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Study the Efficiency of Vermicompost on Growth and Yield Attributes of Tomato (*Lycopersican esculentum*)

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ABSTRACT

Background: Judicious application of inorganic fertilizers is very essential to obtain high yields of improved crop varieties. But the liberal and continuous application of inorganic fertilizers under intensive crop production systems resulted in multiple nutrient deficiency in the soil besides causing imbalance in soil physico-chemical properties. Further the increased use of inorganic fertilizers resulted in diminishing soil fertility and unsustainable crop yields, besides creating additional problems in soil such as soil acidity, alkalinity, soil and ground water pollution. Organic agriculture is environment friendly, ecological production system that promotes and enhances biodiversity, biological cycles and biological activity. It is based on minimal use of off-farm inputs and management practices that restore, maintain and enhance ecological harmony. Organic materials such as compost, vermicompost, poultry manure, oilcakes, green manures and crop residues can substitute inorganic fertilizers to maintain productivity and environmental quality. The quality of agricultural produce, particularly horticultural produce *viz.,* vegetables, flowers and fruits get improves when the nutrients are supplied through organic manures than in the form of fertilizers.

Methods: Keeping all above information in view, a present experiment was carried out to study the effect of application of different ratio of vermicompost amended with soil on the growth, yield and quality of tomato crop (*Lycopersican esculentum*). A pot culture experiment was conducted to study the efficiency of vermicompost on plant growth and yield.

Result: From the study, application of organic manures *viz* vermicompost resulted better crop growth and quality parameters in tomato crop and remarkably improvement in soil fertility was also observed. Application of vermicompost at 25 per cent and 50 per cent treatments not showed significant difference in growth and quality parameters of tomato crop. Regarding the quantity of vermicompost application, the cost of cultivation was reduced in 25 per cent vermicompost applied treatment than 50 per cent vermicompost applied treatment. Therefore, application of 25 per cent vermicompost treatment was found to be the best suited practice for tomato crop cultivation and also increased a net return, improved quality products and sustaining the soil health. Application of organic manure is one of the viable approaches for eco-friendly crop production.

Key words: Organic farming, Tomato, Vermicompost, Yield attributes.

INTRODUCTION

India's food production is a success story following the green revolution in late 1960's. However, there have been reports of either stagnating or declining levels of crop production because of over exploitation of natural resources and excessive use of chemicals in agriculture which led to poor sustainability of farm production. We have to think of several alternatives for sustaining our food production without sacrificing the environment and ecology. One of the alternatives is organic farming. Organic agriculture is environment friendly, ecological production system that promotes and enhances biodiversity, biological cycles and biological activity. It is based on minimal use of off-farm inputs and management practices that restore, maintain and enhance ecological harmony. The primary goal of organic agriculture is to optimize the health and productivity of interdependent communities of tiring soil, plant, animal and people. Organic products provide lucrative business in the world market. Organically grown food is expected to fetch higher price and this can offset any loss due to lower yield. Organically grown product has got its own export values, for which a systemic research and development programme in respect of sustaining agricultural production through pure organic agriculture needs initiation. Judicious application of inorganic fertilizers is very essential to obtain high yields of improved crop varieties. But the liberal and continuous application of inorganic fertilizers under intensive crop production systems resulted in multiple nutrient deficiency in the soil such as zinc, sulphur *etc.*, besides causing

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imbalance in soil physico-chemical properties. Further the increased use of inorganic fertilizers resulted in diminishing soil fertility and unsustainable crop yields, besides creating additional problems in soil such as soil acidity, alkalinity, soil and ground water pollution. Due to adverse effects of chemical fertilizers, interest has been stimulated for the use of organic manures (Follet *et al.,* 2005).

Organic materials such as compost, vermicompost, poultry manure, oilcakes, green manures and crop residues can substitute inorganic fertilizers to maintain productivity and environmental quality (Chaudhary, 2009). It is reported that the quality of agricultural produce, particularly horticultural produce *viz.,* vegetables, flowers and fruits improves when the nutrients are supplied through organic manures than in the form of fertilizers. This is because of the supply of all essential plant nutrients by the manures besides growth principles like enzymes, hormones and growth regulators *etc*. As a result, the metabolic function gets regulated more effectively, resulting in better synthesis of proximate constituents and consequent improvement in the quality of produce. Keeping all above information in view, a present study was carried out to study the effect of application of different ratio of vermicompost amended with soil on the growth, yield and quality of tomato (*Lycopersican esculentum*).

