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Original Research Article

Cultivation of Organic Tomato (*Lycopersicum esculentum*) through Adaptive Trial

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A B S T R A C T

Chhotanagpur plateau, often considered as the vegetable bowl of eastern India but most of the vegetable growers of this region grow their crops by following traditional package of practices. As a result, they obtain the lower crop yield. The need for different vegetables is increasing day by day with ever increasing population of our country. In this context, advance package of practices has been incorporated in the present study with the objective of harnessing more crop yield. Although, toxic residual effect of different plant protection chemicals has often been reported in crops obtained by means of adopting advance package of practices that may cause health as well as environmental hazards, therefore, priority has been given in this experiment to adopt organic package of practices for growing at least safe vegetable. Mean performance of different studied characters recorded significant differences under different growing conditions of tomato. Almost all of the cases, advance growing condition recorded desirable results followed by organic and conventional growing conditions. Significant results were found for different parameters of tomato which ultimately ensured a higher yield (1.24 times more than conventional practice) and low cost of cultivation (cost is 1.17 times more in case of conventional practice) than conventional practice. The organic cultivation packages of practices were environment friendly, reduced cost of cultivation, ensured higher productivity and increased profitability.

Keywords

Tomato, Organic farming, Character association, Participatory adaptive trial

Introduction

Tomato (*Solanum lycopersicum*) is one of the most important and widely consumed solanaceous fruit vegetables of the world. It gives a high yield within a relatively short period and it is economically attractive. Thereby, the area under cultivation of this crop is increasing day by day. In India, tomato occupied 760000 ha with a production of 18.39 MT (Anonymous, 2017). Tomatoes are an essential component of human diet for the supply of vitamins and minerals. Red tomatoes contain lycopene, an anti-oxidant that may contribute to protect against carcinogenic substances. Lycopene, the most important anti-oxidant has been linked with reduced risk of prostrate and various other forms of cancer as well as heart diseases (Adeniyi and Ademoyegun, 2012). Tomato consumption might be strongly protective against neurodegenerative diseases and beneficial for reducing cardiovascular risk associated with type-II diabetes. Organically grown tomato has found to be significantly

influence the nutrient content as compared to tomato grown through conventional fertilizers application (Shankar *et al*. 2012). This investigation aimed to study the effect of organic products like *Sasyagavya* and *Virus Damanam* on growth and yield of tomato.

Materials and Methods

The participatory adaptive trial on organic cultivation of tomato was conducted in Ajaygarh village of Ranchi district of Jharkhand state of India to evaluate the efficiency of some organic tomato in 2011. The village is about 300m above from the sea level and located $85^0$44'E to $85^0$46'30"E (longitude) and $23^0$24'N to $23^0$25'30"N (latitude). Twenty progressive small and marginal farmers were selected for conducting adaptive trial to cultivate tomato (var. Pusa Ruby) organically and conventionally in plot size of 0.10 acre respectively. Time to time data were collected on different quantitative characters of tomato like plant height (cm), branches/plant, fruits/plant, diameter of fruit, fruit weight (g) and yield (q/0.10acre). Finally data were analyzed to prepare the manuscript by following standard statistical methods.

Adaptive trial

Adaptive trial is a method of determining the suitability or otherwise of a new practice in a farmer's situation. This may be regarded as an on-farm participatory technology development process in which farmer's choice and farmer's opinion about the practice are most important. This is the first stage of a new and improved practice that passes through, before it is taken up for result or method demonstration, or recommended for large scale adoption.

Organic package of practices

Trichoderma treated seed (@10 g per kg of seed) were on sown on **r**aised seed beds of size 8.0m x 1.0m x 0.015m. *Trichoderma sp*. an anaerobic facultative fungus acts as an organic fungicide and acts as antagonists on different pathogenetic fungus. Five percent *Trichoderma* solution was sprayed again after 7 and 14 days of sowing on the seedlings to avoid fungal diseases. Mulching was done with the locally available bio-mass. *Virus Damanam* [a mixture of cow dung, cow urine, neem (*Azadirachta indica*) leaf paste, ghato (*Clerodendrum viscosum*) leaf paste, green chilli (*Capsicum* sp.) paste and garlic (*Allium sativum*) paste] in the ratio (5:5:5:5:2:2), an organic insecticide and which is capable of controlling viral infestation by reducing vector population was sprayed (5% solution) after 14 days of sowing.

The seedlings were transplanted after 23 days and was dipped in *Shasyagavya* (10% solution), a fermented organic nutritive solution was prepared by cow dung, cow urine, kitchen waste, rice water and fresh water (1:1:1:1:1:10) and *Trichoderma viride* inoculated FYM was applied at the root zone. The spacing was maintained at 45cm (plant to plant) x 60cm (line to line) in raised bed furrow system.

