Annals of Plant and Soil Research 21(4): 367-370 (2019)

Influence of organic inputs on the growth, yield and quality of tomato (*Solanum lycopersicum* L.) cv. SIVAM

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Received: July, 2019; Revised accepted: October, 2019

ABSTRACT

The field experiment to study the influence of organic inputs on growth, yield and quality of tomato (Solanum lycopersicum L.) cv. Sivam" was carried out at Annamalai University during 2017–2018. The experiment was conducted in randomized block design with 13 treatments and three replications. The treatments consisted of two organic inputs (farmyard manure and vermicompost along with foliar spray of panchakavya. The results revealed that the application of 25 t FYM + 5 t vermicompost ha^{-1} + 3 % panchakavya (foliar spray) produced maximum plant height, internode length at various growth stages and branches plant^{-1} (7.88) leaves plant^{-1} (32.1) and leaf area (77.1 cm^2). Minimum days to first flowering (18.55), days taken for 50% flowering (36.41), maximum flower clusters (14.03) and number of flower cluster^{-1} (6.25) were recorded with 25t FYM + 5t vermicompost + 3% panchakavya. Treatment T_{12} produced the maximum fruits plant^{-1} (20.30), fruit weight (42.93 g), fruit yield plant^{-1} (998.93 g). The total soluble salts, ascorbic acid and acidity were recorded maximum with this treatment (T_{12}).The lower values of growth yield attributes, yield and quality parameters (except days for taken for flowering) were recorded under control.

Key words: Growth, flowering, yield, quality, FYM, Tomato, Panchagavya, vermicompost

INTRODUCTION

Tomato (*Solanum lycopersicum* L.) is one of the popular vegetables, grown universally in home gardens, greenhouse and market gardens for shipment and canning. In India, it is grown in an area of 808.54 lakh ha with an annual production of about 19696.92 lakh Mt. In Tamil Nadu, it is grown in an area of 38.78 lakh ha with an annual production of 840.21 lakh Mt (Anonymous, 2017). For the growers, the performance and yield of crop are very much important and for the consumer, the quality is the foremost factor. One of the best methods for maximization of crop yield is the use of balanced fertilizers. Organic manures play a vital role in improving the soil fertility and productivity of soils. The use of organic manures like vermicompost and farmyard manure partly substitute chemical fertilizers and also reduce the cost of production. Vermicompost increases soil organic matter, nutrient content, improves the soil structure and cation exchange capacity. Vermicompost is a rich and recognized source of mineral nutrient. Besides it also acts as a chelating agent and regulates the availability of metallic micronutrients to the plants. Farmyard manure is the commonly used organic but its availability is becoming scarce. Farmyard manure increases crop yield by accelerating respiratory process with increasing cell permeability and hormonal action. Panchakavya is the single organic input, which can act as a growth promoter and immunity booster. It has a significant role in providing resistance to pest and diseases and in increasing the overall yield (Natarajan, 2000). There is a need to evaluate the effect of alone application of organic manures and panchkavya and combined application of (FYM + vermicompost + panchkavya) on tomato. Therefore, the present investigation was carried out to study the influence of various organic manures and foliar application of panchakavya on the growth, yield and quality characters of tomato.

MATERIALS AND METHODS

The investigation was carried out at Annamalai University, Annamalainagar, Tamil Nadu during 2017-2018. The experiment was laid out in a randomized block design with 13 treatments, which were replicated thrice. The treatments comprised of two organic manures (FYM and vermicompost) at different levels. Foliar spray of panchakavya (3 per cent) was also included in the treatment schedule. The treatments were: T_1 Control, T_2 12.5 t FYM ha^{-1},

T_3 12.5 t FYM ha^{-1} + 3% panchakavya, T_4 25 t ha^{-1} FYM, T_5 25 t ha^{-1} FYM + 3% panchakavya, T_6 2.5 t ha^{-1} vermicompost, T_7 2.5 t ha^{-1} vermicompost + 3% panchakavya, T_8 5 t ha^{-1} vermicompost, T_9 5 t ha^{-1} vermicompost + 3 % panchakavya, T_{10} 12.5 t ha^{-1} FYM + 2.5 t ha^{-1} vermicompost + 3 % panchakavya, T_{11} 25 t ha^{-1} FYM + 2.5 t ha^{-1} vermicompost + 3 % panchakavya, T_{12} 12.5 t ha^{-1} FYM + 5 t ha^{-1} vermicompost + 3 % panchakavya, T_{13} 25 t ha^{-1} FYM + 5 t ha^{-1} vermicompost + 3 % panchakavya. The seedlings from the nursery were transplanted in the main field, by adopting recommended culture practices for tomato in which different combination of organic manures were applied. Farmyard manure and vermicompost were applied as basal dose. Foliar application of panchakavya (3 %) was done at fortnightly intervals commencing from 30 days after sowing to final harvest. Various growth, yield and quality characters such as plant height, internodal length, number of branches, number of leaves per plant, leaf area, days taken for first flowering and days taken for fifty percent flowering, number of flower clusters per plant and number of flowers per cluster, number of fruits per plant, single fruit weight, fruit yield per plant, total dry matter production. The total soluble solids, ascorbic acid and acidity were determind by adopting standard procedures. The data based on the mean of individual characters were ststistically analysed as described by Panse and Sukhatma (1967).

