D-5632
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RESEARCH ARTICLE Agricultural Science Digest, Volume Issue : ()

Effect of Composted Sugarcane Trash and Bagasse on the Growth and Yield of Tomato (*Solanum lycopersicum* L.)

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10.18805/ag.D-5632

ABSTRACT

Background: Organic farming proves many advantages for recycling regenerates the waste matter into wealth and can wipe out the use of chemical fertilizers and pesticides. Sustainable agriculture can be ensured in future with the help of organic farming which includes various processes of biological origin such as compost and vermicompost.

Methods: The study was conducted at Alanthurai, Coimbatore, Tamil Nadu. Agro-industrial waste of sugarcane trash and bagasse were collected and were used for biocomposting process using *Pleurotus florida, Trichoderma asperelloides*, microbial consortium and *Eudrillus eugeniae*. Six different treatments were incorporated in the present study. Vegetative parameters such as shoot length, root length, number of leaves, fresh weight and dry weight at different stages (30, 60 and 90 DAS), number of flowers and number of branches on 60 and 90 DAS. On 90th day yield characters like number of fruits, diameter of fruits, single fruit weight, fruit yield per plant and fruit yield per plot were analyzed.

Result: A significant increase in shoot length, root length, number of leaves, fresh weight and dry weight was observed in T_3 - C_3 (Predecomposted sugarcane trash + *Trichoderma asperelloids* and Microbial consortium 5 t/h) treatment, followed by T_1 - C_1 (Predecomposted sugarcane trash *Pleurotus florida* and earthworm (*Eudrilus eugeniae*) 5 t/h) treatment on 30, 60 and 90 DAS. A significant increase in number of flowers and number of branches was observed in T_3 treatment followed by other treatment on 60 and 90 DAS. The maximum amount in number of fruits, diameter of fruit, single fruit weight, fruit yield per plant and fruit yield per plot were noted in T_3 treatment, followed by T_1 treatment on 90 DAS and minimum amount were reported in control (soil). The results of the study clearly indicated that treatment T_3 significantly increased the vegetative parameters and yield characters in tomato.

Key words: Bagasse, DAS, *Eudrilus eugeniae, Pleurotus florida*, Sugarcane trash, *Trichoderma asperelloids*.

INTRODUCTION

Organic farming is an important factor in the successful cultivation of healthy plants. This method of farming can be explored as an eco-friendly and sustainable waste management approach. Organic farming consists of environmental friendly raw material that can be returned to soils as biofertilizers. On an average a hectare of sugarcane generates about 10 tons of trash. Trash contains 28.6% organic carbon, 0.35 to 0.42% nitrogen, 0.04 to 0.15% phosphorous and 0.50 to 0.42% potassium. The sugarcane trash incorporation in the soil influences physical, chemical and biological properties of the soil (Shree Harsha Kumar *et al*., 2018). Sugarcane trash incorporation reduces the bulk density of the soil and there is an increase in infiltration rate and decrease in penetration resistance. Sugarcane trash can be easily composted by using the fungi like *Trichurus, Aspergillus, Penicillium* and *Trichoderma*. Bagasse is a lignocellulosic waste from sugar mills and agricultural processing. The plants grown on sugarcane bagasse yielded a 22% increase in root length, 20% increase in plant height and 63% increase in the number of roots. Bagassse can be used as raw material organic fertilizer and recycled in agriculture as organic fertilizer product. Bagasse also has high nutrient content that is beneficial for plant growth. Bagasse products are biodegradable and compostable. *Solanum lycopersicum* is an important vegetable crop that belongs to the family solanaceae. The species originated in western South America. Root decoction is ingested for relief from tooth pain. Tomatoes are rich in lycopene, a substance with beneficial effects on the heart and prostrate. It is also used for rheumatism and headaches. The main objectives of the present investigation was to evaluate the impact of sugarcane trash and bagasse on growth and yield parameters in tomato (*Solanum lycopersicum* L.).

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How to cite this article: Gnanamani, K. and Vijayalakhsmi, A. (2022). Effect of Composted Sugarcane Trash and Bagasse on the Growth and Yield of Tomato (*Solanum lycopersicum* L.). Agricultural Science Digest. DOI: 10.18805/ag.D-5632.

Submitted: 05-07-2022 **Accepted:** 15-11-2022 **Online:** 02-12-2022

MATERIALS AND METHODS

The present study was conducted from July to September 2019-2020 at Alanthurai (10.9536 N.7885 E) Coimbatore, Tamil Nadu. The method adopted for decomposition of agro

waste sugarcane trash and bagasse was pit composting and subjected to field experiment using randomized block design with three replications.

