Tea Dust Powder into Valuable Organic Fertilizer Using *Eudrilus euginae*

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**ABSTRACT**

Wastes are the very big query of this century and its disposal is to be ecofriendly. As a result there is a magic called vermicomposting in which without troubling the environment, using tea dust powder and observes different reproductive stages of the worms, cocoons and cast potential for sprouting. The nature and texture of control and pre-decompost mixture with tea dust powder and cow dung mixture were partially composted with 60 days and fully composted after 90 days. The yield has high nutrient worm casts and also observed cocoons and young ones. Vermi casts are enriched nutrient supplement to germination of cow pea seeds. This increases the plant growth parameters and enhanced the plant growth. Adult earthworm of *Eudrilus euginae* worked with the tea dust powder and produced casts gave the macronutrients and was utilized in seeds germination.

**Key words:** Cow pea seeds, *Eudrilus euginae*, Tea dust powder.

**INTRODUCTION**

Vermicomposting refers to the use of earthworms to alter biodegradable waste into high quality manure (Parekh and Mehta, 2015). Vermicompost is applied to high value crops as a source of plant nutrients. For instance, agro-based waste vermicompost has been utilized for greenhouse kale production in the Central highlands of Kenya (Karuku et al., 2018). Global waste production is predicted to increase from the current 2 billion tonnes per year to 3.4 billion tonnes in 2050 (Kaza et al., 2018).

Vermicomposting converts organic wastes into organic fertilizer (Rosman et al., 2017). Worms considered as tiller and a soil indicator for environmental quality because they contribute enriched soil to agricultural field. These earthworms are major producers of natural manure without any factories and considered as gift to farmers. (Annapoorani, 2014). Periodical physic-chemical analyses of different combinations of vermicompost were observed in declining trend from its initial days of vermicomposting. Considering the above facts was possible with the biocconversion of these organic wastes into manure probably minimizing the environmental pollution caused by their disposal (Mahaly, 2018).

Seed germination and growth are two important physiological processes that occur in a seed. Superior seed germination and seedling growth promises good yield of crop plants. *In vitro* experiments using different plant growth regulators in varied concentration on pulse crops are carried with an objective to improve quality of species and enhance crop production. Thus, different plant growth promoting hormones have distinct role in germination process and growth of pulse crop plants. (Sharma and Jain, 2016). Seed storage is an important factor on which the seed qualities greatly depend. Without proper storage seed quality degraded rapidly with absorbing moisture from the surrounding environment, which invites different diseases. (Islam et al., 2018).

**MATERIALS AND METHODS**

**Selection and collection of test animals**

The exotic, epigeic earthworm, *Eudrilus eugeniae* (Kinberg) is selected and collected from the agricultural farmyard in Karamadai and maintained in vermibed prepared with mixture of red soil and cowdung in the ratio 1:1. Sample of *E. eugeniae* was obtained from the vermibed and brought to the laboratory condition (29°C; 1 70% R.H) for 10 days. (Fig 1) shows the bulk sample of *E. eugeniae* along with an adult citallate worm.

**Collection of samples**

The substrates for vermicomposting such as tea dust powder after extraction of tea was collected from Avinashilingam Educational Trust Hostel, Coimbatore.

**Predigestion Process**

The vermibed was prepared by mixing dried cowdung with tea dust residues. During predigesting period water was sprinkled for aerobic degradation. After 20 days of predigestion the composting worms were collected from the mass culture. Six treatments were maintained in triplicates. In the prepared vermibed 10 worms/Kg was introduced. Experiments were carried for 60 and 90 days.
Preparation of pre-digested soil- cow dung mixture
Red soil was collected at different points in the university campus of Avinashilingam Institute for Home Science and Higher Education for Women and brought to the laboratory. The mixture of red soil and dried cow dung was prepared at the ratio of 1 : 1 w/w, sprinkled with minimum quantity of pollutant-free tap water and kept in large earthen tank for predigestion. Predigestion of organic mixture was carried out for a period of 21 days (Ramalingam and Thilagar, 2000) by regular mixing and turning of the red soil-cow dung mixture was used for mixing for further investigation.

