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**RESEARCH ARTICLE**

# INFLUENCE OF BAGASSE - *TRICHODERMA HARZIANUM* T22 COMPLEX VERMICOMPOST ON HIGHER YIELD OF *CAPSICUM* ANNUUM

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**ABSTRACT**

*Capsicum annuum* is a large perennial shrub which has been used in medicine and culinary forms, although, it was used in traditional medicine for the treatment of various diseases. For the better growth of this plant, now a day's organic fertilizer such as vermicompost was used in spite of using inorganic fertilizers like Urea. The usage of Urea in agriculture land also leads to the soil infertility. In our previous study, to improve the soil health and plants growth we designed different combination of vermicompost with cow dung, bagasse, and *Trichoderma harzianum* T22 at different compositions and analysis their physio - chemical properties and found that bagasse, and *Trichoderma harzianum* T22 complex vermicompost were best among them. So the current study is to find out the influence of bagasse - *Trichoderma harzianum* T22 vermicompost on *Capsicum* annuum growth parameters. The plant were cultivated in the bags contained the vermicompost at different concentration and the growth parameters were studied at 15th, 30th, 45th and 60th day. The growth of plants in different concentrations bags were studied with respect to Plant height, No. of buds and flowers. Finally our study reveals that the bagasse - *Trichoderma harzianum* T22 complex vermicompost in 20% concentration had higher yield when compare to the inorganic fertilizer.

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## INTRODUCTION

The application of inorganic fertilizer mostly Urea to agriculture is now very common in practice, using composts derived from various green wastes in agriculture is tardily coming back. Compost contains variable amounts of N, P and K, and is a valuable source of plant nutrients (Narkhede *et al*., 2011; Jeyabal and Kuppuswamy, 2001). But, it also has some side effects such as immature growth, soil infertile, etc., Increase in application of inorganic fertilizers in agriculture has detoriated the soil quality. Since, it is important to protect our environment so organic fertilizers were used. Among various sources of organic matter, vermicompost have been recognized as having considerable potential as soil amendments. Application of vermicompost produced by biodegradable waste is one of the most economical and attractive methods of solving the environmental problems such as waste disposal and the requirement to increase the organic matter content of soil (Berova *et al*., 2010). It improves the soil fertility level by means of organic farming. Organic agriculture is one among the longest spectrum in production methods that are supportive of the environment (Watson *et al*., 2002; Aruna *et al*., 2017). In the present study, soil analysis was done prior to the experiment to determine the availability of nutrients in the soil and also to calculate the equivalent amount of organic or chemical fertilizer requirement of soil nutrients.

Chilli (*Capsicum* sp.) is a plant species which belongs to the *Capsicum* annuum is a large perennial shrub cultivated in most parts of the world (Adhikary and Gantayet, 2012). It is native to southern North America and northern South America and grows in the winter frosts. It can survive in several seasons and grow into a crop. It provides *Capsicum* a pungent smelling substance is a substituted benzyl amine derivative. It is used for medicinal purposes and also used as a culinary herb (Sahoo *et al*., 2015). This pharmacology activity is due to the presence of photochemical present in it. In particular, capsaicin phytochemical creates a burning sensation ("hotness"), which in extreme cases can last for several hours after ingestion (Dhanalakshmi *et al*., 2014). In 2013, global production of both green and dried chili pepper was 34.6 million tones, with 47% of output coming from China alone. India was the top producer of dry peppers, producing 1.4 million tons by both organic and inorganic forms of agriculture. The normal control plot without any vermicompost dose shows apparently very normal growth with immature buds and leaves. By the implementation of vermicompost as an organic fertilizer the plants grows very fastly and buds were well developed (Arancon *et al*., 2005).

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## MATERIALS AND METHODS

### Collection of substrates

Urea was purchased in nearby store, Thanjavur. To observe the lacking nutrients, soil analysis was performed. Vermicompost studies have been performed in Periyar Maniammai University. All the chemicals used were analytical grade and the glass wares were completely sterilized.

### Field experiments

Vermicompost at concentrations of 0, 5, 10, 15 and 20% was applied in the field. Nearly, About 25 seeds were planted per plot; watering was done by consecutive days on each plot. Plant height, number of leaves, number of buds, etc., were monitored and measured at 15, 30, 45, and 60 day's interval period. On 60th day all *Capsicum* annum (Chili plant) plants were uprooted to study the fresh wt. and dry wt. biomass. A comparative data was prepared between each level of fertilizer concentration on grown plants (Narkhede *et al*., 2011).

### Estimation of chlorophyll

Chlorophyll content of the plant leaves was estimated spectrophotometrically. It is the main part of plant to grow well (Arnon, 1949).

### Environmental condition

All the processes were performed at the suitable condition for the growth of *Capsicum* annuum plant.

