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On farm assessment of toria (*Brassica campestris* L.) variety Sushree under mid central table land zone of Odisha

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Abstract
The study was carried out through participatory on farm testing during *rabi* season of 2014-15 at Bauligarh village in Angul district under mid central table land zone of Odisha on farmers field with an objective to evaluate the performances of Toria variety Sushree as compared to the farmers practice (Rai shoriso). The HYV Sushree recorded higher plant height (153.78 cm), branches plant^{-1} (4.68), dry matter plant^{-1} (32.16g), siliquae plant^{-1} (173.19), seeds siliqua^{-1} (12.13) and 1000 seed weight (4.29 g) than Rai shoriso. The same also produced seed yield 12.64 q ha^{-1} which is 44.96 % higher yield than local check with stover yield (42.36 q ha^{-1}) and harvest index (22.98%). The variety grown with recommended technologies gave additional net return Rs.11006.61 ha^{-1} with benefit-cost ratio 1.80 as compared to farmers practice and thus the existing variety (Rai shoriso) can be replaced by Sushree since it fits to the existing farming situation for higher productivity and income.

Keywords: toria, on farm testing, growth, yield and economics

1. Introduction
Toria (*Brassica campestris* L.) is an important oilseed crop of Odisha after harvest of kharif paddy. Toria is a short duration crop cultivated largely in Assam, Bihar, Orissa and West Bengal in the east mainly as winter crop. The rapeseed-mustard, which contributes nearly 80% of the total *rabi* oilseed production, is a vital component in edible oil sector. The rapeseed-mustard crops are diverse in their agro-climatic requirements and crop management practices (DRMR, 2011) [2].

Among the seven edible oilseeds cultivated in India, rapeseed-mustard contributes 28.6% in the total oilseeds production and ranks second after groundnut sharing 27.8% in the India's oilseed economy. The mustard growing areas in India are experiencing the vast diversity in the agro climatic conditions and different species of rapeseed-mustard are grown in some or other part of the country (Shekhawat *et al.*, 2012) [13].

In Odisha Rapeseed and Mustard is grown in an area of 116 thousand hectares. The total production comes to 49 thousand tonnes with a productivity of 422 kg ha^{-1} which is much below the national average of 1176 kg ha^{-1} (Pati and Mahapatra, 2015) [9].

One of the major constraints for such low yield is the non-availability of high yielding and resistant variety in the state also in the district. Different varieties with different genetic makeup mature at different dates. In spite of cultivation of high yielding varieties, improved cultural practices and plant protection measures, favourable weather so a must for good harvest (Rao *et al.*, 1999) [10]. Hence an attempt has been made to evaluate performance of toria variety Sushree through on farm testing for its wider cultivation in the existing farming situation for higher productivity and income.

2. Materials and Methods
The study was carried out through participatory on farm testing during *rabi* season of 2014-15 in Bauligarh village of Banarpal district in Odisha on farmers field. The experimental site lies in 84^0 16´ to 85^0 23´ E longitude and 20^0 31´ to 21^0 41´ N latitude and average elevation of 300 m above sea level. Climate of the region is fairly hot and humid monsoon and mild winter with average annual rainfall of 1401.9 mm. The mean maximum and mean minimum temperature vary from 39.6 ^{o}C in April to 23.5 ^{O}C in December and from 23.5 ^{0}C in June to

11.3 ^{0}C in January respectively. The soil of the site is slightly acidic in reaction (pH-5.2 to 5.7), sandy loam in texture with medium organic carbon content (0.52 to 0.64 %), nitrogen (272 to 290 kg ha^{-1}), potassium (170 to 179 kg ha^{-1}) and low phosphorus (9.0 to 10.5 kg ha^{-1}) contents.

The tested high yielding variety Toria "ORT (m) 7-2 "Sushree" was released from OUAT in 2012 is early maturity, brownish red seed, non-lodging, non-shattering can be suitable for late sown condition, escapes aphids and Alternaria blight infestation.

The treatments were consisted of HYV and local varieties viz T_1: HYV ORT (m) 7-2 (Sushree), T_2: HYV ORT (m) 6-2 Anuradha T_3: Local (Rai shoriso) and were replicated ten times in a Randomized Block Design. The crops were sown during 1st week of October and harvested during 3rd week of December. Ten different farmers each having 0.1 hectare of land cultivated the toria varieties Sushree, Anuradha and local (Rai shoriso) with recommended package of practices. The recommended fertilizer dose were N: P: K 60:37:30 kg ha^{-1} respectively. Full dose of P and K as basal and N in 2 splits i.e 50% as basal and 50% at 30 DAS. Three numbers of irrigations were given during seeding, flower initiation and siliquae development.

Observations on different growth and yield parameters were taken and economic analysis was done by calculating cost of cultivation, gross return, net return and B: C ratio. Available soil nutrients as well as nutrient content were determined following the standard procedures (Jackson, 1973) [4]. Final crop yield (seed & stover) were recorded and the gross return were calculated on the basis of prevailing market price of the produce. Harvest index is the relationship between economic yield and biological yield (Gardner *et al*., 1985) [3]. It was calculated by using the following formula;

$$\text{Harvest index (\%)} = \frac{\text{Economic yield}}{\text{Biological yield}} \times 100$$

The data were statistically analyzed applying the techniques of analysis of variance and the significance of different sources of variations were tested by error mean square of Fisher Snedecor's 'F' test at probability level 0.05 (Cochran and Cox, 1977) [1].

