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ANALYSIS OF THE QUALITY OF VERMICOMPOST FROM MIXED OF SAWDUST, BANANA STEMS, MANURE, AND VEGETABLE WASTE

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ABSTRACT

Excessive and continuous use of inorganic fertilizers can pollute the environment. Therefore, to support sustainable agriculture, other alternatives are needed to meet the nutrients, namely the use of organic fertilizers, such as vermicompost fertilizer. This study used sawdust, banana weevil, cow dung, and vegetable waste as thefeed and media for the cultivation of earthworms. This study aims to determine the content of N, P, K, C-org, C/N, and pH in the vermicompost fertilizer product. Earthworm cultivation was carried out from December 2020 to March 2021 in Perlabian Village, Kampung Rakyat District, South Labuhanbatu Regency. Worm cultivation was carried out with two feeding treatments. The first treatment was given 1 kg of cow dung which had been diluted with 1 liter of water plus 250 grams of vegetable waste (K1) and the second treatment was given 2 kg of cow dung diluted in 1 liter of water and 500 grams of vegetable waste (K2). Feeding is conducted every 2 to 3 days for 1 month. The results of the next study were analyzed descriptively (comparing the results of the study with the standard compost of SNI-19-7030-2004). The test results showed that K1 vermicompost contained C-Org of 8.89%, N of 0.75%, P of 0.16%, K of 0.26%, C/N of 11.85 and pH of 6.5. The K2 vermicompost comprised C-Org of 10.92%, N of 0.86%, P of 0.16%, K of 0.23%, C/N of 12.69 and pH of 6.5. Based on the results of the analysis, the vermicompost produced in this study met the SNI-19-7030-2004 standard as compost and the K2 vermicompost contained higher organic and nitrogen content than the K1 vermicompost.
Keywords : Banana Stem, Cow Manure, Sawdust, Vegetable Waste, Vermicompost

INTRODUCTION

Fertilization is one of the important activities in plant cultivation because it serves as a provider of nutrients that plants need to sustain life. Fertilization aims to increase soil fertility and biological activities carried out by adding adequate amounts of organic matter (Sianturi, 2019). Fertilization can be done by adding nutrients from outside, either in chemical or organic form.Proper fertilization is necessary. Because the excessive and continuous use of inorganic fertilizers can pollute the environment. Inorganic fertilizers only act as a supplier of nutrients without being able to improve the physical and biological properties of the soil.

Indriani (2004) states that inorganic fertilizers can cause negative impacts such as hardening and damaging soil, polluting water, and harming the balance of nature. In contrast, the application of organic fertilizers could fruit the benefits. It can increase soil fertility, improve soil physical properties such as improving and setting soil aggregates, reducing soil plasticity, forming soil granulation, forming soil cohesion, increasing the ability to hold water, and other bad properties of the soil (Sianturi 2019). The application of organic fertilizers can also affect the chemical properties of the soil such as increasing soil pH and organic C (Putera, 2016).

According to Dewi (2017), organic fertilizers have a very important role in soil fertility. The use of them in the cultivation of food crops can improve the physical, chemical, and biological properties of the soil. Therefore, to support sustainable agriculture and other alternatives, the use of organic fertilizers, such as vermicompost fertilizer is needed to satisfy the nutrients.Vermicompost fertilizer is the fertilizer taken from the worm's living medium. Cooperation between earthworms and microorganisms has an impact on the success of the decomposition process (Sinha, 2009). According to Elfayetti (2017), vermicompost is a product of soil physically and chemically mixed with excreta. It is rich in microbial living cells. Sahrul (2017) stated that vermicompost can help restore soil fertility. There are many microorganisms and organic carbon in vermicompost. It supports the development of ecosystems and the soil food chain.

