

Vermicomposting Using Waste Papers as Substrates for African Night Crawler (*Eudriluseugeniae*)

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Abstract: As part of the implementation of Solid Waste Management Program, accumulating volumes of waste paper generated is everybody's concern. Proper waste disposal and segregation should be done. Thus, a research was conducted utilizing the different waste papers as substrates for African night crawler (*Eudriluseugeniae*). The objective of the study is to determine which among the different waste papers is the best substrate for African night crawler as compared with those fed by agricultural wastes. The study was conducted using Completely Randomized Design. Results revealed significant differences in the change in weight of African night crawler, weight of waste paper consumed, weight of vermicompost produced, number of eggs and number of juveniles produced by the African night crawler after feeding with the different waste papers. Feeding the African night crawler with carton and bond paper resulted in significant increase in weight of African Night Crawler, number of juveniles, weight of consumed paper and weight of vermicompost produced. On the other hand, the combined agricultural wastes gave the highest number of eggs produced. Therefore, waste papers such as carton, bond paper and newsprints can be used as feeding materials for African night crawler. Carton and bond paper were the best substrates over newsprint for improved vermicompost produced, increase in African night crawler biomass, weight of vermicompost produced and number of juveniles.

Keywords: vermicomposting, *Eudriluseugeniae*, African night crawler, waste paper, substrates

1. Introduction

Over the years, garbage problems in the country are considered one of the serious problems both in the rural and urban setting. The improper and indiscriminate disposal of wastes has compounded the problem. As a solution to this, Republic Act 9003 (Ecological Solid Waste Management Act) was enacted to help lessen the problems in waste handling and disposal. Proper segregation of wastes is an important component embodied in the guidelines. Sad to note, that in spite of the efforts to implement and solve the problem in waste segregation, many do not follow and cannot internalize the changes on waste segregation. This scenario makes it difficult for the implementor to successfully implement and follow guidelines contained in the Ecological Solid Waste Management Act. The indifferent attitude and reluctance of the populace make it difficult for the implementor to gain success in solving problems on waste management.

In Nueva Vizcaya State University, as an academic institution serious efforts were done to implement the guidelines in the solid waste management act. In fact, the University has a unit assigned to take good care of the wastes generated within the campus. However, full success has not been attained because of the attitude of some stakeholders.

The University generates agricultural wastes from the different projects and waste papers from different offices. In support to the problem on wastes management, the Center for Environmental Resources Management and Sustainable Development (CERMSD) has initiated vermicomposting utilizing wastes from the different projects. It is now in full swing and also contributes modest amount to the university for sale of vermicompost. However, it was also observed

that there were accumulating volumes of different wastes papers generated in different offices within the campus. These wastes need immediate attention and recycling them is necessary for more efficient utilization instead of throwing or burning them. Moreover, burning of wastes is prohibited under the ecological solid wastes management act because of its hazards to the environment and to humans. Furthermore, backyard burning or simply burning of garbage releases toxic air pollutants which leads to respiratory diseases like asthma, bronchitis, lung cancer, and even death [4].

To provide solution on this problem, this study sought to find a positive and useful way in recycling wastes paper through vermicomposting. Vermicomposting is a method of composting using earthworms to turn organic wastes into very high quality compost [2]. The paper wastes served as feeding materials to *E. eugeniae*, a composting earthworm and considered the most efficient vermicomposting species. Thus, this study in vermicomposting using different waste papers as substrate is very necessary for proper waste management.

2. Objectives

The general objective of the study was to determine which among the different waste papers is the most preferred by the African Night Crawler (*Eudriluseugeniae*) for vermicomposting. Specifically the study aimed to:

1. Determine if there are significant differences on the weight of vermicompost produced, weight of waste papers consumed, change in weight of African night crawler, number of eggs and juveniles produced by *E. eugeniae* when fed with cartons, bond paper and newsprint; and

- determine which type of waste paper is the best substrate for *E. eugeniae*.

3. Methodology

The study was conducted for five months at the Center for Environmental Resources Management and Sustainable Development (CERMSD), Nueva Vizcaya State University Bayombong, Nueva Vizcaya, Philippines.

