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Selamat berkarya.

Salam hormat

Prof. Umi Purwandari
QUALITY ANALYSIS OF "KOSMOS" TKKS COMPOSE USING SELULOTIC MICROORGANISM

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ABSTRACT

Indonesia is the largest palm oil-producing country in the world. Riau Province is a province with the largest oil palm plantation area in Indonesia. The area of oil palm plantations in Riau province is 2.21 million hectares, or 17.84% of Indonesia's total area of oil palm plantations. TKKS waste has been used to fertilize young oil palm plants by spreading it around the oil palm trees, but empty bunches have become a comfortable place for oil palm pests such as oil palm beetles to develop. Emptuy bunches of solid waste are also processed into compost. This study aimed to determine the comparison of the chemical composition of oil palm empty fruit bunches compost using cellulolytic microorganisms and TKKS compost. This research is a descriptive study that describes the chemical composition of compost with cellulolytic microorganisms. The treatments used in this study were the differences in the ratio of TKKS and cow dung KM1 (100:0), KM2 (90:10), KM3 (80:20), KM4 (70:30), KM5 (60:40) and KM6 (50:50). This study's results were the selected treatment, namely KM5 with an N content of 0.73%, C/Organic 9.28%, C/N ratio 12.29%, P 0.42%, K 3.99%, while the TKKS content only N 6.28%, C/Organic 14.19%, C/N ratio 2.26%, P 1.88%, K 2.51% and Mg 1.61%.

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INTRODUCTION

Indonesia is the largest palm oil-producing country in the world. Riau Province is a province with the largest oil palm plantation area in Indonesia. The area of oil palm plantations in Riau province is 2.21 million hectares, or 17.84% of Indonesia’s total area of oil palm plantations (BPS, 2019). One of the districts that have oil palm plantations is Kuantan Singingi Regency. The area of oil palm plantations in 2019 was 133,982.21 ha and production of 406,721.96 tonnes (Direktorat Jenderal Perkebunan, 2020).

The largest producer of palm oil can produce commercial products in palm oil and its derivatives. The production process generates substantial solid and liquid waste. Oil palm mills with a capacity of 60 tonnes of fresh fruit bunches (Tandan Buah Segar) / hour produce 220 kg/day of empty palm fruit bunches (Tandan Kosong Kelapa Sawit), while palm oil mill effluent is 650 m³ / day (Wardiani, 2013). For each processing of 1 ton of FFB, 22 - 23% of EFB will be produced or as much as 220-230 kg of TKKS (Lukas et al., 2018)

So far, TKKS waste has been used to fertilize young oil palm plants by spreading it around the oil palm trees, but empty bunches have become a comfortable place for oil palm pests such as oil palm beetles to develop. Empty bunches of solid waste are also processed into compost (Faisal et al., 2010)

The chemical components of TKKS are 33.25% cellulose, 23.24% hemicellulose, 25.83% lignin, 8.56% water, and 4.19% extractives (Dewanti, 2018). This content can be used in the composting process as an effort to reduce TKKS waste. TKKS contains organic material, which is difficult to degrade. Lignin in oil palm empty bunches is relatively difficult to degrade. Efforts are made to accelerate composting by adding organic material and activating cellulolytic microorganisms (Rahmadanti et al., 2019).

Gusmawartati et al. (2013), cellulolytic microorganisms (MOS) are microorganisms capable of enzymatically degrading cellulose through cellulase enzyme activity. Cellulolytic microorganisms break down cellulose to produce glucose that other heterotrophic microorganisms can use as a carbon source to decompose organic matter (composting).

In composting TKKS, organic materials such as livestock manure and other organic materials can also be added. According to Harapan, (2000), Cow dung is a type of ruminant livestock that is relatively more favored by the general public. A rotting pile of cow dung is a turning point in the nitrogen cycle. Cow dung contains large amounts of nitrogen linked to proteins present in the plant parts that cows eat. Various bacteria release this nitrogen by breaking down proteins into simpler compounds and finally into nitrates that plants can absorb through roots.

Cellulolytic microorganisms are microorganisms capable of producing cellulase enzymes. Cellulase enzymes play a role in degrading cellulose into glucose (Aiman dan Astuti, 2012). Usually, the cellulolytic microorganisms used are Bacillus and Trichoderma. Therefore, to speed up composting, it is necessary to add organic matter (cow dung) with cellulolytic microorganisms to produce fully matured compost.