MATERIALS AND METHODS

The experiment was conducted at Faculty Center for Agricultural Education and Research, Ramakrishna Mission Vivekananda Educational and Research Institute, Coimbatore campus November 2018 to April 2019. The collecetd soil was properly processed and their initial characteristics were analysed. The pot culture experiment was conducted using tomato plant (variety PKM1) in a completely randomized design. The experimental lay out in six treatments with four replications.

The treatments includes T_1- Control (Soil alone 4 kg), T_2- Soil (4 kg)+100% Recommended dose of fertilizer (150:100:50), T_3- Soil (4 kg) +FYM (1 kg)-25%, T_4- Soil (4 kg) +FYM (2 kg)-50%, T_5- Soil (4 kg)+Vermicompost (1 kg)-25% and T_6- Soil (4 kg)+Vermicompost (2 kg)-50%. The organic manures like Vermicompost (VC) and Farmyard Manures (FYM) were used in the study. The nutrient contents *viz.,* nitrogen, phosphorus and potassium were analyzed as per the standard methods. Each pot was filled with four kg of processed soil and recommended doses of fertilizers and required level manures. Manures and fertilizers were thoroughly mixed with soil. Twenty one days old healthy seedlings were transplanted in each pot and maintained two plants per pot. First watering was given immediately after transplanting and subsequent watering was given at two days interval based on the soil moisture content in the pots. After attaining the physiological maturity, the fruits were harvested manually. First picking was carried out on 75 days after transplanting and subsequent picking were done at 10 days interval. Totally three pickings were carried out for the study.

The data on various characters studied during the investigation was statistically analyzed (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Growth attributes

The plant growth parameters *viz* plant height, shoot length, root length, number of branches, number of leaves and leaf area index were measured and tabulated in Table 1. The highest plant height, shoot length and root length of 90.2 cm, 56.5 cm and 33.7 cm were recorded in T_6 (Soil + Vermicompost 50%), followed by T_5 (Soil + Vermicompost 25%) and T_4 (Soil + FYM 50%). The lowest plant height, shoot length and root length of 72.5 cm, 49.1 and 23.4 were observed in control (T_1), respectively. The highest number of branches, number of leaves and leaf area index of 12, 160 and 0.67 were recorded in T_6 (Soil +Vermicompost 50%), followed by T_5 (Soil + Vermicompost 25%) and T_4 (Soil + FYM 50%). The lowest plant height, shoot length and root length of 5, 72 and 0.32 were observed in control (T_1), respectively. The plant growth parameters *viz* plant height, shoot length, root length, number of branches, number of leaves and leaf area index were differ significantly among the treatments. Growth attributes like plant height, shoot length, root length, number of branches, number of leaves and leaf area index were remarkably increased by the application of organic manures. This could be due to the steady supply of macro and micro nutrients. This similar trend of increase in number of branches was also observed by Selvaraj *et al.* (2003), who indicated that the application of organics manure increases the growth parameters of

Table 1: Effect of vermicompost on tomato plant growth attributes at harvest stage.

Treatments	Plant height (cm)	Shoot length (cm)	Root length (cm)	Number of branches	Number of leaves	Leaf area index (cm)
T_1	72.5	49.1	23.4	5.0	72	0.32
T_2	87.3	55.2	32.1	10.0	149	0.57
T_3	87.4	55.0	32.4	10.0	145	0.44
T_4	88.4	55.8	32.6	12.0	158	0.50
T_5	88.8	56.2	32.6	11.0	156	0.60
T_6	90.2	56.5	33.7	12.0	160	0.67
SEd	1.225	0.546	0.469	0.545	1.701	0.052
CD (0.05%)	2.410	1.024	0.955	1.043	3.462	0.118

thyme. The application of organic manure produced more of vegetative growth (leaves) followed which might be due to the presence of readily available nutrients to the plants. Similar trend of increase in vegetative growth was observed by Beaulah *et al.* (2002), who indicated that the maximum number of branches and number of leaves of moringa was obtained by the application of organic manures. Senguptha *et al.* (2001), also reported that application of organic manures enhanced the plant growth, number of leaves, leaf size, weight of leaves and keeping quality of leaves of betel vine (*Piper betel* L.). Leaf area index (LAI), good measures of plant growth was also found higher in organic manure *viz* vermicompost applied treatment, which might be due to higher availability of nitrogen in soil as reported by Zodhy *et al.* (1994). The steady and prolonged availability of nutrients might have produced taller plants, which in turn increased LAI and better plant canopy.

