

# Comparative influence of fertilizer and vermicompost addition on growth and quality of Tomato plant

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## ABSTRACT

Present study has been conducted to investigate the effect of chemical fertilizer and vermicompost on growth and quality of tomato plant. It was tested by preparing different treatments of VC10 (Soil+VC10%), VC15 (Soil+ VC15%), SF10 (Soil+ Fertilizer), Soil (control). After the time period of 60-70 days, the plant which was supplemented with vermicompost shows improvements in growth, plant height, more number of leaves and branches, dry weight of leaves, stem diameter, length of root. The soil supplemented with chemical fertilizer shows reduced values for all the above said parameters. Quality of tomato fruit was determined in terms of titrable acidity, vitamin C, total soluble, dissolved and suspended solids, total phenolic content, lycopene content, proteins, reducing sugars, antioxidant activity which were found to be maximum in VC15 treatment.

*Key words:* Organic manure, Vermicomposting, Growth parameters, Antioxidant activity, Chemical fertilizer

## Introduction

Adverse effects of chemical fertilizers on the health of farmers using them and the society consuming the chemically grown foods is the major area of concern all over the world. Millions of people suffer from many dangerous diseases and thousands die every year but organically grown fruits and vegetables have been found to be very nutritious, rich in antioxidants and can be highly beneficial for human health (Sinha and Valani, 2011). Organic foods have high antioxidants levels than chemically grown foods. Vermicompost is finely divided manure with high porosity, aeration, drainage and water holding capacity and microbial activity and is stabilized by interaction between earthworms and microorganisms in a non-thermophilic process (Edwards and Burrows, 1988). It is made up of carbon (C), hydrogen (H) and oxygen (O) and contains many macronutrients and micronutrients which

exhibit progressive effects on plant growth and yield as inorganic fertilizers when applied to soil (Singh *et al.*, 2008). In the present research work effect of addition of chemical fertilizer and vermicompost on growth of plant and quality of tomato were studied.

## Methodology

Vermicompost was properly filtered through a mesh of proper pore size which allowed only the compost to pass through it and then collected the fine mixture. Soil and vermicompost were mixed in the proportion of VC10 (soil+10% VC), VC15 (soil+15%VC), SF10 (urea 10%), Soil (control). Vermicompost and urea were mixed separately with soil up to depth of 15-20 cm. After mixing, planting of tomato plants was done in the pots. Moisture was provided by spraying water on the tomato plants. After the time period of 60- 70 days,

growth of tomato plant was observed in every treatment. Various parameters of growth and quality characteristics of tomato by following standard methods were determined.

## Results and Discussion

### Growth parameters

The vermicompost treatments showed greater plant height as compared to soil(control) and SF10 treatment. The increase in plant height shows that vermicompost contains high microbial activity due to the presence of fungi, bacteria, actinomycetes etc. These microbes have the ability to produce plant growth regulators such as auxins, gibberellins, cytokinin, etc which promote the plant growth. The urea addition in soil might reduce or shows negative impact on the growth of microbes and soil itself contains less microbial activity as compared to vermicompost. The results are comparable to the findings, that different doses of vermicompost caused different responses in growth parameters of *L. esculentum* plant (Azarmi *et al.*, 2008). The differential response of plants to differed doses of vermicompost is due to production of lesser quantity of growth promoting substances by lower doses of vermicompost than higher doses (Arancon *et al.*, 2004).

It was noted that the number of leaves were 192 in VC15, 188 in VC10, 123 in soil(control) and 81 in SF10 treatment. The stem diameter was 8.77mm in VC15, 8.66 mm in VC10, 5.67mm in SF10 and 5.51mm in soil (control). It was higher in vermicompost treated plants than soil (control) and SF10. In other study Tomati *et al.* (1988), noted that increase in plant height and stem diameter was due to the high microbial activity in vermicompost. Stem elongation, dwarfing and early flowering have been found to be because of the hormone effect in a wide variety of plants. It was noted that number of

branches were 48 in VC15, 46 in VC10, 25 in soil (control), 21 in SF10 and number of fruits was 6 in VC15, 7 in VC10, 2 in SF10, 1 in Soil (control). After 90 days length of root was noted in each treatment. Length of root was 22 cm in VC15, 20 cm in VC10, 14 cm in SF10, 12 cm in soil (control) treatment. Dry weight of leaves was found to be maximum in VC15 treatment.

