Vermicompost Production using Rabbit (Oryctologus cuniculus) Manure

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ABSTRACT

This study aimed to use rabbit manure as a raw material in vermicomposting and to determine its nutrient content. It converted the manure collected from the Bulacan Agricultural State College rabbit project into vermicompost and was able to produce 12 sacks of vermicast within two semesters. Based on the results of the nutrient analysis, vermicast from rabbit manure had 1.64% total nitrogen, 1.90% total phosphorus, 2.45% total potassium, 18.65% organic carbon, 32.07% organic matter, and 11:1 carbon-nitrogen ratio. Comparison with vermicompost from other animal manure (goat, carabao and cattle) using the same substrates in the College showed that rabbit manure had comparably higher nitrogen, phosphorus, potassium than goat, carabao, and cattle manure; and higher organic carbon and organic matter than carabao, and cattle manure; and lower carbon-nitrogen ratio compared with the three other animal manure

Keywords

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Introduction

The conversion of agricultural land to residential areas, commercial buildings, roads and other non-food producing land use are the sign of urbanization. Philippines is a developing country that quickly converts agricultural land to a more intensive and job-producing buildings. In addition, soil degradation is continuously occurring causing agricultural production to be lesser productive than expected. The soil that used to be productive turns to be acidic and unfertile, becoming less productive. Land conversion and degradation causes decrease in food production, but can be contemplated by having a productive soil with high organic matter content.

Animal manure is commonly used as organic fertilizer to plants. These can be used by direct application but most effective when composted. Bulacan Agricultural State College has its own rabbit production project. Rabbit is an herbivore animal that feeds on grasses and other plants. Produced under science-based production systems, rabbits were shown to have growth and reproductive performance in Philippine condition which is comparable to other countries in the tropics (Nicolas et al., 2019). Like most animal manures, rabbit manure is an important source of organic matter and provides some nutrients as well (Lukefahr, 2010). Their manure holds essential nutrient elements like nitrogen, phosphorus, potassium and other nutrient elements. Rabbit manure can be used directly from under the hutch; while air-dried manure will not burn plants and can be used on top-dress lawns, or mulch roses, vegetables, and flower beds (British-Columbia 4-H, 2009). Rabbit manure has been used in composting together with rice straw and mushroom residue (Li-li *et al*, 2013).

Vermicomposting is a green technology that converts organic wastes into plant available nutrient rich organic fertilizer (Piya *et al*, 2018). Vermicomposting is a simple biotechnological process of composting, in which certain species of earthworms are used to enhance the process of waste conversion and produce a better end product (Saranraj and Stella, 2012). The earthworms do not only make the nutrients more available but also it becomes biologically active because of the microorganisms present in their digestive system.

Organic fertilizers greatly contribute to the micronutrient content of the soil. Organic fertilizers also help the soil to improve its structure for favorable root growth. In chemical properties of soil, organic fertilizer is known to have a high Cation Exchange Capacity (CEC) which is responsible for holding positively charge nutrients. It also contributes to the buffering capacity, drainage, and water holding capacity. In biological manner, living organism is higher in organic soil.

Philippine population is continuously growing making the demand for food also increase. Nowadays, Filipinos living in the urban area try to practice urban farming to support their food needs, specifically in the form of vegetables, and other horticultural crops. These urban farmers have embraced vertical farming, hydroponics, pot culture, square foot gardening and other ways of urban farming. Application of organic fertilizer in urban farmed vegetables is a popular way of supplying nutrients.

Objectives

The general objective of this research was to use rabbit manure as a raw material in vermicomposting and to determine its nutrient content.

Specifically, it aimed to:

a. Produce vermicomposted rabbit manure from the BASC rabbit project;

b. Determine the nutrient content and chemical properties of the vermicomposted rabbit manure; and

c. Compare the nutrient content to vermicomposted carabao, cattle and goat manure from BASC.

Methodology

Vermi-bed Preparations

This project utilized five available vermi compost beds in the vermicomposting project located at the College of

Agriculture, Bulacan Agricultural State College. These beds were prepared to support the environmental requirements of vermi (African Night Crawler).

The rabbit manure was the primary substrate to be used in vermicomposting, which was gathered from the Rabbit Production Project located at College of Agriculture, BASC. Other substrates that was used are Kakawate (*Gliricidia sepium)* leaves, Banana (*Musa spp.*) pseudostem and leaves, Ipil-ipil (*Leucaena leucocephala*) leaves, and Rice (*Oryza sativa*) straw. Banana pseudostem serve as egg deposition of African Night Crawler (*Eudrilus eugeniae*) and also to contribute to the nutrient content of the vermicast.

Table 1: Percent by weight of different substrates in the rabbit vermicompost

Substrate	**Percent by weight**
Rabbit Manure	30
Banana Pseudostem and Leaves	40
Kakawate leaves	10
Ipil-ipil leaves	5
Rice Straw	15

Vermicomposting Process

The raw materials were put in the bed in different layers. Rabbit manures were placed at the bottom of the bed, followed by chopped banana pseudostem and leaves together with the African Night Crawler. Another layer of rabbit manure will be placed together with other substrates (vegetable clippings, leaf litters, etc.). After all materials are layered, the bed was watered to promote moist condition. All materials were turned upside-down so that the raw materials was mixed; this will be done weekly. Watering was supplied regularly just to maintain moist condition. After months, the vermicompost was collected, separating the vermi, and was air dried and sieved.

Nutrient Analysis

Samples of the sieved vermicompost were submitted to regional soils laboratory, Regional Field Office III, San Fernando City, Pampanga for nutrient analysis. Analysis was done to determine its percent Total Nitrogen, Total Phosphorus, Total Potassium, Organic Carbon, Organic Matter and Carbon to Nitrogen ratio.

