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Performance of cluster frontline demonstrations on production and productivity of rapeseed in Assam

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ABSTRACT

Oilseeds productivity in Assam, India is far less than the national average because of poor crop management and cultivation of low yielding varieties. Cluster frontline demonstration is an effective tool for technology transfer and better technology adoption by the farmers to bridge the yield gaps in oilseed crops. A study on cluster frontline demonstration on rapeseed was conducted for 3 consecutive years i.e. 2017-18 to 2019–2020 in different districts of Assam, India. On the basis of 3 years data, it was observed that increased in yield of rapeseed variety TS-38 under cluster frontline demonstration over local check or farmers practices ranges from 29.67% during 2018-19 to 46.82% during 2019-20. Technological yield gap was highest (2.12 qha^{-1}) during 2017-18 and lowest (1.68 qha^{-1}) during 2019-20. Maximum extension yield gap of 3.24 qha^{-1} was observed during 2019-20 and lowest (2.30 qha^{-1}) was observed during 2018-19. Highest gross return (39,989 ₹.ha^{-1}) and net-returns (24,154₹ ha^{-1}) were obtained during 2019-20 in demonstration plots, while lowest gross return (36,426 ₹.ha^{-1}) and net-returns (19,317 ₹.ha^{-1}) were recorded during 2017-18. Highest benefit-cost ratio (2.18) was observed during 2018-19 while lowest benefit cost ratio (2.03) was found during 2017-18 in demonstration plots.

1. Introduction

The yellow revolution during the late 1980's has given an impetuous momentum to the oilseed production and two and half fold increase in the oilseed has been observed till late 1990's, which make the country fourth largest producer of oilseed accounting for about 20 per cent of the global area and 10 per cent of the global production (Kumar and Tiwari, 2020; Singh *et.al.,* 2015). Despite, oilseeds being second largest agricultural commodity in India after cereals, the country imports a large chunk of it to meet the domestic demand (Meena *et al.,* 2012). Out of all the oilseeds, the rapeseed & mustard is the second highest crop grown India after soybean, however it rank top in the north east (www.justagriculture.in, 2021). Among the north eastern states of India, due to the wide variety of agro-climatic conditions and soil types, Assam enabling cultivation of various oilseeds such as; groundnut, sesamum, rapeseed & mustard, linseed and castor occupied 28.82 million hectares during 2020-21(Statistical Handbook of Assam, 2021). The total area under rapeseed-mustard was 0.28 million hectares with a total production of 0.18 million tones, contributing 1.56 per cent of the total production of rapeseed-mustard in India (DRMR, 2020-21, Project Coordinator's Report). The average yield of rapeseed-mustard in Assam is 647 kg/ha (Economic survey of Assam, 2020-21) which is far behind than the national average i.e.1281 kg/ha (DRMR, 2020-21).

The average yield gap of rapeseed-mustard indicates that the huge yield gap exists between potential yield and yield under real farming situation (Meena *et al.,* 2012) in Assam. The major reasons for such yield gap were non-adoption of scientific management practices along with the non-availability of quality seeds. Front line demonstration of scientific management practices of recent technologies in farmer's field can reduce the yield gap to maximum extent.

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The FLD in oilseeds is a unique programme started by Ministry of Agriculture, Govt. of India, conducted under close supervision of farm scientists. Main objective of FLDs' in oilseeds is to increase production and productivity of oilseeds crops under different agro-ecological situations and to demonstrate and popularize improved agro technology on farmers' fields under varied farming situations for effective transfer of generated technology to fill the gap between improved technology adopted and the indigenous technology of the existing situation.

The present investigation was undertaken in oilseeds by considering the above points. The study was conducted to demonstrate and transfer the recent agro technology through FLDs' in oilseeds with the objectives of enhancing productivity, profitability, narrowing the extension and technological yield gaps. Framing appropriate extension strategy for effective transfer of technology to the farmers field and motivate farmers to adopt such technology for sustaining oilseed production in Assam.

2. Materials and methods

Frontline demonstrations on improved farm technology (Table 1) were conducted by Krishi Vigyan Kendras of Assam in rapeseed variety TS-38 during 2017-18 to 2019-20 under the supervision of ICAR-ATARI, Guwahati on 750 ha area of Assam covering 1912 farmers (Table 2). In demonstration plots, full package of recommended practices were adopted whereas, in the adjoining farmers' fields, crop was grown as per the practices followed by the farmers which served as control / local check (Table 1). The study area covered all the six agro climatic zones of Assam. The primary data on grain yield, farmers' practices etc. were collected from the beneficiary farmers through plot cutting methodology followed by personal interviews. The yield increase in demonstrations over farmers' practice was calculated by using the following formula:

%Yield increase over farmers' practice

$$= \frac{\text{Avg. yield in demonstration plots- average yield in farmers field}}{\text{Average yield in farmers field}} \times 100$$

Estimation of technology gap, extension gap, technology index: The estimation of technology gap, extension gap and technology index was done using following formula (Kadian *et al.,* 1997; Samui *et al.,* 2000):

i) **Technology gap** = Potential yield-Demonstration plot average yield

ii) **Extension gap** = Demonstration plot average yield - Farmer's plot average yield

iii) **Technology Index** $= \frac{(Pi-Di)}{Pi} \times 100$

Where,

Pi = Potential yield of i^{th} crop.