Yield attributes

The plant yield parameters *viz* number of fruits, fruit weight and fruit yield were calculated and tabulated in Table 2. The highest number of fruits, fruit weight and fruit yield of 18, 46.2 g and 30.8 t ha^{-1} were recorded in T_6 (Soil + Vermicompost 50%), followed by T_5 (Soil + Vermicompost 25%) and T_4 (Soil + FYM 50%). The lowest plant height, shoot length and root length of 6, 28.4 g and 6.3 t ha^{-1} were observed in control (T_1), respectively. The plant yield parameters *viz* number of fruits, fruit weight and fruit yield were significantly differ among the treatment. In the present study, the increase in fruit number, fruit weight and fruit yield of tomato were observed under organic manure *viz* vermicompost applied treatment. Natarajan (1990) also found significant increase in green fruit weight per plant in chillies with the application of organic manures through the oil cakes. Anitha *et al.* (2020) also found Application of 50% vermicompost showed maximum yield and quality attributes of Radish. The significant increase in fruit yield of okra when applied with oil cake as a source of organic manures was observed by Karup *et al.* (1997). The maximum fruit yield and maximum number of fruits were obtained with the application farm yard manure as a source of organic manure (Rajbir, 2016).

Fruit quality parameters

The quality parameters of fruits *viz* titratable acidity and ascorbic acid content were analyzed and given in Table 3. The highest value of titratable acidity and ascorbic acid content of 0.542 per cent and 278.3 (mg of 100 g) were recorded in T_6 (Soil + Vermicompost 50%), followed by T_5 (Soil + Vermicompost 25%) and T_4 (Soil + FYM 50%). The lowest value of titratable acidity and ascorbic acid of content 0.257 per cent and 239.4 (mg of 100 g) was observed in control (T_1), respectively. The tomato fruit quality parameters *viz* titratable acidity and ascorbic acid content were significantly differ among the treatments. Application of organic manure showed the higher fruit quality characters, which might be due to the organic nutrient source which releases numerous active enzymes, vitamins, macro and micro nutrients. Maheswarappa (1997) also reported that increased oleoresin yield with the application of organics manures. Subbaiah *et al.* (1998) also observed higher capsaicin content at higher rate of nitrogen application through organic manures. Prabhakaran and Pitchai (2002) reported that the application of recommended dose of nitrogen through organic manures recorded higher ascorbic acid content and crude protein in tomato fruit compared with inorganic fertilizers. In respect of absolute control, lower value of quality attributes were recorded because of lower soil nutrient availability.

Table 2: Effect of vermicompost on yield attributes of tomato.

Treatments	Number of fruits per plant	Fruit weight (g)	Fruit yield t ha^{-1}
T_1	6.0	28.4	6.3
T_2	17.0	45.4	28.6
T_3	14.0	44.6	23.1
T_4	16.0	46.0	27.2
T_5	18.0	45.9	30.5
T_6	18.0	46.2	30.8
SEd	1.043	0.191	1.572
CD (0.05%)	2.122	0.387	3.168

Table 3: Effect of vermicompost on quality parameters of tomato fruit.

Treatments	Titrable acidity (Grams of citric acid per 100 g)	Ascorbic acid content (mg 100 g^{-1})
T_1	0.257	239.4
T_2	0.364	250.8
T_3	0.446	263.2
T_4	0.485	269.6
T_5	0.534	275.7
T_6	0.542	278.3
SEd	0.062	2.746
CD (0.05%)	0.130	5.438

CONCLUSION

Application of organic manures *viz* vermicompost resulted better crop growth and quality parameters in tomato crop was observed. Application of vermicompost at 25 and 50 per cent treatments not showed significant difference in growth and quality parameters of tomato crop. Regarding the quantity of vermicompost application, the cost of cultivation was reduced in 25 per cent vermicompost applied treatment than 50 per cent vermicompost applied treatment. Therefore, application of 25 per cent vermicompost treatment was found to be the best suited practice for tomato crop cultivation and also increased a net return and improved quality products.

Conflict of interest: None.

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