Results and Discussion

Vermicompost Production

In this project, majority of the manure from the BASC rabbit production project were converted into vermicompost. Within two semesters of the project, four vermi beds per semester, have been utilized and 16 sacks of rabbit vermicompost have been produced.

Nutrient Analysis

The vermicast from rabbit manure together with the other substrates Kakawate leaves, Ipil-ipil leaves, Banana pseudostem and leaves, and rice straw were subjected to nutrient analysis, and the results are shown in Table 2.

Table 2. Nutrient content of vermicomposted rabbit manure

Type of Soil Nutrient	**Contents**
Total Nitrogen (N), %	1.64
Total Phosphorus (P_2O_5), %	1.90
Total Potassium (K_2O), %	2.45
Organic Carbon (OC), %	18.65
Organic Matter (OM), %	32.07
Carbon Nitrogen Ratio (C:N)	11:1

When it comes to total nitrogen (%), the study yielded 1.64 %. This is similar to the results of Adeniyan *et al* (2011) wherein rabbit droppings have 1.04 % N, but different from the reported 3.3-3.7% by Lukefahr (2010). In terms of total phosphorus, the study revealed 1.90% P, similar again to Adeniyan *et al* (2011) with 0.99% P, likewise with Lukefahr with 1.3-5.2% P. For total potassium, the study got 2.45 % K_2O, near the reported 2.05 % Adeniyan *et al* (2011), but not within the range reported by Lukefahr (2010) which is 2.9-3.5 %. Lukefahr (2010) explained though that the level of N,P, and K will depend on the rabbit's level of nutrition. The study's result on organic carbon, 18.65%, is similar to those reported by Adeniyan *et al* (2011) that reported 16.7% organic carbon.

Comparison of Rabbit Vermicompost to Other Animal Manure

Table 3 shows the nutrient analysis of vermicast composted using rabbit manure compared to other animal manure such as goat, carabao, and cattle based on the research conducted by Tejada *et. al* (2019) at Bulacan Agricultural State College.

The table shows that the vermicast produced using rabbit manure contains 1.64% total nitrogen which is higher compared to all other vermicomposted animal manure.

Table 3. Nutrient analysis of different vermicomposted animal manure.

Laboratory Analysis	**Rabbit Manure**	**Goat Manure**	**Carabao Manure**	**Cattle Manure**
Total Nitrogen (N), %	1.64	1.26	1.21	0.74
Total Phosphorus (P_2O_5), %	1.90	1.35	1.06	0.78
Total Potassium (K_2O), %	2.45	0.33	0.38	0.18
Organic Carbon	18.65	25.23	15.83	15.90

(OC), %				
Organic Matter (OM), %	32.07	44.15	27.71	27.82
Carbon Nitrogen Ratio (C:N)	11:1	20:1	13.1	21:1

Vermicast using rabbit manure contains the highest amount of total phosphorus which is 1.90 percent followed by 1.35 percent from vermicast produce using goat manure while carabao and cattle manure has 1.06% and 0.78%, respectively.

The vermicast produce using rabbit manure contains the highest amount of total potassium (K_2O) which is 2.45%. Vermicast from Carabao, Goat and Cattle manure contains 0.38%, 0.33% and 0.18%, respectively.

Organic matter includes all the elements of organic compounds the carbon, hydrogen, oxygen, nitrogen, and others while organic carbon only counts the percent carbon. Carbon-to-nitrogen ratio or CN ratio pertains to the ratio of mass of carbon to the mass of nitrogen. The higher the CN ratio the slower the decomposition, while the lower the CN ratio the more it stinks. According to USDA Natural Resources Conservation Service (2011), soil microorganism needs a diet with a C:N ratio near 24:1 for its body maintenance and energy, 16 parts of carbon used for energy and eight parts for maintenance. If the C:N ratio is lower than 16:1 what happens is that the microbes leaves the excess nitrogen in the soil. This surplus nitrogen will be available for growing plants, or for soil microorganisms to use to decompose other residues that might have ratio greater than 24:1.

The vermicast from rabbit manure has lower percent of organic carbon compared to goat manure but higher than carabao and cattle manure. This is the same with the result from organic matter content which goat manure shows highest percent. Although all the substrates from the vermicomposting are all organic materials, the reason why the rabbit manure vermicast has lower organic matter maybe because it contains higher amount of cellulose or fibre from the rabbit fur which is harder to digest by the earthworms compared to the other substrates. The fur and dried leaves of grasses which were left uneaten by rabbits and fell from the cage were part of the collected rabbit manure that was used in vermicomposting. In terms of carbon nitrogen ratio (C:N ratio) vermicast from rabbit manure has the highest capability to supply nitrogen to the soil.

Conclusion and Recommendations

This research study aimed to produce vermicompost from rabbit manure derived from the BASC Rabbit Project. In two semesters, a total of 16 sacks of rabbit vermicompost have been produced. Analysis of vermicast using rabbit manure showed that it has a balance amount of total nitrogen, phosphorus and potassium which is comparatively higher than vermicompost produce using Goat, Carabao and Cattle manure. The organic carbon and organic matter content of the vermicast is lower than other vermicast, because the rabbit manure used contained other waste materials from the rabbit project such as fur and dried leaves of forages.

Future studies may be conducted using only the rabbit manure, removing the fur and dried leaves beneath the cages, in order to increase the organic carbon and organic matter content from rabbit vermicompost. Vermicast produced may be applied to the vegetables and crops grown in the College, and the effect of rabbit vermicast on their growth and yield may be studied and compared to other types of fertilizers.

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