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Estimation of gap and economic analysis of cluster frontline demonstrations on mustard crop

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Abstract
The level of acceptance of advanced agricultural technology in the innovation diffusion process is the most important element for encouraging a gain in agricultural production. The goal of the current study was to compare the yield disparities between the farmers' practices and the improved package of practices of rapeseed mustard under Cluster Font Line Demonstrations (CFLD) on mustard crop by KVK Fatimabad during *rabi* 2022–2023 season. The results revealed that the yield of mustard grown in demonstration plots was much higher than that of check plots (farmer's practice). Overall, the output of demonstration plots was 17.49% higher than that of check plots. The 3.03 q ha^{-1} average extension gap brought attention to the need for farmers to receive education through a range of extension approaches in order to adopt improved agricultural technology. An average technology index was 22.54% across three clusters. The economic feasibility of the intervention was shown by a Good B: C ratio. The aforementioned information suggests that mustard crop productivity may be increased through cluster demonstrations, which encourage farmers to use the types of scientific production methods that were exhibited in the CFLD plots.

Keywords: Frontline demonstration, oilseeds, mustard, technology gap, extension gap.

Introduction

The economics of agriculture depend significantly on oilseed in many regions of the world. The top five producers of oilseeds in the world are the United States, Brazil, Argentina, China, and India accounts for 82 per cent of total production. After groundnut, mustard-rapeseed is the most significant oil seed crop in India, accounting for around 25 per cent of all oilseed output. Oilseed crops, the second-largest group of agricultural products after grains because of their high fat content, are crucial to the Indian agricultural economy. After soybean and palm oil, rapeseed mustard is the third-largest group of oilseed crops in the world. Mustard, which accounts for nearly one-third of all oil produced in India, is the principal edible oilseed crop. Indian mustard seeds have an oil content that ranges from 30 to 48 per cent. The remainder of this oil, which is also used to create medicines and animal feed, is a great source of energy. Due to its role as a food preservative, it is a highly popular media for prickles (Gopale *et al.*, 2022) [4]. In addition to the benefits of oil made from mustard rapeseed, the seeds, sprouts, leaves, and fragile plants provide health benefits when used as vegetables and seasonings. Selenium, calcium, magnesium, iron, phosphorus, zinc, magnesium, manganese, and other elements are present in them. (Verma and Prasad, 2023) [8]. Indian mustard (*Brassica juncea*) is grown across the country over an area of 8.06 million hectares, yielding 11.75 million tonnes and 1457 kg ha^{-1}, respectively. The state of Rajasthan has the greatest acreage dedicated to this crop, with the next-largest amounts being in Uttar Pradesh, Haryana, Gujarat, Maharashtra, Punjab, Assam, and West Bengal. Haryana is the third-largest state in the country, producing 1.37 million tonnes across 0.71 million hectares with an average yield of 1914 kg ha^{-1} in 2021–2022. Due to population expansion and growing living standards, India's domestic usage of edible oils has greatly increased over time. When compared to the 115.71 lakh tonnes of net domestic edible oil availability in 2021–2022, it reached a level of 20.82 lakh tonnes, with imports covering the 141.94 lakh tonnes of necessary edible oil (Anonymous, 2022) [1].

It demonstrates that there is still a sizable imbalance between the supply and demand of edible oil, which is covered by large imports that cost a sizable sum of foreign currency. There is necessity to overcome various biotic, abiotic, and socio-economic restrictions that prevent the yield potential from being fully used. To overcome stagnant oilseed output and achieve self-sufficiency in the production of edible oilseeds, the government decided to push the most recent production technology in oilseed among farmers. Cluster frontline demonstration (CFLD) is a novel strategy used by the Indian Council of Agricultural Research on Oilseed and Pulse crops to create a direct line of communication between scientists and farmers. To boost the indigenous production of oilseeds, the project namely

National Food Security Mission (Oilseed) was implemented by ICAR-Agricultural Technology Application Research Institutes (ATARI) all over India through KVKs to enhance the oilseed production in the country. This project authorized KVKs to show the potential of oil seed production technologies generated by ICAR and State Agricultural Universities (SAUs) to the farmers for higher production and better productivity and profitability. During demonstrations, farmers' were guided by KVK scientists about land preparation, improved varieties, seed treatment, integrated nutrient, pest and disease management in mustard production technologies.

Keeping in view of the realistic approach of CFLDs for dissemination of technology, the present study was planned to assess the technological and yield gap between demonstrated technology and the technology adopted by the oilseed growers.