According to Siahaan and Sudiarso (2018), vermicompost fertilizer contains a lot of macro and micronutrients needed by plants. In general, vermicompost comprises nitrogen, phosphorus, minerals, and vitamins (Simanungkalit, 2006). Krisnawati (2015) added that the nutrients found in vermicompost fertilizer are very beneficial for the growth of plantations. This kind of fact puts the quality of vermicompost on a higher level than other organic fertilizers. Vermicompost fertilizer which is a product of earthworm cultivation in the form of organic is considered very suitable for increasing soil fertility and plant growth. The cultivation of vermicompost can be done by using media and feed on various organic materials. They can be taken from various organic wastes. The nutrient content of vermicompost depends on the food given. According to Sinha (2009), the media is the place for worms to live and to get their feed. The feed can be in the form of organic waste, sawdust, cow dung, straw, and others. Therefore, in this study sawdust, banana weevil, cow dung, and vegetable waste were used. Many of these wastes are found wasted at the research site but still have high organic matter.

Malik (2012) stated that traditional wood processing produces wood waste reaching 25% of the volume of wood material. If in one wood mill processes about 100 m3 per day, then about 24 m3 of sawdust is obtained. The mill burns the sawdust wastes to eradicate them. Burning waste will cause smoke and CO2 emissions. It harms the environment (Wardani, 2017). Dewi (2017) said that sawdust contains cellulose, hemicellulose, lignin, and pentosan. It can be utilized by other organisms.

Banana plants have many benefits. Besides the fruits, some other parts like the heart, stem, fruit skin, and weevil are also beneficial for people. People do not realize the benefit of them. They throw them away as wastes. Nevertheless, according to Benedict (2013), the banana weevil has the potential as a source of local microorganisms. It can be used as a food source for microbes to develop properly. The banana hump contains 66.2% carbohydrates, protein, water, and other important minerals (Bilqisti et al, 2010). According to Sukasa et al. (1996), the banana weevil has a starch content of 45.4% and a protein content of 4.35%. In addition, banana weevil contains microorganisms to decompose organic matter. The decomposer microbes are located on the outside and inside (Suhastyo, 2011). Likewise, cow dung and vegetable waste have similar benefits. According to Huda and Wikanta (2017), one cow produces manure ranging from 8-10 kg per day or 2.6-3.6 tons per year. Cow dung contains nutrients that can be used for plant growth. The nutrients comprise 1.53% Nitrogen, 0.67% Phosphate, 0.70% Potassium, and 63.44 C/N (Hartatik & Widiowati, 2006). Besides producing these macro elements, cow manure also produces a number of micronutrients, such as Fe, Zn, Bo, Mn, Cu, and Mo. The composition of the nutrients is 1.03% K, 0.92% N, 0.23% P , 0.38% Ca, 0.38% Mg (Novia, 2015).

Amrullah (2015) stated that market vegetable waste is material that is discarded from the effort to improve the appearance of vegetables to be marketed. Vegetable waste usually consists of materials that have quite a lot of water content, so they decompose easily and quickly. Vegetable waste dominates the total market waste, which is an average of 2.96 tons per day. The composition of vegetable waste that was found the most was spinach, kale, chicory, green mustard, tomatoes, spinach, and a small number of other vegetables (Febriyantiningrum, 2018).

The organic materials found in these wastes seem useless. People never think about their benefit. Therefore, this study aims to use cow dung, sawdust, banana weevil, and vegetable waste as feed and media for the cultivation of earthworms. It is the way to obtain vermicompost that can be used as organic fertilizer. To determine the quality of this vermicompost fertilizer product, several laboratory analyses will be carried out. It leads to the findings to recognize the nutrient content.

MATERIALS AND METHODS

Worm cultivation was carried out in Perlabian Village, Kampung Rakyat Subdistrict, Labuhan Batu Selatan Regency, from December to March 2021. The vermicompost analysis was carried out at the PT. Socfindo Perbaungan, Teluk Mengkudu and Sei Rampah Subdistricts, Serdang Bedagai Regency, North Sumatra.The materials for this research were earthworm, soil, sawdust, banana weevil, cow dung, vegetable waste. The species of earthworm is Lumbricus rubeltus. The tools used in this study were earthworm rearing containers, racks, scales, tarpaulins, nails, and other tools.