## RESULTS and DISCUSSION

### Field experiment observations

Effective results were obtained at 20% concentration of the vermicompost plot. On 15th day, plant height was 10 cm which is the highest among the other normal plots. Also, higher number of leaves and flowering buds of the plants were observed. On 30th day, at 15 and 20% concentration of vermicompost plot shows height of plant 15.8cm and 17.0 cm and that of chemical fertilizer (Urea) showing 14.8 cm and 15.2 cm respectively (Table 1 & 2). Whereas, the control plot has shown 11.5 cm height, after the same growth period (without any fertilizer dose). Considerable difference in the heights of plant has been observed on 30th day in both the chemical fertilizer and vermicompost dosed plants (El-Bassiony *et al*., 2010). Also in 20% concentration plot of vermicompost, highest number of buds has been observed. As compared to chemical fertilizer plots and control plots all other vermicompost applied plots shown maximum increase in plant height, number of leaves, and number of buds has been noticed which indicates the higher efficiency rate at 20% concentration.

### At semi maturation stage of plants

On 45th day, control plot shown 24.0 cm height, 10 leaf no. and 6 no. of buds, Whereas, in chemical fertilizer applied plot, shown 30.2 plant height, 14.0 no. of leaves and 6.9 no. of buds at 20% dose. However, in vermicompost applied plot at the same concentration dose, 36.2 cm of plant height, 16 no. of leaves and 102 no. of buds was observed. All the values were measured in an average.

**Table 1. Growth parameters of *Capsicum* annum after application of Urea at various doses (n=3)**

| S.No | Observation | 0% (Control) (Avg±SD) | 05% (Avg±SD) | 10% (Avg±SD) | 15% (Avg±SD) | 20% (Avg±SD) | Days |
|---|---|---|---|---|---|---|---|
| 1 | Height (cm) | 4.5 ± 0.2 | 4.7±0.2 | 5.7±0.4 | 6.5±0.2 | 8.2±0.1 | |
| 2 | No. of leaves | 2.8 ± 0.1 | 3.7±0.4 | 3.2±0.2 | 4.6±0.3 | 5.4±0.2 | After 15 days |
| 3 | No. of buds | 0.8 ± 0.3 | 1.6±0.2 | 1.4±0.3 | 2.3±0.2 | 3.5±0.1 | |
| 1 | Height (cm) | 10.8±0.2 | 12.6±0.3 | 13.5±0.6 | 14.1±0.4 | 14.7±0.4 | |
| 2 | No. of leaves | 5.3±0.2 | 7.4±0.1 | 8.6±0.7 | 9.7±0.4 | 9.3±0.2 | After 30 days |
| 3 | No. of buds | 3.5±0.3 | 3.4±0.1 | 3.7±0.3 | 4.8±0.2 | 5.4±0.2 | |
| 1 | Height (cm) | 23.3±0.6 | 26.3±0.1 | 27.2±0.2 | 28.5±0.1 | 29.8±0.3 | |
| 2 | No. of leaves | 9.1±0.2 | 10.6±0.5 | 11.4±0.1 | 12.3±0.2 | 13.4±0.3 | After 45 days |
| 3 | No. of buds | 4.1±0.1 | 4.6±0.6 | 4.6±0.1 | 5.6±0.2 | 6.7±0.7 | |
| 1 | Height (cm) | 31.5±0.5 | 32.5±0.4 | 33.7±0.1 | 34.8±0.6 | 35.8±0.6 | |
| 2 | No. of leaves | 10.5.±0.4 | 13.3±0.5 | 15.3±0.7 | 17.2±0.7 | 18.9±0.5 | |
| 3 | No. of buds | 6.7±0.7 | 7.2±0.2 | 7.7±0.3 | 7.6±0.5 | 8.2±0.4 | |
| 4 | No. of fruits | 7.8±0.4 | 7.6±0.2 | 8.7±0.5 | 8.6±0.3 | 9.9±0.4 | After 60 days |
| 5 | Fresh wt. (g) | 17.2 ±0.5 | 18.6±0.4 | 19.2±0.5 | 22.2±0.4 | 24.4±0.3 | |
| 6 | Dry wt. (g) | 5.7±0.2 | 6.6±0.4 | 7.18±0.3 | 9.18±0.5 | 10.37±0.2 | |