Shasyagavya, 10% solution (source of plant nutrients) and Virus *Damanam*, 5% solution (as plant protection measure) were sprayed periodically i.e. four times at 10 days interval starting 30 days after transplanting. Mulching was done with locally available biomass followed by staking to prevent fruit damage.

Conventional package of practices

The untreated seeds were sown on raised

seed bed on the same day as in organic seed bed. The seedlings were transplanted after twenty three days of sowing but without following the organic practices. The spacing for Tomato was maintained at 45cm (plant to plant) x 60cm (line to line) in raised bed furrow system. Mulching was not done by using locally available biomass. The plot was treated as per prevalent local management practices and staking was not done.

Results and Discussion

Results obtained from the experiment have been presented and discussed hereunder:

a) Effect of organic products on different growth parameters and yield of tomato

Periodical application of *Sasyagavya,* Virus *Damanam* and mulching made a significant impact on the yield of tomato. The proposed organic method of cultivation practices resulted 1.24 times more yield than the conventional practices. Elizabeth *et al.* 2013, also reported increase in crop yields over the first few years of organic farming which have been attributed to gradual improvements in soil properties, such as the capacity of the soil microbial community to mineralize N or to suppress disease. Kumar *et al.* 2010 also stated that the seed test weight was highest in case of plots treated with vermicompost. This practice showed significant results for several yield attributing parameters. As the sample size was less than 30, to make a comparative study between organic practices and conventional practices of tomato cultivation, paired-t test was followed to calculate level of significant along with calculations of mean, standard deviation, standard error of mean and coefficient of variance etc. (Table:1). All the yield attributing parameters were statistically significant at 5% level of significance (Table 2). Organic practices resulted 1.31 times more height, 1.44 times more number of branches per plant, 2.5 times more fruits per plant, 1.19 times more polar diameter of a fruit, 1.20 times more equatorial diameter of a fruit and ultimately 1.62 times more weight per fruit which lead to 1.24 times more yield than the convention al practices (Table 1). More or less similar results were obtained by Solaiman and Rabbani (2006), Shukla *et al.* (2011).

Table.1 Comparative study of tomato cultivation

Parameter		**Mean**	**S.D.**	**SE_m**	**CV** at 5%
Height of the Plant (in cm.)	Organic Treatment	88.15	7.27	1.62	8.25
	Conventional Practice	67.63	13.55	3.03	20.04
Number of Branches per Plant	Organic Treatment	25.43	4.80	1.07	18.89
	Conventional Practice	17.63	2.39	0.53	13.57
Number of Fruits per Plant	Organic Treatment	25.43	4.80	1.07	18.89
	Conventional Practice	17.63	2.39	0.53	13.57
Polar Diameter (in cm) of a Fruit	Organic Treatment	3.97	0.82	0.18	20.82
	Conventional Practice	3.35	0.55	0.12	16.47
Equatorial Diameter (in cm) of a Fruit	Organic Treatment	18.73	3.05	0.68	16.30
	Conventional Practice	15.67	2.75	0.61	17.57
Weight (in gram) of Single Fruit	Organic Treatment	91.71	41.44	9.26	45.19
	Conventional Practice	56.77	28.88	6.45	50.87
Yield (in quintal/0.10acre)	Organic Treatment	0.97	0.16	0.04	16.63
	Conventional Practice	0.78	0.17	0.04	21.14

Table.2 Paired t-test for tomato cultivation

Parameter	t-calculated value
Height of the Plant	6.64*
No. of Branches per Plant	6.70*
No. of Fruits per Plant	13.48*
Polar Diameter of a fruit	3.69*
Equatorial Diameter of a Fruit	6.31*
Weight per Fruit	3.69*
Yield of Tomato	2.82*

*Significant at 5% level of significance

Table.3 Benefit Cost ratio analysis of organic and conventional tomato cultivation

Particulars	Organic treatment	Conventional practices
Benefit Cost Ratio	**1.94**	**1.46**

b) Cost: benefit ratio of Organic and Conventional tomato

The organic inputs e.g. cow dung, cow urine, neem leaf, kitchen waste etc. were locally available in the village and so monetary cost was not involved but the cost of seed and labour were calculated. In conventional practice additional costs were incurred on fertilizer and its application through labour. The organic plot was mulched resulting in very low weed infestation alongside earthing-up was not undertaken saving labour cost compared to conventional cultivation. The yield of the organic plot was higher than conventional plot. The benefit cost ratio for organic practice was 1.94 compared to 1.46 for conventional practice (Table 3).

In conclusion, the higher yield and benefit cost ratio were documented under organic package of practices followed by conventional growing environments. Yield attributing parameters were statistically significant at 5% level of significance Thus in one hand it was eco-friendly and on the other hand reduced the cost of cultivation but at the same time providing reasonable productivity and profitability.

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