

**EFFECT OF VERMICOMPOST ON THE GROWTH
AND YIELD OF *CAPSICUM ANNUM*****BLESSY JOHN¹ AND DR M. LAKSHMI PRABHA^{2*}**¹ B.Tech Biotechnology, ^{**2} Assistant Professor Karunya University, Tamil Nadu, India**ABSTRACT**

The study was aimed at understanding the effect of vermicompost on the growth and yield of *Capsicum annum*. The main aim of this investigation was focused on the assessment of the potency of selected earthworm species *Eudrilus eugeniae* with respect to their biodegradation of Lady's finger waste into organic manure known as vermicompost. The present study has been carried out to estimate macro and micronutrients, physiochemical parameters, enzymes and biochemical parameters in vermicompost before and after inoculation of earthworm species and also a comparative study was done on the effect of vermicompost on the growth parameters namely shoot length and number of leaf count in *Capsicum annum*. The results of the study revealed that the total macronutrients and micronutrients showed elevated levels in vermicompost when compared to control. The enzyme activities amylase, cellulase, invertase, biochemical parameters namely protein; physiochemical parameters namely pH showed elevated levels after vermicomposting. The vermicompost applied plant *Capsicum annum* showed an increased shoot length and number of leaves when compared to the inorganic fertilizer applied plant. Hence based on the various studies performed it was concluded that this quality of vermicompost obtained from the degradation of the Lady's finger waste by *Eudrilus eugeniae* is an effective organic manure which would facilitate increased uptake of the nutrients by the plants resulting in higher growth and yield.

KEYWORDS : Lady's finger, vermicomposting, *Capsicum annum***DR M. LAKSHMI PRABHA**

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INTRODUCTION

In the modern age of development the increasing quantity of solid waste is one of the growing problems in both developed and developing countries. Earthworm farming (vermiculture) is another biotechnique for converting solid organic waste into compost¹. Vermiculture biotechnology refers to the breeding and propagation of earthworms. The vermiculture provides for the use of earthworms as natural bioreactors for cost-effective and eco friendly waste management². Earthworm fecundity is based on the rate of cocoon production, hatching success of cocoons and number of offspring's emerging from each cocoon. The success of composting depends upon the fecundity of the earthworm. It has the efficiency to consume all types of organic rich waste material including vegetable wastes, industrial, dairy farm wastes, garden waste, sugar mill residues, slaughter house waste, hatcher waste and municipal wastes³. Vermicompost is a rich source of vitamins, hormones, enzymes, macro and micronutrients which when applied to plants help in efficient growth⁴. The growth rate is fast due to increased uptake of macro and micronutrients present in the vermicompost, which results in increased shoot length and number of leaves in vermicompost applied plants. Earthworms effectively harness the beneficial soil micro flora, destroy soil pathogens and convert organic wastes into vitamins, enzymes, antibiotics, growth hormones and protein rich casts. Earthworm bioreactors have an in-house supply of enzymes such as amylase, cellulase, nitrate reductase, acid and alkaline phosphatases. These enzymes biodegrade the complex biomolecules into simple compounds. The digestive enzymes of earthworm are responsible for the decomposition and humification of organic matter. These enzymes are active at a very narrow pH range and efficiently maintain the non-linear pH parameters⁵. Earthworms change the soil in many beneficial ways. They increase the soil's plant available nutrient content (example :

nitrate, phosphate, exchangeable calcium and soluble potassium), growth regulators and useful bacteria populations⁶. These bacteria are called plant growth promoting bacteria (PGPB) and work to directly stimulate growth by fixing nitrogen, dissolving nutrients, producing growth hormones and anti-fungal compounds⁷. Earthworm casts have large particulate surface areas allowing for more microbial active sites and strong retention of nutrients. Earthworms and their casts promote increased soil moisture and air content, bulk density and soil drainage⁸. Vermicompost also increases the levels of soil enzymes like dehydrogenase, acid and alkaline phosphatases and urease. Use of vermicompost over the years build up the soil's physical, chemical and biological properties restoring its natural fertility. Vermiculture biotechnology will bring in 'economic prosperity' for the farmers, 'ecological security' for the farms and 'food security' for the people⁹. The study was formulated with the aim of exploiting the potential lying in earthworm species to convert the biodegradable wastes into high quality organic manure and the influence of vermicompost on the growth of plants.

