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Assessment of Cluster Front Line Demonstrations on Rapeseed (*Brassica campestris* L.) in Tirap District of Arunachal Pradesh

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ABSTRACT

Rapeseed (*Brassica campestris* L.) is one of the important oil seed crop cultivated in Tirap district of Arunachal Pradesh. The production and productivity of rapeseed in the district is low and constant attempts are being made to improve the production and productivity, area increase, adopting high yielding varieties and improved cultivation practices. Krishi Vigyan Kendra, Tirap conducted Cluster Front Line Demonstration (CFLD) at the farmers' field in 24 villages of the district during 2017-18, 2018-19 and 2019-20. The critical inputs and constraints in existing production technology were identified. Lack of high yielding variety, inadequate input availability, pest and disease incidence and lack of technical knowhow were the predominant identified causes of low productivity of rapeseed in Tirap district. The results of three years demonstrations of variety TS-46 revealed yield increased by 30.97 per cent (2017-18), 28.61 per cent (2018-19) and 26.78 per cent (2019-20) respectively. The additional return in demonstrated plots under TS-46 ranged between Rs. 5732 to Rs. 7285 per hectare during different years. The technology index ranging from 3.6 to 12.9 per cent was found between CFLD demonstration plots and farmers' practices during the different time line. It can be concluded that rapeseed production can be enhanced by encouraging farmers through adoption of high yielding variety TS-46, improved technologies and ensuring need based inputs in due time.

Keyword: CFLD, Rapeseed, Growth, Yield, Economics, Gap

INTRODUCTION

The Cluster Front Line Demonstration (CFLD) is an applied approach to accelerate the dissemination of proven technologies at farmers' fields in a participatory mode with an objective to explore the maximum available resources of crop production and also to bridge the productivity gaps by enhancing the production in national basket (Kumar and Jakhar, 2020). Rapeseed and mustard comprising eight different species *viz.* Indian mustard, toria, yellow sarson, brown sarson, gobhi sarson, karan rai, black mustard and taramira, are being cultivated in 53 countries spreading all over the globe. Rapeseed (*Brassica campestris* L.) and Indian mustard (*Brassica juncea*) are the major edible oilseed crops after soybean and accounts for about 75-80 per cent of the 6.8 m/ha rapeseed and mustard crops. In 1986 the government of India started Oilseed Technology Mission for Research and Development of oilseed crops and the productivity increased from 1262 kg/ha (2012-13) to 1397 kg/ha in the year 2017-18 at national level. Rapeseed and mustard cultivated in 5.96 m ha area with 8.32 m tones production and 1397 kg/ha productivity in 2017-18 (Agricultural statistics at a glance, 2018). Still the average productivity of rapeseed and mustard in India (1.39 t/ha) is lower than the world average (1.97 t/ha).

During 2018 the area of rapeseed cultivation in Tirap district of Arunachal Pradesh was 102 ha, producing 950

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q at an average of 768 kg/ha (Hand book of statistics, Tirap District, 2018). The productivity was quite low due to lack of high yielding varieties, lack of proper nutrient management, intercultural operations and seed treatment. The productivity of crops per unit area could be increased by adopting improved practices in a systematic manner along with high yielding varieties (Ranawat *et al.,* 2011; Rai *et al*., 2016). The drivers of productivity of gobhi sarson (*Brassica napus*) were proper time of sowing and irrigation while use of phosphorus and irrigation at proper time were found to be significantly affecting the productivity of toria (*Brassica rapa*). The hybrid gobhi sarson productivity was affected by weed control and knowledge about different production recommendations (Kumar *et al.,* 2018). Singh *et al.* (2014) concluded that training programmes backed by the field demonstrations proved to be the most effective tool for speedy dissemination of knowledge and technical skills to the farmers whereas, Kaur *et al.* (2014) concluded that front line demonstration program was effective in changing attitude of farmers towards improved cultivation.

To full fill the domestic requirement of oil, Indian government imports a huge quantity of oilseeds. In this regard, to sustain the production and consumption system, the Department of Agriculture, Co-operation and Farmers Welfare had sanctioned the Cluster Frontline Demonstration on *Kharif* and *Rabi* oilseed to ICAR–ATARI Zone VI, Guwahati under National Food Security Mission. To implement the project the Zone VI had selected KVK Tirap for rapeseed cultivation with an objective to boost the production and productivity of oilseed. To demonstrate the need based specific technologies such as high yielding short duration varieties (TS-46), cultural practices, integrated pest management in rapeseed the cluster front line demonstrations were conducted and assessment on various parameters was performed.

MATERIALS AND METHODS

The present investigation of CFLD was conducted by KVK Tirap, Arunachal Pradesh in Deomali and Khonsa subdivision under rainfed condition for last three years during rabi season (2017-18, 2018-19 and 2019-20). An extensive survey was conducted to collect information from selected farmers. Preferential ranking technique was utilized to identify the constraints faced by the farmers in rapeseed cultivation. The quantification of data was done by ranking the constraints and then calculating the Rank Based Quotient (RBQ) as given by Sabarathanam (1988) with the following formula.

$$RBQ = \frac{\Sigma \text{ fi } (n + 1 - \text{ith})}{N \times n} \times 100$$

Where, fi = number of farmers reporting a particular problem under i^{th} rank

N = Number of farmers

n = Number of problems identified

Based on the problems faced by the farmers mentioned, the cluster frontline demonstrations were designed and scientific interventions were being taken.

