DOI :https://doi.org/10.36378/juatika.v5i1.2665
JUATIKA
JURNAL AGRONOMI TANAMAN TROPIKA
VOL. 5 NO. 1 January 2023
eissn 2656-1727
pissn 2684-785X
Hal : 218 – 231

Optimization Of Composting Time from Palm Fronds and Empty Buttons Of Palm Oil (*Elaeis guineensis* Jacq) with Various Bioactivators

Ali Mustafa Silalahi, Pauliz Budi Hastuti, Ryan Firman Syah*
3Program Studi Agroteknologi, Institut Pertanian Stiper, Jl. Nangka II Maguwoharjo, Yogyakarta, 55282
*e-mail: ryan@instiperjogja.ac.id

ABSTRACT

Composting or decomposition is a method of processing solid waste which has a high content (70% -80%). Empty fruit bunches from the processing of Crude Palm Oil Factory and fronds of palm oil (TM) plants have the potential to be used as organic fertilizer. Composting without a biodecomposer takes a long time of seven months, so a bioactivator is needed to speed up the process. Research with the aim of determining the influence of various bioactivators in accelerating the composting of palm fronds and empty bunches has been carried out at PT. Bahana Karya Semesta unit of Sungai Air Jernih Estate, Pauh, Sarolangun, Jambi in November 2021-February 2022. The Research method used was a Complete Randomized Design (RAL) with two factors. The first factor is bioactivator consisting of four types such as LCPKS (liquid waste from crude palm oil factory), MOL (Local microorganism), EM4 (Effective microorganism 4) and cow dung. The second one is the compost material consisting of empty fruit bunch/EFB (5 kg), fronds (5 kg), EFB + fronds (2.5 kg + 2.5 kg), EFB + fronds + LCC (legume cover crop) (2 kg + 2kg + 1kg). C/N ratio, temperature, campiness, shrinkage, crumbly and color of compost were also recorded. The results showed that the bioactivator can decompose organic material with some of the parameters that we measured. The analysis of C/N ratio showed that each treatment gave different results. Palm fronds + LCPKS had the highest C/N ratio of 91, meanwhile the combination of EFB+cow dung showed the lowest C/N ratio of 23. The material of EFB + fronds + LCC showed the highest pH value of 6.36 and the highest compost depreciation of 57.48%. The variety of compost material has the same influence on the temperature, campiness and color of the compost. Meanwhile, the type of bioactivator had the same influence on temperature, pH, shrinkage, crumbly and color of the compost.
Keywords : *compost; bioactivator; EFB; palm fronds*

1. INTRODUCTION

Oil palm is one of the plantation commodities with increasingly large areas of land. The area of oil palm plantations in 2019 amounted to 14,456,611 hectares with CPO production reaching 47,120,247 tons. Furthermore, it is estimated that in 2021, the area of oil palm plantations will increase to 15,081,021 hectares with an increase in CPO production to 49,710,345 tons. The increase in the area of oil palm plantations is accompanied by an increase in the volume of waste produced, namely empty palm fruit bunches (tankos) and fronds which so far have only been collected between the oil palm plantations. Empty oil palm bunches and fronds have the potential to become compost.(DG of Plantation, 2021).

Oil palm empty fruit bunches (tankos) are a complex organic matter composed of 42.7% cellulose, 27.3% hemicellulose, 17.2% lignin. Processing 1 ton of fresh fruit bunches (FFB) produces empty palm fruit bunches of 20-23% or 200-230 kg. The palm oil mill with a processing capacity of 60 tons/hour, if it operates for 20 hours, will produce 200 tons of FFB and within one year it is estimated that 60 thousand tons. Composting for empty palm fruit bunches (tankos) using palm oil liquid waste decomposers at various doses for 8 months showing a decrease in C/N 24-45 and not showing mature compost according to standards(Zainudin & Rofik, 2019). Empty palm fruit bunches (tankos) compost contains nutrients, namely: K (4–6%), P (0.2–0.4%), N (2–3%), Ca (1–2%), Mg (0.8 –1.0%) and C/N (15.03%)(Azlansyah et al., 2014).

Old fronds are cut 1-3 fronds when harvesting and every month 2-4 fronds must be cut with a weight of 5.40 kg/frond then arranged in the dead bins. Based on the research results, the palm frond contains nutrients, namely N 2.6-2.9 (%); P 0.16-0.19(%); K 1.1-1.3(%); Ca 0.5-0.7(%); Mg 0.3-0.45(%); S 0.25-0.40(%); Cl 0.5-0.7(%). In research (Mardiana et al., 2018)showed that composting fronds without a biodecomposer or with the addition of manually chopped biodecomposers in oil palm plantation plots for 7 months was able to reduce C/N to 39-45 and did not yet show mature compost.

The results of LCC (Legume Cover Crop) pruning have great potential as an organic fertilizer because they contain high N from the symbiosis with Rhizobium bacteria in fixing N from the air. The LCC added to the empty palm fruit bunches (tankos) and oil palm fronds is expected to help reduce the C/N of the empty palm fruit bunches (tankos) and oil palm fronds compost so that nutrients can be available to plants. LCC fertilizer contains 2.48% N, 0.215 P and 1.7% K(PM Pardede, Armaini, 2014).