RESULTS AND DISCUSSION

Making vermicompost is done by keeping earthworms for four weeks. The cultivation medium was made from a mixture of 2 kg of topsoil in oil palm plantations, 500 grams of sawdust, 500 grams of banana weeds, and 1 kg of earthworm seeds measuring 8 cm. Worms are fed every 2-3 days according to the dose. This experiment was carried out with two treatments of feeding dosing. The first treatment was given 1 kg of cow dung which had been diluted with 1 liter of water plus 250 grams of vegetable waste (K1) and the second treatment was given 2 kg of cow dung diluted in 1 liter of water, and 500 grams of vegetable waste (K2). Furthermore, earthworm treatment is carried out by stirring the media at the time of feeding.

After four weeks of cultivation, the vermicompost was harvested by separating the worms from the media. The vermicompost was then packed for further testing in the laboratory with the observed variables for the compost quality test. It will test the content of N, P, K, organic C, C/N, and pH. The results of the analysis of the vermicompost were then compared with the standard SNI-19-7030-2004 compost.

Table 1. Result of Analysis of Nutrient Content of Cassava

NO	Parameter	K1	K2	SNI 19-7030-2004	Criteria of SNI
1	C-org (%)	8,89	10,92	9,80 – 32	corresponding
2	N-Kjeldahl (%)	0,75	0,86	0,40	corresponding
3	P-total(%)	0,16	0,16	0,10	corresponding
4	K-total (%)	0,26	0,23	0,20	corresponding
5	pH	6,5	6,5	6,80 - 7,49	corresponding
6	C/N	11,85	12,69	10 – 20	corresponding

Based on the results of laboratory tests on both vermicompost fertilizers and when compared with the compost quality standard SNI-19-7030-2004, it can be seen that the nutrient content of vermicompost in this study meets the SNI standard as compost as seen in Table 1. It is proved from the test results where the content of all parameters meets the minimum standard as compost except pH.

The vermicompost in this study was dark black, odorless, smooth in texture, and small soil grains. According to Mashur (2001), good quality vermicompost is characterized by brownish to black, odorless, crumbly textured, and C/N < 20 in size. Likewise, in Mulat’s (2003) research, it is stated that the characteristics of ripe vermicompost are blackish, odorless, and crumb structure. Moreover, it is easy to disperse or break easily when clenched and has a higher carbon content and lower nitrogen. it results in higher C/N. This is in line with this study, where the C/N content of this vermicompost was 12.69. According to Mashur (2001), the quality of vermicompost depends on the type of feed used, the type of worms, and the age of the vermicompost. It can be proven from this research that different feeding can produce different quality nutrient content. In vermicompost with feeding in the form of 2 kg of cow dung diluted in 1 liter of water and 500 grams of vegetable waste, it turned out to have a higher carbon and nitrogen content than those given 1 kg of cow dung which had been diluted with 1 liter of water plus 250 grams of vegetable wastes. Several studies on the nutrient content of vermicompost have also been carried out.

Based on Simanungkalit's research (2006), vermicompost contains 2.160% organic C, total N of 0.658%, C/N ratio of 3.281%, P2O5 of 0.171%, K2O of 0.327%, Ca of 0.055%, Mg of 0.052%, Fe is 0.092, Al is 0.036, and pH is 5.2. As for vermicompost based on the research of Dailami et al, (2015), it contains 0.63% nitrogen, 0.35% phosphorus, 0.20% potassium, 0.23% calcium, 0.26% magnesium, 0 sodium 0.07%, copper 17.58%, zinc 0.007%, manganium 0.003%, iron 0.79%, boron by 0.21%, and water storage capacity of 41.23%. Saputra (2019) added that the vermicompost fertilizer contains nutrients such as N (0.50 - 4.50%), P (0.06-0.68%), K (0.10-6.80%), Ca (0.85-0.68%). 3.50%), and Mg (0.10-0.21%).Vermicompost contains complete nutrients, a number of beneficial microorganisms, and growth-regulating hormones. The vermicompost has a high cation exchange capacity (CEC) so that the nutrients in this vermicompost can be quickly available and can be quickly absorbed by plant roots (Sianturi 2019). Munroe (2003) stated that the advantage of vermicompost is nutrient content needed by plants such as N, P, K, Ca, Mg, S, Fe, Mn, Al, Na, Cu, Zn, Bo, and Mo depending on the materials used.