Selection of treatment
For exposure of earthworms to different treatments of tea dust are used in the present study. The different samples are taken for present study they are T1, T2, T3, T4, T5 and T6 test conditions.

Exposure of worms to different samples
600gm samples were introduced with pre-digested red soil-cow dung mixture. 10 clitellate Eudrilus eugeniae were introduced in each tray. 300gms of pre-digested red soil and different concentration of cowdung mixture (without sample) was also kept in similar tray and introduced with ten worms. Control (C) and treatment mixtures (T1 to T6) were maintained under laboratory conditions (28±1°C) and at 60 to 70 percent of moisture by regular sprinkling with tap water every day. The trays were individually covered with thin net cloth in order to prevent the escape of the worms and also to provide sprinkle of water for the worms to work on the mixture. The worms were kept in room temperature for a maximum period of 60 and 90 days.

Observation of worms
During interval of every 30 days, worms in control and treatment trays were observed for the morphological changes of worms with minimum disturbance. The mixtures were photographed at the end of the treatment period of 60 and 90 days.

Soil management, seed germination and experiment
Experiment were carried out at the Department of Zoology Laboratory. Red soil and different treatment of vermicompost, homogenized to a fine texture and removing inert matter before being used for seed sowing. Red soil and caste of tea dust powder 1:1 (75g: 75g=150g). 10 Cow pea seeds of each treatment (cow pea seeds) were sown in each pot for germination. Three replications of each treatment were arranged in a completely randomized design (CRD). Watering was done every evening until completion of the experiment in Department of Zoology, Avinashilingam Institute for Home Science and Higher Education for Women, during the year of 2018-19.

RESULTS AND DISCUSSION
The control and remaining worm worked treatments were analyzed for 90 days. Final day each treatment was examined and results were analyzed. The texture of the control and worm worked mixture in all the treatment T0 to T6 was observed on 60 day. It could be observed that T1 to T6 mixture exhibited more granules of worm casts to red soil and cow dung mixture without worms.

The nature of control (soil-cow dung) and partially composted mixture (60 days) and fully composted mixture (90 days) of all treatments were observed. The earthworm...
survival was observed to find the degrading potential of treatments T1 to T6. Hence the following studies like physiochemical and micro nutrients in vermicompost were analyzed in order to find the quality of decomposed soil after 90 days of vermicomposting process were given in (Fig 1).

Control and treatment does not show any increased temperature and warmth. These were a positive appearance of treatment and the worms were good and healthy suppressed movement in day time and active movement in night time.

In the case of composting ability showed high range and in the process of reproductive analysis recorded normal and active cocoons, young ones and adults are multiple in numbers. This result proves the tea dust and cow dung mixture was the best substrate for vermicomposting.

Given the data on the different concentration of tea dust and cow dung mixture for a prolonged period of 90 days and it was observed that gradual increase of adults, cocoons and young ones. Compost process was carried out for 30 days with tea dust and cow dung mixture in wet condition, which was used for pre-decomposing process with earthworms.

**Germination studies using vermicompost**

Earthworms use a wide variety of organic materials has sufficient nourishment from the waste and produce good organic matter. Demanded that organic residues comprising, agricultural farms, household and kitchen wastes with dead or decaying materials can be used as bedding materials for vermicomposting. The data showed that application of vermicompost helped in significant germination and increase were as plant height, nutrient content.

The experimental results of different treatments of cow pea seeds as revealed significant responses of yield attributed. Application of tea dust significantly increased the growth parameters and enhanced the photo synthetic activity when compared to control. The sprouts grown well according to different concentrations when compare to control.

The results of the study clearly indicated that vermicomposting have better options for converting organic solid wastes into nutrients having rich organic bio fertilizer for improving productivity of crops. The study also revealed that *Eisenia fetida* is a good organic useful source which feed on any types of organic waste and then convert it into organic compost. The vermicompost being easily and cheaply produced can be used as a source of additional income (Paul, 2015). In contrast *E. euginae* worked tea dust powder gave good yield of casts and also it has reached potential germination of cow pea.