MATERIALS AND METHODS

The Lady's finger waste was collected from Karunya Ladies Hostel, Karunya University campus, Coimbatore, Tamil Nadu. The collected waste was allowed for partial decomposition for 10 days. Then the wastes were mixed with cowdung in 3:1 ratio. The exotic earthworms *Eudrilus eugeniae* were used for vermicomposting. Pits of 0.75 x 0.75 x 0.75 m size were dug and the floor of the pit was covered with a lattice of wood strips to provide drainage. Rectangular shaped vermicompost tanks were constructed and the floor of the tanks was covered with a lattice of wood strips to provide drainage. Totally 2 pits were maintained for the purpose. The pit 1 was maintained as a reserve for earthworms while the pit 2 was maintained for the experimental

purpose. In the second pit 200 kgs of Lady's finger waste was taken along with the earthworm *Eudrilus eugeniae* which was released on the surface at the rate of 60 worms per square feet. Care should be taken to avoid light and rainfall. The compost sample was taken on the 25th day of composting for analysis of physiochemical parameters macro and micro nutrients, enzymes and biochemical parameters. The compost sample was taken on the 25th day of composting for analysis of physiochemical parameters macro and micro nutrients, enzymes and biochemical parameters. The pH of the sample was also estimated. Estimation of total nitrogen was done by Pellett and Young, method¹⁰. The nitrogen in organic material is converted to ammonium sulphate by sulphuric acid during digestion. This salt, on steam-distillation, liberates ammonia which is collected in boric acid solution and titrated against standard acid. Estimation of total phosphorus, potassium, iron and copper was also done¹¹. Various enzymes involved in the degradation of complex organic material into

simple compounds such as amylase, cellulase, invertase was estimated. Biochemical parameters like Protein was estimated by Lowry's Method and carbohydrate was done by anthrone method. Studies on the effect of vermicompost on growth parameters of *capsicum annum* were conducted. The seeds were sowed in three different pots namely Vermicompost, Inorganic Fertilizer and control. The Shoot length and the number of leaves were counted on the 25th day of planting.

RESULTS AND DISCUSSION

The earthworm *Eudrilus eugeniae* was analyzed to find the degrading potential of Lady's finger waste. Hence the following investigations namely estimation of macro and micro nutrients, assay of enzymes and biochemical parameters were performed to find out the quality of vermicompost. The effect of vermicompost on growth parameters of selected vegetable plant namely *Capsicum annum* was studied.

Table 1
Analysis of physiochemical, biochemical parameters, enzymes and nutrients present in the vermicompost.

Parameters	Control	Vermicompost
pH	6.0	6.9
Nitrogen (%)	0.18	0.46
Phosphorous (%)	0.88	1.26
Potassium (%)	0.36	0.58
Iron (%)	0.55	1.36
Copper (%)	0.25	1.57
Amylase (mg/g)	1.5	2.1
Cellulase (mg/g)	1.9	4
Invertase (mg/g)	3.9	5.1
Proteins (mg/g)	15	19.6
Carbohydrates (mg/g)	45	33

From the above Table 1 the level of pH was increased in vermicompost when compared to control. Increase of pH in vermicompost might be due to participation of microbes in the degradation of organic wastes representing aerobic metabolism. However the present results are in line with the studies of Gajalakshmi and Abassi⁵, which showed that earthworms are sensitive to changes in pH and prefer conditions of neutral reaction. The

nitrogen content in vermicompost is found to be increased on the 25th day of composting. Increase in nitrogen content is due to the fact that earthworms enhanced the nitrogen cycle which attributed to increased levels of nitrogen in vermicompost. Tripathi and Bhardwaj¹² reported that increase in nitrogen content was found in the final product in the form of mucus, nitrogenous excretory substances, growth stimulating hormones and enzymes from

