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Productivity Enhancement of Toria through Frontline Demonstration in Gajapati District of Odisha, India

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A B S T R A C T

The field study was carried out by Krishi Vigyan Kendra, Gajapati to assess the yield gap of toria (*Brassica campestris* var. toria) through frontline demonstration in north eastern ghat region of Odisha. Toria is most important oilseeds crop after harvest of kharif rice in rainfed areas of Gajapati. Productivity of the crop is lower in farmer's field due to several constraints. Non-adoption of improved technologies is one of the major causes for its lower productivity. Frontline demonstrations on improved technologies were conducted at 125framers' fields of Gajapati district in four clusters during rabi season of 2019-20. Improved crop management practices recorded the highest mean seed yield of 7.68 q ha^{-1} which was 62.83 per cent higher than the yield obtained with farmers practice (4.73 q ha^{-1}). It was also noticed higher mean net return of Rs. 20068.60 with B:C ratio of 1.92 when compared with farmers practice (Rs. 9115 with B:C ratio of 1.92). The average technological gap, extension gap and technological index were recorded 2.32 q ha^{-1}, 2.96 q ha^{-1} and 23.2 per cent respectively. Due to adoption of improved package of practices, demonstration plots recorded higher average seed yield over local check.

Introduction

Rapeseed-mustard crops in India comprise traditionally grown indigenous species, namely 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/vesicaria* Mill.), which have been grown since about 3,500 BC along with non-traditional species like gobhi sarson (*Brassica napus* L.) and Ethiopian mustard or karan rai (*Brassica carinata* A. Braun) (DRMR, 2012).

It is important rabi season oilseeds crop and grown in 5.96 mha area with production of 8.32 mt & productivity of 1397 kg ha^{-1} (AGRISTAT 2018). It contributes about one third of the total oil production in the country.

In Odisha, rapeseed mustard is cultivated in an area of 145.36 thousand hectares with production of 61.63 thousand tonnes and productivity of 424 kg ha^{-1} (OdishaAGRISTAT2013-14) 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 winter season after harvesting of kharif rice. Productivity of the crop is lower in farmer's field due to several constraints.

One of the major constraints for such low yield is the non-availability of high yielding variety. Besides that, faulty sowing practices, improper crop geometry, indiscriminate use of fertilizers, other intercultural operations (Tiwari *et al.,* 2017), lack of water management and climatic variabilities are predominant reasons for limiting the potential yield of the crop. Keeping in mind frontline demonstrations on toria were conducted to enhance the productivity and profitability of improved technologies on farmer's fields.

Materials and Methods

The present study was carried out by Krishi Vigyan Kendra, Gajapati under sustainable agriculture practice (SAP) during *rabi* season of 2019-20 in the farmers field of four villages (Lubru, Sanakhani, Kesra and Malaspadar) of Gajapati district in clusters mode. The study was conducted on laterite soils with low to medium fertility status and acidic in soil reaction under rice-based cropping system.

The demonstration field experienced total rainfall of 87.3 mm with maximum and minimum temperature of 32 ^{0}C and 10 ^{0}C respectively throughout the growing period. During the study, total area of 50 ha was covered with demonstration plot size of 0.4 ha under frontline demonstration and the same area adjacent to the demonstration plot was kept as farmer's practices with active participation of 125 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 variety Uttara which has high yield potential (10q/ha) and oil content (42%) with moderately resistant to white rust, downy and powdery mildew; seed treatment, timely sowing, line sowing, maintenance of optimum plant population, recommended fertilizer application, lifesaving irrigation, plant protection measures, etc.

The sowing was done in the month of November with spacing of 30 X 10 cm behind the plough and the seed rate of toria was 8-10 $kgha^{-1}$. The recommended dose of fertilizer applied in the demo plot was 60:30:30 kg ha^{-1} of N, P_2O_5 and K_2O respectively.

