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EFFECT OF VERMICOMPOST ON GROWTH AND YIELD OF TOMATO

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ABSTARCT

Vermicompost are produced through interaction between earthworm and microorganism by the breakdown of organic wastes. The present study is to evaluate the growth and yield pattern of tomato by the application of different concentrations of vermicompost. Significant results were observed in growth parameters on 30th day, 45th day and 60th day. The yield was also significantly higher in tomato plant treated with optimum concentration of vermicompost.

KEYWORDS: growth parameters, tomato, vermicompost, yield,

INTRODUCTION

Vermiculture or vermicomposting is derived from the Latin term vermis, meaning worms. Vermicompost are produced through the interaction between earthworm and microorganism by the breakdown of organic wastes. It is a stabilized, finely-divided peat-like material with a low C: N ratio and high water holding capacity that constitute a source of plant nutrition which is released gradually through mineralization whenever the plant needs them (Mathivanan *et al*., 2012; Dominguez *et al*., 1997). Earlier work by Theunissen *et al*. (2010) on the growth and nutrient status of vegetables have revealed a positive effect on plant nutrition, photosynthesis, chlorophyll content and nutrient content of different plant components namely roots, shoots and fruits.

Physical participation in degrading organic substrates results in fragmentation, thereby increasing the surface area of action, turnover and aeration. On the other hand, biochemical changes in the degradation of organic matter are carried out by microorganisms through enzymatic digestion, enrichment by nitrogen excrement and transport of inorganic and organic materials. Earthworms play a vital role in plant growth and productivity. The selection of suitable earthworm species for vermicomposting is an important step of the overall process. Out of the thousands of species of earthworms, only a few are suitable for vermicomposting of organic wastes. *Eisenia foetida* is the most widely used earthworm species for vermicomposting due to its well-established potential for the vermicomposting of compostable organic materials such as agricultural wastes and animal manures. Animal wastes are an important resource that is used to supplement organic matters and improve soil conditions. The main aim of the present investigation is to study the effect of vermicompost on the growth and yield of tomato plant.

MATERIALS AND METHODS

The experiment was carried out with tomato in pot culture in Avinashilingam Institute for Home Science and Higher Education for Women. For preparing vermicompost, the ingredients required are vegetable wastes, fruit wastes, leaf wastes, banana stem wastes, earthworm and cattle dung. Vermiculture and vermicomposting are the two steps of vermitechnology. Vermitechnology mainly comprises of following steps:

i) use of solid material for bedding,
ii) addition of organic material for feeding of earthworm,
iii) separation of vermicompost product and
iv) Production and separation of earthworms for further use.

Collection of materials for compost preparation

- ✓ Collection of vegetable, fruit, leaf and banana wastes from pazhamudhir nilayam situated in and around Coimbatore.
- ✓ Collection of cowdung from farm.

Preparation of Vermicompost

Vermicompost is prepared in a well-defined pit. A suitable earthworm (*Eisenia foetida*, a red worm) was selected. Direct sunlight and rain should be avoided in the shed. For the production of vermicompost crop residue, cattle dung (except pig, poultry and goat), farm wastes, vegetable market wastes, leaf wastes, flower market wastes, agro-industrial wastes, fruit market

wastes and all other bio- degradable wastes were added. The cattle dung should be dried in open sunlight before using for vermicompost production. The vermicomost becomes suitable for use as manure, in 50 days. The pot study was carried out with tomato (*Lycopersicon esculentum* Linn) under varying treatments of vermicompost.

The soil taken for plant growth study was light red soil with a pH 8. Pots were treated with different concentrations of vermicompost (T_1-15g, T_2 -17g, T_3 - 19g and T_4 -21g) and the control pot was maintained without vermicompost. The tomato plant was grown in control and vermicompost treated soil. Triplicates were maintained.

Growth Parameters

Plant samples were uprooted carefully on 30th, 45th and 60th day. The following growth parameters were measured and recorded for all the treatments.

1. Root Length (cm)
2. Shoot Length (cm)
3. Number of leaves
4. Fresh Weight
5. Dry Weight

Root Length

The plants were taken from control and other treatment pots and washed to get rid off adhering soil particles. Then, the length of the roots was measured with the help of a scale from root collar point to root tip and expressed in centimeter. Ten seedlings were randomly selected from each treatment and their root length was measured using cm scale and recorded.

Shoot Length

The shoot length of the plants was measured with the help of scale from the root collar point to shoot apex and expressed in centimeter. Ten seedlings were randomly selected from each treatment and their shoot length was measured using cm scale and recorded. Three readings were taken for statistical analysis.

Number of leaves

The number of leaves present in the uprooted plants was calculated.

