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The Utilization of Sawdust and Various Decomposers as Raw Materials for Organic Fertilizer Production

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Abstract

Sawdust is an abundant material in rural areas of Lima Puluh Kota Regency, making its utilization an effective way to prevent it from being wasted. Sawdust also has great potential to enrich soil with essential elements needed by plants. The process of making organic fertilizer typically involves the addition of microorganisms to accelerate the decomposition of organic materials. One of the challenges in producing and developing organic fertilizer is selecting the right decomposer to ensure that the composting process does not take too long and can be quickly applied and utilized by farmers. This study aims to identify the best decomposer capable of breaking down and accelerating the composting process of sawdust waste. The study used a Completely Randomized Design with the following treatments: sawdust:chicken manure (2:1) + bioactivator, sawdust:chicken manure (2:1) + bio tanduria, sawdust:chicken manure (2:1) + m21 dan sawdust:chicken manure (2:1) + *Trichoderma sp*. Observation parameters: compost maturation time (days), texture, color, moisture and temperature. From all observations of sawdust compost, treatment A2 (sawdust:chicken manure (2:1) + bio tanduria) showed the best results, and the composting time was also relatively short.

Keywords: Compost, Decomposer, Organic Fertilizer, Organic Material, Sawdust

1. Introduction

In the production of organic fertilizer, organic materials such as livestock manure, rice straw, reeds, sawdust, and agricultural waste can be used. According to research by Chan et al., 2022 and 2024, sawdust waste was found to have the highest nutrient content compared to other raw materials such as rice straw, banana stems, and corn cobs or husks. The study revealed that the highest moisture content and nutrient levels were found in compost made from sawdust, at 1.03% N, 1% P, 1.82% K, 1.1% Ca, and 34.9% C organic.

Sawdust is an abundant material in rural areas of Lima Puluh Kota Regency, making its utilization an effective way to prevent it from being wasted. Sawdust also has great potential to enrich soil with essential elements needed by plants. Large amounts of sawdust are produced every year, and if not properly utilized, it will become waste that pollutes the environment, poses health risks, and increases the potential for fire hazards. In Lima Puluh Kota Regency, there are numerous wood processing facilities that produce furniture.

Organic fertilizer made from sawdust can naturally provide essential nutrients to plants, reducing dependence on expensive chemical fertilizers. This can help farmers lower production costs and increase their profits. Additionally, utilizing sawdust as organic fertilizer promotes the concept of a circular economy. In a circular economy, waste is viewed as a resource that can be reused. By converting sawdust into organic fertilizer, we adhere to the principles of reuse and recycling, transforming waste into a valuable product that can be reintegrated into the production cycle.

The process of making organic fertilizer typically involves the addition of microorganisms to accelerate the decomposition of organic materials. These microorganisms are commonly known as bioactivators. Naturally, organic materials will decompose on their own in nature, but the process takes a long time. Therefore, the production of organic fertilizer often includes bioactivators, which are specific microorganisms responsible for breaking down

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natural materials, making them ready for use as fertilizer. Based on the research by Chan (2023), a chemical analysis of various composts derived from different organic materials showed that sawdust compost had the highest nutrient content. Only one type of bioactivator was used in the process, namely the M21 decomposer.

One of the challenges in producing and developing organic fertilizer is selecting the right decomposer to ensure that the composting process does not take too long and can be quickly applied and utilized by farmers. This study aims to identify the best decomposer capable of breaking down and accelerating the composting process of sawdust waste.

2. Material and Methods

The research was conducted from May to July 2024 at the Payakumbuh State Agricultural Polytechnic, located at the coordinates 0.2771° North Latitude and 100.6981° East Longitude. The study used a Completely Randomized Design with the following treatments: A1= Sawdust:chicken manure (2:1) + Bioactivator, A2= Sawdust:chicken manure (2:1) + Bio Tanduria, A3= Sawdust:chicken manure (2:1) + M21 and A4= Sawdust:chicken manure (2:1) + *Trichoderma sp*. The research flowchart can be seen in Figure 1.

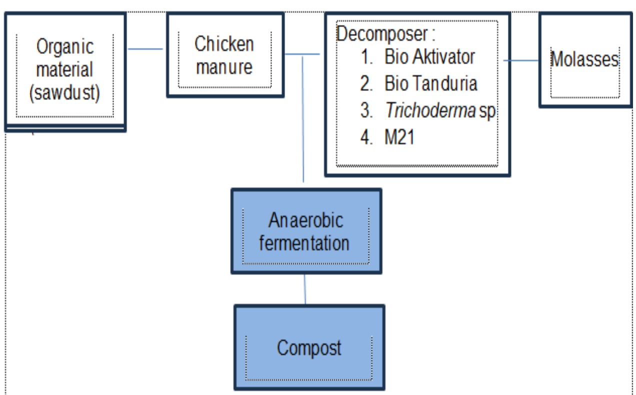

Figure 1. Flowchart of compost production

The organic material to be composted was placed in composter bags with a height of 80 cm. Each treatment was repeated 3 times, resulting in a total of 12 experimental units.