The extension gap, technology gap and technology index were calculated by using the formula as suggested by Samui *et al*. (2000).

Extension gap (q/ha) = DY (q/ha) – LY (q/ha)

Technology gap (q/ha) = PY (q/ha) – DY (q/ha)

$$\text{Technology index (\%)} = \frac{\text{Technology gap (q/ha)}}{\text{PY (q/ha)}} \times 100$$

Where, DY = Demonstration Yield, LY = Local Check Yield, PY = Potential Yield of the variety

The technology was demonstrated at 24 different villages of the district which lies between the latitude 26^o 38' to 27^o 47' N, longitudes 96^{o}16' to 95^{o}40' E and altitude 150-1250 m above MSL. As a whole, the soil of the demonstration sites was sandy loam in texture, acidic in reaction (pH 5.3), medium in organic carbon content (0.77%), medium in available nitrogen content (347 kg/ha), medium in available P_2O_5 (25.7 kg/ha) and low in available K_2O (120.2 kg/ha). On an average the climate of the district is hot and humid at lower altitude and cold at upper altitude. The average annual rain fall of the district is 2520.00 mm with 139 rainy days. Year wise number of farmers, number of clusters, area covered and

Table 1: Year wise details of cluster front line demonstration on rapeseed

Year	Nos. of demonstrations	Nos. of Clusters	Area (ha)	Seasonal rain fall (mm)	Nos. of rainy days	Need based input
2017-18	125	5	50	178.9	15	Improved seed of rapeseed, Variety: TS-46, uniting together of small land holder in a cluster of big size, soil testing and soil test based N, P, K application, Placement of yellow adhesive sticker, insecticide Malathion 50 EC
2018-19	75	3	30	153.9	13	
2019-20	375	15	150	109.0	10	

all the need based critical inputs provided to the farmers are presented in Table 1.

The farmers were trained to follow the package and practices for scientific cultivation of rapeseed through on and off campus training, method demonstration, group meetings, *kisan gosthies* and farmers' scientist interactions. The full package and practices like soil testing, fertilizer application, line sowing, timely weed management practices, integrated pest management etc were ensured. Seeds were sown by broadcasting method with seed rate 8 kg/ha. The cultivation of rapeseed with their own varieties under traditional practices was considered as local check or farmers' practice.

RESULTS AND DISCUSSION

Before conducting the CFLD preferential ranking techniques were utilized to identify the constraints faced by the respondent farmers in rapeseed cultivation. The findings of ranks given by different farmers (Table 2) indicated that lack of suitable high yielding varieties (83.66%), inadequate input availability (78.00%), and pest and disease problem (73.40%) were the three major constraints. Similar constraints were also reported by Sreelakshmi *et al*. (2012); Arjunkumar *et al*. (2016); Dupare *et al*. (2019).

The performance on growth parameters such as plant height, numbers of branches and yield parameters *i.e.* numbers of siliqua/plant and numbers of seeds/siliqua revealed that all CFLD plots irrespective of cultivation year were found better in case of newly introduced variety of rapeseed, TS-46 along with improved practices than farmers' practices under same conditions and presented in Table 3 and Table 4. Time taken for 50 per cent flowering in CFLD plots was 45.4 days which was 13.3 days earlier than farmers' practice (58.7 days). This might be the short durational varietal characters of TS-46. The infestation of pest and disease was also found less in CFLD plots than farmers' practice which was the effect of improved scientific cultivation practices with integrated pest management and proper operations of cultural

Table 2: Ranks given by farmers for different constraints of rapeseed cultivation

Constraint	RBQ	Overall rank
Lack of high yielding varieties	83.66	I
Inadequate input availability	78.00	II
Pest and disease problem	73.40	III
Lack of technical knowledge	68.74	IV
Weed problem	62.30	V
Low soil fertility/problematic soil	56.28	VI
Lack of post harvest management	50.32	VII
Labour shortage	44.70	VIII
Low price of farm produce	40.58	IX
Small and fragmented land holding	33.45	X

Table 3: Growth parameters of cluster frontline demonstration on rapeseed

Treatment	Plant height (cm)	Nos. of branch/ plant	Nos. of siliqua/ plant	Nos. of seed per pod	Days to 50% flowering	Pest and disease infestation
*CFLD plots	88.53	16.65	90.85	15.54	45.4	Less
*Farmers' practice	64.8	8.7	53.2	13.47	58.7	Medium

*Average of three years

practices. Similar trend of results on pigeon pea cultivation was also reported by Kalita *et al*. (2019).

