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Population Growth rate of African Night (*Eudrilus eugeniae*) Crawler Fed with Different Leguminous Leaves as Supplement

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ABSTRACT

Earthworms are not just converting garbage into valuable manure but also keep our environment healthy. The study was conducted to determine the growth rate of African Night Crawler (ANC) fed with different leguminous leaves as a supplement. A total of 15 worm bins were used for the 5 treatments replicated 3 times adopting the Completely Randomized Design (CRD). The worms were fed with different leguminous leaves as a supplement in a 25% volume to other substrates. The treatments of the study were the following: Treatment 0 (control), fed with rice straw and manure, Treatments 1, 2, 3 and 4 fed with ipil-ipil, kudzu, madre de cacao, and peanut, respectively, with the ration of 1 part cattle manure, 2 parts rice straw and 1 part legume or 1:2:1. The result

showed significant differences in the final weight and in the final population of the worms. Earthworms fed with madre de cacao as supplement obtain the heaviest weight and highest population. It is noteworthy that peanut and Ipil-Ipil had more than doubled the population growth rate of African Night Crawler (ANC) while Madre de cacao had tripled the increase. The study showed that vermiculture utilizing a 1:2:1 ratio by weight of cattle manure, Rice straw added with different legumes had affected the population growth rate of African Night Crawler.

Keywords **—** African Night Crawler, Leguminous leaves, supplement, population growth rate, culture substrate, experimental design, Philippines

INTRODUCTION

Earthworms are invertebrate animals that have a tube shape, soft and segmented body. They belong to Olegocheata of the Annelida phylum. African night crawler (*Eudrilus eugeniae*) is the worm commonly used in vermicomposting. Is an earthworm species indigenous to Africa but extensively bred in the USA, Canada, Europe and Asia (Dominguez, Edwards, & Subler, 2001). It is a large worm that grows extremely rapidly and is reasonably prolific (Madge, 1969; Neuhauser, Kaplan, & Hartenstein 1979; Viljoen and Reinecke, 1989; Reinecke, Viljoen, & Saayman, 1992; Reinecke and Viljoen, 1993). It can stay up to the 6 – inch portion of the topsoil but is dependent on decaying organic materials above the soil for survival (Appelhof, & Olszewski, 2017).

Earthworm sucked cattle manure or farmyard manure along with other farm wastes and converted them into compost. Other non – toxic solid and liquid waste of the industries and household garbage can also be converted into vermicompost. Earthworms are not just converting garbage into valuable manure but also keep our environment healthy. The earthworms seem that they don't eat, they derived their nourishment on the microorganisms that are eating the organic matter (Oliver, 1941).

Vermicomposting which is an oxidation and stabilization process which utilizes the action of the earthworms and microorganisms produces stable, non-toxic materials suitable for as soil conditioner. It also has the lowest bioavailable heavy metal content than other conventional compost (Dominguez, Edwards, & Subler, 1997).

Knowledge about the reproduction in earthworm is necessary for effective utilization of its potentials in animal agriculture (Ndelekwute, Essien, Assam, & Ekanem, 2016). This is because due to renewed interest in the use of earthworms in soil restoration schemes (Brun, Cluzeau, Trehen, & Bouché, 1987); waste management (Tripathi & Bhardwaj, 2004) and animal feeding (Taboga, 1980). Recent researches are focused on examining ways of manipulating environmental conditions in order to maximize growth and reproduction rate. Maximization of reproduction rate may be possible with good knowledge of reproduction dynamics.

OBJECTIVES OF THE STUDY

The objectives of this study were to determine the growth performance of African Night Crawler (ANC) or earthworm fed with different legumes as a supplement. Specifically, the study sought to 1) Determine the growing population rate of the vermin in each treatment; 2) Identify which of the different legumes used gives the best result on the reproduction of earthworm.

METHODOLOGY

Research Design

Worm bins were laid out adopting the Completely Randomized Design (CRD). There were five (5) experimental treatments replicated 3 times with a total of 15 worm bins.

The experimental treatments of the study were the following:

To = Control (rice Straw, Cattle manure)
T1 = (Rice Straw, Cattle manure) + Ipil-Ipil
T2 = (Rice straw, Cattle manure) +kudzu
T3 = (Rice Straw, Cattle manure) +Madre de Cacao
T4 = (Rice straw, Cattle manure) + Peanut

Research Site

The study was conducted at the vermihouse of the college of agriculture and technology of Jose Rizal Memorial State University-Tampilisan Campus. The area is shaded and well-drained with available water and a cool temperature.

Experimental animal

The study used 500 grams of African night crawler per treatment. The worms were obtained from the reliable source who is a farmer cooperator of the vermicomposting facility of the Department of Agriculture.

Collection of organic materials/substrate

Different legume leaves such as ipil-ipil, kudzu, madre de cacao, peanut leaves were collected and air dried, cattle manure and rice straw were also collected, air dried shredded and placed in separate bags ready for its use.

Shredding

The substrate materials, rice straw, and cattle manure were chopped into a finer size to facilitate easy sucking of worms using the shredder machine.

Fermentation

The base materials of the culture substrates were prepared in a ratio of 1:2:1 (cow dung, rice straw, legumes) and was properly mixed and moistened, then was covered with polyethylene plastic to initiate anaerobic decomposition for 15 days before placing in the bins.

Placing of substrates in the bins

After the fermentation, the substrate was placed six (6) inches from ground level in the worm bins. The different leaves were incorporated into the decomposed substrate. Addition of fermented substrates to the corresponding worm bin was done when the substrates are already consumed.