Collection of agro-industrial waste

The agro industrial waste of sugarcane trash and sugarcane bagasse was collected from in and around Coimbatore. It was chopped into small pieces, sun dried and preserved for further study. The collected raw samples were used for the pre-decomposition with the incorporation of *Pleurotus florida, Trichoderma asperelloides, Eudrillus eugeniae* and microbial consortium. The process of composting was conducted in 1.5 feet length and 4 square feet width compost pit. It was filled by sugarcane trash and sugarcane bagasse waste. It was allowed to decompost for 30 days. This work was done from February to April 2019.

Field culture experiment with the treatments

The field culture experiment was conducted with tomato (*Solanum lycopersicum* L.) in Alanthurai, Coimbatore. The compost was mixed thoroughly and applied to the field. Viable seeds were selected and they were sown in the field with three replications. As per recommendation of Tamil Nadu Agricultural University, Coimbatore, plant protection measures and other cultural practices were followed.

C: Control.

T_1: C_1 (Predecomposted Sugarcane trash, *Pleurotus florida* and earthworm (*Eudrilus eugeniae*) 5 t/h).

T_2: C_2 (Predecomposted Sugarcane trash, *Trichoderma asperelloids* and earthworm (*Eudrilus eugeniae*) 5 t/h).

T_3: C_3 (Predecomposted Sugarcane trash, *Trichoderma asperelloids* and Microbial consortium 5 t/h).

T_4: C_4 (Predecomposted Sugarcane bagasse, *Pleurotus florida* and earthworm [*Eudrilus eugeniae*) 5 t/h].

T_5: C_5 (Predecomposted Sugarcane bagasse, *Trichoderma asperelloids* and earthworm (*Eudrilus eugeniae*) 5 t/h).

T_6: C_6 (Predecomposted Sugarcane bagasse, *Trichoderma asperelloids* and Microbial consortium 5 t/h).

Statistical analysis

The data obtained from various observations on 30, 60 and 90 DAS were analyzed statistically using One-way and Two -way ANOVA.

RESULTS AND DISCUSSION

Vegetative parameters

Among all treatments T_3 - C_3 (Predecomposted Sugarcane trash *Trichoderma asperelloids* and Microbial consortium 5t/h) treatment registered maximum shoot length (57.1, 71.6 and 99.2 cm), root length (14.17, 22.77 and 44.20 cm), number of leaves (37.00, 81.00 and 110.33), on 30, 60 and 90 DAS, followed by T_1 - C_1 (Predecomposted Sugarcane trash *Pleurotus florida* and earthworm (*Eudrilus eugeniae*) 5t/h) (50.3, 68.3 and 95.4 cm), (12.60, 20.73 and 41.73 cm), (30.67, 75.00 and 106.00), on 30, 60 and 90 DAS over the control (31.5, 47.0 and 78.3 cm), (6.40, 10.27 and 27.27 cm), (18.33, 68.00 and 90.00), on 30. 60 and 90 as shown in Table 1.

Fresh weight and dry weight

A significant increase in fresh weight (26.60, 44.93 and 52.23 g) and dry weight (5.83, 6.73 and 7.93 g) on 30, 60 and 90 DAS was observed in T_3 - C_3 (Predecomposted Sugarcane trash *Trichoderma asperelloids* and Microbial consortium 5t/h) treatment followed by T_1 - C_1 (Predecomposted Sugarcane trash *Pleurotus florida* and earthworm (*Eudrilus eugeniae*) 5t/h) (24.50, 43.00 and 48.67 g) and (5.53, 6.17 and 7.47 g) over the control (14.83, 23.63 and 33.83 g) and (2.53, 3.57 and 4.33 g) on 30, 60 and 90 DAS as shown in Table 2.

Number of flowers and number of branches

The results as presented in Table 3, the number of flowers and number of branches was found to be maximum in T_3 - C_3 (Predecomposted Sugarcane trash *Trichoderma asperelloids* and Microbial consortium 5 t/h) treatment (34.67 and 44.67) and (16.00 and 22.00) followed by T_1 - C_1 (Predecomposted Sugarcane trash *Pleurotus florida* and earthworm (*Eudrilus eugeniae*) 5 t/h) treatment of (32.00 and 42.00) and (13.00 and 20.33) when compared to the control (19.67 and 24.00) and (5.67 and 8.00) on 60 and 90 DAS.

