# Evaluation of vermicompost in Improving Yield of Capsicum (*Capsicum annum*)

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## ABSTRACT

**Vermicompost is a superior bio fertilizer for organic farming. Compost tea improves crop vigor and to control pest and diseases. A pot experiment was conducted to evaluate the effect of vermicompost and compost tea on yield, some agronomic parameters and resistance to pest and disease of capsicum. Vermicompost was prepared using weed trashes and cattle manure with the help of earth worms (*Esienia spp*). Compost tea was prepared by dipping vermicompost in aerated water for a day. Mixtures of vermicompost and soil (1:1, 3:1, 1:3), mixture of poultry manure and soil (1:1) and with and without application of compost tea used as treatments. Highest yield was recorded in poultry manure where as higher keeping quality was recorded in vermicompost treated plants. Plant height, root volume and number of leaves per plant were improved with the application of vermicompost over DOA recommendation. Moisture content of pods was not affected by treatments. Less pest damage reported in vermi treatments and poultry manure over DOA recommendation. Application of compost tea had a positive effect only in vermicompost treated plants. However, no effect of compost tea was observed in controlling pests in capsicum.**

**KEYWORDS:** Capsicum, Compost Tea, Organic Farming, Vermicompost

## INTRODUCTION

Capsicum is one of the popular vegetables in Sri Lanka. Capsicum belongs to family solanaceae. Its Cultivated extent in 2004 Maha was 2899 ha with an average production of 4.35 Mt/ha (Anon, 2005). More than 68% of crop is produced in Badulla, Nuwara Eliya, Kurunegala, Matale and Monaragala districts. The variety CA 8 is the popular variety among farmers in Makandura area. Variety CA 8 yields 6-8 Mt/ha in wet zone and 10-15 Mt/ha in dry zone (Bandara, 2005).

Capsicum is susceptible to various pest and diseases. Farmers use various types of chemicals to control pest and diseases. This may be attributed to high cost involve in capsicum cultivation. Therefore, cost of production is a problem in capsicum cultivation and hence, it is expensive vegetable in Sri Lanka. If the cost of production could be reduced, it will be beneficial to farmers and consumers too (Galkaduwa, 2005).

Use of chemical pesticide and chemical fertilizer in farming create too many problems to the ecosystem and to human health. Considering these problems especially bad effects on human health a very high demand exist for food which comes from non chemical agriculture. Hence organic farming is prioritized at present. Organically produced food has high demand in local and international market as organic foods are superior to chemically produced food in qualitatively (Smith, 2002). However organic farming is not cost effective in Sri Lanka as inputs for organic farming such as compost and organic manure are expensive (Maraikar, 1996).

Vermitechnology is a very good option for organic farming as it involves simple technology, low cost and gives far superior bio organic fertilizer than conventional compost and other organic fertilizers available (Anon, 2006a). Vermicompost contains plant macro and micro nutrients. Superiority of vermicompost is mainly due to very high contents of beneficial microbes, high content of plant growth hormones, chemicals responsible for resistance against the pest and diseases (Arancon *et a.,l* 2004). Compost tea can be obtained by brewing of vermicompost and it is full of beneficial microbes and beneficial plant growth compounds. This could be used as a liquid fertilizer and as a bio pesticide against various diseases and pests. Therefore vermicompost and compost tea can replace chemical fertilizers and pesticides in modern farming and could be used in organic farming (Anon, 2006b). A pot experiment was conducted to evaluate yield, agronomic characters and pest and disease incidence in capsicum grown under different levels of vermicompost with and without applying compost tea.

## MATERIALS AND METHODS

The study was carried out at the Regional Agricultural Research Development Center, Makandura, situated in the low country intermediate zone, at an elevation of 30 m above mean sea level. Experiment was conducted during the period of February 2006 to August 2006.