earthworms. Phosphorous content present in vermicompost is high compared to control. The enhanced phosphorous level in vermicompost is due to mineralization of phosphorous during vermicomposting. The release of phosphorous in the available form is performed partly by earthworm gut phosphatases and further release of phosphorous might be attributed to the phosphorous-solubilizing microorganisms present in vermicompost. The total potassium present in the vermicompost is higher than in control. The increase in the level might be due to the changes in the distribution of potassium between exchangeable and non exchangeable forms¹³. claimed that acid production by the microorganisms is the major mechanism for solubilizing potassium in the organic waste. It is evident from the results that the iron content in vermicompost was higher compared to that of control. The presence of enzymes and co-factors in the earthworm gut increased the iron content in the vermicompost. Our results are in accordance with Sivakumar¹⁴ who reported the presence of iron content in vermicompost. Higher content of copper was seen in vermicompost when compared to control. Increase of copper content in vermicompost might be due to the increased content of several Cu containing oxidizing enzymes. Our results are in accordance with Suthar¹⁵ who reported that elevated levels of copper in vermicompost.

Enzymes present in vermicompost

Earthworm has shown higher activities of vital enzymes which are necessary to degrade complex biomolecules into simpler compounds utilizable by symbiotic gut micro flora. It is therefore easy to speculate that vermicompost are rich in enzymes, which accelerated the mineralization rate and converted the waste into organic fertilizer with higher nutritional value. Hence amylase, cellulase and invertase were assayed in vermicompost obtained with Lady's finger waste by *Eudrilus eugeniae*. The results revealed that a significantly higher amylase was noticed in vermicompost when compared to control. The reason for the increase is due to the presence of rich starch in the organic substrate Lady's finger waste and probably also

due to the presence of amylase producing bacteria. The present work was in accordance with the studies of Haritha¹⁶ who reported that the level of work of amylase increased in the sample. In the present study, the cellulase activity was increased in vermicompost as compared to control. The enzyme cellulase acts upon the substrate carbohydrate which is metabolized by the reproductively active worms. The worms require more energy and hence increased enzyme activity was noticed during the active phase of production. Aira and Dominguez¹⁷ reported a similar increase. The activity of invertase present in Lady's finger waste composted by *Eudrilus eugeniae* is found to be increased. It is increased directly by the worms own enzyme and indirectly by stimulation of the microflora. During their passage through the gut, the microflora gets enhanced in population which may be responsible for the increased enzyme activity. Higher activities of amylase, cellulase and invertase in the wormcasts have been reported by Edwards and Bohlen¹⁸. The reason for increase in the protein content in vermicompost might be due to the presence of proteolytic enzymes that are secreted by the gut of earthworms. Our results are in accordance with Zambare¹⁹ who reported the presence of protein in the vermicompost. In contrast to protein content the carbohydrate content was found to be lower in vermicompost when compared to control. The reason for decrease of carbohydrate content in vermicompost is due to decline in substrate content.

Study on the effect of vermicompost on growth of capsicum annum.

The selected plant namely *Capsicum annum* showed the maximum root length (9cm), shoot length (10cm) and leaf count (8) in vermicompost treatment on 25th day after planting. Vermicompost contains macro and micro plant nutrients in an available form that plants can easily assimilate for their growth and development. This quality manure also contains some of the secretions of worms and its associated microbes, which acts as growth promoters along with other nutrients. Because

of all these vital substances, vermicompost has multifarious effects that influence the growth of *Capsicum annum*. The results of the present study are in bar with Gajalakshmi, Abbasi⁵ who

reported that the impact of vermicompost on the growth and flowering of *Crossandra undulaefolia*, on several vegetables showed maximum growth and yield.