Materials and Methods

The study was conducted in Fatehabad district of Haryana satate to assess the technological and extension gaps between recommended technology under CFLDs mustard demonstrated by KVK Fatehabad and the existing technology of mustard used by the farmers. During rabi season, 2022-23, a total of 125 CFLDs were conducted in three clusters namely Fatehabad, Bhuna and Bhattu Blocks of Fatehabad district over an area of 50 hectares by KVK, Fatehabad of Haryana state. The CCS HAU recommended package of practices for mustard crop was followed in all the demonstration plots. The demonstrations at farmers' fields were regularly monitored at different stages of crop by a multi-disciplinary team of KVK scientists. The yield data and economics of demonstration and check plots was recorded and analysed. Different parameters as suggested by Dayanand *et al*. (2012) [2] were used for calculating gap analysis, costs and returns. The logical tool used for assessing the performance of the FLD is as under:

Extension Gap=Demonstration yield - Check Plot (farmers' practice) yield

Technology Gap = Potential yield – Demonstration yield

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

Results and Discussion

The mustard variety RH 0725 developed by CCSHAU Hisar, which has a production potential of 26.25 q ha^{-1}, was used in CFLDs experiments. Using mustard varieties grown locally, checks have been made locally. Farmers have been given a set of procedures to follow in order to implement the CCS HAU Hisar recommendations. The mustard technologies and critical inputs provided to farmers to demonstrate under CFLD, as shown in Table 1.

Table 1: Particulars of mustard grown under frontline demonstrations and farmers practices

Particulars	Farmers' practice (Local check)	Front Line Demonstrations (Improved technology)
Variety	Local/ RH-30	RH-0725
Seed rate (Kg /acre)	1 -1.5 kg	1.5 kg
Seed treatment	No	Carbendazim @2 g kg^{-1} seed
Line spacing	30 cm	30 cm
Sowing time	1st week of October	25th September to 15th October
Nutrient management	50 kg Urea + 50 kg DAP	52 kg Urea + 50 kg SSP +10 kg $ZnSO_4$
Disease & pest management	As suggested by dealers/ farmers	Bavistin-500 gm, Mencozeb-500 gm, Monocrotophos - 250 ml and Dimethoate-500 ml

Yield analysis

The yield performance of mustard crop obtained by farmers under CFLDs as well as check plots was assessed and presented in Table 2. The results revealed that mustard yield was significantly higher under cluster frontline demonstrations than check plots in all three clusters. In comparison to check plots, Cluster-II had the highest yield increase (20.11%), followed by Cluster-III (16.77%), and Cluster-I (15.60%) over check plots. Overall, 17.49 per cent higher yield under CFLDs was observed than that of check plots. Singh *et al.*, (2014) [5] also suggested that the use of high yielding improved variety under FLD programmes leads to increase in the production as well as productivity also.

FLD practices created great awareness and motivated the other farmers to adopt appropriate oilseed production technologies. Rana *et al.*, (2017) [6] assessed the management of stem rot disease in mustard crop and concluded that the seed treatment with Carbendazim @ 2.0 g kg^{-1} seed controlled stem rot disease more efficiently in mustard crop among two recommended practices *i.e.* Soil treatment followed by seed treatment with *Trichoderme harzinium* and only seed treatment with Carbendazim @ 2.0 g kg^{-1}. The demonstrations resulted in significant average increase in yield of mustard crop and also higher net returns over check plots. The adoption of a set of practices for mustard crops, such as improved variety, seed treatment and integrated pest and disease management, may be the cause of increased yield under demonstrated plots.

Gap analysis

Gap analysis was calculated to assess the extension gap and technology gap. The perusal of the data in Table 2 reveals that extension gap in Cluster-II was higher (3.6 q ha^{-1}) followed by cluster-III (2.8 q ha^{-1}) and Cluster-I (2.7 q ha^{-1}). Shivran *et al.*, (2020) [7] evaluated performance of improved varieties of Indian mustard in terms of gap analysis, yield enhancement and economic viability through front-line demonstrations and found that gaps for technology, extension and technology index were significant and resulted in realizing higher B:C ratio compared to the farmers' practice during six years study period. The overall extension gap was observed 3.03 q ha^{-1}, which emphasized the need to educate the farmers through various extension means for adoption of improved mustard production technology.

The technology gap showed the feasibility of the technology at farmers' field. The lower the value of technology gap more will be the feasibility of technology distributed. The data in Table 2 reveals that technology index range from 18.09 to 25.71 per cent in three clusters. The average technology index of three clusters was 22.54 per cent. Low value of technology index reflects adequacy of technology. This means that technology demonstrated through CFLDs was feasible in that region and needs to popularize through various extension departments for the benefits of farmers.

