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IMPACT OF VERMICOMPOST PREPARED FROM PENAEUS INDICUS SHELL WASTE AND THE LEAF WASTE OF CELOSIA ARGENTEA, JASMINUM SAMBAC USING EUDRILUS EUGENIAE.

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Abstract: In addition to harming human health and the environment, the widespread use of artificial fertilizers and pesticides in agriculture has killed beneficial microbes, degraded soil fertility, and reduced crops' natural resilience to disease. We are rushing to find alternatives to preserve the quality of the land in order to address these issues. Vermicomposting is a lucrative business since many people today choose organic veggies, fruits, and other items because they are made without the use of dangerous chemicals. In addition to giving plants nutrients and hormones that promote growth, vermicompost also strengthens the soil's structure, which increases the soil's ability to hold water and nutrients. The vermicompost prepared using the species *Eudrilus eugeniae* has aided well in converting the raw waste into usable organic waste in the compost, and further the fortified with the leaves of *Jasminum sambac, Celosia argentea*, and shell waste of *Penaeus indicus* were tested for the growth of the earthworm and soil fertility. The results evidently revealed that the different types of wastes have increased the fertility of the soil in terms of soil components as well as substantial growth of the species *Eudrilus eugeniae* accordingly.

Keywords: Vermicompost, *Eudrilus eugeniae*, leaf waste, prawn waste.

1.0 INTRODUCTION

Vermicomposting is a scientific process for creating compost that makes use of earthworms, which are often present in soil and feed on biomass before excreting it as "vermicasts," which are nitrate- and mineral-rich materials rich in phosphorus, magnesium, calcium, and potassium. These improve soil quality and are used as fertilisers (Yatoo *et al.,* 2021). Vermicompost has drawn more attention recently as a result of its exceptional physico-chemical and biological characteristics (Huang et al. 2014). Physically, soils that have been amended with vermicompost have better aeration, porosity, and structure (Zhu *et al.,* 2017), and parameters like pH, conductivity, organic matter, and nutrient status have significantly improved as a result of the application of vermicompost and improved crop growth and yield (Lim et al. 2015).

The "African Nightcrawler," also known as *Eudrilus eugeniae*, is a type of earthworm that is endemic to tropical west Africa and is now common in warm climates under vermicompost. It is a fantastic source of protein and has significant medicinal potential. An ideal temperature range for the African Nightcrawler is between 24 and 30 °C. In 8–10 weeks, the maximum weight of 2.5 grams occurs. By supplying nutrients and favorable environmental circumstances, the addition of cow dung to soil is necessary for earthworm activity and reproduction, which in turn aids in the recovery of nutrients from soil (Bhat *et al.,* 2016, Bhat *et al.,* 2017).

Vermicompost modifies the soil's structure and improves water retention capacity in addition to introducing microbial organisms and nutrients with long-lasting impacts. The physical characteristics of the soil may also be significantly impacted by worm compost. In addition to this, the plant nutrients N, P, K, Ca, Mg, S, Fe, Mn, Zn, Cu and B included in vermicompost when used as a plant enhancer have a favourable impact on plant nutrition, photosynthesis, the chlorophyll content of the leaves, and enhances the nutrient content of the various plant components (roots, shoots and the fruits). Because it encourages the synthesis of phenolic compounds like anthocyanins and flavonoids, which may enhance plant quality and serve as a deterrent to pests and diseases, vermicompost's high humic acid content benefits plant health (Theunissen *et al.,* 2010). Amylase, lipase, cellulase, and chitinase are a few of the enzymes found in vermicompost that can break down organic matter in the soil to release nutrients and make them available to plant roots (Chaoui *et al.,* 2003)

2.0 METHODOLOGY

The compost was prepared in a plastic tank. The tank was designed to store a minimum of 25 kilograms of soil mixture. Gather the biomass from shell waste of *Penaeus indicus*, and the leaf waste of *Celosia argentea*, and *Jasminum sambac*. was roughly crushed after being shade dried for around 8 to 12 days. In the proportion of 2:1:1, soil, cow dung, and test biomass are combined. The material is well mixed before being gently filled as 10 kg in each tank.

