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Performance of Cluster Front Line Demonstration on Toria (*Brassica campestris*) in Anjaw District of Arunachal Pradesh

Naveen Khoisnam[1], S. Peter Singh[2] and Debasis Sasmal[3]
Krishi Vigyan Kendra, ICAR - Anjaw (Arunachal Pradesh)

ABSTRACT

The Cluster Front Line Demonstrations on toria were carried out during two consecutive *rabi* season 2021-22 and 2022-23 using the toria variety TS 67 covering an area of 18 ha. Identifications of the critical inputs and technical backstopping were identified though focus group discussions and face to face interactions with the farmers. The results of the study showed significant increase in the average yield of demonstration plots (28.23%) as compared to farmer's plots. However, lower yield observed in the farmer's practices was due to the considerable gap in the extent of adoption of recommended technology. The average technology gap, extension gap and technology index of toria crop was estimated to be 3.97 q/ha, 1.76 q/ha and 33.12 percent respectively. An average additional income of Rs. 9702 and effective gain of Rs. 8357 were obtained under demonstration plot could be on account of the use of improved technology, non-monetary factors, timely operation of the technology and monitoring. The overall higher yield and returns in demonstrations indicated that the productivity at farmer's field could be enhanced through the adoption of improved technologies.

Key Words: Demonstration, Impact, Toria, Net returns, Technological Index.

INTRODUCTION

Oilseeds are one of the important crops and a major source of income among the states of the North East Region of India. Toria *(Brassica campestris)* is a *rabi* season oilseed crop belonging to the family Cruciferae and genus Brassica. It is the second leading oilseed crop next to soybean and widely grown in North Eastern Region of the country.

The region shares a total of 1.69 percent in area and 1.05 percent in production of oilseeds at the national level. Among the states of the north east region, Assam has the highest area with 309.65 thousand ha and production of 199.93 thousand tons during the year 2022-23 (Directorate of Economics & Statistics, Govt. of India). Arunachal Pradesh is also one of the major oilseeds growing states in the region. The state share around 7.29 per cent in area and 9.90 percent in the production to the total NER area and production. The major oilseeds crops grown in the state are rapeseeds and toria, groundnut, sesame and soybean. The cultivation of these oilseeds crops is most done either in the *Jhum*, low-lying areas under rice fallow or in rice terrace cultivation. In Anjaw district, rainy season starts during the month of March-April and continue upto September-October and so the residual moisture remains abundantly till November to December which provides an ideal condition for cultivation of toria in the rice fallow and *Jhum* land. Bezbaruah and Deka (2019) reported that the farmers who generally keep fallow their field after rice can adopt the cropping system of medium duration rice followed by toria to maximize the production from the same land. Chaturvedi *et al* (2024) reported that due to ignorance and lack of interest, farmers were not employing seed treatment techniques for serious diseases like downy mildew and dumping off.

During the year 2016-17, the area under rapeseeds and toria in the district was 162 ha and during 2022-23 the area under the district expanded upto 182 ha indicating an increase in the growth rate in area of 0.83 percent whereas during 2016-17 the production of toria was 200 t and in 2022-23 the production declines to 187 t indicating

Corresponding Author's Email - soibampeter3@gmail.com
1 SMS Agronomy,2 SMS Social Science, 3 Sr. Scientist & Head, Krishi Vigyan Kendra, ICAR-Anjaw

Table 1. Comparison between technology interventions and farmers practice under CFLD programme.

Sr. No.	Particular	Technology Intervention	Farmer's practice	Adoption gap
1.	Variety	TS-67	Continuous use of old variety TS-36	Full
2.	Seed rate	10 kg/ha	13-15 kg/ha	Partial
3.	Sowing time	First week of October	Mid to last week of October	Partial
4.	Sowing method/spacing	30 cm row	Broadcasting	Full
5.	Seed treatment	Bavistin (@ 5g/ kg seeds)	No seeds treatment	Full
6.	Thinning	First at 25-30 DAS and second at 60 DAS	No thinning	Full
7.	Fertilizer doses	120:40:40- NPK (Kg/ha)	Non-judicious use of fertilizer	Full
8.	Irrigation	Irrigation at critical stage of growth	Rainfed	Partial
9.	Weed management	Pendamethalin @1.0 kg a.i ha^{-1}	No hand weeding or use of herbicide	Full
10.	Plant protection	Dimethoate 30 EC @ 0.5 l /ha against Aphid Mancozeb @ 0.2 % for Alternaria blight	Some of the farmers use Mancozeb @ 0.2 % for Alternaria blight	Partial