Table 2: Cluster wise grain yield and gap analysis of frontline demonstrations on mustard crop

Clusters	No. of Demonstration	Yield (q ha^{-1})		Increase in yield (%)	Extension gap (q ha^{-1})	Technology gap (q ha^{-1})	Technology index (%)
		Demonstration	Farmer's practice				
I	40	20	17.3	15.60	2.7	6.25	23.81
II	50	21.5	17.9	20.11	3.6	4.75	18.09
III	35	19.5	16.7	16.77	2.8	6.75	25.71
	125	20	17.3	17.49	3.03	5.92	22.54

Economic analysis

The data regarding economic indicators *i.e.* cost of cultivation, gross returns, net return and benefit cost ratio are depicted in Figure 1. Economic return was observed to be a function of grain yield and sale price or minimum support price. The data in Figure 1 clearly shows that net return of demonstration plots was Rs. 83.25 thousands ha^{-1} as compared to check plots (farmers' practice) which was Rs.71.28 Thousands ha^{-1}. The higher additional returns obtained under demonstrations could be due to improved technology, nonmonetary factors, timely operations of crop cultivation and scientific monitoring. Favorable benefit cost ratio proved the economic viability of intervention. The B: C ratio was 3.9 under demonstration, while it was 3.7 under control plots. Singh *et al.*, (2014) [5] also concluded that the FLD programme was found to be useful in imparting knowledge and adoption level of farmers in various aspects of oilseed production technologies.

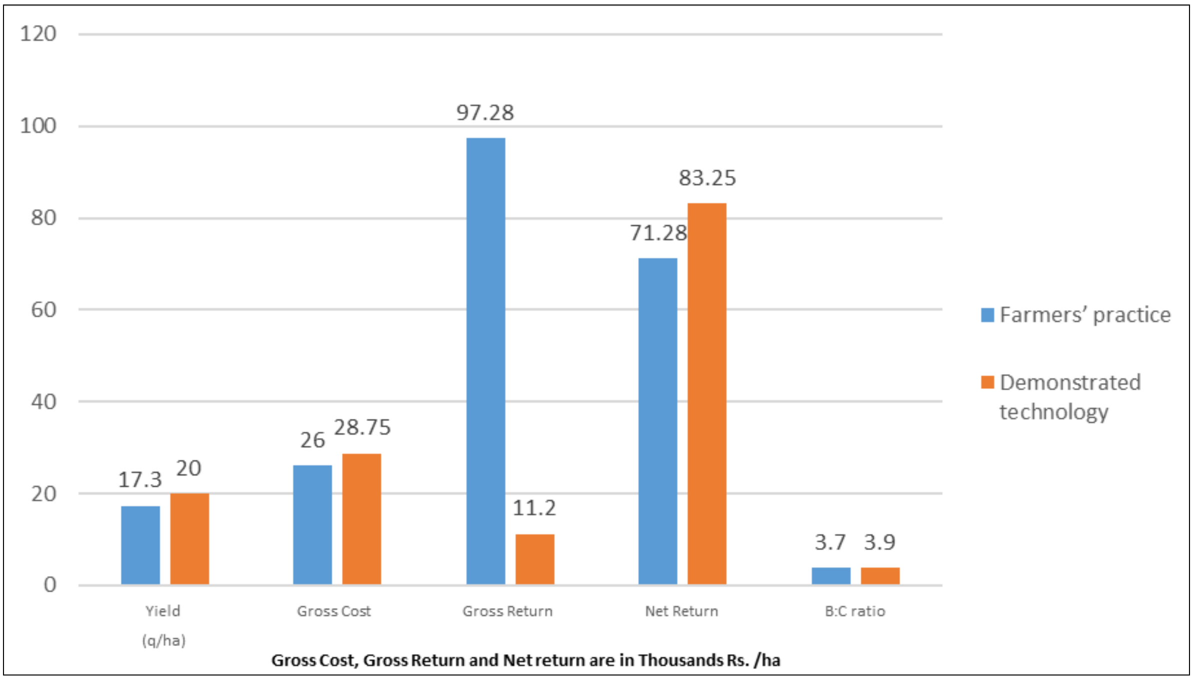

Fig 1: Economic analysis of cluster frontline demonstrations on mustard crop

Conclusion

From the above data it is inferred that the Cluster Front Line demonstration program was successful in influencing farmers' attitudes toward growing mustard. Farmers' skill and knowledge was increased as a result of the demonstration plots of mustard crop being grown using improved technologies. Through cluster demonstrations, farmers can be encouraged to adopt the cutting-edge production techniques that were shown to work in the CFLD plots, thereby increasing mustard crop production and productivity. It has been found that scientific knowledge transmission, provision of high-quality, need-based inputs, and proper application of those inputs can all increase potential yield. For a quicker and more extensive spread of the advised practices among other farmers, the front line demonstration concept may be applied to all farmer categories, including progressive farmers. The availability of soil moisture, rainfall amounts, climatic anomalies, and disease infestation are also to blame for differences in crop yield. Additionally, it was found that farmers in the study area were ignorant of seed treatment for mustard crops, which led to significant losses from diseases spread by seeds like stem rot. It is further recommended that farmers be informed about seed treatment. As a result, the technologies presented under CFLDs helped to increase the area under mustard cultivation as well as production and productivity.

Conflict of interest

The authors declare that there is no conflict of interest among authors.

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