3. Results and Discussion

3.1 Growth parameters

Growth parameters like plant height, no of primary branches plant^{-1} and dry matter accumulation plant^{-1} (Table 1) were significantly increased by 8.60, 19.39 and 49.17 % respectively in HYV toria (Sushree) as compared to local check (Rai Soriso) due to their genetic differences in growth habit of varieties. Sushree produced the tallest plant (153.78 cm), maximum number of primary branches plant^{-1} (4.68), maximum dry matter accumulation plant^{-1} (32.16g) at harvest as compared to other treatments attributed to increased cell division and cell elongation. These results are consistent with Rawat *et al.* (2000) [11].

Table 1: Effect of different treatments on growth parameters at harvest

Treatment	Plant height (cm)	No of Primary branches plant^{-1}	Dry matter accumulation plant^{-1} (g)
Sushree	153.78	4.68	32.16
Anuradha	148.16	4.46	27.43
Rai shoriso	141.6	3.92	21.56
SEm ±	1.597	0.094	0.449
CD at 5%	4.745	0.279	1.332

3.2 Yield attributing characters

Analysis of the data (Table 2) indicated that Sushree recorded (Table 2) the maximum yield attributing characters like no of siliqua plant^{-1} (173.19), no of seeds siliqua^{-1} (12.13), 1000 grain weight (4.29 g) which is 25.03, 16.08 and 9.16 %, respectively, higher than Rai shoriso. This reason may be attributed to genetic variability and environmental adaptability. Anuradha produced siliqua plant^{-1} (157.34), no of seeds siliqua^{-1} (11.22), 1000 grain weight (3.93 g) [1] (Munda *et al.,* 2011) [6]. These might be owing to better nitrogen and carbohydrate metabolism of plants that facilitates synthesis of nucleic acids and hormones which had encouraged the better filling of seeds (Yadav *et al.,* 1999) [14]. Similar results were obtained in mustard due to increased dry matter production and higher translocation of food material for formation of seed in advanced sowing by Kumari *et al.,* 2012) [5].

Table 2: Effect of different treatments on yield attributing characters

Treatment	No of siliquae plant^{-1}	No of seeds siliqua^{-1}	Test weight (1000 grain) (g)
Sushree	173.19	12.13	4.29
Anuradha	157.34	11.22	4.16
Rai shoriso	138.52	10.45	3.93
SEm ±	0.779	0.269	0.062
CD at 5%	2.316	0.801	0.185

3.3 Yield

Sushree produced (Table 3) the maximum seed yield of 12.64 q ha^{-1} which is 44.8 % higher than that of existing local variety Rai shoriso due to higher number of siliquae per plant and seeds per siliqua. HYV Anuradha produced seed yield of 11.45 q ha$^{-1.}$ The trend of stover yields of different varieties was almost similar with seed yields. Maximum Stover yield was obtained from Sushree (42.36 q ha^{-1}) owing to its higher dry matter accumulation whereas Rai shoriso produced least stover yield (34.16 q ha^{-1}). These results are in agreement with Patel and Shelke, 1998); Nath *et al.,* 2012) [8, 7]. Also the HYV Sushree recorded higher harvest index (22.98 q ha^{-1}) in comparison to local check with harvest index 20.34 %(Table 3). The results are in agreement with results of Samant (2015) [12].

Table 3: Effect of different treatments on yield

Treatment	Seed yield (q ha$^{-1)}$	Stover yield (q ha$^{-1)}$	Harvest index (%)
Sushree	12.64	42.36	22.98
Anuradha	11.45	38.48	21.73
Rai shoriso	8.72	29.24	20.34
SEm ±	0.164	0.362	0.376
CD at 5%	0.487	1.077	1.118

3.4 Economics

An analysis on economics (Figure-1) revealed that the HYV Toria Sushree recorded the higher gross return Rs.40303 ha^{-1} & net profit of Rs.17892 ha^{-1} with additional net return of Rs.11006 ha^{-1} as compared to farmers practice**.** The same variety had also maximum B: C ration (1.80) due to its higher productivity followed by HYV Anuradha. Rai shoriso recorded lowest net return (Rs.6886 ha^{-1}) & B: C ratio (1.33) due to its less return (Figure 2).

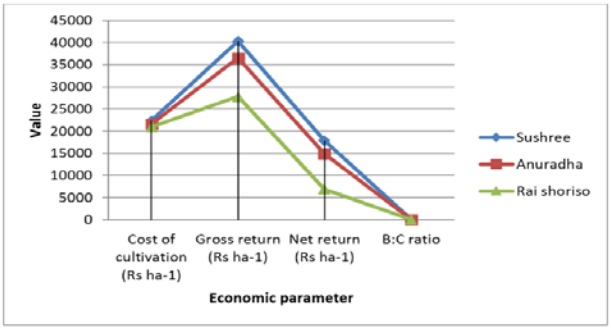

Fig 1: Effect of treatments on Cost of cultivation, Gross return, Net return and B: C ratio

4. Conclusion

Thus, the cultivation of HYV Toria Sushree with improved technologies was found to be more productive and can replace the local check since it fits to the existing farming situation for higher productivity & income and should grown in the district for the well-being of farmers.

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