



## Impact of Vermicompost on Growth, Yield and Quality of Tomato Plant (*Lycopersicon esculentum*)

Simmi Goel\* and Navjot Kaur

\*Department of Biotechnology, Mata Gujri College, Sri Fatehgarh Sahib-140406, Punjab, India.

**Abstract:** The main objective of the study was to prepare vermicompost from the waste and to determine its effect on the qualitative and quantitative yield of tomato plant. The treatment groups consisted of VC (15, 30, 45 and control). The parameters like pH 7.2, Electrical Conductivity (10.70mmhos/cm), Total Hardness (360mg/l), Calcium (160mg/l) and Magnesium (200mg/l) were determined. The present results show that vermicompost treatment has significant growth impact on plant height, number of leaves, fruits, flowers and stem diameter as compared to control.

**Keywords:** Vermicompost, Earthworm, Waste management, vegetable waste, *Eisenia fetida*.

### 1. Introduction

The strategy for agriculture development must be through increased productivity of the land under cultivation, with reduced costs of production and higher use efficiency of inputs with no harm to the environmental quality. The use of chemical fertilizers was a boon for the past but ban for the present. Changes in the soil pH, soil acidifications and lower humic acid contents are major problems of overuse of synthetic fertilizers. Each year, human, livestock and crops produce approximately 38 billion metric tons of organic waste worldwide, which may be an efficient source of organic matter supply in soils. According, to a conservative estimation, around 600 to 700 million tonnes (Mt) of agricultural waste (including 272 million tons of crop residues) are available in India every year, but most of it remains unutilized. This huge quantity of wastes can be converted into nutrient rich bio-fertilizer (vermicompost) for sustainable land restoration practices (Suthar, 2009). Although microbes are responsible for the biochemical degradation of the organic matter, earthworms are the important drivers of the process, conditioning the substrate and altering the biological activity (Aira *et al.*, 2002; Suthar, 2008c). Earlier studies have reported a positive effect of the

vermicompost application on growth and productivity of cereals and legumes (Benik and Bhebaruah, 2004; Suthar, 2006), ornamental and flowering plants (Kale *et al.*, 1987; Nethra *et al.*, 1999), vegetables (Edwards and Burrows; 1988; Atiyeh *et al.*, 2000) etc. The main objective of this study was to evaluate the impact of different doses of vermicomposted manure on growth and yield of a tomato crop under field conditions.

### 2. Materials and Methods

#### 2.1 Addition of bedding material and composting worms

Shredded leaves, straw, hay and dead plants were used as bedding material in the form of 15cm layer at the bottom of the bin. The used bedding materials were soaked in water for 24 hours to ensure that it was sufficiently moist. The bedding material was allowed to set for several days to make sure it doesn't heat up. After the addition of procured beddings, composting worms were added.

#### 2.2 Addition of food wastes

Kitchen wastes and cow dung manure were used as worm-feed. The used kitchen wastes include tea waste,

\*Corresponding author:

E-mail: simmig76@yahoo.co.in; Phone-91-9216503060; Fax: 911763232247.

tea bags, and vegetable residues. Any type of chemicals or plants sprayed with insecticides was not added because they cause worm death. Grinded and blended food wastes were used which lead to speed up the composting process.

### 2.3 Startup of worm working

When beddings, worms and food wastes were added into the bin, the bin was kept for 7-8 days to start up of worm working. After this time period, it was observed that worms started their working by digesting the waste materials. Depletion of food layer was seen during this period. The bin was maintained by controlling various factors like temperature, moisture, pH, light, salt content and urine content.

### 2.4 Temperature and pH

Control of Temperature within the worm's tolerance is vital to vermicomposting process. Worms required different temperature ranges according to their growing stage. The pH of the bin was maintained in the range of 7.5-8.

### 2.5 Moisture and Light

The ideal moisture content range for an effective vermicomposting system is 45-60%. Bedding material plays an important role in holding the moisture within the bin. Straw, hay, leaves manure has good moisture holding ability or high absorbency. The optimum moisture content for maintaining the bin is 70-80% (Domingues and Edwards, 1997).