### Quality of fruits

On comparison of the fruits of tomato plants from each treatment, it was observed that tomatoes of vermicompost treated plant, were better in size, and weight as compared with fruits in soil (control) and SF10 treatment.

With the addition of vermicompost, the pH of tomato juice was decreased. The pH of tomato extract was less in VC 10 (4.2) and VC 15 (4.1) as compared to other treatments. Atiyeh *et al.* (2000b) reported that tomatoes grown in soil mixed with sheep manure vermicompost were ideal for juice production because soluble solids >4.5% and pH<4.4. Fruits with low pH value (grown in organic fertilizers) have more citric acid (Wang and Lin, 2002). Fruits with low pH is more suitable for ripening and have better shelf life (Hernandez *et al.*, 2005). The vitamin C content was found to be higher in VC10 and VC15 treatments as compared to soil (control) and SF10. Leclerc *et al.* (1991) found that carrot and celeriac roots grown organically were higher in ascorbic acids and  $\beta$ -carotene contents. Significantly higher vitamin C was reported in organic foods like spinach, tomato, turnip, apple, cabbage, carrots, potato, pepper and pears total soluble solids content in VC10 and VC15 showed a significant increase as compared with other treatments. Flavour of tomato is associated with higher soluble solids. More the soluble solids more will be the flavour. Singh *et al.* (2008) indicated that vermicompost treatments can significantly change the total soluble solids of fruit. As determined by

**Table 1.** Effect of fertilizer and vermicompost on the growth parameters of tomato plant

Parameters	Soil (control)	Soil+ Fertilizer (SF10)	VC10	VC15
Plant height (cm)	42	32	55	58
Number of leaves	123	81	188	192
Stem diameter (mm)	5.51	5.67	8.66	8.77
Number of branches	25	21	46	48
Length of root (cm)	12	14	22	20
Dry weight of leaves (g)	1.41	0.41	2.65	2.84

**Table 2.** Comparison of effect of fertilizer and vermicompost addition on quality characteristics of tomato

S.No	Parameters	Soil (control)	SF10	VC10	VC15
1	pH	4.6	4.4	4.2	4.1
2	Titration acidity (g/l acid)	0.384	0.512	0.768	0.832
3	Vitamin C	1.19	1.19	2.38	2.38
4	Total soluble solids (pBrix)	4.34	4.36	5.03	5.35
5	Total Dissolved solids (mg/l)	8000	5500	8900	9350
6	Total suspended solids (mg/l)	16460	15780	18880	28000
7	Phenolic content (ppm)	7.4	6.5	11.5	11.6
8	Lycopene ( $\mu\text{g/g}$ )	32.28	29.25	55.13	71.65
9	Proteins ( $\mu\text{l/ml}$ )	240	120	350	365
10	Reducing sugars ( $\mu\text{l/ml}$ )	2150	1700	2600	2550
11	DPPH (%)	61.2	59.0	70.01	80.6
12	Dry matter (%)	5.85	6.79	9.91	6.68

Folin Ciocalteu method, total phenol content was increased from 7.4 to 11.6 ppm. The results were in conformity with Aminifard and Bayat, (2016) who observed that vermicompost treatments positively influenced fruit antioxidant activity, total phenolic, carbohydrate content and total flavonoid. Lycopene content was found to be higher in VC15 treatment. Lycopene found significantly in high amounts in organic tomatoes has been suggested for protection from cardiovascular diseases. Concentration of proteins, reducing sugar and dry matter was found to be higher in VC10 and VC15. Zhao *et al.* (2010) observed in cucumber, the addition of vermicompost significantly improved the overall quality of cucumber, including the ratio of sugar to organic acid, vitamin C and soluble protein in greenhouse compared with addition of pure inorganic fertilizer and pure chick manure compost.

## Conclusion

From the present research work it can be inferred that vermicompost has growth promoting effect resulting in quality enrichment of tomato as compared to chemical fertilizer. Vermicompost can be recommended as an organic fertilizer to improve tomato fruit quality and growth of the plant.

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