Half dose of N and full dose of P_2O_5, K_2O and elemental S (10-12 kg 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 ethyl 5% EC @ 0.75 kg ai $ha^{-1}$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 (Narasimha Rao *et al.*, 2007). The data was further analyzed by using simple statistical tools. The extension gap, technological gap and technological

index along with the benefit cost ratio were worked out (Samui *et al.,* 2000) as given below:

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

Results and Discussion

Performance and yield

Frontline demonstrations are effective extension tools for transfer of technologies to boost the farmer's confidence in demonstration trials. The performance of toria under frontline demonstration was assessed with adoption of improved technologies in four clusters. Results (Table 2& Fig.1) revealed that the demonstration plot recorded 62.83 per cent increase in the yield as compared to the farmers practice (4.73 q/ha) as against 7.68 q/ha in improved technologies.

However, average highest yield (7.83 q/ha) was recorded in 3rd cluster and it was maximum of 8.50 q/ha in the same cluster. 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 (Veeramani *et al*., 2017).

Technology gap

The technology gap refers to the differences between potential yield and yield of demonstration plot. The technology gap of demonstration plots was 2.24, 2.25, 2.18 and 2.62 q ha^{-1} in cluster-I, II, III and IV respectively.

On an average 3.2 q/ha technological gap was found in FLD programme. The technology gap noticed may be due to dissimilarity in fertility status of soil, integrated crop management, protection measures and local weather variability.

Extension gap

Extension gap means the differences between yield of demonstration plot and farmer yield. The lowest extension gap (Table 3)2.73 q/ha was found in cluster-III followed by cluster-IV (2.78) and cluster-II. On an average extension gap of 2.32 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.

Technology index

Technology Index refers the feasibility of the evolved technology in the farmers' fields. Lower the value of technology index means higher the feasibility of the improved technology. The technology index (Table 3) varied from 21.75 to 26.2 per cent.

It was observed the mean technology index of 23.2 per cent was recorded in FLD programmes under 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 rainfed areas.

Table.1 Improved production technology and farmers practices of toria under FLD

S. No	Technology	Improved practices	Farmers practice	GAP (%)
1.	Variety	Uttara	Local (Toria)	Full gap
2.	Land preparation	Ploughing and Levelling	Ploughing and Levelling	Nil
3.	Post emergence herbicide	Quizalofop ethyl 5% EC @0.75 l/ha	No herbicide	Full gap
4.	Seed rate	10 kg/ha	5 kg/ha	Partial gap
5.	Seed treatment	Carbendazim 12 + Mancozeb 63 % WP @ 2 g/Kg	No seed treatment	Full gap
6.	Fertilizer dose	Recommended dose of fertilizer 60:30:30 (NPK). In addition to application of Allwin Wonder Plus @ 5 kg/ha	Indiscriminate application	Partial gap
7.	Irrigation	Life saving irrigation	No irrigation	Partial gap
8.	Plant protection	Application of Thiamethoxam 25% WP @ 0.4 g/l for controlling aphids,Acetamiprid @ 0.3g/l to control White fly, Carbendazim 12% + Mancozeb 63% WP @ 2g/l to control leaf blight	Chlorpyriphos 20 % EC@ 2ml/l	Partial gap
9.	Harvesting	Physiological maturity stage to avoid shattering	Harvest maturity	Partial gap

Table.2 Impact of improved production technology on productivity of toria

Cluster No.	Village	FLD (Nos)	Yield(q/ha)				% increase in yield over local check
			Improved Practice			Traditional practice	
			Max.	Min.	Average	Local check	
I	Lubru	25	8.25	7.28	7.77	4.5	72.56
II	Sanakhani	25	8.45	7.05	7.75	4.7	64.89
III	Kesra	50	8.5	7.15	7.83	5.1	53.43
IV	Malaspadar	25	7.69	7.07	7.38	4.6	60.43
	Average	31.25	8.22	7.14	7.68	4.73	62.83

Table.3 Indication of potential yield, demonstration yield, farmers yield, technological gap, extension gap and technology index of toria cultivation

Cluster	Village	Potential yield (kg/ ha)	Demonstration yield (kg /ha)	Farmers Yield (kg/ ha)	Technological gap (q/ha)	Extension Gap (q/ha)	Technology index
I	Lubru	10	7.77	4.5	2.24	3.27	22.35
II	Sanakhani	10	7.75	4.7	2.25	3.05	22.5
III	Kesra	10	7.83	5.1	2.18	2.73	21.75
IV	Malaspadar	10	7.38	4.6	2.62	2.78	26.2
	Average	10	7.68	4.73	2.32	2.96	23.20