Sutanto (2002) added that vermicompost has the advantage of providing nutrients nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg) in a balanced and available amount. Moreover, increasing the content of organic matter, increasing the soil, providing plant growth hormones, reducing the risk of pathogen infection, synergistic with other organisms benefit the plantations. It would be a buffer for negative soil effects. Simanullang et al., (2014) also stated that vermicompost is a fertilizer derived from worm droppings (Lumbricus rubellus) that contain macro and micronutrients, such as Nitrogen (N), Phosphorus (P), Calcium (K), Sulfur (S), Magnesium (Mg), Iron (Fe) and Potassium (Ca). It also contains several growth hormones such as auxin, gibberellins, and cytokinins. According to Putera (2016), vermicompost also contains growth-stimulating hormones for plants, such as 2.76% gibberellins, 1.05% cytokinins, and 3.80% auxins.

Furthermore, vermicompost fertilizer has complete nutrients. they come from used worm media which can be used as organic fertilizer to improve soil physical properties, soil chemical properties, and soil biology. Organic matter plays a role in improving soil physical properties. It binds soil particles to be more crumbly. It is also able to increase soil stability and the soil's ability to store water. Nevertheless, the use of vermicompost is better than other composts that contain lots of nutrients for plants (Arifah, 2013).

Vermicompost has advantages over other organic fertilizers. It has almost all the elements needed by plants. Furthermore, vermicompost also contains higher macro elements. It is also able to neutralize soil pH. All the nutrients needed by plants are found in vermicompost. They are available in a lot of quantities. Vermicompost also contains plant growth hormones. These hormones will stimulate the growth of the trunk, roots, leaves, and shoots on the trunks and branches (Elfayetti, 2017).

Purnama (2012) added that vermicompost has the advantage of providing nutrients like nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), and magnesium (Mg). They are composed in balanced. They are available in gross quantities. They could boost the availability of organic matter. Moreover, they help people to enhance the function of soil for cultivation. They have an important part in providing plant growth hormones, reducing the risk of pathogen infection, and synergizing with other organisms to build mutual symbiosis as a buffer for negative soil effects.

Susanna (2010) stated that vermicompost plays a role in increasing plant growth because it contains macronutrients such as carbon (C), nitrogen (N), phosphorus (P), potassium (K), and other micronutrients such as zinc (Zn), copper (Cu), manganese (Mn) which function in fertilizing plants and inducing plant resistance. Vermicompost also contains plant growth hormones such as auxin, gibberellins, and cytokinins which are absolutely needed for optimizing plant growth. It greatly affects the productivity of a plant. In addition, vermicompost can improve the physical properties of the soil. It can make the soil loose. It helps the plant to grow healthier and more resistant. Indeed, vermicompost also improves the biological properties of the soil by increasing the number of beneficial microbes.

The content of vermicompost nutrients such as nitrogen is important to stimulate overall plant growth. while phosphorus serves to transport energy from metabolism in plants. Another one is potassium. It has an important role in the process of photosynthesis, transportation of assimilated products, enzymes, and minerals including water. The last one is N-inhibiting bacteria. It helps enrich the N element needed by plants (Susanna 2010).

CONCLUSION

The vermicompost fertilizer analysis meets the standards of SNI-19-7030-2004 as compost. Feeding earthworms affect the quality of the nutrients produced. The K2 vermicompost contained higher organic C- and nitrogen than the K1 vermicompost.

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