a negative growth rate of 0.81 percent (Economics, Statistics and Evaluation Division, Govt. of India, 2023). Prior to intervention of CFLD programme on rapeseeds and toria under KVK Anjaw, some of the farmers grew this oilseed crops in small areas of the district and were not aware about the newly developed high yielding varieties for its cultivation in larger scale and using the old varieties such as TS-36. The objective of CFLDs programme was to popularize the improved technology and the potential of newly developed varieties (TS-67) was for enhancing the production and productivity at the farmers field.

MATERIALS AND METHODS

The study was carried out among 32 farmers under CFLDs on toria variety TS-67 during the year 2021-22 and 2022-23 in 3 Community Development blocks of the district namely Hayuliang, Metengliang, Walong and Kibithoo covering 16 villages covering a cultivating mean area 18 ha. During the period 2016-17 introduction of toria variety (TS-36) was done and till now the farmers have been cultivating the same variety. Therefore, with a view to popularize and create awareness among the farmers, KVK Anjaw introduced toria variety TS-67. Prior to the demonstration of toria, brief information regarding the farming systems of the villages were collected through field visits and interactions with the farmers, Gaon Bura and PRI members. Generally, sowing of toria is done during the month of October and harvesting in the month of March-April. For carrying out the

Table 2. Extent of technology adoption of rapeseed under CFLD.

Sr. No.	Technology adopted	Before CFLD	After CFLD	Change in number of adopted farmers	Percent (%)
1.	Selections of varieties	6 (18.75)	16 (50.00)	10	166.66
2.	Time of sowing	9 (28.12)	27 (84.37)	18	200.00
3.	Seed rate	11(34.37)	28(87.50)	17	154.54
4.	Seed treatment	0 (0.00)	18 (56.25)	18	18.00
5.	Method of sowing	8 (25.00)	24 (75.00)	16	200.00
6.	Fertilizer application	5 (15.62)	17 (53.12)	12	240.00
7.	Irrigation management	3 (9.37)	14 (43.75)	11	366.66
8.	Weed management	8 (25.00)	25 (78.12)	17	212.50
9.	Pest and Disease management	7 (21.87)	25 (78.12)	18	257.14

**Figures in parenthesis are percentage*

demonstration, farmers were selected and critical inputs were used at the farmer's field. Timely monitoring of the demonstrated field was also done by KVK scientists. As a part of horizontal expansion and to realize the benefits of the technology, demonstrations, field days, hands on training and group discussions were conducted as and when required so as to create capacity building among the farmers. The data output on yield of the crops were collected both for demonstration and farmer's plot. Further, data were compiled and finally yield gap between the demonstrated technology and farmer's practices were estimated. Economic analysis such as gross return, net return and benefit cost ratio was calculated on the basis of the market prices of inputs used. The technology gap, extension gap and technology index were calculated using the formulas defined by Samui *et al* (2000) which are given below.

Technology Gap = Potential Yield (P_y) - Demonstrated Yield (D_y)

Extension Gap = Demonstration Yield (D_y) - Farmer's Practices Yield (F_y)

$$\text{Technology Index (\%)} = \frac{Py - Dy}{Dy} X\ 100$$

Benefit Cost Ratio = Gross Return/Gross Cost

RESULTS AND DISCUSSION

Technological gap analysis

It was observed that there was a full gap in case of the use of use of HYV, sowing method, seed treatment, thinning, fertilizer doses, and weed management, whereas, a partial gap was observed in case of seed rate, sowing time, irrigation and plant protection which generally might be the reason of low productivity of farmer's practices. During the course of interaction with the farmers, it was also realized that they have been continuing the old variety over long period either may be due to the unavailability of HYVs seeds or lack of awareness of the recommended technologies. Generally, farmer's practices broadcasting method of sowing seeds instead of using the recommended method of practices due to which they used higher seed rate. Also, it was also noticed that farmers do not used seed treatment for management of seed borne diseases and application of micro-nutrients due to the lack of awareness and locally unavailability or at nearby market. Further, farmers in the entire district follows rainfed system of agriculture and moreover, during the month of December-January due to the lack of moisture during the growing stage yield of toria crops reduced due to lack of irrigation during the crucial stage.

