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Impact of Cluster Front Line Demonstration (CFLD) on Yield & Economics of Toria in Rain-fed North Eastern Coastal Plain Zone of Odisha

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Toria is one of the most important oilseed crop after harvest of *Kharif* rice in rainfed areas of Balasore district of Odisha. Krishi Vigyan Kendra, Balasore conducted Cluster Front Line Demonstration programme on Toria during *Rabi* 2019-20 to assess its impact on yield and income gap through scientific cultivation practices. The study was conducted in four villages of the district covering 180nos. farmer to find out the extension gap, technology gap, technology index and

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economic indexes of the crop before and after the intervention. The study revealed that, average yield of 8.5q/ha was obtained in the CFLD plot which was 44.06 per cent higher than the farmer's practice. Similarly, the technology gap, extension gap and technology index were found to be 1.5q/ha, 2.6q/ha and 15 per cent, respectively. The average gross income in demonstrated plot was found to be Rs.34840/ ha as compared to Rs.23420/ha in farmers practice. Likewise, average net income of Rs.17040/ha was found in demonstration plot while it was Rs.8420/ha in farmers plot. The Benefit-cost ratio was found to be 1.96 in the demonstration plot which is higher as compared to 1.56 at farmer's practices. The Study was conducted by Krishi Vigyan Kendra, Balasore to analyze the yield gap of Toria (*Brassica campestris* var. toria) through Cluster frontline demonstration in North Eastern Coastal Plain Zone of Odisha.

Keywords: Oilseed; toria; cluster; CFLD; extension gap; yield; economics.

1. INTRODUCTION

"India is the 4th largest oilseeds producer in the world. It has 20.8% of the total area under cultivation globally, accounting for 10% of global production. Traditional indigenous species of Rapeseed-mustard crops in India comprise of toria (*Brassica campestris* L. var. toria), brown sarson (*Brassica campestris* L. var. brown sarson), yellow sarson (*Brassica campestris* L. var. yellow sarson), Indian mustard [*Brassica juncea* (L.) Czernj&Cosson], black mustard (*Brassica nigra*) and taramira (*Eruca sativa*)" (DRMR, 2012). "Toria ((*Brassica campestris* L. var. toria)) a member of family Brassicaceae., is the 3rd most important oilseed crop and cultivated in 6.26 m ha area with production of 8.68 mt with productivity of 1387 kg ha-1" (Anonymous, 2022)

"In Odisha, rapeseed mustard is cultivated in an area of 106.30 thousand hectares with production of 46.35 thousand MT and productivity of 436 kg ha-1 (Odisha AGRISTAT 2018-19) which is much lower than national average. Among rapeseed mustard, toria (*Brassica campestris* L. var. toria) is second most important oilseed crop after Indian mustard cultivated in the state. It is gown as rainfed crop in North Eastern Coastal Plain Zone during rabi season after harvesting of *Kharif* rice. In Balasore district, Toria is cultivated in an area of 4000ha area with production of 1.92thousand MT & productivity of 480kg ha-1" (Odisha AGRISTAT 2018-19). "Lower productivity of Toria may be due to use of low yielding variety, low seed replacement, faulty sowing of seed without seed treatment, indiscriminate use of fertilizer without soil testing, no foliar nutrition provided, lack of water management and high disease pest incidence are predominant factors for limiting the potential yield of the crop. The concept of frontline demonstration (FLDs) creates direct interface between scientists and farmers, in which improved technologies are demonstrated for increasing crop yield. Therefore, efforts have been made through Cluster Front Line Demonstrations (CFLDs) to introduce improved package of practices of oilseeds with a view to increase its productivity and profitability in Balasore district of Odisha". The Cluster Front Line Demonstration (CFLD) is an applied approach to accelerate the dissemination of proven technologies at farmer's 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.

2. MATERIALS AND METHODS

The present study was carried out by Krishi Vigyan Kendra, Balasore under sustainable agriculture practice (SAP) during *Rabi* 2019-20 in the farmer's field of four villages (Gadasahi, Bishnupur, Nuagan, Nilakanthapur) of Balasore district. The demonstration was conducted on alluvial soils with low to medium fertility status and moderately acidic in soil (pH 6.1) reaction under rice-based cropping system. Soil organic carbon (0.65%), available nitrogen (575 kg ha^{-1}) was high whereas potassium (290 kg ha^{-1}) and available phosphorus is medium (23.5 kg ha^{-1}) whereas boron was below the critical limit (0.4mg kg^{-1}). During the study, 70 ha area was covered under frontline demonstration and the same area adjacent to the demonstration plot was kept as farmer's practices with active participation of 180nos. of farmers. Before conducting FLDs, a list of farmers was prepared from group meeting and specific skill training was given to the selected farmers regarding package of practices of Toria. The improved technology (Table 1) included cultivation of Toria var. Uttara which has high yield potential (10 q/ha) and oil content (42%) with moderately resistant to white rust, downy and powdery mildew. Seed treatment,

Table 1. Details of technologies followed for improved practices and farmer practices under FLD