RESULTS AND DISCUSSION

The results showed that the plant height and internodal length were significantly increased with advanced growth stages (Table 1). The plant height was found to increase significantly with the application of organic manures along with panchakavya. This may be due to application of nutrients, increased photosynthetic activity, chlorophyll formation, nitrogen metabolism and auxin contents in the plants which ultimately improving the plant height. The findings are also in agreement with the findings of Jenny and Malliga (2016) in tomato and Bade *et al.* (2017) in chilli. Organic manures improve the soil physical conditions and promotes microbial and soil organic matter, which in turn produces organic acids, which inhibits particularly IAA oxidase enzyme, resulting in enhancing the promotive effect of auxin – IAA, which has direct effect on plant growth. Combined application of 25 t FYM + 5 t vermicompost ha^{-1} + 3 % panchakavya as foliar spray recorded the maximum number of branches, number of leaves, leaf area and internodal length which may be due to increased rates of photosynthesis and photosynthates supply for maximum branches.

Table 1: Influence of organic inputs on growth characters in tomato cv. Sivam

Treatment	Plant height (cm)			Internodal length (cm)			Branches /plant	Leaves $plant^{-1}$	Leaf area (cm^2)
	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT			
T_1	30.9	44.1	52.1	1.84	3.27	4.48	4.14	18.2	32.8
T_2	34.6	50.5	58.2	2.31	3.94	4.87	5.48	24.2	43.7
T_3	36.3	52.7	61.7	2.63	4.01	4.92	5.80	26.0	45.6
T_4	35.5	51.8	61.5	2.61	4.28	4.94	5.26	25.1	46.2
T_5	36.3	52.6	51.5	2.73	4.30	4.98	5.94	26.4	48.8
T_6	34.9	51.3	59.4	2.86	4.24	5.01	5.60	25.3	51.8
T_7	36.5	52.5	61.0	2.97	4.32	5.06	6.01	26.8	54.7
T_8	37.5	53.1	62.7	3.28	4.43	5.10	5.83	28.8	59.1
T_9	39.2	57.2	65.2	3.62	4.62	5.27	6.25	30.9	65.4
T_{10}	37.2	54.2	62.6	3.25	4.55	5.21	6.08	30.3	54.1
T_{11}	40.2	56.4	67.6	3.90	4.85	5.66	6.82	31.5	72.1
T_{12}	38.3	50.2	62.9	3.60	4.53	5.23	6.15	27.9	55.4
T_{13}	42.5	57.9	70.4	4.60	5.64	6.25	7.88	32.1	77.1
SED	0.47	0.55	1.12	0.08	0.26	0.19	0.33	0.24	2.18
CD (p=0.05)	0.97	1.15	2.31	0.16	0.52	0.38	0.68	0.58	4.49

T_1 Control, T_2 12.5 t FYM ha^{-1}, T_3 12.5 t FYM ha^{-1} + 3% panchakavya, T_4 25 t ha^{-1} FYM, T_5 25 t ha^{-1} FYM + 3% panchakavya, T_6 2.5 t ha^{-1} vermicompost, T_7 2.5 t ha^{-1} vermicompost + 3% panchakavya, T_8 5 t ha^{-1} vermicompost, T_9 5 t ha^{-1} vermicompost + 3 % panchakavya, T_{10} 12.5 t ha^{-1} FYM + 2.5 t ha^{-1} vermicompost + 3 % panchakavya, T_{11} 25 t ha^{-1} FYM + 2.5 t ha^{-1} vermicompost + 3 % panchakavya, T_{12} 12.5 t ha^{-1} FYM + 5 t ha^{-1} vermicompost + 3 % panchakavya, T_{13} 25 t ha^{-1} FYM + 5 t ha^{-1} vermicompost + 3 % panchakavya