Di =Average demonstration plot yield of i^{th} crop.

Economic analysis : Cost of cultivation of oilseeds include cost of inputs like seeds, fertilizers, pesticides purchased by the farmers (in farmers' practice) /supplied by the Krishi Vigyan Kendra (in demonstration plots) as well as hired labour, sowing charges of bullocks / tractor, post-harvest operation charges paid by the farmers etc. (Table 3). The farmers' family labour was not taken into consideration in the present study. The net-return was worked out accordingly by taking cost of cultivation and gross return. Similarly, the Benefit-Cost-Ratio (BCR) was worked out as a ratio of gross returns corresponding costs of cultivation.

Table 1. Details of demonstrated technologies under CFLDs and farmers practices in rapeseed in Assam

Crop	Technology component	Demonstration plot	Farmers practice
Rapeseed	Variety	TS-38	Local
	Seed rate	10 kg/ha	15 kg/ha
	Sowing method	Line sowing	Broadcasting
	Nutrient Management	Integrated Nutrient Management (INM)	Basal application of Urea and SSP
	Plant protection	Plant protection measures were taken up as per requirement.	Nil
	Technical guidance to farmers	Time to time	Nil

3. Results and discussion

Grain yield

Data presented in Table 2 revealed that transfer of improved farm technologies of rapeseed through FLDs resulted in invariably higher grain yield (9.72 to10.16 q ha^{-1}) than farmers' plot yield (6.92 to 7.75 q ha^{-1}), which may be attributed to the adoption of recommended agro-technologies in demonstration plots. Similar kind of findings regarding yield enhancement due to use of recommended agro-technologies in FLDs' were reported by Sagar and Chandra, 2004; Choudhary *et al.,* 2009b; Sharma *et al.*, 2012 and Kumar *et al.*, 2017. Data presented in Table 2 revealed that per cent yield increased in rapeseed variety TS-38 in demonstration plots over farmers' plots was lowest (29.68%) during the year 2018-19 and highest (46.82%) during the year 2019-20. This study showed that adoption of improved farm technologies in rapeseed changes the productivity during the year 2017-18, 2018-19 and 2019-20. The productivity increased from 6.97 to 9.72q ha^{-1} with 39.46 per cent increase in yield over the local practices during the year 2017-18, 7.75 to 10.05 q ha^{-1} with 29.68 per cent and 6.92 to 10.16 q ha^{-1} with 46.82 per cent increase in yield over the local practices during the year 2018-19 and 2019-20 respectively. The yield enhancement through adoption of improved farm technology has also been reported in earlier studies of FLDs' (Vedna, 2007;? Sharma *et al*., 2012; Choudhary *et. al.,* 2009b and Kumar *et al.,* 2017).

Technological yield gap

Technological yield gap affecting yield in rapeseed variety TS-38 was highest (2.12 q ha^{-1}) during the year 2017-18 followed by (1.79 q ha^{-1}) during the year 2018-19 while lowest yield gap was observed (1.68 q ha^{-1}) during the year 2019-20. Generally, the technological gaps appear even if the FLDs' are conducted under the strict supervision of farm scientists on the farmers' fields. This may be attributed due to intervention of some major factors like lack of irrigation facilities, uneven distribution of rainfall, variation in soil fertility, cultivation on marginal land, non-congenial weather conditions, disease and pest management problems faced? Recent citation). These observations indicates that location specific crop management is need of the hour to bridge the gap in potential and demonstration yields (Vedna *et al.,* 2007).

Extension yield gap

Higher extension yield gap indicates that there is a strong need to educate and motivate the farmers through various extension means for adoption of improved farm technologies in oilseeds over existing local practices to reverse the existing trend (Kumar *et al.,* 2016). Refinement in the local farmers' practices for higher adoption of location specific generated farm technology for sustaining crop productivity is another option open for the research scientists. Table 2 revealed that maximum extension yield gap of 3.24 q ha^{-1} was observed during 2019-20 and lowest (2.30 q ha^{-1}) was observed during 2018-19. Similar kind of finding was reported by Choudhary *et al.,* 2009b. Extension yield gaps are the indicators of lack of awareness for the adoption of improved farm technologies by the farmers (Choudhary *et al.,* 2009b and Kumar *et al.,* 2017). The study infers that extension functionaries of Assam should give emphasis on dissemination of proven farm technologies in farmers' field to enhance the oilseed productivity over existing levels.