Similar work was reported by Dhanalakshmi *et al*. (2014) that the application of vermicompost increases the shoot length (13.03, 11.53, 13.10 and 10.90), number of branches (8.00, 15.33, 16.67 and 19.47) in vegetable crops of okra, brinjal, tomato and chilli. The present study supported by

Table 1: Effect of composted sugarcane trash and bagasse on the shoot length, root length and number of leaves on *Solanum lycopersicum* L.

Treatment	Shoot length (cm)			Root length (cm)			Number of leaves		
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
C	31.5	47.0	78.3	6.40	10.27	27.27	18.33	68.00	90.00
T_1	50.3	68.3	95.4	12.60	20.73	41.73	30.67	75.00	106.00
T_2	36.3	34.4	82.8	7.33	12.60	31.00	20.67	78.67	91.67
T_3	57.1	71.6	99.2	14.17	22.77	44.20	37.00	81.00	110.33
T_4	41.5	62.3	91.5	10.80	18.70	39.33	28.67	72.00	103.00
T_5	36.9	59.8	88.6	9.03	16.83	35.73	26.00	68.33	98.33
T_6	35.1	50.4	80.4	8.10	14.73	34.20	22.67	64.67	94.67
SED		0.36697			3.11812			3.02896	
Cd (p<0.05)		0.74074			6.29409			6.11412	

DAS- Days after sowing.

Table 2: Effect of composted sugarcane trash and bagasse on the fresh weight and dry weight of *Solanum lycopersicum* L.

Treatment	Fresh weight (g)			Dry weight (g)		
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
C	14.83	23.63	33.83	2.53	3.57	4.33
T_1	24.50	43.00	48.67	5.53	6.17	7.47
T_2	17.63	29.43	38.50	3.13	4.43	5.23
T_3	26.60	44.93	52.23	5.83	6.73	7.93
T_4	22.43	39.03	44.67	4.97	5.87	6.90
T_5	19.63	35.80	42.13	4.23	5.40	6.10
T_6	16.43	32.30	40.87	3.63	4.73	5.43
SED		2.95570			0.43680	
Cd (p<0.05)		5.96625			0.88170	

DAS- Days after sowing.

Table 3: Effect of composted sugarcane trash and bagasse on the number of flowers and number of branches of *Solanum lycopersicum* L.

Treatment	Number of flowers		Number of branches	
	60 DAS	90 DAS	60 DAS	90 DAS
C	19.67	24.00	5.67	8.00
T_1	32.00	42.00	13.00	20.33
T_2	23.00	26.67	6.67	11.67
T_3	34.67	44.67	16.00	22.00
T_4	28.67	38.67	11.33	18.33
T_5	27.00	35.00	10.00	16.00
T_6	26.00	31.00	8.00	14.00
SED	2.82843		2.65772	
Cd (p<0.05)	5.79393		5.44424	

DAS- Days after sowing.

Mahmud *et al*. (2020) who confirmed that the application of vermicompost showed maximum number of leaves (51) in pineapple (*Ananas comosus* var. MD2). The results coincides with Silpa and Vijayalakshmi (2022) who confirmed that the application of biocomposted cocoa shell and jack fruit peel waste increased the shoot length (175.83 cm), root length (39.23 cm) and number of leaves (37.50) in *Vigna unguiculata* (L.) Walp. The present study was supported by Raihing, P. and Vijayalakshmi (2022) reported that the application of vermicompost increased the shoot length, root length, fresh weight and dry weight in black gram (*Vigna mungo* L.).

The present study is in agreement with Manimegala and Gunasekaran (2020) who reported that the application of vermicompost and NPK fertilizer increased the number of leaves (72.54), number of branches (16.50) and number of flowers (51.83) in egg plant (*Solanum melongena* L.). The results was on par with Priya and Santhi (2014) who confirmed that the application of vermicompost showed maximum shoot length (29.88) and root length (10.0) in *Solanum nigrum*. Similar work was reported by Sakthivigneswari and Vijayalakshmi (2016) who reported that the application of biocompost increase the shoot length (90.47), root length (60.10), number of leaves (180.33), number of flowers (28.67), fresh weight (55.47) and dry weight (6.17) in *Solanum nigrum* L.

