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Comparative study on Effects of Chemical Fertiliser, Vermicompost and Farm Yard Manure on Tomato Plant Growth and Soil Fertility

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ABSTRACT

A healthy soil environment is necessary to produce the desired crops, which means it should have all the essential nutrients. Nutrients are used in large quantities in growing plants and therefore need to be replaced regularly to maintain productivity and for this purpose fertilizers are used in the fields. Chemical fertilizers are essential to increase proper growth and yield of crops and act as catalysts in providing nutrients to plants for better growth and yield. On the other hand, fertilizers can threaten our ecosystems, soil, plants, human and animal lives. Despite past gains in crop production through chemical fertilizers, recent observations of stagnant or declining yields have raised concerns about the long-term sustainability of crop production. In the long term, they also damage the natural composition of the soil, leading to unsustainable crop production. Of course, chemical fertilizers add nutrients to the soil, but they don't add anything else. Plants need more than just nutrients to survive. They also need organic matter and living organisms. Thus, the integrated use of organic and inorganic nutrient sources will not only supply essential nutrients to the soil, but may also have a certain synergistic interaction to increase their effectiveness and thereby reduce environmental risks. Nutrients from chemical fertilizers improve initial crop establishment, while nutrients from mineralization of organic manure support yield later. In the present experiments, pot experiment was conducted to study the comparative effect on growth of tomato plant and its soil fertility. The soil parameters and growth of plant were observed and studied. The studies show positive impacts on farm yard manure and vermicompost on the soil as well as on the growth of tomato plant as compared to the chemical fertilizer. The healthy growth of plant with more green leaves and flowering and fruits were observed with application of farm yard manure and vermicompost. It concludes application of farm yard manure and vermicompost is effective and better for the healthy growth of tomato plant and fertility of the soil.

Key words: Tomato, Chemical fertilizer, Organic fertilizer, Vermicompost, Farmyard manure, soil fertility

Introduction

Aim/Objective

To study on Comparative Effects of Chemical Fertiliser, Vermicompost and Farm Yard Manure on

Tomato Plant Growth with its Soil Fertility.

Modern chemical fertilizers contain one or more of the three elements most important in plant nutrition: nitrogen, phosphorus and potassium. Sulfur, magnesium and calcium are secondary trace elements. Frequent and high rate uses of chemical fer-

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tilizer have been associated with some environmental pollution, alteration in soil texture and physical properties of the soil.

Among the sources of organic matter and plant nutrients, farm manure is of great importance. Manure means waste from stables and sheds, including excrement and straw or other bedding material. A large amount of manure is produced by farm animals. Such manure has value in maintaining and improving the soil because it contains plant nutrients, humus and organic matter. However, manure provides many indirect benefits. It supplies humus, which improves the physical character of the soil by increasing its ability to absorb and store water, improve aeration and support the activity of lower organisms. Manure incorporated into topsoil will help prevent erosion from heavy rain and slow down evaporation of water from the surface. In fact, manure's value as a mulching material may be greater than its value as a source of essential plant nutrients.

Vermicomposting is an excrement of earthworms, called castings, which can improve the biological, chemical and physical properties of soil. Chemical secretions in the earthworm's digestive tract help break down soil and organic matter, so the castings contain more nutrients that are immediately available to plants.

Review of literature

Khan *et al.* (2018) was studied on the impact of various media combinations on growth, qualitative and quantitative yield of tomatoes as well as on chemical and physical properties of soil. The study comprised of seven different media treatments turned out to be the better media and perform best for plant growth due to its highest nutritional value as compared to all other treatments. Thus, by using natural fertilizers, the quality of tomatoes can be enhanced while soil fertility will also be maintained (Khan *et al.*, 2018).

Sarolkar (2022) studied on Azolla compost is used as microbial inoculant or biofertilizer and promotes the growth and increase the yield by 20-30%. Besides acting as N₂ fixing for rice production. Azolla compost also contains other nutrient i.e., N, P, K content. Four types of fertilization regimes Azolla compost, Inorganic fertilizer, FYM, no fertilizer was compared. The effect of plant growth, yield was investigated. The main result showed that: Azolla compost and FYM more effectively pro-

moted plant growth, number of fruits and height of plant with other fertilizer treatments. Azolla compost can be recommended as a fertilizer to improve tomato fruit quality and yield (Sarolkar, 2022).

3. Adeyeye *et al.* (2018), is studied on one of the limiting factors to crop production in Sub-Saharan Africa is due to poor soil fertility and in order to increase the crop yield to meet ever increasing population of this region, fertilizer is required as in the form of organic or inorganic manure. There seems to be some level of specificity in crop adaptation to the type of fertilizer in order to increase its growth and yield potentials (Adeyeye *et al.*, 2018).

4. Hashemi Majd *et al.* (2004) studied on vermicomposting and composting are efficient methods for converting solid wastes to useful products. Incorporation of composts and vermicomposts into potting and container media is a potential use for these materials (Hashemi Majd *et al.*, 2004).