The high content of cellulose, hemicellulose, lignin in corncosm and palm fronds causes the decomposition process of these materials to take a long time. So as to speed up the decomposition time can be assisted by the provision of bioactivators that can break down organic matter to become compost, including LCPKS (Palm Oil Mill Liquid Waste), MOL (Local Microorganisms), EM-4 (Effective Microorganisms) and cow dung.

Banana weevil contains carbohydrates (66%), protein (4.35%), and contains microorganisms that decompose organic matter or decomposers.(Kesumaningwati, 2018). The types of microorganisms that have been identified in banana weevil MOL are Bacillus sp., Aeromonas sp., Aspergillus nigger, Azospirillium, Azotobacter and cellulolytic microbes. These microbes play a role in decomposing organic matter. The tankos compost with the banana weevil MOL decomposer has chemical qualities including: pH 8.59; C/N ratio 31.48; N total 1.78 %, P2O5.41%; and K2O 1.59%(Kesumaningwati, 2015).

Palm oil mill effluent (LCPKS) or Palm Oil Mill Effluent (POME) is organic agro-industrial waste in the form of water, oil and organic solids originating from the by-products of processing fresh fruit bunches (FFB) of oil palm to produce Crude Palm Oil (CPO). . Palm oil mill liquid waste is brownish in color, consisting of dissolved and suspended solids in the form of colloids. LCPKS can be used as organic fertilizer, but processing is required to reduce BOD, COD and oil content, increase pH, increase nutrient content and degrade organic matter (dissolved and suspended matter). LCPKS is rich in microorganisms that can degrade organic nitrogen compounds and microorganisms that decompose organic carbon and phosphorus compounds such as Aspergillus fumitus, Aspergillus ustus, Pseudomonas(Widyastuti et al., 2019).

*Effective Microorganisms*4 (EM-4) contains more than 80% microorganisms that effectively decompose organic matter. There are 5 main groups contained in EM4, namely photosynthetic bacteria, Lactobacillus sp., Streptomyces sp., yeast (yest), actinomycetes. So that it is expected to help speed up the decomposition process of empty fruit bunches and palm fronds(Hety & Prasetya, 2017). The use of EM-4 can affect the C/N ratio in goat manure so that it cooks faster or decomposes faster(Suryanto, 2019). The application of EM-4 combined with molasses will have a positive effect on composting organic matter, especially organic matter(Ardiningtyas, 2013).

Rahmadanti et al., (2019) explained that giving cow dung can reduce the C/N ratio of empty palm oil bunches because they contain high nitrogen. In addition, cow dung also contains various nutrients and is rich in microorganisms which can improve the quality of compost and speed up the composting process of empty palm oil bunches. Nutrients in cow dung consist of 0.97% nitrogen, 0.69% phosphorus (P2O5), 1.66% potassium (K20), 1.0-1.5% magnesium (Mg).

Midrib and tankos consist of materials that are difficult to decompose, requiring a fast way to decompose these components in order to increase plant nutrients. Because of that, it is necessary to do research on optimizing the composting time of palm fronds and empty fruit bunches with various bioactivators.

2. RESEARCH METHOD MATERIALS

The research was conducted at Sinarmas Palm Oil Plantation, PT Bahana Karya Semesta, Sungai Air Jernih Estate, Pauh District, Sarolangun Regency, Jambi Province in November 2021 - February 2022. The tools used in this research were scales, pH meters, thermometers, hoes, machetes , ex-fertilizer sacks, wood, markers, tarpaulin, scales. The materials used are tankos, palm fronds, EM4, LCPKS, LCC, MOL, cow dung, water, palm sugar, and agricultural lime.

Research using a Completely Randomized Design (CRD) model with two factors with. The first factor is the type of bioactivator which consists of 4 levels namely: LCPKS, MOL, EM 4, cow dung. The second factor is materials consisting of 4 levels, namely: empty palm fruit bunches (Tankos) (5 kg), Midrib (5 kg), empty palm fruit bunches (Tankos)+ Midrib (2.5 kg + 2.5 kg), Empty palm fruit bunches (Tankos) + Midrib + LCC (2 kg + 2 kg + 1kg). From these two factors, 4 x 4 = 16 treatments were obtained. Each treatment was carried out 3 repetitions to obtain 48 sample units. Compost measurements were carried out on C/N parameters, temperature, pH, color, friability, aroma, weight shrinkage.The results of the observations were analyzed using analysis of variance at the 5% level. To find out the difference between each treatment, the DMRT (Duncan's Multiple Range Test) test was carried out at a real level of 5%.

The tools to be used in this study were scales, pH meters, thermometers, hoes, machetes, ex-fertilizer sacks, wood, markers, tarpaulin, scales. The materials used are empty palm fruit bunches (tankos), palm fronds, EM4, LCPKS, LCC, MOL, cow dung, water, palm sugar, and agricultural lime.