Fresh Weight

Fresh weight of the plants was measured with the help of an electronic digital balance and expressed in grams.

Dry weight

The collected plant materials were kept in hot air oven at 55°C for 24 hours. Then, the dry weight of the plants was measured using an electronic digital balance and expressed in grams.

Pot Culture Experiment

Pot culture experiments were conducted with tomato seeds to study the response of different doses of vermicompost on the growth of the test plant. The pot culture experiment was conducted in the green house of Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, Tamil Nadu.

The experiment was carried out in the period from December 2016 to March 2017. The size of the experimental pot was 30cm x 24cm x 30cm. Experimental pots were filled with different doses of vermicompost. Triplicates were maintained for each treatment.

Yield Parameters

The number of fruits harvested per plant in each treatment were counted and expressed as number of fruits per plant.

RESULTS AND DISCUSSION

Vermicompost significantly stimulates the growth of a wide range of plant species including several horticultural crops (Hashemimajd *et al*., 2004). There is also a large variation in the effects of vermicompost depending on the plant species or even the variety considered.

Description of the tomato plant

Plate1

The tomato plant is native to South America, but, grows in temperate climates worldwide. Tomato is an easily grown vine plant that belongs to the night shade family Solanaceae (Plate 1). The tomato (L*ycopersicon esculentum* L.) is a short-lived perennial plant, grown as an annual typically growing to 1-3 m tall, with a weakly woody stem that usually scrambles over other plants. The fruit is an edible, brightly colored (usually red, due to the pigment lycopene) berry, commonly much larger in cultivated forms. The tomato begins its colorful and varied history upon the coastal highlands of Western South America, where it was being enjoyed by the native people for a long time. Tomatoes are consumed raw, or in salads, sauces and drinks. Tomatoes are rich in Vitamin A and are a kitchen-favourite throughout the world. Fruits can be harvested within 60-70 days' time

Growth parameters

The growth parameters namely shoot length, root length, number of leaves, fresh weight and dry weight were measured on 30th day, 45th day and 60th day and tabulated.

The growth was found to be higher in the pots treated with 19g vermicompost (T_3) on all the days tested (Table 1, 2 & 3). Plant growth parameters such as shoot length, root length, number of leaves, fresh weight and dry weights were better in vermicompost treated plants rather than the control plant. These results are in accordance with the earlier findings (Tomati *et al*., 1988; Joshi and Vig, 2010; Bachman and Metzger, 2008). In terms of plant growth and soil health, vermicompost plays an important role in improving soil texture, aeration, soil compaction and thus enhances more water and nutrients uptake by plants from their surrounding areas of root zone.

Table 1: Growth Parameters of Tomato on 30th Day.

S. No.	Treatment	Shoot length	Root length	No. of leaves	Fresh weight	Dry weight
1	T_0	5.93 ± 0.35	3.17 ± 0.25	8.33 ±1.15	1.39 ± 0.04	0.03 ± 0.01
2	T_1	7.13 ± 0.93	5.20 ± 0.10	9.00 ± 1.00	1.42 ± 0.10	0.03 ± 0.00
3	T_2	8.60 ± 0.75	3.73 ± 0.68	11.00 ± 1.00	1.51 ± 0.06	0.05 ± 0.00
4	T_3	9.37 ± 0.15	6.30 ± 0.10	14.33 ± 0.58	1.80 ± 0.05	0.07 ± 0.00
5	T_4	7.03 ± 0.25	4.17 ± 0.42	12.67 ± 1.15	1.63 ± 0.07	0.05 ± 0.00
SEd		0.4681	0.3098	0.8165	0.0535	0.0046
CD (p<0.05)		1.0430	0.6904	1.8193	0.1192	0.0102
Cd (p<0.01)		1.4836	0.9820	2.5878	0.1695	0.0144

Table 2: Growth Parameters of Tomato on 45th Day.

S. No.	Treatment	Shoot length	Root length	No. of leaves	Fresh weight	Dry weight
1	T_0	10.33± 1.53	6.00 ± 1.00	19.67 ± 0.58	1.20 ± 0.26	0.40 ± 0.09
2	T_1	12.33 ± 1.53	7.00 ± 1.00	24.67 ± 1.53	1.73 ± 0.12	0.59 ± 0.03
3	T_2	14.00 ± 3.61	9.00 ± 1.00	24.00 ± 1.00	2.23 ± 0.15	0.76 ± 0.05
4	T_3	13.33 ± 1.53	11.00 ± 1.00	26.33 ± 3.21	2.73 ± 0.15	0.88 ± 0.02
5	T_4	11.67 ± 2.08	6.00 ± 1.00	23.33 ± 1.15	1.67 ± 0.21	0.58 ± 0.06
SEd		1.8012	0.8165	1.4298	0.1520	0.0456
CD (p<0.05)		4.0134	1.8193	3.1859	0.3387	0.1016
Cd (p<0.01)		5.7089	2.5878	4.5318	0.4818	0.1445

Table 3: Growth Parameters of Tomato on 60th Day.