After incorporating all the bio waste, the compost mixture was covered with dry straw or gunny bags after releasing the earthworms over it. The earthworms of similar sizes were selected and to each tank of 10 kg compost, 20 animals were introduced. The moisture level of the compost is kept constant by routine watering. In order to keep out pests like ants, lizards, mice, and snakes as well as shield the compost from rains and direct sunlight, the tank was covered with a thatch roof or a simple net. Keep an eye on the compost frequently to prevent overheating. Keep the temperature and humidity appropriate.

S.No.	Sample	Components in Compost preparation	Ratio of the components
1	Control	Soil : Cowdung : Cowdung	**2:2:1**
2	Test 1	Soil : Cowdung : *Jasminum sambac*	**2:2:1**
4	Test 2	Soil : Cowdung : *Celosia argentea*	**2:2:1**
5	Test 3	Soil : Cowdung : *Penaeus indicus*	**2:2:1**

After 50 days of composting, the size and weight of the earthworms were recorded, and samples of the compost were tested for macronutrient content.

3.0 RESULTS

Macronutrient Analysis

The macronutrients carbon, nitrogen, phosphorus, and potassium were evaluated before and after introducing the earthworms revealing that the species *E. eugeniae* had a great impact in improving the soil quality that was identified by the elevation of the nutrients that was evaluated arithmetically. Earlier the total carbon was found to be 17.5% before introduction of the worms, where at the end of 50 days the amount of total carbon was found to be 24.41%, 26.24%, 25.45%, and 29.64% in the control, compost with *J. sambac*, *C. argentea*, and *P. indicus* respectively. In the similar fashion the quantity of Nitrogen, Phosphorus, and Potassium also increased in a similar fashion.

Table 2: Macronutrient analysis of various test compost after 50days (in %)

S.No	Components	Before the introduction of Earthworms	After 50 Days of Earthworm introduction			
			Control	Test 1	Test 2	Test 3
1	Total Carbon	17.5	24.41	26.24	25.45	29.64
2	Nitrogen	1.61	2.18	2.40	2.21	3.10
3	Phosphorus	2.64	3.24	3.41	3.21	3.26
4	Potassium	2.18	3.18	3.10	3.41	5.61