Similar work was reported by Sumathi *et al.* (2014) who observed that the application of vermicomposts increased the number of branches (6.120) in *Abelmoschous esculentus*. The present study is in correlation with Kavitha *et al*. (2013) who confirmed that the combined application of biofertilizer, chemical fertilizer and vermicompost increase in shoot length (13.13), root length (8.25), number of leaves (30.02), fresh weight (1.76) and dry weight (0.25) 40th days of growth in *Amranthus tristis*. The results coincides with Senthilkumar and Sivagurunathan (2012) that the application of bacterial biofertilizers increases the shoot length (30.0), root length (14.6) and number of leaves (9.6) (23.4), (7.1) and (8.8) in cowpea (*Vigna siensis* Edhl) and green gram (*Phaseolus radiata* L.).

Yield parameters

Among all treatments T_3 - C_3 (Predecomposted Sugarcane trash *Trichoderma asperelloids* and Microbial consortium 5t/h) treatment registered maximum number of fruits/plant (47.7), diameter of fruit (7.3 cm), single fruit weight (79.07 g), fruit yield per plant (5.82 kg) and fruit yield per plot (39.66 kg) on 90 DAS, followed by T_1 - C_1 (Predecomposted Sugarcane trash *Pleurotus florida* and earthworm [*Eudrilus eugeniae*) 5 t/h] (33.7, 6.3 cm, 76.57 g, 5.68 kg and 38.37 kg) on 90 DAS over the control (19.0, 3.5 cm, 56.53 g, 2.96 kg and 28.96 kg) on 90 DAS as shown in the Table 4.

The present study was correlated with the findings of Eswaran and Mariselvi (2016) who reported that the application of organic manure and vermicompost increased the number of fruits (19.43) and (22.38) in tomato (*Lycopersicum esculentum*). The present findings was supported by Mullaimaran and Haripriya (2016) who confirmed that the application of organic manures increased the single fruit weight per plant (54.42) and fruit yield per plot (48.35) in tomato. The present study is correlated with Saraswathy and Prabhakaran (2014) who observed that the application of vermicompost increased the number of fruits per plant, fruit weight, fruit weight per plant and fruit yield per plant in tomato (*Lycopersicum esculentum* Mill.).

Table 4: Effect of composted sugarcane trash and bagasse on the yield parameters of *Solanum lycopersicum*. L.

Treatment	Number of fruits	Diameter of fruit (cm)	Single fruit weight (g)	Fruit yield per plant (kg)	Fruit yield per plot (kg)
	90 DAS	90 DAS	90 DAS	90 DAS	90 DAS
C	19.0	3.5	56.53	2.96	28.96
T_1	33.7	6.3	76.57	5.68	38.37
T_2	26.0	4.3	65.03	4.65	32.93
T_3	47.7	7.3	79.07	5.82	39.66
T_4	32.0	5.3	71.40	5.35	36.56
T_5	28.0	5.2	67.80	4.86	34.88
T_6	24.3	4.2	61.87	3.96	30.76
SEd	1.6330	0.0992	2.5165	0.0498	0.0382
CD ($p<0.05$)	3.5028	0.2128	5.3980	0.1068	0.0820

DAS- Days after sowing.

Similar work was reported by Singh *et al*. (2013) who reported that the application of vermicompost increased fruit weight (92.9 g) and fruit yield per plant (4.013 kg) in tomato (*Solanum lycopersicum* L.). The present finding was supported by Adhikary *et al*. (2016) who reported that the application of manures and fertilizers increased the number of fruits per plant (37.61), fruit diameter (5.33 cm), weight of individual fruit (75.14g) and fruit yield per plant (30.03 kg) in tomato.

The present study was in correlation with the findings of Palia *et al*. (2021) who reported that the application of organic and inorganic fertilizers increase the diameter of fruit (29.18 cm) in brinjal (*Solanum melongena* L.). The results was on par with Haghighi *et al*. (2016) who confirmed that the application of municipal solid waste compost, peat, perlite and vermicompost increased fruit weight (80.36 g) in tomato (*Lycopersicum esculentum* L.).

CONCLUSION

The present research is to brighten the possibilities of using sugarcane trash and bagasse waste in enchancing the crop productivity. Agro industrial waste can be recycled and used as a cheaper source of organic nutrients. Organic manures improve the soil fertility and biological properties of the soil. From the results, it can be concluded that the application of the treatment [T_3 - C_3 (Predigested Sugarcane trash *Trichoderma asperelloids* and Microbial consortium 5t/h)] showed maximum on the yield parameters of Tomato (*Solanum lycopersicum* L.).

ACKNOWLEDGEMENT

We would like to thank Avinashilingam Institute for Home Science and Higher Education for Women Coimbatore for the facilities provided to carry out the research work.

Conflict of interest: None.

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