Figure 1
Effect of vermicompost on *Capsicum annum* after 15 days

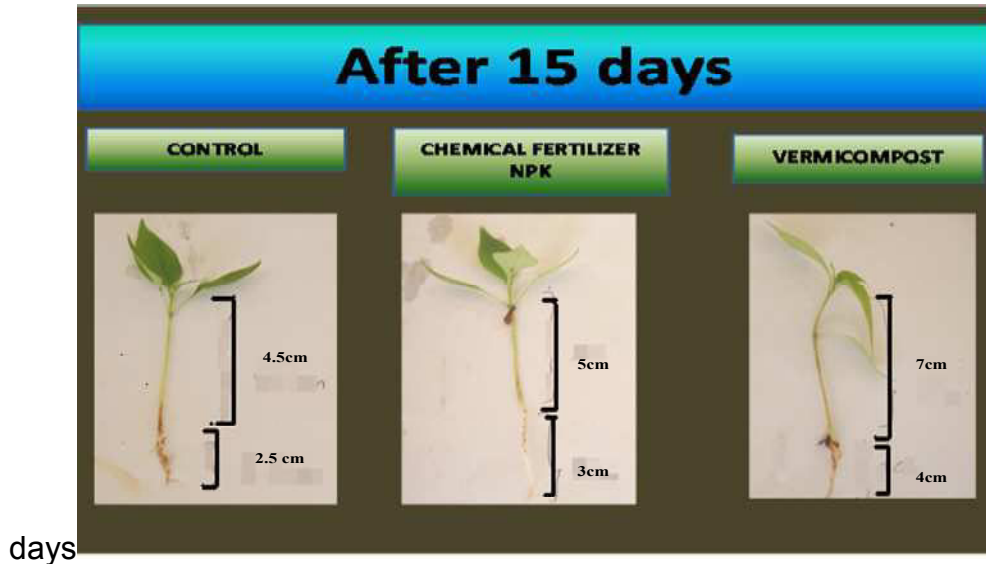
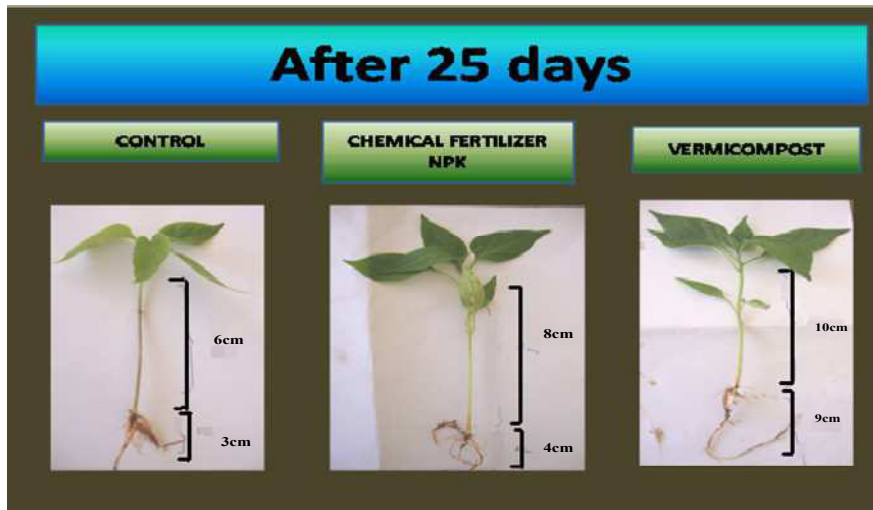


Figure 2
Effect of vermicompost on *Capsicum annum* after 25 days



There was found to be an increase in the shoot length, root length and the number of leaves on the plant treated with vermicompost.

CONCLUSION

Investigations were carried out to explore the potential of selected earthworm namely *Eudrilus*

eugeniae in the degradation of Lady's finger waste and to convert the waste into organic

manure called as vermicompost. The Lady's finger waste was collected from Karunya Ladies hostel, Coimbatore. The collected waste was allowed to partially decompose for 20 days. Then the wastes were mixed with cow dung in a ratio of 3:1. The exotic species (*Eudrilus eugeniae*) was collected from Selvam Organics, Pollachi and cultured in laboratory for proper growth and survival. The levels of macro nutrients like nitrogen, phosphorous, potassium and micro nutrients like iron and copper showed higher levels in the vermicompost as compared to the control. The levels of enzymes like amylase, cellulase and invertase showed higher enzyme activities on the 25th day of composting. The compost digested by the earthworm showed an increase in the level of biochemical parameters like protein and it was found to decrease in case of carbohydrate on the 25th

day of composting. The following parameters were noticed by the studies on the effect of inorganic fertilizer and vermicompost on the growth parameters in *Capsicum annum*.

a) Growth parameters

The growth parameters namely shoot length and number of leaves were maximum in vermicompost applied plants followed by inorganic fertilizer applied plants. Our present study on the growth parameters in *Capsicum annum* substantiates the vermicompost action on the yield of the plants. With regard to further studies we are planning to collect different types of degradable fruit and vegetables wastes and degrade it with different types of earthworm species and also to check the productivity of the vermicompost obtained on the growth and yield of various vegetable and medicinal plants.

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