Fig. 1: Macronutrient analysis of various test compost after 50days

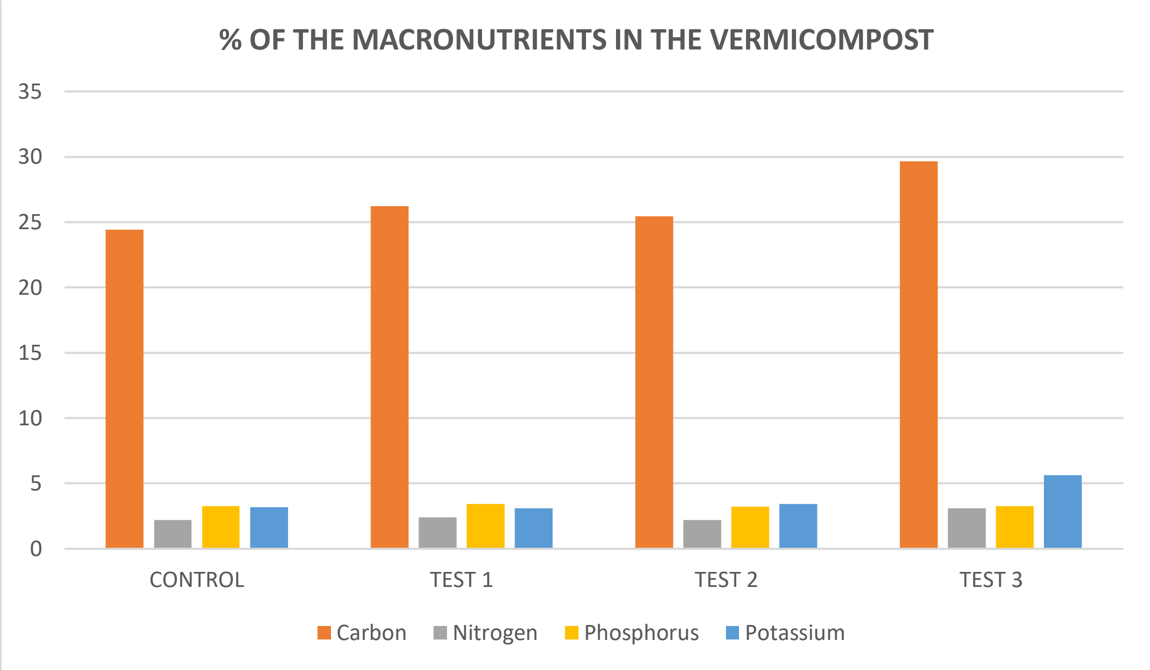
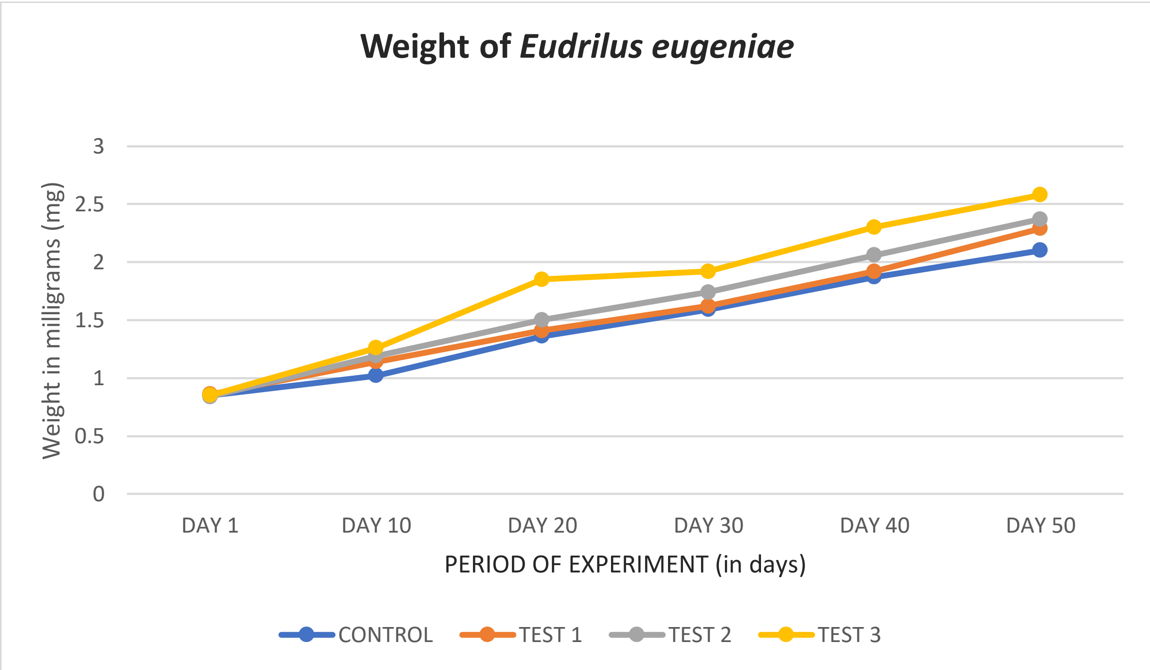


Fig. 2: Weight analysis of Eudrilus eugeniae in various test compost after 50days



The quality of the compost was evidentially fair in the compost fortified with *P. indicus* and then followed *C. argentea*, *J. sambac*, and then the control. The growth of the earthworm was also significant in the compost fortified with *P. indicus* and then followed *C. argentea*, *J. sambac* and the control.

4.0 DISCUSSION

Due to their positive impacts on a variety of soil qualities, compost or vermicompost made from various organic wastes is a vital agricultural supplement (Zandvakili et al. 2019). Vermicompost has been demonstrated to be more effective than compost as both an organic fertiliser and a bio-control agent (Edwards and Arancon 2004b). According to a meta-analysis, adding vermicompost to soil increases root and shoot biomass by 57 and 78%, overall biomass by 13%, and commercial crop yield by 26% on average (Blouin et al. 2019). Vermicompost can improve the development and productivity of any agricultural crop, including horticulture crops like tomato, brinjal, green beans, garlic, medicinal plants, and fruit like bananas, papayas, and pineapple. (Ravindra *et al.*, 2019; Samadhiya *et al.*, 2014;Soobhany *et al.*, 2017a.).