### *1. Production of Vermicompost*

1m X 0.5m X 1m cement tanks were used prepared for production of vermicompost. Mixture of 300 kg of weed trashes and 50 kg of cow dung was put into tank and about 2000 earth worms of *Esienia* species were added into the tank. Then the moisture content of the mixture was maintained at about 70 to 80 % by adding appropriate amount of water daily.

One month after introduction of earth worms, compost was harvested and used for the experiment.

### 2. *Production of Compost Tea*

Fresh vermicompost was filled in to the Poplin cloth bag and soaked in container of water. It was aerated by using aquarium pump for twenty four hours. Then the extract was taken as compost tea.

### 3. *Planting*

Forty clay pots of 8L were used for the experiment.

Top soil was collected from a fallow field at RARDC, Makandura. Then soil was mixed with different ratios of vermicompost and 1:1 ratio with poultry manure. These mixtures were used as different treatments in the experiment.

Treatments;

$T_1$ - Control; Soil only with application of chemical fertilizer (DOA recommendation)
$T_2$ - Mixture of soil and poultry manure in 1:1 ratio
$T_3$ - Mixture of soil and vermicompost in 1:1 ratio
$T_4$ - Mixture of soil and vermicompost in 3:1 ratio
$T_5$ - Mixture of soil and vermicompost in 1:3 ratio
$T_6$ - Mixture of soil and vermicompost in 1:1 ratio + compost tea spray
$T_7$ - Mixture of soil and vermicompost in 3:1 ratio + compost tea spray
$T_8$ - Mixture of soil and vermicompost in 1:3 ratio + compost tea spray

Clay pots were filled with the mixtures. Three seedlings (three weeks old) of CA 8 capsicum variety were planted in each pot. Then pots were arranged in completely randomized design (CRD) with five replicates. Pots were watered daily with tap water. Fresh compost tea prepared in previous day was applied to appropriate treatments weekly.

### 4. *Collection of Data*

Following data were collected during the experiment;

I. Yield
II. Keeping quality of the harvest
III. Moisture content of pods
IV. Root volume
V. Plant height
VI. Number of leaves in plant
VII. Severity of pest attack

Mature pods were harvested weekly after 45 days of establishment and weighed to take yield.

Harvest was put in to a polythene bag with enough holes to facilitate proper aeration. These bags were kept in a room under normal temperature and good ventilation. Pods in bags were daily observed for the freshness and post harvest diseases. Time taken to loose their freshness was counted. Disease incidence also was monitored.

Fresh weight of three pods from each plant was measured separately using an electronic balance. Then each pod was put in to a paper bag and kept under an oven set to 60°C until a constant weight was obtained. Then the dry weight of pod was measured using same balance. Moisture content of pods was calculated using fresh and dry weights of pods.

$$\text{Moisture content} = \frac{(\text{fresh weight} - \text{dry weight})}{\text{fresh weight}} \times 100$$

Plants were uprooted carefully not to damage any root in the plant after taking the harvest. Root system was separated and washed properly. Washed roots were allowed to dry off under air. Then root volume was measured using water displacement method.

Height of uprooted plants was measured using a meter ruler. Number of leaves also countered in same plants

After one month, plants in pots were ranked according to the appearance of pest attack severity.

| Rank | Severity (%) |
|---|---|
| 1 | < 5 |
| 2 | 05 – 25 |
| 3 | 25 – 50 |
| 4 | 50 – 75 |
| 5 | >75 |

This ranking was done by evaluating the appearance of plants

## RESULTS AND DISCUSSION

### 3. *Yield of Capsicum*

**Table 1 - Yield of capsicum per pot (three plants):**

| Treatment | Yield (g) per Pot |
|---|---|
| T1 | 795.49[a] |
| T2 | 3975.79[e] |
| T3 | 827.59[b] |
| T4 | 859.73[b] |
| T5 | 1048.48[c] |
| T6 | 875.49[b] |
| T7 | 1954.79[d] |
| T8 | 2247.38[d] |
| **LSD** | **21.34** |
| **CV** | **14.68** |

Figures denoted by different letters are significantly different by LSD ($p<0.05$)

Significant yield differences were recorded in different treatments. The highest yield was observed in pots treated with poultry manure where as lowest was recorded in pots treated with DOA recommendation.