Table 2: Year wise yield performance of Rapeseed variety TS-38

Years	Area (ha)	No. of FLDs	Potential yield (q/ha)	Avg. demo yield (q/ha)	Avg. Yield of local check (q/ha)	% increase over local check	TYG (q/ha)	EYG (q/ha)	TI (%)
2017-18	460	1136	11.84	9.72	6.97	39.45	2.12	2.75	17.91
2018-19	210	537	11.84	10.05	7.75	29.67	1.79	2.30	15.12
2019-20	80	239	11.84	10.16	6.92	46.82	1.68	3.24	14.19

* TYG: Technology yield gap, EYG: Extension yield gap, TI: Technology index

Table 3: Economics of CFLDs and farmers practice for rapeseed cultivation in Assam

Years	Average cost of cultivation (Rs./ha)		Average gross return (Rs./ha)		Average net return (Rs./ha)		Benefit-Cost ratio	
	DP	FP	DP	FP	DP	FP	Demo	Check
2017-18	18616	15689	36426	25370	19317	9682	2.03	1.63
2018-19	18041	17238	39482	30143	21435	12834	2.18	1.76
2019-20	20523	16929	39989	27607	24154	10678	2.04	1.64

*DP- Demonstration plot FP- Farmers' plot

Technology index

Technology index indicates the feasibility of generated farm technologies in the farmers' fields under existing agro climatic situations (Vedna *et al.,* 2007; Choudhary *et al.*, 2009b). Lower the technology index, higher is the feasibility of generated farm technology under farmers' fields and vice-versa (Kumar *et al.,* 2016). Data in Table 2 revealed that technology index varied from 14.19 to 17.91 per cent in rapeseed. Lowest technology index (14.19 per cent) was recorded during 2019-20 followed by 15.12 per cent during 2018-19 while highest magnitude of technology index was observed 17.91 per cent during 2017-18. Similar kinds of findings were reported by Choudhary *et al.*, 2009b and Meena *et al.,* 2012. The reason behind the higher technology index during the year 2017-18 may be due to higher incidence of pest and diseases resulting in poor yields which could be possible reasons for reducing crop's cultivation among the farmers of Assam. Importance should be given by the farmers on integrated pest and disease management to overcome the incidence of pest and diseases for sustainable productivity of the crop. Poor seed germination and poor stand at early vegetative stage due to water stress is another possible reason for poor yields causing higher technology index. Therefore, importance should be given on location specific moisture conservation technologies, so that the crops could perform better under water stress conditions in farmer's fields. The study inferred that introduction of high yielding varieties (HYVs') and demonstration of improved technology through FLDs' on oilseeds followed by intensive awareness campaign besides creation of better irrigation infrastructure eventually may lead to higher technology adoption in oilseeds among the farmers of Assam.

Economic analysis

Economic analysis of rapeseed variety TS-38 during the year 2017-18 to 2019-20 showed that the highest gross (Rs. 39,989 ha^{-1}) and net-returns (Rs. 24,154 ha^{-1}) were obtained during the year 2019-20 in demonstration plots, while lowest gross (Rs. 36,426 ha^{-1}) and net- returns (Rs. 19,317 ha^{-1}) were recorded during the year 2017-18 (Table 3). Similar kind of finding was also reported by Kumar *et al.,* 2017. The variations in the economic returns may be attributed to the variable performance of rapeseed in different years.

Highest BCR (2.18) was observed during 2018-19 while lowest BCR was found to be 2.03 during 2017-18. Overall, economic analysis data inferred that transfer and adoption of improved technology in oilseed cultivation may substantially enhance the farmer's income which in turn can lead to better livelihood option for farmers.

4. Conclusions

It became evident from the study that the technological and extension gap in the rapeseed & mustard can be filled by popularizing recommended package of practices with emphasis on use of seeds of improved crop varieties, proper seed rate, balanced nutrient application and proper use of plant protection measures etc. The strategic extension efforts through KVKs in organizing Cluster Front Line Demonstrations can give a confidence to farmers as it is based on the "Seeing is believing" philosophy. The combo of Scientific Management Practices, improved seeds and Strategic Extension would increase the production and net income of the rapeseed & mustard. The dissemination of location specific crop management practices and improved technologies imbedded with high yielding varieties (HYVs') leads to improve oilseed productivity and profitability in the state and subsequently enhance the diversify the farming system of the state.

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