## 3. Results and Discussion

### 3.1 Chemical characterization of vermicompost

Vermicompost contains plant growth influencing materials produced by microorganisms. Earthworm casting contains more plant nutrients like calcium, magnesium, phosphorous, potassium etc. (Muthukumarvel *et al.*, 2008). Vermicompost has a low pH, it is beneficial for stabilizing soil fertility and plant growth. The various parameters of vermicompost were determined with the help of standard methods (Table 1) (AOAC, 1990). The parameters like pH 7.2, Electrical Conductivity (10.70mmhos/cm), Total Hardness (360mg/l), Calcium (160mg/l) and Magnesium (200mg/l) were found.

### 3.2 Effect of addition of vermicompost on soil pH

Vermicompost (pH 7.2) was mixed with soil up to 15cm for 30-35 days. After this time period, the pH of soil (7.8) was decreased. This shows that vermicompost increases the fertility of soil by lowering the pH of the soil. At 10<sup>th</sup> day, the pH was 7.6. After another 10 and 35 days, pH was lowered to 7.4 and 7.2 respectively.

### 3.3 The effect of vermicompost on the growth, yield and quality of tomato plant (*Lycopersicum esculentum*)

Soil from his garden was mixed with different concentrations of vermicompost. Four treatments were prepared as follows: - VC15 (Soil + 15%VC); VC30 (Soil + 30%VC); VC45 (Soil + 45%VC); Soil (Control). After 60-70 days, the results were recorded which shows the growth promoting effects on tomato plants supplied with vermicompost (Table 1).

The growth rate was maximum in treatment VC15 following the order of VC30 and VC45 and control. Fruits of tomato plants of treatments VC15, VC30, VC45 were better in colour and size than fruits of plant in control. Vermicompost acts as a buffer to stabilize the pH of soil. The soil with high pH is supplied with vermicompost and this treatment leads to lower down the soil pH (Azarmi *et al.*, 2008). Vermicompost was mixed with soil up to the depth of 15cm for 30-35 days. After this period of time, the pH of the soil decreased to 7.2 whereas the initial pH of soil was 7.8. As from above studies and result, it is clear that vermicompost has positive effects on the growth, yield and quality of tomato plant.

### 3.4 Plant Height

The plant height was 50cm, 52cm, 53cm in VC15, VC30, VC45 treatments respectively, whereas the plant height in control was 40cm. A significant increase in stem diameter and plant height of tomato plant was observed by the addition of different concentrations of sheep manure vermicompost in soil (Gutierrez-Micel *et al.*, 2007). The increase in plant height shows that vermicompost contains high microbial activity due to the presence of fungi, bacteria, actinomycetes, yeast etc.

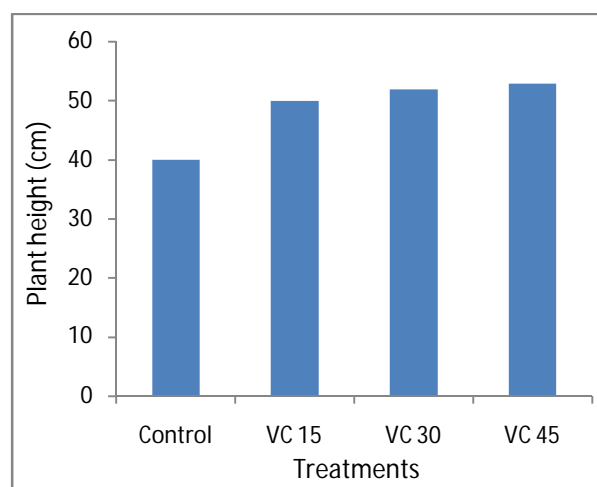


Fig. 1. Height of tomato plants in different treatments.

Table 1. Effect of vermicompost on tomato plants in different treatments.