Compost can be applied to land or plants if it meets the compost quality standard, according to SNI 19-7030-2004. The importance of knowing the nutrients contained in compost will determine the results of plant growth (Rahmawati, 2017). This study aimed to determine the comparison of the chemical composition of TKKS compost using cellulolytic microorganisms and TKKS compost.

METHOD

Research location

This research was conducted in Taluk Kuantan, Kuantan Singingi Regency, for four months.

Materials and Research Tools

Preparation of the place

Composting site is done in a building with a flat floor and is free from standing water, and a roof that protects it from the sun and rain and is close to sources of organic matter such as empty oil palm bunches and cow dung. Each experimental unit was made in sizes 0.5 × 0.5 m with a distance between the plots of 1 m.

Materials

The materials used in this research were chopped empty fruit bunches with 5 - 10 cm, which were obtained from PT. Duta Palma, cow dung, isolates selected were Carrier
isolate (CMC liquid), Mushrooms Waste Wood Origin Perawang, Bacteria Waste Wood Origin Siak). The tools used in this research are scratching, scale, chopper machine, bucket, shovel, rope, 50 kg plastic sack, and other writing tools.

Random Sampling is chosen to determine the sample that will be the source of the data. Then the data was obtained from several treatments carried out in the field, and then the data were then analyzed to obtain quantitative data. This study had six treatment levels, each repeated three times to obtain 18 experimental units. Following are the treatment levels of this research:

KM1 = 100% oil palm empty bunches (20 kg) + Trichoderma (100 gr) + Bacillus bacteria (100 ml)
KM2 = oil palm empty bunches 90% (18 kg) + Trichoderma (100 gr) + 10% cow manure (2 kg) + Bacillus bacteria (100 ml)
KM3 = 80% oil palm bunch (16 kg) + 20% cow manure (4 kg) + Trichoderma (100 gr) + Bacillus bacteria (100 ml)
KM4 = Oil palm empty bunches 70% (14 kg) + 30% cow manure (6 kg) + Trichoderma (100 gr) + Bacillus bacteria (100 ml)
KM5 = Oil palm empty bunches 60% (12 kg) + 40% cow manure (8 kg) + Trichoderma (100 gr) + Bacillus bacteria (100 ml)
KM6 = 50% empty oil palm bunches (10 kg) + 50% cow manure (10 kg) + Trichoderma (100 gr) + Bacillus bacteria (100 ml)

KM= Kompos Mikroorganisme Selulolitik

Data analysis

The data analysis used is quantitative analysis with Microsoft excel. This analysis is used to describe the result of the compost content by cellulolytic microorganisms.

Observation parameters

The observation parameters in this study were the analysis of chemical properties of KOSMOS and TKKS compost, N content, C-Organic content, C / N ratio, P content, K content, and Mg content.

RESULT AND DISCUSSION

Cellulolytic microorganism compost (Kompos Mikroorganisme Selulolitik/KOSMOS) is compost made from oil palm empty bunches (TKKS) with cellulolytic microorganisms. This compost is analyzed at the PT Panca Surya Garden Laboratory. Following are the results of the analysis of KOSMOS nutrient content.

The results of this study were to compare the nutrient content of KOSMOS and TKKS compost only. Table 1 shows that the content of N, C-Organic, and P elements in KOSMOS is lower than TKKS alone, while the C / N ratio in KOSMOS is higher than TKKS compost only.

Content of N

Based on the chart shows that the N nutrient in KOSMOS is lower than the TKKS compost only. The N nutrient content in KM1 and KM2 treatments did not meet the Indonesian National Standard (SNI), namely 0.4%. Nutrient N increased with the addition of cow dung in each KOSMOS treatment. Cow manure contains ammonia which plays a role in the composting process. According to Ratna et al. (2017), the amount of N nutrient during the composting period has increased due to the decomposition process of organic matter by microorganisms by converting ammonia to nitrite. Besides, the renovation of N nutrients is assisted by microorganisms, namely Trichoderma sp. This was also stated by Hasibuan et al. (2012) stated that the increase in the number of nitrogen nutrients was due to the renovation process carried out by Trichoderma sp.
Table 1 Results of analysis of KOSMOS nutrient content and TKKS COMPOST

