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Standardization of growing media for tomato production in containers

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Abstract
A study was conducted for standardizing the growing media for tomato in containers at Horticultural College and Research Institute, Tamil Nadu Agricultural College University Coimbatore, during 2017-18. The experiment was laid out in open condition, with eight treatments and three replications comprising of various combinations of red soil, FYM, vermicompost, cocopeat and rice husk on volume basis. The design followed was CRD. Among the different combinations, the treatment containing Red soil + cocopeat + (50% FYM + 50%Vermicompost) (T_5) @ 1:1:1 on volume basis registered for significant maximum plant height (43.64, 53.82 and 61.14 cm), number of leaves (36.48, 62.77 and 70.12), number of branches (3.90, 7.02 and 7.70) on 30, 60 and 90 days after transplanting. Number of fruits (22.55), individual fruit weight (49.49 g), fruit length (6.37 cm), fruit girth (14.98 cm), yield per plant (1.101 kg) and quality parameters *viz.*, ascorbic acid (20.08 mg 100^{-1}), TSS (5.25 °brix), acidity (0.57 %) and lycopene (2.94 mg 100^{-1}) were also high in T_5 (Red soil + cocopeat + (50% FYM + 50%Vermicompost). B: C ratio was highest (3.36) in the treatment containing T_4 (Red soil + Cocopeat + Rice husk (1: 1: 1).

Keywords: Standardization, growing media, tomato production, containers

Introduction
Tomato (*Lycopersicum esculentum* L. Mill.) is one of the most important vegetable crop grown widely all over the world. In India, tomato ranks second among vegetables next to potato in terms of area and production. Tomato universally treated as 'Protective Food', is being extensively grown as an annual plant. Tomato is a rich source of minerals, vitamins and organic acids. Tomatoes are important source of lycopene, minerals, vitamin-A, B and also excellent source of vitamin-C.

Growing media are materials, in which plants are grown. It has three main functions: 1) provides aeration and water, 2) allow for maximum root growth and 3) physical support to the plant. Growing media should have large particles with adequate pore spaces between the particles and light and fluffy (well-aerated) that promotes fast seed germination, strong root growth and adequate water drainage, thus, providing a congenial rhizosphere for better root-growth. Various ingredients have been used to produce growing media for vegetable production (Bilderback *et al*., 2005) [2].

The effects of growing media on tomato production in containers are not well known. The importance of media choice, relative to other production factors, needs to be evaluated for the production of tomato. Several studies have investigated the effect of growing media on the yield of vegetables. But in India, different combinations of media that should meet the criteria's like light weight to support the roof top, reusable, good soil physical, chemical and biological properties, etc., have to be standardized for tomato production in containers and hence the study was undertaken.

Materials and Methods
A experiment was conducted in Orchard, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore during 2017-2018 for two seasons. The experiment was laid out in a Completely Randomized Design with 8 treatments each replicated thrice. Growing media such as red soil, farm yard manure, sand, cocopeat, vermicompost and rice husk were used in different combination s detailed below.

T_1 Red soil + Sand + FYM (1:1:1) – Control
T_2 Red soil + Cocopeat + FYM (1:1:1)
T_3 Red soil + Cocopeat + Vermicompost (1:1:1)
T_4 Red soil + Cocopeat + Rice husk (1:1:1)
T_5 Red soil + Cocopeat + (50%FYM + 50% Vermicompost) (1:1:1)
T_6 Red soil + Cocopeat + (50% FYM + 50% Rice husk) (1:1:1)
T_7 Red soil + Cocopeat + (50% Vermicompost + 50% Rice husk) (1:1:1)
T_8 Red soil + Cocopeat + (33 % FYM + 33% Vermicompost + 33% Rice husk) (1:1:1)

To all the trearments, neemcake, *Pseudomonas* and biofertiizers like *Azospirillum and* Phosphobacteria were added equally to promote the growth. Tomato cv. PKM 1 was transplanted in 24×24 ×40 cm size grow bags and it was grown in open condition. Regular agronomic practices were carried out and plant protection measures were taken up chemically.