These findings are in agreement with those of Yeptho *et al.* (2012). Leaf area was significantly increased with the combined application of farmyard manure and vermicompost, which helps in greater assimilation of food material by the plant which resulted in greater meristematic activities of cells and consequently the number of leaves, length and width of leaf of plant (Patil *et al.* 2010).. The plants supplied with 25 t FYM + 5 t vermicompost ha^{-1} + 3% panchakavya as foliar spray showed early flowering and higher flower production (Table 2). This might be due to the better nutritional status of the plant,. Further, due to greater photosynthetic effect, flowering was induced, thus affecting early initiation of flower bud formation. The results of the present study are in accordance with the findings of (Singh *et al.* 2018, Marimuthu *et al.* 2019) in tomato. The dry matter production was found to be significantly higher in the treatment which received combined application of 25 t FYM ha^{-1} + 5 t vermicompost ha^{-1} + 3% panchakavya. Similar findings were reported by Jenny and Malliga (2016) in tomato and Bade *et al.* (2017) in chilli and Marimuthu *et al.* (2019) in tomato. Spraying of panchakavya was found to increase the plant height and total weight of plant, which in turn resulted in the increased dry matter production due to higher amounts of nutrient uptake from the soil. Sarkar *et al.* (2014) and Swain *et al.* (2015) also reported similar results in chilli.. In tomato, number of fruits and single fruit weight are the most important traits in determining the yield and these traits were greatly influenced by the application of organic manures along with panchakavya as foliar spray (Table 2). The number of fruits and single fruit weight was higher in the treatment combination of 25 t FYM + 5 t vermicompost ha^{-1}+ 3% panchakavya, which may be due to increased supply of major plant nutrients and are required in larger quantities for growth and development of plants. The increased nutrient availability from the organic manures might have increased the various endogenous hormonal levels in the plant tissue, which might be responsible for enhanced pollen germination and pollen tube growth, which ultimately increased the number of fruits per plant, resulting in higher yields. This is in line with the findings of Jenny and Malliga (2016) in tomato, Bade *et al.* (2017) in chilli and Meena *et al.* (2019) in okra.The favourable effect of panchakavya on fruit yield may be due to the fact that panchakavya acts as growth-promoter and immunity booster. Panchakavya stock solution creates a depression, which facilitates a cosmic ray link. The results of the present study are in accordance with those of Marimuthu *et al.* (2019) in tomato.

Table 2: Influence of organic inputs on yields attributes, yield and quality of tomato

Treatments	Days taken for first flowering	Days taken for 50 (%) flowering	Flower clusters $plant^{-1}$	Flowers $cluster^{-1}$	Fruits $Plant^{-1}$	Fruit weight (g)	Yield $plant^{-1}$ (g)	Total soluble solids (%)	Ascorbic acid (mg $100\ g^{-1}$)	Acidity (%)
T_1	26.5	45.5	6.5	3.03	10.3	26.6	350.0	3.07	17.1	0.32
T_2	23.6	43.1	8.5	3.86	15.1	32.9	597.4	4.33	18.9	0.40
T_3	22.1	43.0	8.8	4.13	15.5	35.2	648.6	4.50	19.1	0.48
T_4	23.0	41.8	8.6	4.03	15.5	34.2	632.4	4.68	18.7	0.42
T_5	21.4	41.1	9.5	4.26	16.5	35.5	692.8	5.01	19.2	0.46
T_6	22.3	41.2	8.9	4.20	16.3	34.5	667.3	4.76	19.6.	0.34
T_7	21.0	41.0	9.5	4.27	16.8	35.7	708.3	5.09	19.7	0.49
T_8	20.9	40.8	10.1	4.29	17.5	36.9	756.1	5.14	20.3	0.50
T_9	20.6	39.3	12.0	4.91	18.0	38.0	800.0	5.70	21.7	0.53
T_{10}	20.6	40.5	10.0	4.30	17.7	37.7	782.6	5.44	20.4	0.51
T_{11}	20.4	37.8	12.6	5.50	19.1	40.4	895.2	6.19	22.1	0.54
T_{12}	20.7	40.6	10.1	4.31	17.2	37.9	764.4	5.47	20.4	0.52
T_{13}	18.5	36.4	14.0	6.25	20.3	42.9	998.9	6.70	23.2	0.62
SED	0.93	0.69	0.61	0.28	0.53	1.17	28.59	0.23	0.49	0.03
CD (p=0.05)	1.93	1.42	1.26	0.58	1.09	2.41	58.78	0.48	1.01	0.05

The quality parameters like ascorbic acid, total soluble solids, acidity and shelf life were significantly influenced by the application of organic manures along with panchakavya (Table 3). The highest values for the quality characters was recorded with 25 t FYM + 5 t vermicompost

ha^{-1} were applied along with foliar spray of 3% panchakavya. Application of organic manure showed a definite advantage in improving the quality of fruits over the inorganic fertilizers. The results of the present study which envisaged increased quality attributes due to organic manures is in agreement with the findings of Jenny and Malliga (2016) and Singh *et al.* (2018) in tomato and Bade *et al.* (2017) in chilli,

Thus, it can be concluded from the present study, the application of farmyard manure + vermicompost + panchakavya 3 per cent as foliar spray had significantly beneficial effect on the growth, yield and quality of tomato.

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