<table>
<thead>
<tr>
<th>Nutrient content</th>
<th>Treatment of TKKS only</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>KM1</td>
</tr>
<tr>
<td>N</td>
<td>0.37</td>
</tr>
<tr>
<td>C-Organik</td>
<td>7.28</td>
</tr>
<tr>
<td>Rasio C/N</td>
<td>20.09</td>
</tr>
<tr>
<td>P</td>
<td>0.20</td>
</tr>
<tr>
<td>K</td>
<td>1.59</td>
</tr>
<tr>
<td>Mg</td>
<td>0.14</td>
</tr>
</tbody>
</table>

Cellulolytic microorganisms also play a role in composting. These microorganisms can decompose organic matter into simpler ones. Wardati et al. (2017), accelerating organic matter decomposition needs to be done with microorganisms that can remodel organic materials, for example, cellulolytic microorganisms. Cellulolytic microorganisms, namely Bacillus sp. require the element N to form bacterial cells and nutrients for bacteria during the composting process. This causes a decrease in N in KOSMOS due to the use of N elements by cellulolytic microorganisms. The same thing was stated by Purnomo et al. (2017), during the fermentation process, elemental N is needed for nutrition for bacteria in maintaining and forming body cells. The more nitrogen content, the faster the organic matter will break down. The N content is very beneficial for plants, increases plant growth, produces chlorophyll, and accelerates leaf growth (Pramana and Heriko, 2020).

Figure 2 shows that the C-organic content of KOSMOS is lower than TKKS compost only. According to SNI 19-7030-2004, C-Organic's minimum content is 9.80%, and the maximum is 32%. KM1, KM2, KM5, and KM6 are not following the Indonesian National Standard on Compost. The amount of C-Organic elements varies, this is because microorganisms need carbon to degrade organic matter. According to Ratna et al. (2017), carbon content is an energy source for microbes to break down organic matter. Carbon dioxide will evaporate in the composting process so that the amount of C-Organic can be reduced.

Cellulolytic microorganisms carry out the change of carbon in organic matter. These microorganisms can degrade cellulose and hemicellulose in empty oil palm bunches. According to Saskiawan (2015), the composting process with cellulolytic microbes will accelerate the breakdown because these microbes release enzymes to degrade cellulose. Cellulase enzymes will hydrolyze cellulose into glucose.
The C-Organic content influences the C/N ratio, the higher the C-Organic content, the higher the C/N ratio. The same thing was stated by Pane et al. (2014) an increase in the C/N ratio is influenced by the C-Organic content in compost and will affect the rate of decomposition. If the C/N ratio is higher, it needs to be decomposed to become rotten.

Content of P

Based on the chart, the treatment of KM1 and KM6 on KOSMOS is lower than that of TKKS Compost only, while KM2, KM3, KM4, KM5, and KM6 are the same or higher than TKKS Compost. Based on the SNI, the drinking P content is 0.10%. The N content influences the phosphorus content in KOSMOS. The higher the Nitrogen content, the higher the phosphorus content. According to Purnomo et al. (2017), N content influences the composting process. The same thing is supported by Hidayati et al. (2010) the phosphorus content is related to the N content in organic matter, the higher the nitrogen content, the higher the multiplication of microorganisms, and the higher the amount of phosphorus.

Content of K

The nutrient content obtained in the treatment of KM1 0.14, KM2 0.30, KM3 0.34, KM4 0.35, KM5 0.55, KM6 0.39. The content contained in each treatment is lower than TKKS. Magnesium availability can occur due to the weathering-weathering process of minerals containing magnesium-containing minerals. Furthermore, due to this process, magnesium will be free in the soil solution. This situation can cause magnesium loss with percolation water, and magnesium is absorbed by plants or other living organisms, adsorbed by clay particles, and precipitated into secondary minerals.

CONCLUSION

Based on the research that has been done in Composting TKKS with the Help of Cellulosic Microorganisms, the best treatment is KM5 with the content of N content of 0.73%, C-Organic 9.28%, C/N ratio 12.29%, P 0.42%, K 3.99%, while the TKKS content only is N 6.28%, C-Organic 14.19%, C/N ratio 2.26 %, P 1.88%, K 2.51%, and Mg 1.61%.

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