Table 3. Impact of CFLD on yield and gap analysis of toria crop in Anjaw district.

Year	Area (ha)	No. of demonstration	PY (q/ha)	Av. Yield (q/ha)		% increase in yield	TG gap (q/ha)	EG (q/ha)	TI %
				DP	FP				
2021 - 22	12	10	12	8.12	6.42	26.47	3.88	1.70	32.33
2022 - 23	24	22	12	7.93	6.10	30.00	4.07	1.83	33.91
Mean	18	16	12	8.02	6.26	28.23	3.97	1.76	33.12

PY- Potential Yield, DP- Demonstrated Plot, FP- Farmers' practice, TG- Technology gap
EG-Extension gap, TI- Technology index

Impact of technology demonstration

It was revealed that the numbers of farmers using the improved varieties increased from 18.75 to 50 percent through demonstrations (Table 2). Similarly, in case of sowing time the numbers of adopters significantly increase from 28.12 to 84.37 percent. After the adoption of CFLD, the numbers of farmers also significantly increased from 34.37 to 87.50 percent which indicates the positive impact in maintaining the seed rate among the selected farmers. Prior to the intervention of CFLD most of the farmers adopted broadcasting methods of sowing however after the adoption of CFLD programme the numbers of farmers following line sowing method of sowing increased from 25 to 75 percent. Regarding the seed treatment, none of the farmers practiced seed treatment method but after the intervention of CFLD the numbers of farmers increased to 56.25 percent. The numbers of farmers following recommended dose of fertilizer and their application method increased from 15.62 to 53.12 percent. It can be mentioned that farmers of the district are fully dependent on rainfall and none of the farmers practiced irrigation system in toria crops however, after intervention of CFLD programme some of the farmers have adopted irrigation system through canals, rivers and perennial stream as such the management of irrigation system the numbers of farmers increased to 43.75 percent from 9.37 percent. In case of weed management of toria crop, the numbers of farmers increased from 25 to 78.12 percent. As far as pest and diseases management of toria crop is concern, the numbers of farmers increased from 21.87 to 78.12 percent. It was also observed that the technology intervention on toria crop has made awareness among the non-practicing farmers in the district regarding the scientific package and practices of toria. Further, it was also realized that the overall impact on the adoption level in the production of toria increased by 201.72 percent under CFLD.

Yield Analysis

Perusal of the data (table 2) revealed that the yield of toria fluctuated successively over the two years period in the demonstration plots which could be increased by 26.47 to 30 percent through technology intervention over farmers practice. The maximum average yield of 8.12 q/ha was observed during 2021-22 and minimum yield of 7.93 q/ha was recorded during 2022-23 under the CFLD programme. Also, the average seed yield of toria under demonstration was 8.02 q/ha as compared to 6.26 q/ha in farmers practices which indicates that use of improved varieties of toria TS-67 along with improved technology contributed 28.23 percent higher production than farmer's variety. It was evident that the performance of toria TS-67 was better than the farmer's variety TS-36. Less productivity in farmer's practices may be due to the use of old varieties for longer period, variation in sowing time, low level of agronomic management in addition to timely non-availability of resources. These findings were in agreement with Prasad *et al* (2020). Manan and Sharma (2017) concluded that in order to meet the ever growing demand of oil in the country, the gap is to be bridged through management techniques. Optimum crop geometry, balanced NPK fertilizers, intercultural operations and inclusion of farmyard manure are

Table 4. Economic impact of CFLD on toria crop at farmer's field.