Particulars	Technology interventions	Farmer's practices	% Gap
Variety	Uttara	Local Toria (Baliapal Rai)	100
Land Preparation	Ploughing and Leveling	Ploughing	50
Soil Testing	Grid based soil sample collected, tested & SHC issued	No soil testing	100
Weed Management	Post emergence use of Quizalofop-p-ethyl 5% EC @1ltr/ha Hand weeding at 15–20 DAS	No herbicide application No practice of hand weeding	100
Seed rate	8kg/ha	12kg/ha	50
Seed treatment	Vitavax Power@ 2g/kg seed	Carbendazim @ 2 g/kg seed	50
Time of sowing	1st Week of November	Mid November	50
Method of sowing	Line Sowing (Sowing crops in 30 cm rows and thinning at 15-20DAS	Broadcasting	100
Organic input application	FYM @ 2.5 t/ha	FYM@ 1.5t/ha	67
Fertilizer application	Soil test based fertilizer application N:P_2O_5:K_2O@50:30:25kg/ha (Farmers contribution)	Indiscriminate use of fertilizers without soil testing N:P_2O_5:K_2O@60:30:30kg/ha	25
Micronutrient application	Foliar application Boron (10.5%) @ 1.25kg/ha	No micronutrient applied	100
Irrigation	2Nos. Life-saving Irrigation at critical growth stages	Rainfed	50
Pest population monitoring	Installation of pheromone trap@ 5nos./ha for monitoring of Spodoptera population	No pheromone trap use	100
Plant Protection	Application of Flonicamid 50 WG@ 0.3g/ltr for Aphid, Emamectin Benzoate 5%SG @ 0.4g/ltr for spodoptera pod borer & Hexaconazole 5%@ 2ml/ltr for stem rot& leaf spot management	Application of Profenophos 50 EC@ 2ml/ltr for pod borer &Carbendazim 50WP@ 1g/ltr for stem rot by some progressive farmers only	50
Harvesting	Physiological maturity stage to avoid shattering	Harvest maturity	50

timely sowing, line sowing, maintenance of optimum plant population, recommended fertilizer application, life saving irrigation and plant protection measures is provided (Table 1). The sowing was done in the month of November with a spacing of 30 cm (R-R) x 10 cm (P-P) and the seed rate of Toria was 8 kg ha-1. The soil test based dose of fertilizer applied in the demo plot was 50:30:25 kg ha-1 of N, P_2O_5 and K_2O respectively. Half dose of N and full dose of P_2O_5 and K_2O, Boron @ 1kg ha^{-1} and Sulphur @ 30kg ha^{-1} were applied at the time of sowing and the remaining N was applied after thinning at 15-20 DAS. Post emergence herbicide Quizalofop-p-ethyl 5% EC @ 0.75 kg ha^{-1} was applied at 20-25 DAS. The crops were harvested at physiological maturity stage with suitable method to avoid shattering of siliqua.

"The yield of demonstration plot as well as local check was recorded using random crop cutting. Qualitative data was converted into quantitative form and expressed in terms of per cent increase in yield" [1]. The extension gap, technological gap and technological index along with the benefit cost ratio were worked out [2] as given below:

Technology gap = Potential yield - Demonstration yield
Extension gap = Demonstration yield - Farmer's yield
Technology index = (Technology gap/potential yield) x 100

Standard agronomic practices were followed for cultivating the crop. Findings on different parameters like days to germination, growth and yield attributes were recorded and economic analysis was done. Three pickings were done and the final crop yield was recorded. The gross return was calculated on the basis of prevailing market price of the produce. Net return and benefit-cost ratio was calculated using the following formula:

Net return = Gross return (ha^{-1}) – Cost of cultivation (ha^{-1})

$$Benefit\ Cost\ Ratio = \frac{Gross\ return\ (ha-1)}{Cost\ of\ cultivation\ (ha-1)} \times 100$$

Statistical analysis of the recorded data was conducted by using the online computer program 'OPSTAT' developed by Sheoran et al., 1998. The results are presented at 5% level of significance (p = 0.05).

3. RESULTS AND DISCUSSION

3.1 Yield

"Frontline demonstrations are effective extension tools for transfer of latest technologies to boost the farmer's confidence & yield improvement. The performance of Toria under frontline demonstration programme was assessed with adoption of improved technologies. Results (Table 2) revealed that the demonstration plot recorded 45.2 per cent increase in the yield (8.5q/ha) as compared to the farmers practice (5.9 q/ha)". This is corroborated by the findings of [3] This may be attributed due to higher level of adoption and medium soil fertility status of the cluster. The higher yield of Toria under improved technology was due to use of latest yielding varieties, integrated nutrient management and integrated pest management as per Table-1 & in corroboration with the findings of Veeramani et al., [4] and Ghosh et al., [5].

3.2 Technology Gap

"The technology gap refers to the differences between potential yield and yield of demonstration plot. The technology gap of demonstration plots was 1.5 q/ha. The technology gap noticed may be due to dissimilarity in fertility status of soil, integrated crop management, protection measures and local weather variability". Similar finding were observed by [6,7,8].