Materials and Methods

The experiment was carried by using three types of fertilizers which are the farm yard manure, chemical fertilizers and vermicompost. Each type of fertilizer is applied to plant in with specific dose (trial and error method).

Chemical fertilizers (NPK for tomato) applied 50 mL on alternative days from sapling stage as per the dosage recommend by the user manual.

Home based Farmyard manure and etidiafoetida based earthworm vermicompost were applied in every seven days in 100 g from sapling stage (time period was analysed based on the trial observations).

Soil analysis was carried out in 2 stages, before addition of fertilizers and further addition of fertilizers.

Using a material in the experiments

Pasture land of soil, earthen pots, vermicompost, Farm yard manure, chemical fertilizer, tomato plant.

Preparation of soil

1. Collection of soil sample was done from the pasture land from campus itself.
2. The collected soil sample was dried at room temperature under dark condition.
3. After drying the sample were crushed with mortar and pestle for uniform particle size and sieved through 0.5 mm mesh screen.

4. After the proper soil preparation 1 kg soil is used for the pre analysis.

Study site

The Pot experimental research was carried out at Chhatrapati Shahu Institute of Business Education and Research Trusts, College of Non-Conventional Vocational Courses For Women, Kolhapur.

Tomato variety

TO-1057 was selected based on available in the markets of the Kolhapur district.

Experimental Design

Treatment of Different fertilizers on same 4 tomato plants was taken for the experiment —

- 1st plant was grown with vermicomposting at the rate of 100g per week
- 2nd plant was grown with FYM rate of 100g per week
- 3rd plant was grown with any inorganic fertilizer rate of 100g per week
- 4th plant was grown without any fertilizers

Observation

Soil analysis was carried out in 2 stages, Pre-analysis of soil sample i.e., before addition of fertilizers and post-analysis soil sample i.e., addition of fertilizers.

Table 1 shows the soil fertility of the pre analysed soil while Table 2 is shows the soil fertility report of

Table 1. Soil fertility report of pre-analysis soil sample

Sr. No.	Soil Parameters	Analysis Result
1.	OCOM (mg/L)	1.95
2.	pH	7.45
3.	Water holding Capacity (%)	25.049
4.	Nitrogen Kg/ha	2144.51
5.	Potassium Kg/ha	11.76
6.	Phosphorous Kg/ha	492.441

Table 2. Soil fertility report of post-analysis soil sample (After addition of fertilizers)

Sr. No.	Parameters	Soil with Chemical	Soil with Farmyard manure	Soil with vermicompost
1.	OCOM (mg/L)	3.799	8.19	12.128
2.	pH	6.90	7.52	7.29
3.	Water holding Capacity (%)	37.327	42.311	45.355
4.	Nitrogen Kg/ha	15115.52	3060.73	3010.56
5.	Potassium Kg/ha	165.312	83.328	55.104
6.	Phosphorous Kg/ha	5283.48	1056.69776	4411.456

post-analysis soil sample i.e. after addition of the fertilizers to the soil. Table 3 shows results of plant growth after the treatment of fertilizers.

Results and Discussion

After the analysis of the pre and post analysis of the soil sample, it was observed that there is positive change in the quality of the soil. The parameters of the soil sample have increased after the application of the various fertilizers. Comparatively, we observed more fertile soil after the application of the vermicompost and farmyard manure than the chemical fertilizer.

The Organic Carbon Organic Matter is more in the soil applied with farmyard manure and vermicomposting comparatively than the chemical fertilizer.

The pH of the soil is around neutral that were applied for all the three fertilizers.

We can also observe more water holding capacity in soil applied with farmyard manure and vermicomposting.

There is a significant increase in nutrients is observed in nitrogen, potassium and phosphate after the application of the farmyard and vermicomposting in soil.

Also, we observed a healthy growth, i.e. height of the plant and more green colour leaves in tomato plant with the application of the farmyard manure and vermicomposting than the chemical fertilizer.

The flowering is observed less with the application of chemical fertilizer than in farmyard and vermicomposting and fruiting is observed more with the application of chemical fertilizer than in farmyard and vermicomposting. This indicates that, fruiting is early with the application chemical fertilizer than farmyard and vermicomposting manure.

Table 3. Plant growth report after the treatment of fertilizers

	Chemical	Farmyard	Vermicomposting
Flowers count (No./ saplings)	3	10	14
Fruits (No./ saplings)	24	4	2
Height (in cm)	67	85	70
Leaf colour	Yellowish	Green	Green

Conclusion

It was concluded that a healthy growth of the tomato plant, the fertility and quality of the soil is increased with more water holding capacity and maintained neutral pH, with the significant positive change in the nitrogen, phosphorus and potassium after the application of the farmyard manure and vermicompost in the soil.

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Conflicts of Interest

Authors hereby declare that there is no any conflict of interest amongst authors.

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