Observation parameters:

1. Compost maturation time (days), Compost maturation time (days) is calculated based on the duration from the beginning of the fermentation or composting process until the compost is considered mature and ready for use.
2. Texture, Compost texture is assessed manually (qualitatively) by grabbing a handful of compost, squeezing it by hand, and observing its form and feeling its texture.
3. Color, The determination of compost color is generally carried out visually (qualitatively) by directly observing the color of the finished compost. Color is an important indicator in assessing the maturity level of the compost.
4. Moisture, The determination of moisture in compost is carried out manually.
5. Temperature, The measurement was carried out using a compost thermometer (stem thermometer).

3. Results and Discussion

In composting, several factors influence the process, including particle size, which determines the spacing between materials (porosity). Efforts to increase surface area can be achieved by reducing the size of the material particles, such as through shredding. According to Suryanti (2009), the smaller the size of the original material pieces, the faster the decomposition process. The optimal size of raw material pieces is approximately 4 cm; if the pieces are too small, the pile becomes compact, preventing air circulation.

3.1. Compost maturation time

The composting time is the number of days required for the composting process until the compost is fully matured. Ideally, the time needed is around 14 to 120 days. Matured compost, or compost that has fully decomposed, is characterized by its black color and the absence of a rotten or strong odor. The results from the observations of each treatment are shown in Table 1.

Table 1. Compost maturation time (days)

Treatments	Repetition		
	1	2	3
A1	45	45	45
A2	37	36	35
A3	42	42	42
A4	47	46	48

From Table 1, it can be seen that the fastest composting time was found in treatment A2, repetition 3, which took 35 days. The longest composting time occurred in treatment A4, repetition 3. The difference in composting duration is caused by the varying microorganism content in each decomposer. In treatment A1, the decomposer used contained 12 types of decomposing bacteria: Bacillus, Megatherium, Lactobacillus sp, Streptomyces, Acetobacter sp, Azospirillum, Pseudomonas fluorescens, Aspergillus niger, Trichoderma, Metharizium anisopliae, Rhizobium sp, Actinomycetes sp, and Yeast. Meanwhile, treatment A4 contained only one type of fungus, *Trichoderma sp*.

The composition or number of microorganisms present in decomposers plays a crucial role in accelerating the decomposition process. Bacteria produce enzymes such as cellulase, protease, and lipase, which expedite the breakdown of organic materials. These enzymes facilitate the transformation of coarse materials into mature compost. The population of microorganisms involved in the decomposition of organic materials continuously changes, and these microorganisms can be increased by adding activators (Rahmawati, 2003).

3.2. Texture

The observation parameters and texture of the produced compost can be seen in Table 2. From Table 2, the texture produced for all treatments is fine (most of the organic material has decomposed into small particles; the texture is not as fine as soil but slightly coarse) and when held, it feels loose (light and easy to handle) and is brown to dark brown in color.

Table 2. Observation of compost texture and color

Treatment	Image	Description
A1		Smooth (*Brownish Black*) 7,5 YR 3/2
A2		Smooth (*Brownish Black*) 7,5 YR 3/2
A3		Smooth (*Brownish Black*) 7,5 YR 3/2
A4		Smooth (*Brownish Black*) 7,5 YR 3/2

The compost results from all treatments have met the quality compost criteria according to Isroi (2008), which states that compost should be dark brown to black, similar to the color of soil. The more mature the compost, the fewer the fibers and the smaller the particle size. According to Syukur and Nur (2006), organic material is decomposed into elements that can be absorbed by microorganisms, causing the size of the organic material to break down into smaller particles, which results in the pile volume shrinking by about three-quarters during the compost maturation process.

Texture affects aeration, water absorption, and nutrient distribution in the soil. Compost with good texture is easier to mix with growing media and helps improve soil structure. The observations of the texture of the produced compost show that all treatments (A1, A2, A3, A4) resulted in a texture suitable for use as growing media.

3.3. Color

Based on the visual analysis of sawdust compost using the Munsell Soil Color Chart as a reference, the color of the compost produced in the 8th week is dark brown (7.5 YR, 3/2). According to the Indonesian National Standard (SNI) for Compost No.19-7030-2004, mature compost is characterized by a blackish color with particles measuring 25 mm. Okalia, Ezward, and Nopsagiarti (2018) stated that mature compost will appear black, differing from the original compost materials. The observation of compost color can be seen in Table 2.

The color changes that occur during the composting process are influenced by the presence of activators or decomposers used. From Table 2, it can be noted that all observations show that the compost color in the 8th week is dark brown. This is due to the effective utilization of the activator by microbes. Differences in compost color at the end of the observation indicate the maturity level of the compost. Junedi (2008) suggested that compost is considered mature if it undergoes a color change to become darker and has an earthy smell.

According to the Indonesian National Standard, mature compost no longer resembles its original form because it has been broken down naturally by microorganisms active during the composting process (Setyoirini, 2006). Mature compost has an earthy smell because its contents resemble soil matter and are dark brown to blackish in color, formed as a result of stabilized organic materials (Amalia, 2016). The color changes in compost depend on the mixture of materials used.