Yield of plants treated with vermicompost was significantly higher than that of DOA recommendation. Yield increment was observed with

increasing the rate of application. Application of compost tea also showed significant yield increment over the vermicompost treatments without compost tea.

### *4. Keeping Quality*

**Table 2 - Number of days taken to lose the freshness of the pod:**

| Treatment | No of Days to Loose Freshness of the Pod |
|---|---|
| T1 | $8^{c}$ |
| T2 | $8^{c}$ |
| T3 | $11^{b}$ |
| T4 | $11^{b}$ |
| T5 | $12^{a}$ |
| T6 | $11^{b}$ |
| T7 | $11^{b}$ |
| T8 | $11^{b}$ |
| **LSD** | **2.58** |
| **CV** | **16.97** |

Figures denoted by different letters are significantly different by LSD ($p<0.05$)

The keeping quality of the pods was significantly lower in plants which were treated with chemical fertilizer and poultry manure than that of vermicompost (Table 2). Though no significant difference observed between plants treated poultry manure and chemical fertilizer, poultry manure showed very low keeping quality. Post harvest diseases; anthracnose and stem end rot were observed in pods taken from poultry manure treated plants during storage where as no other pods showed any post harvest diseases.

Pods taken from vermicompost treated plants showed significantly higher keeping quality showing the improvement of keeping quality with application of vermicompost. However, no significant difference was observed among the rates of vermicompost. Further, application of compost tea has shown no significant effect on keeping quality.

### *5. Moisture Content of Pods*

**Table 3 - Differences among the moisture content of pods taken from the plants treated with different fertilizer levels:**

| Treatment | Moisture Content of Pods (%) |
|---|---|
| T1 | 92.45 |
| T2 | 92.49 |
| T3 | 93.16 |
| T4 | 93.20 |
| T5 | 93.55 |
| T6 | 93.61 |
| T7 | 92.78 |
| T8 | 93.07 |
| **LSD** | **1.11** |
| **CV** | **0.81** |

Figures denoted by different letters are significantly different by LSD ($p<0.05$)

There was no significant difference in moisture content of the pods among the treatments (Table 3). This observation is debatable with the reports of Smith (2002) who reported low moisture content in compost treated plants.

### *6. Growth Parameters of Capsicum Treated With Different Fertilizer Levels*

Table 4 shows the differences in plant height, root volume and number of leaves per plant among different fertilizer rates. Plant height and number of leaves, were significantly lower in chemically fertilized plant than those of other treatments. However, there was no significant difference recorded in these two parameters among poultry manure and different levels of vermicompost treated plants. Further, no effect of compost tea on these parameters too.

**Table 4 - Growth parameters of capsicum treated with different fertilizer levels:**

| | Plant Height(cm) | Root Volume(ml) | No of Leaves |
|---|---|---|---|
| T1 | $16.53^{b}$ | $7.70^{c}$ | $15.00^{d}$ |
| T2 | $20.80^{a}$ | $13.73^{a}$ | $35.37^{b}$ |
| T3 | $22.67^{a}$ | $9.54^{b}$ | $27.25^{c}$ |
| T4 | $22.57^{a}$ | $10.65^{b}$ | $36.00^{b}$ |
| T5 | $22.35^{a}$ | $9.75^{b}$ | $32.00^{b}$ |
| T6 | $23.55^{a}$ | $12.96^{ab}$ | $26.75^{c}$ |
| T7 | $22.55^{a}$ | $13.97^{a}$ | $42.75^{a}$ |
| T8 | $21.92^{a}$ | $13.34^{a}$ | $34.00^{b}$ |
| **LSD** | **2.95** | **3.19** | **9.30** |
| **CV** | **9.29** | **12.25** | **20.31** |

Figures denoted by different letters are significantly different by LSD ($p<0.05$)

The lowest root volume was recorded in plants treated with chemical fertilizer (Table 4). It was significantly different from the other treatments. However, there was no significant difference of root volume among the poultry manure and different levels of vermicompost. Significant increment of root volume was observed with the application of compost tea.