Year	Gross Expenditure (Rs./ Ha)		Add. Cost (Rs./ha)	Selling price (Rs. / Qtl.)	Gross income (Rs./ Ha)		Net return (Rs./ Ha)		Add. Income (Rs./ Ha)	Effective gain (Rs./ha)	B:C ratio (Demo)	B:C ratio (FP)
	Demo.	FP			Demo.	FP	Demo.	FP				
2021-22	23150	22010	1140	6000	48720	38520	25570	16510	9060	7920	2.10	1.75
2022-23	24300	22750	1550	6500	51545	39650	27245	16900	10345	8795	2.12	1.74
Mean	23725	22380	1345	6250	50132	39085	26407	16705	9702	8357	2.11	1.74

the building blocks for achieving the utmost yield targets of rapeseed-mustard.

Technology Gap

The technology gap indicates the gap in the demonstration yield over the potential yield. The trend of technology gap ranged between 3.88 to 4.07 q/ha which reflects the farmer's cooperation in carrying out the demonstration with encouraging results in subsequent years indicated in the table 3. The mean technology gap turned out to be 3.97 which suggest that there is still a gap in technology demonstration which prevents the participating farmers from benefitting from variety potential output. The persisting technology gap might be attributed due to the dissimilarity in fertility status of soil enriching soil nutrient especially with organic manure and weather parameters. In addition to this depending upon the identification and use of farming situations, specific interventions may have greater implications in enhancing the yield of toria . The results have also indicated that CFLD programme on toria crops have significant impact on the demonstrated village as the farmers have motivated and horizontally spread through the improved agricultural practices.

Extension gap

The extension gap refers to the differences between the yield of demonstrated plot and the farmer's practices. The mean extension gap was observed to be 1.76 q/ha. The extension gap showed an increasing trend ranging from 1.70 to 1.83 during the consecutive year study (Table 3). This scenario directed the importance to enhance farmer's knowledge through adoption of improved technologies to reverse the trend. Also the existing gap could be minimize through adoption of various extension activities such as imparting training programme, awareness programme, field demonstration, updating of knowledge through print and electronic media etc. so as to motivate the farmers to adopt improved agricultural practices. These findings were in agreement with Sharma *et al* (2019); Sangwan *et al* (2021).

Technological Index

The technology Index indicates the feasibility of the adopted technology at the farmer's field level. Lower technology index indicates the efficiency of the technological performance and vice versa. The technology Index during the two years showed less variation ranging from 32.33 to 33.91 percent as indicated in table 3. The average technology index was recorded at 33.12 percent and these variations might be on account of persisting weather conditions, differences in the soil fertility status, unavailability of irrigation facilities, diseases outbreak, infestation of pest and diseases and improper management of agricultural practices.

Economic performance

The results (Table 4) revealed that monetary return were directly influenced by the market price of toria seeds and the cost of production during the two years consecutive study periods. Inputs such as seeds fertilizer, bio-pesticides and insecticides were considered as technological interventions and on average an additional average cost of Rs. 1345 were incurred under the demonstration of toria. The results of the economic analysis of toria under Cluster Front Line Demonstration indicates an average gross return of Rs. 50132 per ha and net return of Rs. 26407 with benefit cost ratio of 2.11 as compared to farmers practices of 1.74. The average additional net return of Rs. 9702 per ha and effective gain of Rs. 8357 per ha obtained under the demonstration might be the results of the improved technology, non-monetary factors, timely operation of agricultural practices and

monitoring. The overall results indicated the positive impact of Cluster Front Line Demonstration over the existing farmer's practices.

CONCLUSION

It was evident that the Cluster Front Line Demonstration has given a positive impact in increasing the yield of toria by 28.23 percent provided the improved varieties of toria coupled with improved technologies in the demonstrations and thus increased the production. The demonstrations of the technology under CFLD were found to be more liable as compared to the farmer's practices. The persisting gap in technology and extension could be minimized through inducing of technical knowledge and capacity building programme. Economic analysis showed that the net return of Rs. 26407 with benefit cost ratio of 2.11 could be derived from the introduction of CFLD which was found to be more as compared to farmer's practices. Majority of the farmers have replaced the old varieties with improved varieties due to the efforts made by KVK Anjaw in boosting up the production and productivity as well as horizontal expansion of the technology in the district.

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