkar, D.S. and Kanwat, M. 2019. Assesment of cluster front line demonstrations on rapeseed (*Brassica campestris* L.) in Tirap District of Arunachal Pradesh. *Indian Journal of Extension Education* 55(3): 17-22.

Katare, S., Pandey, S.K. and Mustafa, M. 2011. Yield gap analysis of rapeseed-mustard through front line demonstrations. *Agriculture Update* 6: 5-7.

Meena, R.K., Singh, B., Meena, R.K. and Shinde, K.P. 2020. Impact of front line demonstrations on mustard production and profitability in sri ganganagar district of rajasthan, India. *Global Journal of Bioscience and biotechnology* 9(3): 106-110.

Mitra, B. and Samajdar, T. 2010. Yield gap analysis of rapeseed-mustard through front line demonstration. *Agricultural Extension Review* 22: 16-17.

Naagar, K.C., Chhipa, B.G., Dhakar, S.D. and Yadav, C.M. 2017. Role of Front Line Demonstration in Boosting the Mustard Production. *Annals of Arid Zone* 6(3&4): 129-130.

Panten, K., Bramley, R.G.V., Lark, R.M. and Bishop, T.F.A. 2010. Enhancing the value of field experimentation through whole-of-block designs. *Precision Agriculture* 11: 198-213. doi:10.1007/s11119-009-9128-y

Pringle, M.J., McBratney, A.B. and Cook, S.E. 2004. Field-scale experiments for site-specific crop management. Part II. Geostatistical analysis. *Precision Agriculture* 5: 625–645. doi:10.1007/s11119-004-6347-0

Rohit and Singh, J. 2019. Impact of front-line demonstrations on sesame (*Sesamum indicum* L.) in Agra district of U.P. *Journal of Pharmacognosy and Phytochemistry* 8(6): 339-341.

Sagar, R.L. and Chandra, G. 2004. Front line demonstration on sesame in West Bengal. *Agricultural Extension Review* 10: 7-10.

Sangwan, M., Singh, J., Pawar, N., Siwach, M., Solanki, Y.P. and Ramkaran 2021. Evaluation of Front-Line Demonstration on Mustard Crop in Rohtak District of Haryana. *Indian Journal of Extension Education* 57(2): 6-10.

Singh, D., Meena, M.L. and Choudhary, M.K. 2011. Boosting seed spices production technology through front line demonstrations. *International Journal of Seed Spices* 1(1): 81-85.

Singh, K.K., Singh, R.P.N. and Mishra, D. 2019. Evaluation of front-line demonstration of Oilseeds in Raebareli District. *Indian Journal of Extension Education* 55(3): 49-52.

Singh, S.N., Singh, V.K., Singh, R.K. and Singh, R.K. 2007. Evaluation of on-farm front line demonstrations on the yield of mustard in Central Plains Zone of Uttar Pradesh. *Indian Research Journal of Extension Education* 7: 79-81.

Sones, K.R., Duveskog, D. and Minjauw, B. 2003. Farmer Field Schools: The Kenyan experience. Report of the Farmer Field School stakeholders' forum held 27th March 2003 at ILRI, Nairobi, Kenya. FAO/KARI/ILRI, Nairobi, Kenya.

Wuest, S., McCool, D., Miller, B., and Veseth, R. 1999. Development of more effective conservation farming systems through participatory on-farm research. *American Journal of Alternative Agriculture* 14(3): 98-102. doi:10.1017/S0889189300008195

Yadav, D.B., Kamboj, B.K. and Garg, R.B. 2004. Increasing the productivity and profitability of sunflower through front line demonstrations in irrigated agroecosystem of eastern Haryana. *Haryana Journal of Agronomy* 20(1&2): 33-35.

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