### *05. Severity Of Pest And Diseases*

There were no diseases recorded in the experiment. Leaf curling due to pest attack was observed in latter stage of the experiment. The highest pest attack was recorded in control plants (plants treated with DOA recommendation) where as lowest was recorded in plants treated with vermicompost (Soil: vermicompost 1:3) and vermicompost (Soil: vermicompost 3:1) with application of compost tea. Plants treated with poultry manure also showed low pest damage compared to the plants treated with vermi treatments (soil: vermicompost 1: 1 with compost tea and soil: vermicompost 1: 3 with compost tea) and DOA recommendation. This shows the nil effect of compost tea in controlling pest damage. However plants with vermin treatments and poultry manure

compost tea in controlling pest damage. However plants with vermin treatments and poultry manure showed less pest damage over DOA recommendation.

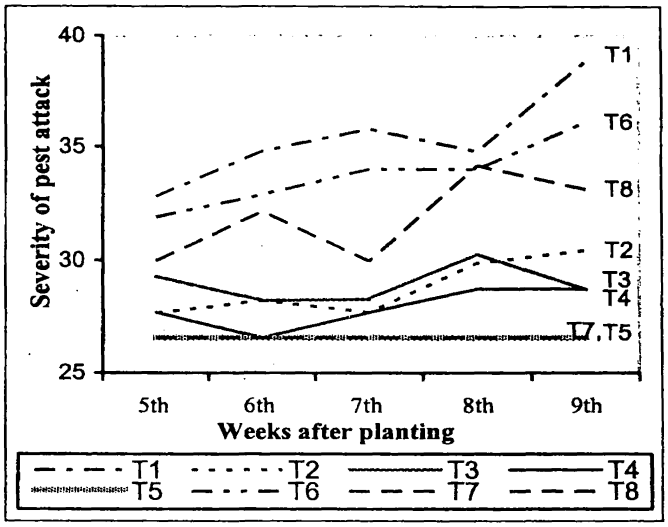


**Figure 2- Severity of pest attack of capsicum treated with different fertilizer levels and compost tea:**

Results showed that vermicompost was superior to the chemical fertilizer in improving yields and agronomic parameters. Previous work has shown that vermicompost has been superior to other organic fertilizers (Anon 2006a). How ever, it was not observed in our experiment, which showed, best fertilizer as poultry manure. This may be due to the incorrect method of extracting worms from vermicompost which involved long exposure of vermicompost to the direct sunlight. Many nutrients, important chemicals would have volatilized and the beneficial microbes would have died under the direct sun light leading low quality of vermicompost. Though compost tea is proven to be effective in developing vigor and resistance of plants, it was not clear in our experiment. This may be due to the low quality of vermicompost which used for making compost tea. Further, only aerobic compost tea was used in this experiment. But anaerobic compost tea has performed well in some instances. Anaerobic compost tea would have been better in managing pests in capsicum which we were not tested. Therefore experiment should be repeated with improved method of extracting worms from vermicompost which does not involve direct exposure of vermicompost to sunlight and using both aerobic and anaerobic compost tea.

## CONCLUSIONS

Vermicompost was effective in improving yields and agronomic parameters of capsicum over chemical fertilizer (DOA recommendation). Poultry manure performed superior to the vermicompost which showed controversy to previous records. Aerobic compost tea had no positive effect in controlling pest damage of capsicum. Further studies should be needed to confirm the results of this experiment.

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