Data was recorded for morphological characters *viz.,* plant height (cm), number of leaves, and number of branches on 30, 60 and 90 days after transplanting. Other characters *viz.,* days taken for first flowering, number of fruits per plant, individual fruit weight (g), fruit length (cm), fruit girth (cm) and yield per plant (kg) were recorded. Quality parameters *viz.,* ascorbic acid (mg 100^{-1}), TSS (°brix), acidity (%) and lycopene (mg 100^{-1}) were recorded. B: C ratio was calculated and presented.

Results and Discussions

Growth parameters

Among the different combinations, T_5 [Red soil + Cocopeat + (50% Vermicompost + 50% FYM)] recorded maximum plant height of 43.64 cm, 53.82 cm and 61.14 cm at 30, 60 and 90th DAT respectively. The data revealed that the highest number of leaves (36.48, 62.77 and 70.12) and number of branches (3.90, 7.02 and 7.70) were highest in the same treatment at 30, 60 and 90th DAT respectively. The lowest values for these parameters were recorded in control. The increased plant height might be due to the role of vermicompost in increasing the availability of nutrients to the plant system and thereby increasing plant growth as reported by Warner *et al.* (2004) [14]. It has been reported that, organic manure decomposition leads to increased microbial population with subsequent release of nitrogen for the growth (Lourduraj and Yadav, 2005) [5]. Addition of cocopeat has high water holding capacity and it might have improved the physical and chemical properties of media which reflected in an enhancement in plant height as supported by Savithri and Khan (1993) [11].

The application of FYM and vermicompost along with inorganic fertilizers provided adequate N which is associated with high photosynthetic activity and vigorous vegetative growth that significantly increased the number of leaves in cabbage as reported by Kabir *et al.* (1998) [4].

Table 1: Effect of growing media on plant height, number of leaves and number of branches in tomato cv. PKM 1

Treatments	Plant height (cm)			Number of leaves			Number of branches		
	30DAT	60DAT	90DAT	30DAT	60DAT	90DAT	30DAT	60DAT	90DAT
T_1	32.86	41.77	52.50	26.88	44.60	55.34	2.10	5.27	6.12
T_2	38.64	47.40	55.11	31.43	52.65	61.45	2.75	5.67	7.02
T_3	41.77	48.78	58.56	34.68	53.07	65.43	3.50	6.23	7.49
T_4	36.65	45.13	53.47	27.43	46.88	60.34	2.16	5.63	6.58
T_5	43.64	53.82	61.14	36.48	62.77	70.12	3.90	7.02	7.70
T_6	36.97	48.30	55.37	32.92	51.46	61.57	3.03	6.49	6.93
T_7	40.71	51.90	57.20	35.67	55.03	66.32	3.36	6.95	7.39
T_8	39.95	51.64	54.93	30.47	52.07	61.40	3.26	6.13	6.73
S. Ed.	0.85	1.22	1.00	0.55	1.07	1.47	0.39	0.29	0.17
CD(P=0.05)	1.73	2.46	2.02	1.12	2.17	2.97	NS	0.59	0.35

Yield parameters

The data revealed that the combination of different growing media affected the yield parameters of tomato as shown in Table 2. In the present study, among the various treatment combinations T_5 (Red soil + Cocopeat + (50% Vermicompost + 50% FYM)) recorded maximum number of fruits per plant (22.55), individual fruit weight (49.49 g), fruit length (6.37 cm), fruit girth (14.98 cm) and yield per plant (1.106 kg) and it was followed by T_7 (Red soil + Cocopeat + (50% Vermicompost + 50% Rice husk). Minimum values were recorded in T1-Control. Minimum number of days taken for flowering (26.81) was noticed in the same T_5. Accumulation of more number of fruits in case of T_5 (Red soil + Cocopeat + (50 % Vermicompost + 50% FYM) might be due to the increased number of flowers which have formed into fruits due to adequate availability of major and minor nutrients supplied by the organic sources during its growth and development. The increased yield per unit area by applying both organic (vermicompost) and inorganic fertilizers could be attributed to the beneficial effects of vermicompost which contains growth promoters, micro and macro nutrients (Bano and Kale, 1987) [1].