The variety TS-46 resulted superior on yield in comparison with *Jukangkon* (local check) in different years. The yield of rapeseed increased by 2.28 q/ha (2017-18), 2.18 q/ha (2018-19) and 1.84 q/ha (2019-20) over the yield obtained under farmers' practice (Table 4). These results clearly indicates that due to adoption of appropriate technology and variety TS-46, use of balanced dose of fertilizer, integrated pest management practices and timely intercultural operations, appropriate weed management practices, the yield of rapeseed could be increased between 26.78 and 30.97 per cent over the yield obtained under farmers' practice. Superior growth parameters like more number of primary branches and siliqua per plant and more numbers of seeds per siliqua in CFLD plots were the reason for higher yield.

The result is in conformity with the finding of Tiwari *et al.* (2003) and Chaudhary *et al.,* (2018). The highest yield 9.64 q/ha and 7.36 q/ha in CFLD plots and Farmers' field respectively was recorded in 2017-18 over other two years which might be due to favourable environmental condition *viz.* more rainfall (178.9 mm) and more rainy days (15 days) during 2017-18.

Economic returns was observed to be a function of yield and whole sale price which varied along with year. Different variables like seed, fertilizers, pesticides etc. were considered as cash inputs for the CFLD demonstrations as well as for farmers' practice. The additional return in demonstrated plots under TS-46 ranged between Rs.5732 and Rs. 7285 per hectare during different years in comparison with farmers' practices. In CFLD plots approximately Rs.1000/ha extra expenditure was involved over farmers' practice which was very less and affordable to small and marginal farmers. Gross return, net return and BCR recorded higher in demonstrated plots over farmers' practice irrespective of year of cultivation. The highest gross return (Rs. 31,812/ha), net return (Rs. 14,938/ha) and B:C (1.88:1) was recorded during 2017-18 in CFLD plots than 2018-19 and 2019-20 which might be due to highest yield of rapeseed during 2017-18 (Table 5). Similar trends of results also reported by Dhaka *et al.* (2010); Balai *et al.* (2012); Patel *et al.* (2013).

An extension gap ranging from 1.84 to 2.28 q/ha was found in between CFLD demonstration plots and farmers' practices during the different time line. The extension gap was higher under TS-46 in the year 2017-18 than 2018-19 and 2019-20 (Table 6). Such gap might be attributed due to higher yield for favourable environmental condition along with adoption of improved technologies in demonstrations than farmers' practices. Wide technology gap was observed during these years and this

Table 4: Yield analysis of cluster front line demonstrations of rapeseed on farmers' field

Year	Technology demonstrated	Demonstration yield (q/ha)	Farmers Practice yield (q/ha)	Percent increase
2017-18	High Yielding Variety TS-46, Fertilizers application as per recommendation, IPM	9.64	7.36	30.97
2018-19	- do -	9.35	7.27	28.61
1919-20	- do -	8.71	6.87	26.78

Table 5: Economic analysis of cluster front line demonstrations of rapeseed on farmers' field

Year	Economics of Demonstration (Rs./ha)				Economics of local check (Rs./ha)			
	Gross Cost	Gross Return	Net Return	BCR	Gross Cost	Gross Return	Net Return	BCR
2017-18	16874	31812	14938	1.88	14431	23440	9206	1.62
2018-19	16488	30861	14374	1.87	15450	22537	7087	1.46
1919-20	16622	29620	12998	1.78	15620	21909	6289	1.40

Table 6: Gap analysis of cluster front line demonstrations of rapeseed on farmers' field

Year	Potential yield (q/ha)	Demonstration yield (q/ha)	Farmers' Practice yield (q/ha)	Extension gap (q/ha)	Technology gap (q/ha)	Technology index (%)
2017-18	10	9.64	7.36	2.28	0.36	3.6
2018-19	10	9.35	7.27	2.08	0.65	6.5
1919-20	10	8.71	6.87	1.84	1.29	12.9

was lowest (0.36) during 2017-18 and was highest (1.29) during 2019-20 (Table 6). The difference in gap during different years could be due to differential climatic conditions in each year. Similarly, the technology index for all the demonstrations during different years were in accordance with technology gap. The lowest and highest technology index 3.6 and 12.9 respectively recorded during 2017-18 and 2019-20. Technology index shows the feasibility of the variety at the farmers' field. Higher technology index reflected the inadequacy of technology and or insufficient extension services for transfer of technology. The results are in conformity with the findings of Singh and Kumar (2012) and Saravanakumar (2018).

CONCLUSION

The study emphasizes the need to educate the farmers in adoption of improved technology to narrow the extension gaps through various technology transfer centers. Therefore, it is suggested that these factors may be taken into consideration to increase the scientific temperament of the farmers. Potential yield of variety can be achieved by imparting scientific knowledge to the farmers, providing seeds of high yielding variety, need based quality inputs in due time and ensuring timely agricultural operations. The technologies demonstrated under cluster front line demonstrations had been exploited to obtain the maximum yield, net profit and additional income of rapeseed cultivation which lead to economic viability of the farming in the district.

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