3.3 Extension Gap

"Extension gap means the differences between yield of demonstration plot and farmer yield. On an average extension gap of 2.6 q ha-1 was found in demonstration field. It emphasized the farmers to educate more through various extension programmes *i.e.*, frontline demonstration for adoption of improved production and protection technologies to minimize the range of wide extension gap. More and more use of latest production technologies with high yielding varieties will subsequently change this alarming trend of galloping extension gap and help in improving socio-economic condition of farmers" as suggested by Mandal et al., [9] and Basumatary et al., [10].

Table 2. Effect of improved production technology on yield of Toria

Cluster No.	Village	Demo (Nos.)	Area (ha)	Yield (q/ha)				Increase in yield over local check (%)
				Demonstration Yield			Traditional practice	
				High	Low	Average	Local check	
I	Gadasahi	57	16.0	9.42	7.61	8.52	5.75	48.2
II	Nuagan	33	14.0	9.25	7.86	8.56	5.82	47.1
III	Bishnupur	60	20.0	9.19	7.82	8.51	5.91	44.0
IV	Nilakanthapur	30	20.0	9.13	7.67	8.40	5.94	41.4
Mean				9.2	7.7	8.5	5.9	45.2

Table 3. Economic impact of improved technology (IT) on toria over farmers practice (FP) in Balasore district, Odisha

Cluster No.	Village	Cost of Cultivation (Rs/ha)		Gross Return (q/ha)		Net return (Rs/ha)		BC Ratio		Additional Net return over FP (Rs/ha)
		Demo	Check	Demo	Check	Demo	Check	Demo	Check	
I	Gadasahi	17700	14800	34932	23000	17232	8200	1.97	1.55	9032
II	Nuagan	17950	15300	35096	23280	17146	7980	1.96	1.52	9166
III	Bishnupur	17800	14700	34891	23640	17091	8940	1.96	1.61	8151
IV	Nilakanthapur	17750	15200	34440	23760	16690	8560	1.94	1.56	8130
Mean		17800	15000	34840	23420	17040	8420	1.96	1.56	8620

Table 4. Yield gaps analysis of cluster frontline demonstrations (CFLDs) on Toria in Balasore district, Odisha

Cluster No.	Village	Potential Yield (q/ha)	Demonstration Yield (q/ha)	Farmer's Practice (q/ha)	Technology gap (TG) (q/ha)	Extension Gap (EG) (q/ha)	Technology Index (TI) (%)
I	Gadasahi	10	8.52	5.75	1.48	2.77	14.8
II	Nuagan	10	8.56	5.82	1.44	2.74	14.4
III	Bishnupur	10	8.51	5.91	1.49	2.60	14.9
IV	Nilakanthapur	10	8.40	5.94	1.60	2.46	16.0
Mean		10.0	8.5	5.9	1.5	2.6	15.0

Fig. 1. Toria is at flowering stage 2019-20

Fig. 2. Toria is at harvesting stage 2019-20

Fig. 3. Successful farmer of CFLD Toria 2019-20

3.4 Technology Index

"Technology Index refers the feasibility of the evolved technology in the farmers' field. Lower the value of technology index means higher the feasibility of the improved technology. It was observed that the mean technology index of 15 per cent was recorded in CFLD programmes under four clusters, which showed the efficacy of good performance of technical interventions. This will accelerate the adoption of demonstrated technical intervention to enhance productivity in Toria cultivation in rain fed areas". Similar result is obtained by the study of [11,12,13].

3.5 Economic Return

The economic data (Table 4) reveals that the cost involved in the adoption of improved technology in Toria varied and profitable almost twice. The cultivation of Toria under improved technologies recorded the higher net return and B:C of Rs17,040/- per ha and 1.96 respectively as compared to farmers practice. Similar findings were reported by Mandi et al*.* [14]. The benefit cost ratio of demonstration plot under improved cultivation practices was higher than farmer's practices may be due to higher yield obtained from yielding variety Uttara under improved technologies compared to farmers practice. The same trend was observed by Mokidue et al. [15] and Anuratha et al*.* [16], [17-20].

4. CONCLUSION

Krishi Vigyan Kendra, Balasore introduced Toria var. Uttara through cluster frontline demonstration during 2019-20 at four different villages of the district mainly in three blocks (Bahanaga, Baliapal and Jaleswar). The spread of the technology was recorded through diagnostic field visit, crop survey and focused group meeting. It can be concluded that CFLD on toria variety Uttara proved to the best in respect of yield (8.5q/ha), net return (Rs 17,040/- per ha) and benefit cost ratio (1.96). The findings of the study revealed that wide gap existed in potential and demonstration yield in high yielding toria varieties due to technology and extension gap in Balasore District of Odisha. Horizontal expansion of improved variety increased to a great extent within shortest period possible due to various extension activities like training programme, field day, diagnostic field visit etc. organized under CFLD in the farmer's field. The productivity level gain and higher return from CFLD plot over conventional practices created greater awareness and motivated other farmers to adopt improved production technology of toria in the Balasore district.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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