Two kilograms of African night crawler were procured from Bay, Laguna Philippines and were temporary fed with mixed agricultural wastes while waiting for the date of the experiment and also for acclimatization for one month. Waste papers were collected within the campus while hog manure was collected in the Swine Project of the university.

A 1 m x 5 m concrete vermicomposting bed was prepared for the experiment, which was divided into twelve compartments for the different treatments following the experimental layout of the study. The flooring of the vermicomposting beds were lined with sacks.

Preparation of Feeding Materials

The control treatment was prepared using 20kgs (dry weight) of combined rice hay and grass clippings mixed with dried and ground hog manure. Tap water was added to the mixture to maintain 60% moisture and was set aside and covered with plastic for two weeks for predecomposition process. After two weeks the preparation for other treatments was done. Three types of waste papers namely: cartons, bond paper and newspapers were used. Ten kilograms (dry weight) each of cartons, bond paper and newspapers were shredded using a shredder. Thirty kilograms (dry weight) of hog manure was dried and ground. Mixture of each feeding materials was 10kgs of the waste paper (carton, bond paper and newsprint) was added with 10kgs of hog manure. After mixing the feeding materials, tap water was added to the mixture to maintain the 60% moisture requirements. The following were the corresponding proportions of feeding materials per treatment:

- T₁- 20kgs of predecomposed rice hay, grass clippings and hog manure (Control)
- T₂-10 kgs of shredded cartons and 10kgs of dried, pounded hog manure
- T₃-10kgs of shredded bond paper and 10kgs of dried, pounded hog manure
- T₄-10kgs of shredded newsprint, and 10kgs of dried, pounded hog manure.

The experiment was laid out in a Completely Randomized Design (CRD) replicated four times. All treatments were added with water to maintain the 60% moisture requirements of the substrates. The prepared substrates per treatment was divided into four for replications 1, 2, 3 and 4 and placed in a cemented compost bin based on the lay-out of the study. One hundred grams (100 g) of *E. eugeniae* were placed in each compartment with the prepared feeding materials. The set-up was covered with black net for protection and watering was done as needed. Thirty days after stocking of African night

crawler the experiment was terminated. Data on weight of vermicompost produced, the weight of waste papers consumed, change in weight of African night crawler, number of juveniles and eggs of *E. eugeniae* were gathered and subjected to F-test using the Analysis of the Variance. The gathered data was analyzed using the SPSS 11.5 Statistical program.

4. Results and Discussion

African Night Crawler (*Eudriluseugeniae*) is a composting earthworm and efficient in converting wastes into vermicompost. This study determined if there are significant differences in the vermicompost produced using different types of waste papers as substrate compared with combined agricultural wastes. Results of the Analysis of the Variance (ANOVA) revealed significant differences on the weight of vermicompost, weight of consumed waste paper, change in weight of African night crawler (ANC), number of juveniles and number of eggs of African night crawlers.

5. Weight of vermicompost

The weight of vermicompost produced by African night crawler after feeding with different types of waste papers as substrate was found significant. The weight of vermicompost obtained using different waste papers as feeding materials to African night crawler were higher (2943 g, 3199 g and 2872 g) than those fed with agricultural wastes (1800 g) and served as the control (Figure 1). There was an increase in the amount of vermicompost produced of 63.5% for carton (T₂), 77.72% for bond paper (T₃) and 59.56% for newsprint (T₄).

The study conducted by Afidchao et al. (2007) also revealed significant differences on the amount of vermicast produced by African night crawler when fed with different types of agricultural wastes [1]. On the contrary, study conducted by Paraguas et al. (2013) using different types of waste papers as feeding materials did not yield significant different on the amount of vermicast produced by the African night crawler [3]. Similarly, in another study conducted by Lagrio (2007) using different ratios of mushroom spent as feeding materials to *E. eugeniae* did not give significant differences on the amount of vermicast produced by the African night crawler [2].