3.4. Moisture

Several factors that influence the process of making organic fertilizer include moisture, temperature, and pH. Moisture plays a crucial role in microbial metabolism and must be maintained within a range of 40% to 60%. Meanwhile, the temperature will rapidly increase within the compost pile, ranging from 30°C to 60°C (Supriatna et al., 2015). When measured with a dampness analyzer, the moisture level ranges from 5 to 8 (wet). The measurement results can be seen in Table 3.

From observations conducted from week I to week VII, the moisture content of compost across all treatments was found to be wet, ranging between 5-8. The water content in compost should not be too low or too high. When the water content is too low, it may disrupt the growth and metabolism of microorganisms, thereby affecting the decomposition process. Excessively high water content can also have a negative impact on the compost. During the composting process, a reduction in water content occurs because microorganisms in the compost consume water for their growth (Lestari and Sembiring, 2010).

3.5. Temperature

In the composting process, there will be an increase in temperature. This temperature increase is beneficial for microorganism growth, allowing microorganisms to grow up to threefold, and the enzymes produced are also more effective in breaking down organic materials (Wahyono, 2008).

Table 3. Moisture measurements from week I to VIII

No	Treatments	Weeks							
		I	II	III	IV	V	VI	VII	VIII
1	A11	WET	WET	WET	WET	WET	WET	WET	WET
2	A13	WET	WET	WET	WET	WET	WET	WET	WET
3	A13	WET	WET	WET	WET	WET	WET	WET	WET
4	A21	WET	WET	WET	WET	WET	WET	WET	WET
5	A22	WET	WET	WET	WET	WET	WET	WET	WET
6	A23	WET	WET	WET	WET	WET	WET	WET	WET
7	A31	WET	WET	WET	WET	WET	WET	WET	WET
8	A32	WET	WET	WET	WET	WET	WET	WET	WET
9	A33	WET	WET	WET	WET	WET	WET	WET	WET
10	A41	WET	WET	WET	WET	WET	WET	WET	WET
11	A42	WET	WET	WET	WET	WET	WET	WET	WET
12	A43	WET	WET	WET	WET	WET	WET	WET	WET

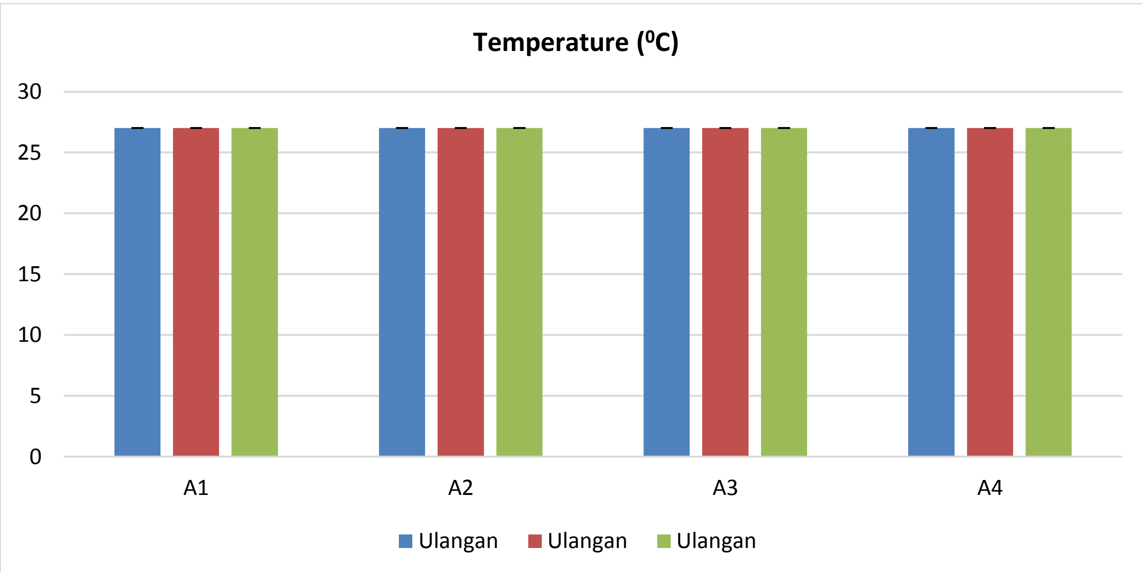

Figure 2. Average temperature during composting.

In this study, the temperature increase was observed through the presence of water vapor on the cover of the composter bag. The water vapor is produced by the heat generated during the composting process. In this study, the final compost temperature was 28°C. According to SNI 19-7030-2004 regarding compost quality standards, the maximum allowable temperature is no more than 30°C. Therefore, in this study, the composting temperature met the standard values for all composters across all treatments.

4. Conclusion

Observation parameters: compost maturation time (days), texture, color, moisture and temperature. From all observations of sawdust compost, treatment A2 showed the best results, and the composting time was also relatively short.

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