The used tea dust powder is the suitable substrate for making compost because already they diluted and it is a waste. The composition of various nutrients showed increment in their concentration. The pot assay results show the improvement in plant growth. The approximate of cost efficacy is also in the favour of making compost in this way (Gurav and Sinalkar, 2013). Above said results were go in line with the tea dust powder provides nutrient organic fertilizer for our kitchen garden.

In this vermicompost contain more amount of micro and macro nutrient compared to other composting methods. We use this *Vermicompost* for the plant and also we use ordinary soil and garden compost for the plant growth. We get good result in vermi-compost applying plant than other plants. (Celes et al. 2018). Readly available nutrients present in vermicast may help germination of seeds and also improves plant growth was observed in this experiment using *E. euginae*.

**CONCLUSION**

Earthworm’s active participate in the movement of top soil and sub soil makes the rotation as well as aeration to the soil which enriches the environment. This study helps to assess possible strategies to use the tea dust can be degraded using *E. euginae*. However it will eventually increases the number of surviving worms due to the rising source of nutrient. The contents of microorganism present in the soil for better humification and enhanced activity during the vermicomposting process which causes high mineralization and produce many cocoons and so many young ones. The tea dust waste is the suitable substrate for making compost is harmless, preferred for the sustainable agro waste management. It is also rich source of macro nutrient and high values of nutrients are the best biofertilizer may be preferable in agriculture field and also kitchen garden.

**REFERENCES**

Annapoorani, C.A (2014). Toxic effect of aluminium on reproduction and survival of *Eudrilus eugeniae* (Kimberg). International Journal Current Microbiology Applied Science. 3(5): 493-500.

Celes, S.N., Naveena, R., Panicker, L.T., Shalini, S and Amutha, M. (2018). Effect of vermicompost on plant growth. International Research Journal of Engineering and Technology. 2395-0056 S (3).

Gurav, M and Sinalkar, S. (2013). Preparation of organic compost using waste tea powder. National Conference on Biodiversity: Status and Challenges in Conservation - ‘FAVEO’. 97-99.

Islam, M. S., Hasan, M. K., Hossain, M. A. K. M., Hakim, M. A., Islam, S. M and El Sabagh, A. (2018). Germination of black gram (*Vigna mungo*) L. seed is influenced by different storage containers and storage periods.International Journal of Innovative and Emerging Research. 28: 70-89.

Kaza, S., Yao, L. C., Bhada-Tata, P and Van Woerden, F. (2018). A Global snapshot of solid waste management to 2050. Urban Development. Washington, DC: World Bank. © World Bank. https://openknowledge.worldbank.org/handle/10986/3 0172License: CC BY 3.0 IGO.

Mahaly, M., Abbiramy, K., Senthil, K., Arumugam, S. K., Kajiyaperumal, C and Karuppannan, N. (2018). Vermicomposting of distillery sludge waste with tea leaf residues. Sustainable Environment Research. 28: 223-227.

Parekh, S. A. and Mehta, M. J. (2015). Vermicomposting as sustainable option for organic waste management. International Journal of Innovative and Emerging Research in Engineering. 2(1): 13-20.
Paul, R. (2015). Vermicompost: A better option for waste management. Int J Curr Sci. 15: 98-102.

Ramalingam, R. and Thilagar, M (2000). Bio-conversion of agro-waste sugarcane trash using an Indian epigeic earthworm, Perionyx excavates (Perrier). Indian J. Environ and Ecostan. 3(3): 447- 452.

Rosman, P. S., Mohamad, M., Elangovan, T., Hasmi, N. A., Norzehan, E., Mahbob, M. and Anuar, W. N. H. W. (2017). Vermi composting using different substrates of spent tea waste; wood powder and orange peel powder as a potential electric generation. Paper presented at the Symposium on Innovation and Creativity (iMIT-SIC).

Sharma, A and Jain, N (2016). A study on effect of gibberlic acid on seed germination of urad bean. International Journal of Current Microbiology and Applied Sciences. 5(4): 347-350.