Figure 1: Weight of vermicompost produced by *E. eugeniae*

Weight of waste paper consumed

The *E. eugeniae* preference for the different types of papers used in the study as shown in the amount of waste paper consumed differs significantly. Among the three waste papers fed, carton gave the highest consumption (4788.75 g) while newsprint had the lowest (901.44 g) and the least preferred by *E. eugeniae*. Mixed agricultural wastes, carton and bond paper were most preferred by *E. eugeniae* over newsprint (Figure 2). This might be due to the ink used in the newsprint which make it less preferred by the African night crawler worms. Similarly, significant differences were also observed in a study using different waste papers fed to *E. eugeniae*[3].

those fed with mixed agricultural wastes (T1) and those fed with bond paper (T3).

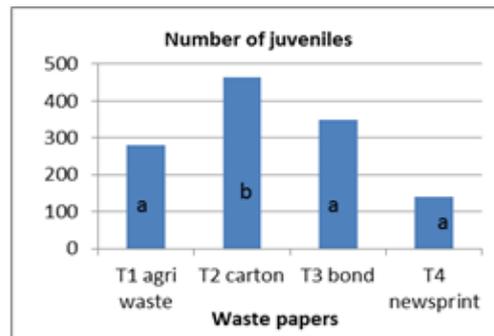


Figure 4: Number of juveniles of *E. eugeniae*

Number of eggs produced

The reproductive potential of African night crawler being a polyembryonic species was found affected by the feeding materials given. Feeding them with mixed agricultural wastes (308) resulted in the highest number of eggs produced but was comparable with those fed with carton (118) and bond paper (198). African night crawler fed with newsprint (50) had the lowest number of eggs produced.

Figure 2: Weight of waste paper consumed by *E. eugeniae*

Change in weight of African night crawler

The change in weight of the African night crawler was significantly affected by the feeding materials given to them. Based on the result, the highest change in weight was observed for those fed by carton (78.75 g) and bond paper (72.50 g) while the lowest were those fed with mixed agricultural wastes. This finding conformed with the studies of Paraguas et al. (2013) using different waste papers [3] and with Afidchao et al. (2007) using different agricultural wastes as feeding materials to *E. eugeniae* [1].

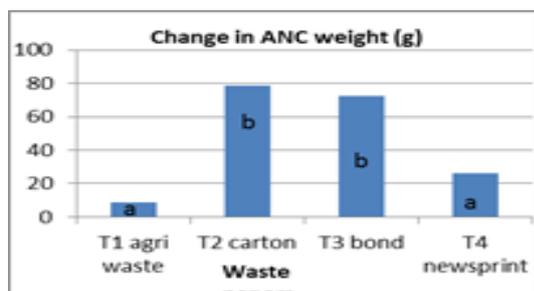


Figure 3: Change in weight of *E. eugeniae*

Number of juveniles produced

African Night Crawler is a polyembryonic organism and therefore capable of producing several eggs. Results of the experiments revealed significant difference on the number of juveniles produced by African night crawler. Those African night crawler fed with carton had the highest number of juveniles produced (464) followed with those fed with bond paper (350). Those fed with newsprints (141) had the lowest number of juveniles produced and was comparable with

Figure 5: Number of eggs produced by *E. eugeniae*

6. Conclusion and Recommendation

Waste papers like cartons, bond papers, newsprints can be used as feeding materials for *E. eugeniae*. Significant differences in weight of vermicompost produced, weight of consumed waste paper, change in weight of African night crawler, number of juveniles and number of eggs produced by the African night crawler after feeding with the different waste papers as substrates. African night crawler with carton and bond paper as substrates resulted in significant increase in the weight of vermicompost produced, weight of consumed paper, change in weight of the earthworms and number of juveniles. On the other hand, combined agricultural waste gave the highest number of eggs produced.

Findings revealed that waste papers such as carton, bond paper and newsprints can be used as feeding materials for African night crawler. Based on the findings of the studyvermicomposting using carton and bond paper as substratesresulted in an improved biomass production of

African night crawler, increase in vermicompost produced and increase in the weight of waste papers consumed and number of juveniles. However, it is suggested that combination of different ratios of waste papers as substrate should also be explored as well as the evaluation and analysis of their nutrient contents.

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