Another reason was the role of cocopeat in the media. Because, cocopeat provides better drainage and air circulation in the root zone. Lack of oxygen in the root-zone negatively affects water and nutrient uptake, which eventually reduced fruit weight (Olle *et al.*, 2012) [7]. Minimum number of fruits and yield in T1- control might be due to non availability of nutrients during its development. Similar findings were reported by Rodge and Yadlod (2009) [10] in tomato and Suge *et al*. (2011) [13] in brinjal.

Quality parameters

The data revealed that the combination of different growing media is significantly affected the quality parameters of tomato as shown in Table 2. In the present study, among the various treatment combinations T_5 (Red soil + Cocopeat + (50% Vermicompost + 50% FYM)) showed maximum ascorbic acid (20.08 mg $100g^{-1}$), TSS (5.25°brix), acidity (0.57 %) and lycopene (2.94 mg $100g^{-1}$).

Increase in quality parameters might be due to increased availability of major as well as minor nutrients especially nitrogen and potassium, as they play vital role in enhancing the fruit quality. Addition of farm yard manure, cocopeat and vermicompost might have helped in better uptake of NPK nutrients including micronutrients which in turn influenced the quality traits and it was supported Nagaraj, 2015 in *Capsicum*.

Minimum values in control might be due to lack of availability of sufficient nutrients. Similar findings were reported by Patil *et al*. (2004) [9] and Singh *et al.* (2010) [12] in tomato.

Benefit cost ratio

In tomato T_4 (Red soil + Cocopeat + Rice husk) registered highest B: C ratio of 3.36. The lowest was observed in T_3 (Red soil + Cocopeat + Vermicompost) with a value of 0.60. When compared to red soil, sand, cocopeat, FYM and paddy husk, the cost of vermicompost is very high thus reducing the B: C ratio in the vermicompost applied bags (T_3, T_5, T_7 and T_8). Increased B: C ratio by the addition of organic amendments was already reported by (Pandey, 2016) [8] in water spinach in containers and Damse *et al.* (2014) [3] in garlic.

Table 2: Effect of growing media on yield attributing traits and quality characters

Treatments	Days taken for first flowering	Number of fruits plant^{-1}	Individual fruit weight (g)	Fruit length (cm)	Fruit girth (cm)	Yield plant^{-1} (kg)	Ascorbic acid (mg 100g^{-1})	TSS (°brix)	Acidity (%)	Lycopene (mg 100g^{-1})	B: C ratio
T_1	30.90	17.03	39.38	5.27	12.77	0.667	16.07	4.37	0.44	2.07	0.95
T_2	29.45	19.19	45.97	5.60	13.65	0.882	16.32	4.72	0.47	2.18	1.41
T_3	27.93	20.68	47.66	6.02	14.35	0.986	17.17	5.01	0.52	2.40	0.60
T_4	30.07	19.31	43.67	5.45	12.90	0.841	15.92	4.49	0.44	2.10	3.36
T_5	26.81	22.55	49.49	6.37	14.98	1.101	20.08	5.25	0.57	2.94	0.96
T_6	28.87	19.28	44.15	5.95	13.65	0.901	18.59	4.83	0.49	2.67	2.12
T_7	27.53	21.63	48.89	6.17	14.72	1.061	19.33	5.14	0.55	2.59	1.12
T_8	28.53	19.49	46.91	6.07	13.75	0.914	17.58	4.82	0.47	2.45	0.91
S. Ed.	0.44	0.45	0.78	0.16	0.35	0.03	0.42	0.10	0.02	0.11	-
CD(P=0.05)	0.90	0.90	1.56	0.32	0.71	0.05	0.85	0.21	0.04	0.23	-

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