TREATMENTS	PLANT HEIGHT (Cm)	NUMBER OF LEAVES	NUMBER OF FRUITS	STEM DIAMETER (cm)	pH OF FRUITS
VC15	50 cm	95	15	0.75	3.7
VC30	52 cm	100	20	0.71	3.5
VC45	53 cm	94	25	0.72	3.4
Soil	40 cm	55	8	0.59	3.8

### 3.5 Number of leaves, fruits and stem diameter

The number of fruits and number of leaves was more in case of vermicompost treatments. The tomato plants in VC treatment lead to more fruits and leaves than in case of soil (control). A significant increase in growth and yield of greenhouse tomato was observed with pig manure vermicompost (Atiyeh *et al.*, 2000). The stem diameter of plants was significantly higher in VC treatments than control.

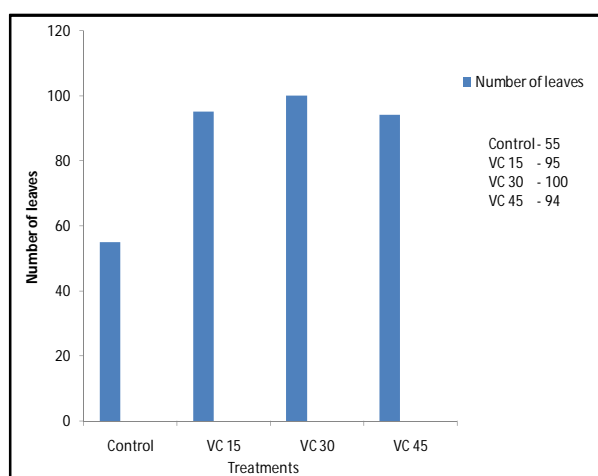


Fig. 2. Number of Leaves of Tomato Plant in different Treatments.

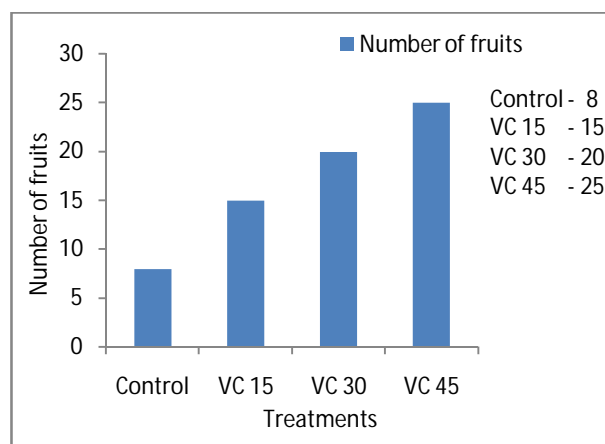


Fig. 3. Number of fruits in different treatments.

### 3.6 pH and quality of fruits

The juice from tomato fruits was extracted in each treatment and then was used to check the pH of fruits.

The pH of fruits of VC15 was 3.7, VC30 had 3.5 and VC45 had 3.4, whereas the pH of fruit control was 3.8. The pH in control and VC treatments were almost same. Fruits of VC treatment plants were better in size and colour as compared with fruits of control.

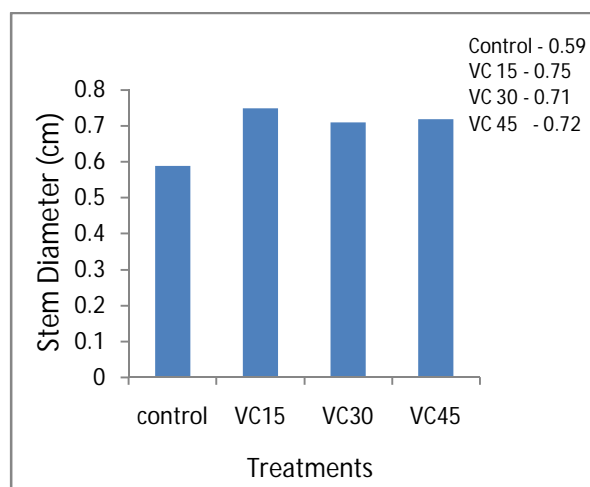


Fig. 4. Stem diameter of plants in different treatments.

## 4. Conclusion

The present research work is an initiative in the direction of organic waste management by using the vermicomposting technique for sustainable development. Thus vermicomposting possess dual working, firstly, it utilizes the wastes and secondly, converts waste into nutrient-rich compost which is called as organic compost and this organic fertilizer has grown promoting effects on a tomato plant.

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