Treatment	Shoot length	Root length	No of leaves	Fresh weight	Dry weight
T0	12.17 ± 0.29	8.00 ± 0.00	22.33 ± 0.58	2.08 ± 0.03	0.67 ± 0.06
T1	14.83 ± 0.29	9.10 ± 0.10	26.67 ± 0.58	2.57 ± 0.08	0.83 ± 0.04
T2	16.73 ± 0.25	10.23 ± 0.25	27.33 ± 1.53	2.73 ± 0.12	0.85 ± 0.05
T3	18.67 ± 1.15	11.83 ± 0.29	28.67 ± 1.53	3.00 ± 0.10	1.00 ± 0.10
T4	17.33 ± 0.58	12.17 ± 0.29	24.67 ± 0.58	2.37 ± 0.06	0.78 ± 0.03
SEd	1.8017	1.7643	2.4398	1.1520	0.1452
CD(P<0.05)	4.1534	2.6193	3.1849	1.2387	0.2056
CD(P<0.01)	7.7091	3.5728	5.5318	1.5818	0.2445

Values are mean ± SD of three samples in each group.

Vermicompost significantly affected plant growth parameters. The present results are in accordance with the earlier studies carried out by Pritam *et al*. (2010). In their studies, they have shown a significant increase in growth parameters with the application of vermicompost in tomato. Vermicompost having hormone-like activity aids in greater root initiation, increased root biomass resulting in enhanced plant growth.

Optimum plant growth and development is important for greater final dry matter and yields. In order to achieve this, sufficient amounts of nutrients should be applied to the soil through inorganic and organic sources. Vermicompost, an organic source of plant nutrients, contains a higher percentage of nutrients for plant growth in readily available form (Nagavallemma *et al*., 2004).

Yield Parameters

The yield was significantly higher in T_3 (Fig. 1). The application of optimum dosage of vermicompost significantly increased the yield. Study by Kashem *et al*. (2015) on the effect of cow manure vermicompost and inorganic fertilizers on the vegetative growth and fruits of tomato plant have shown a significant increase in all the parameters studied in the plants supplied with vermicompost rather than inorganic fertilizer. Microorganism help in faster decomposition of organic manures there by increasing the availability of nutrients to the plants.

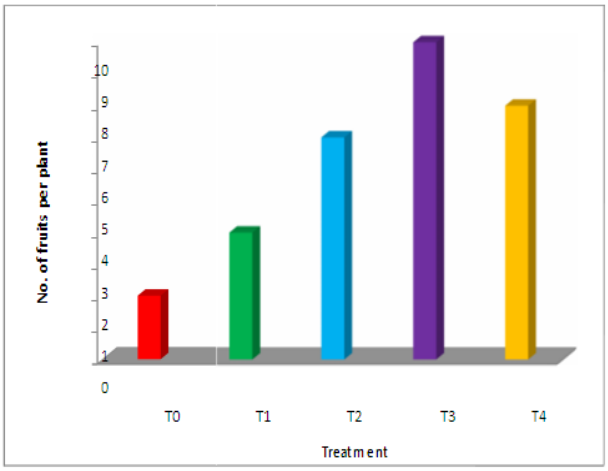

Fig 1: Yield parameter of tomato in different treatments.

Vermicompost plays a major role in improving growth and yield of different field crops, vegetables, flowers and fruits (Lekshmanaswamy, 2014). Cantanazaro *et al*. (1998) have demonstrated the importance of the synchronization between nutrient release and plant uptake and showed that slower release fertilizers can increase plant yield and reduce nutrient leaching. The plant growth also depends on the quantity of vermicompost applied in the plant medium. Use of vermicompost in horticulture at large scale can solve the management and disposal problem associated with macrophytes and also resolves the deficiency of organic matter in such soils in addition to nutrient depletion (Najar and Khan, 2013).

CONCLUSION

The present study confirms that vermicompost at optimum concentration has a tremendous potential of plant nutrients supply for sustainable crop production. Nutrient supply is the result of microbial activity which is excreted through earthworm gut. Earthworms selectively feed on organically rich substrates which get broken down during passage through the gut. To conclude, no single nutrient source like chemical fertilizer, organic manure, biofertilizer is able to meet the total nutrient needs, but, vermicompost increases the quality and quantity of nutrient resulting in quick absorption of nutrients and this will increase the growth and yield parameters of crop plants.

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