**Table 2. Growth parameters of *Capsicum* annum after application of vermicompost at various doses (n=3)**

| S.No | Observation | 0% (Control) (Avg±SD) | 05% (Avg±SD) | 10% (Avg±SD) | 15% (Avg±SD) | 20% (Avg±SD) | Days |
|---|---|---|---|---|---|---|---|
| 1 | Height (cm) | 4.5 ± 0.2 | 6.9±0.7 | 7.6±0.2 | 8.9±0.1 | 9.5±0.3 | |
| 2 | No. of leaves | 2.8 ± 0.1 | 3.6±0.5 | 4.5±0.4 | 5.6±0.2 | 5.9±0.3 | After 15 days |
| 3 | No. of buds | 0.8 ± 0.3 | 2.1±0.4 | 2.7±0.5 | 3.6±0.4 | 4.5±0.5 | |
| 1 | Height (cm) | 10.8±0.2 | 13.2±0.7 | 14.8±0.4 | 15.4±0.5 | 16.6±0.1 | |
| 2 | No. of leaves | 5.3±0.2 | 8.4±0.2 | 9.1±0.5 | 9.6±0.6 | 10.6±0.4 | After 30 days |
| 3 | No. of buds | 3.5±0.3 | 5.9±0.2 | 6.1±0.5 | 6.8±0.02 | 7.5±0.4 | |
| 1 | Height (cm) | 23.3±0.6 | 28.0±0.5 | 30.1±0.6 | 32.2±0.1 | 33.4±0.1 | |
| 2 | No. of leaves | 9.1±0.2 | 12.9±0.1 | 13.6±0.2 | 14.4±0.1 | 15.5±0.7 | After 45 days |
| 3 | No. of buds | 4.1±0.1 | 7.9±0.5 | 8.1±0.7 | 8.6±0.7 | 9.2±0.4 | |
| 1 | Height (cm) | 31.5±0.5 | 36.4±0.6 | 37.5±0.6 | 39.4±0.7 | 40.7±0.4 | |
| 2 | No. of leaves | 10.5.±0.4 | 16.9±0.7 | 17.8±0.2 | 18.3±0.2 | 19.8±0.2 | |
| 3 | No. of buds | 6.7±0.7 | 8.1±0.3 | 8.4±0.2 | 9.4±0.5 | 10.3±0.1 | |
| 4 | No. of fruits | 7.8±0.4 | 9.3±0.5 | 10.4±0.3 | 12.1±0.3 | 12.9±0.7 | After 60 days |
| 5 | Fresh wt. (g) | 17.2 ±0.5 | 23.9±0.7 | 24.8±0.3 | 27.1±0.6 | 27.9±0.4 | |
| 6 | Dry wt. (g) | 5.7±0.2 | 8.65±0.5 | 9.21±0.5 | 13.05±0.1 | 13.38±0.2 | |

**Final observations**

On 60th day, vermicompost plot shows 40.2cm plant height at 20% dose which was highest among all other plots (Table 2). Also, the no. of buds measured was 12.5 and no. of pods obtained were 8.3 in control and 11.2 in chemical fertilizer applied plots, whereas average 12.9 no. of fruits per plant were observed at 20% concentration of vermicompost plot. Not only height, the no. of leaves and flowering buds of each plant has also increased. The no. of buds on plant was higher in both 15 and 20% vermicompost plots at final observation (Arnon, 1949). From the above results, 20% concentration application of vermicompost for a *Capsicum* annum crop at field, the productivity of crop increases compared with 15%. Productivity depends upon the exact required dose which differs from species to species of plants. Vermicompost have the potential for improving plant growth when added to soil and also beneficial for soil fertility. The greatest plant growth responses and yields have occurred usually when vermicompost constituted a relatively small proportion (20-30%) of the total volume of the plant growth medium in which they are incorporated.

**Chlorophyll content**

Chlorophyll content at a 20% dose was 2.6% for chemical fertilizer, 3.2% for vermicompost and 2.4% in control, which indicates that not only the physical characteristics of plant were changed (Arnon, 1949; Atiyeh *et al*., 2002). But, also the chlorophyll content of leaf has enhanced with the application of vermicompost. The increased photosynthetic pigments and leaf gas exchange in red chilli (*Capsicum* annum) is due to application of vermicompost at 15-20%.

**Conclusion**

Numbers of studies were conducted to find out the best organic fertilizer for the higher growth of *Capsicum annuum* plants. On the other hand, Microorganisms plays a major role in the perspectives activities of vermicompost. So, we designed our research to inoculate microorganism *Trichoderma harzianum* T22 in the substrate bagasse which is available in million of tones around the world for the vermicompost process. And the final products were used for the *Capsicum annuum* plants cultivation and the growth parameters were studied. Finally, Our results reveals that the 20% dose concentration of bagasse - *Trichoderma harzianum* T22 complex vermicompost gives better yield in the production of *Capsicum annuum* plant when compare to the inorganic fertilizer, In addition to that, the bulk production of this type of vermicompost also easy. So, we recommended this vermicompost to the farmers for the production of *Capsicum annuum* plants in the agricultural fields.

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