Distribution of earthworm

African night crawlers were distributed equally to all worm bins in equal weight after the initial counting of worms was done.

Maintenance of media

The substrates were moistened regularly (every other day) to provide the right moisture (60 – 80%) for the earthworms to grow and multiply. Ants were controlled by providing enough water to the substrate to deter and drive them away.

Harvesting of casts

The casts were harvested manually. Watering the substrates was stopped three days before harvesting to ease the separation of the cast.

RESULTS AND DISCUSSION

The Average initial weight of African Night Crawler

At the beginning of the experiment, the earthworms were weighed at 500 g per treatment per replication. As presented in Table 1.0, the weight of the earthworms in Treatment 0, 1, 2, 3 and 4 was homogenous.

The Average final weight of African Night Crawler

After 90 days duration, the earthworms were weighed. As presented in Table 1.0, ANOV showed significant differences among treatment means. Post Hoc analysis using Duncan showed that the weight of the earthworms in Treatment

3 significantly had a heavier weight of 2,433.33 g but did not differ with T_4 had 2,016.67 g and T_1 had 1,966.67 g, while T_0 had 1,566.67 g and T_2 had 1,483.33 g obtained lighter earthworms but were comparable with T_1 and T_4. This implies that the final weight of earthworms was affected by the supplementation of leguminous leaves. Result obtained for the number and weight production are less similar to the findings of (Kale, Bano, Vinayak & Bagyaraj, 1986; Nagavallemma et al., 2004; Basheer, Kumar, Ganai, & Agrawal, 2013) who reported an increase in number and weight of earthworm on the basis of quality and quantity of available food. Furthermore (Monebi, & Ugwumba, 2013) mentioned that earthworms cultured in cellulose substrate had the highest total weight gain.

Average initial population

The number of African Night Crawler was weighed for every treatment as shown in summary table 1.0. The mean population for Treatments 0, 1, 2, 3 and 4 were 494.00, 497.33, 479.00, 492.67 and 489.00 pieces, respectively. Levene test of homogeneity of variance is not significant. This implies that the number of populations in each treatment at the start of the study were homogenous.

The Final population of the earthworm

As shown in Table 1.0, the final population of earthworm significantly differed. Post Hoc Test shows that earthworms in Treatment 3 and Treatment 4 with 2,202.00 and 1,821.00 were a comparable number to Treatment 1 had 1,794.33 and Treatment 0 had 1,441.33 but significantly obtained more population of earthworms than Treatment 2 had 1,339.33. Treatments 0, 1 and 2 had a comparable population of earthworms. The differences between the populations of earthworms were contributed to the possible migration due to the moisture, temperature, practical and appropriate practices as basic requirements of earthworms. These findings find support with Zaller et al. (2013) the decline of earthworm individuals might have occurred within the last week before harvest when watering was stopped to facilitate harvesting and some earthworms probably also naturally died during the course of the experiment or might have escaped despite above- and belowground barriers.

Population growth rate

The population growth rate as reflected in Table 1.0 indicates that T_3, T_4 and T_1 figuratively had a higher population growth rate of 346.95, 272.39 and 262.55, respectively. However, T_0 and T_2 had a lower growth rate result of 191.77

and 179.61%. The result implies that the population in Treatment 3 had tripled increase and the population in Treatments 4 and 1 had more than doubled. Studies of Sonia, Felix, and Antony (2016) the earthworm's survival and growth depend on the physical and chemical profile of the feedstuff used in the substrate. The reasons for the enhanced growth and reproduction in T_3, T_4 and T_1 in the present study can also be attributed to the presence of cellulose, hemicellulose, lignin content and enhanced water holding capacity which enables the T_3 to maintain good an ideal moisture as stated by Soniya and Dhanasekaran (2015). Earthworm survival is dependent on soil moisture and on organic matter rich in nitrogen. Leguminous plants which are rich in nitrogen may have further enhanced the availability of nutrients an added benefit in the substrate to boost the growth and reproduction of the worms.

Table 1. Summary on the Initial and Final Weight and an Initial and Final Population of Earthworm as Affected By the Different Leguminous Leaves as a Supplement

Treatment (Different Legumes)	Weight of earthworms (g)		Population of earthworm		Population growth rate (%)
	Initial	Final	Initial	Final	
T_0 – control	500	1,566.67^{b}	494.00	1,441.33^{ab}	191.77
T_1 - Ipil-ipil	500	1,966.67^{ab}	497.33	1,794.33^{ab}	262.55
T_2 – Kudzu	500	1,483.33^{b}	479.00	1,339.33^{b}	179.61
T_3 - Madre de Cacao	500	2,433.33^{a}	492.67	2,202.00^{a}	346.95
T_4 – Peanut	500	2,016.67^{ab}	489.00	1,821.00^{a}	272.39

Note: Treatment means with the same letter vertically do not significantly differ using ANOV and DMRT.

CONCLUSION

The feasibility of using earthworms for waste management as well as a potential source of protein depends on the fundamental knowledge of the basic parameters governing the survival, growth and reproduction of earthworm. The present study emphasized that the reproductive potential of the earthworm is highly influenced by the quality and availability of food. It was concluded that the different legumes fed to the worms as a supplement have a significant effect on the growth and reproduction of earthworm. The investigation had also established

that madre de cacao added as a supplement after the partial decomposition of waste material has an excellent palatable raw material for vermiculture.

TRANSLATIONAL RESEARCH

The findings of the study may be best translated to various media of communication for information dissemination and promotion through extension (RD&E) programs and activities of the agriculture sector. Results also can be made available to relevant Philippine agencies related to organic fertilizer production to improve the procedure and to standardize output.

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