Correspondingly, the use of vermicompost amply proven the growth efficacy of spices like pepper (Arancon *et al.*, 2005), aro matic herbs (Islam*etal.*,2016a), cereals like rice, maize, and wheat (Bhattacharjee *et al.*, 2001; Doan *et al.*, 2015; Erdal and Ekinci 202 0), and ornamental plants (Atiyeh *et al.*, 2002). Vermicompost alone or in combination with fertilisers significantly increased all growth and yield parameters, such as total chlorophyll contents in leaves, dry matter production, flower appearance, length of fruits and fruits per plant, dry weight of seeds, yield per plot, and yield per hectare, in studies done on the effects on Lablab purpureas. Plots receiving vermicompost at 2.5 tons/ha produced the most fruit, with a yield of 109 tons/ha (Meena *et al.*, 2007).

The results of the vermicomposting by Soobhany *et al.,* 2015 demonstrated that the microbial activity in the gut, the gizzard's grinding motions, and the increased population density of microorganisms in the earthworm's cast caused a change in the chemical characteristics when organic substrates are utilised in the vermicomposting process. The type and quantity of waste that was utilised for vermiprocessing determines the nutrient contents of vermicompost in relation to the inoculation amount of *E. eugeniae*. Due to the rise in metal levels in its tissue, *E. eugeniae* was discovered to be a potent metal accumulator. Additionally, they can act as ecologists, attempting to have a significant impact on the physicochemical characteristics of the environments they inhabit.

Webster also reported that vermicompost use in soil builds up fertility and restores its vitality for a long time, and its further use can be reduced to a minimum after some years of application in farms, according to research on the impact of vermicompost on cherries that found that it increased yield of "cherries" for three years after "single application" (2005). According to Mago et al. (2021), An essential component of the vermicomposting process is the C:N ratio. In any vermicomposting system, a proper C:N ratio of the waste mixture is necessary for the survival of earthworms and microorganisms. According to Sharma and Garg (2019), earthworms' consumption of organic matter, cellulose, and hemicellulose may be the reason why the C:N ratio decreases more during the early stages of vermicomposting. Following the vermicomposting of various waste kinds, some researchers have noted a striking decrease in the C:N ratio (Sharma and Garg, 2017).

Earthworms contribute in the transformation of insoluble phosphorus into more soluble forms and increase the activity of phosphorus-solubilizing bacteria. Therefore, the increased phosphorus content of waste mixtures may be mostly due to the phosphatase enzyme present in the gut of earthworms (Mago *et al.,* 2021). According to Suthar (2008), vermicompost may have 64.1–112.8% more phosphorus than the original waste substrates.

Vermicompost applications were also reported by Adhikary to have a disease-suppressing effect on attacks by the fungi *Phomposis* and *Sphaerotheca fulginae* on grapes in the field, *Pythium* on cucumber, Rhizoctonia on radishes in the greenhouse, *Verticillium* on strawberries, and *Phomposis* and *Sphaerotheca fulginae* in the greenhouse, among others. Applications of vermicompost dramatically reduced the incidence of the disease in all of these studies. Additionally, they discovered that when the vermicompost was sterilised, the ability to suppress pathogens vanished, therefore demonstrating that the biological mechanism of disease suppression involved was microbial antagonism. Additionally, a variety of indirect effects on plant development, such as the reduction or suppression of plant diseases, have been linked to vermicompost. Other organic additions like manure and compost have been extensively studied for their ability to control plant diseases (2012).

However, from an ecological and economical standpoint, vermicomposting technology may be one of the best ways to successfully dispose of a variety of degradable waste, improve the quality of the environment, and be utilised as a superior alternative to fertilisers.

5.0 CONCLUSION

Thus, the physical aspects of the soil is improved by the vermicompost, which also helps plants develop strong roots. The soil's fertility and water resistance are both improved by vermicomposting. Additionally, auxins, gibberellic acid, and other plant growth hormones are used to nourish the soil and aid in germination, plant growth, crop yield, etc. hence the role of *Eudrilus eugeniae* are said to have significant role in converting the degradable materials into organic components.

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