Table.4 Economics of improved technologies and farmers practice in toria cultivation

Cluster	Total cost of cultivation (Rs.ha^{-1})		Gross Returns (Rs. ha^{-1})		Net Returns (Rs. ha^{-1})		B:C ratio	
	Improved technology	Local check	Improved technology	Local check	Improved technology	Local check	Improved technology	Local check
I	21701.6	16670	42479.8	24750	20778.2	8080	1.96	1.48
II	21631.4	16950	42121.2	25850	20489.8	8900	1.95	1.53
III	22079.9	17230	41959.5	28050	19879.6	10820	1.90	1.63
IV	21656.8	16640	40783.6	25300	19126.8	8660	1.88	1.52
Average	21767.43	16872.50	41836.03	25987.5	20068.6	9115.0	1.92	1.54

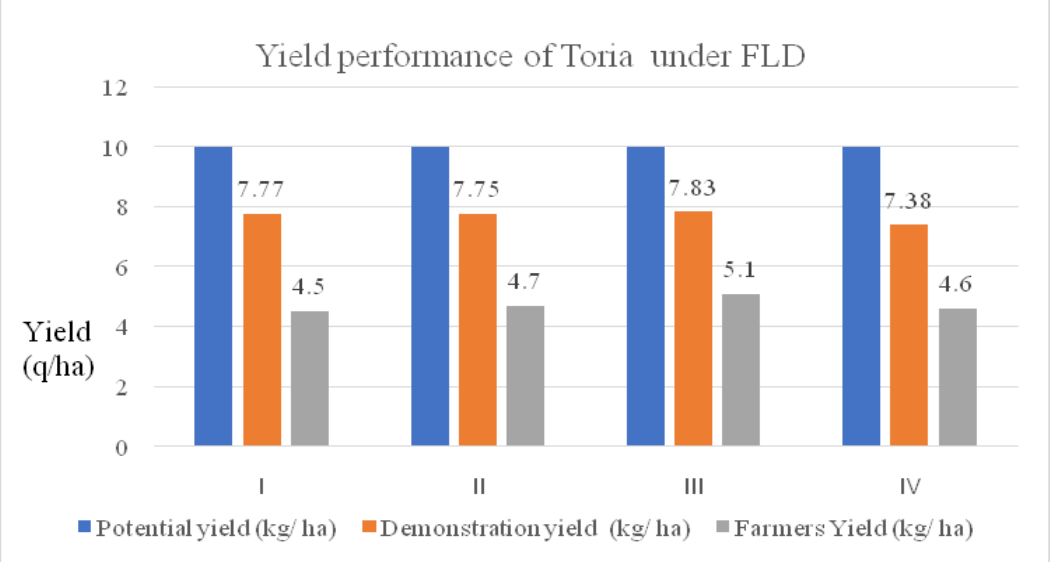

Fig.1 Performance of toria under frontline demonstration

Economic return

It was revealed from economic data (Table 4) 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 of Rs. 20778.2, 20489.8, 19897.6 and 19126.8 per ha as compared to farmers practices (Rs 8080, 8900, 10820 and 8660 per ha incluster- I, II, III and IV respectively.

It was also found that the average net return and B:C of demonstration field was Rs. 20068.6 32247 per ha and 1.94 respectively as compared to farmers practice of Rs 9115 per ha and 1.54. Similar findings were reported by Raju Teggelli *et al.,* (2015).

The benefit cost ratio of demonstration plot under improved cultivation practices was higher than farmer's practices in all the four clusters and this 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.,* (2011) and Anuratha *et al.,* (2019).

It can be concluded from the study that wide gap between the potential and demonstration yields were observed due to technology & extension gaps and also due to the lack of awareness regarding improved technologies in toria cultivation in Gajapati district of Odisha.

The demonstration fields showed a significant positive effect in technology adoption among the farmers and it also created an opportunity to Agriculturists to demonstrate the latest technologies with higher productivity and profitability in farmers' field. The productivity level gain and higher returns under demonstration fields over existing farmer's practices created greater awareness and motivated the other farmers to adopt suitable production technology of toria in the district.

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