Composting starts with preparing the composting area. The composting area is selected in a shady place under the trees, then cleaned of weeds. In the composting area, a shade is made with a plastic roof and a fence around it to prevent rainwater from entering the composting area. The materials needed, such as tankos, are taken from EBA (Empty Bunch Area), LCPKS is taken from waste column 5, palm fronds, self-made banana stem mol, LCC (Legum Cover Crop) type Mucuna bracteata produced from clearing and cow dung from breeders around the gardens of the Clear Water River Estate.

All organic materials, namely empty palm fruit bunches (tankos), palm fronds, LCC, were chopped manually with a size of ± 2 cm with the aim of increasing the surface area of the organic matter, then mixing the ingredients according to the treatment and putting them in ex-fertilizer sacks. The bioactivator is applied evenly to the compost mixture. The need for EM 4 is 1 cc/kg of compost material, before application it is mixed with sugar/molasses, water (1:1:50). MOL application of 10 cc/kg of compost mixed with water in a ratio of 1:5. LCPKS was applied 100 cc according to treatment and cow dung was applied with a ratio of 1:3. Composting is done for 16 weeks. Watering and turning the compost is done every week.

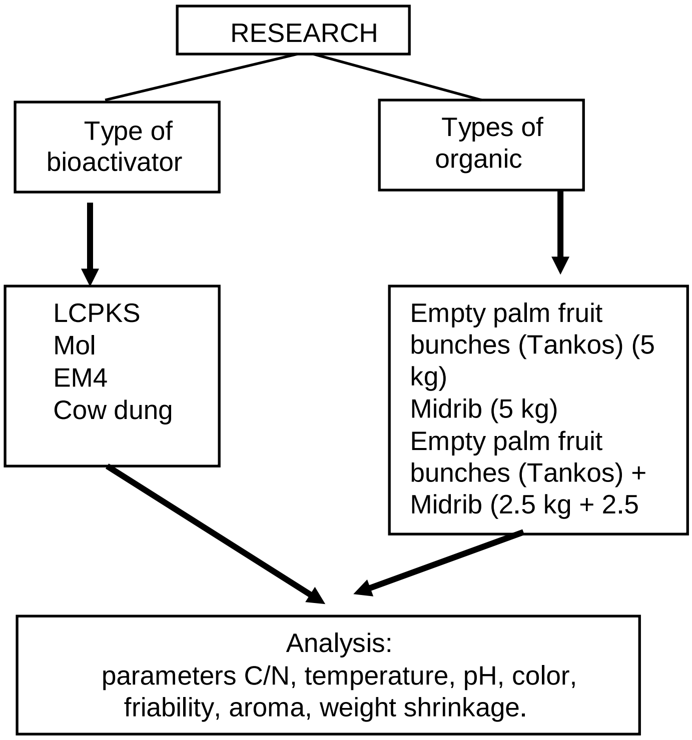


Figure 1. Research Flowchart.

3. RESULTS AND DISCUSSION

A. C/N compost

Table1. The results of the analysis of C/N values in compost

Treatment	Water content (%) (Gravimetry)	C-Organic (%) (furnaces)	N-Total (%) (Kjeldahl)	C/N
Empty palm fruit bunches (Tankos) + LCPKS	54	50.00	1.76	28
Empty palm fruit bunches (Tankos) + MOL	65,8	47,10	1.57	30
Empty palm fruit bunches (Tankos) + EM4	63	47,16	1.71	28
Empty palm fruit bunches (Tankos) + cow dung	68	44.08	1.92	23
Midrib + LCPKS	63,2	54,58	0.60	91
Midrib + MOL	61,4	54,58	0.63	87
Leaf + EM4	63,6	54,41	0.59	93
Midrib + cow dung	64,2	48,20	0.94	51
Empty palm fruit bunches (Tankos) + midrib + LCPKS	56,8	49.88	1.44	35
Empty palm fruit bunches (Tankos) + midrib + MOL	62,4	49.94	1.85	27
Empty palm fruit bunches (Tankos) + midrib + EM4	59,6	52,15	1.15	45
Empty palm fruit bunches (Tankos) + midrib + cow dung	57,4	47.97	1.68	29
Empty palm fruit bunches (Tankos) + midrib + LCC +LCPKS	62,2	50.75	1.74	29
Empty palm fruit bunches (Tankos) + midrib + LCC + MOL	66,8	50,70	1.67	30
Empty palm fruit bunches (Tankos) + midrib + LCC + EM4	63,2	49,48	1.96	25
Empty palm fruit bunches(Tankos)+ fronds + LCC+ cowdung	63,4	44.95	1.86	24

Source: Soil Fertility Laboratory, Faculty of Agriculture, University of Jambi (2022)

Table 1 shows that in general the C/N ratio of compost is still >20. The best treatment combination that was close to standard was compost from tankos compost + cow dung with a C/N of 23. Cow dung bioactivator was able to reduce the lowest C/N value for all types of compost compared to other bioactivators. This is accordingRahmadanti et al., (2019)that the addition of cow dung can reduce the high C/N ratio of empty palm oil bunches because cow dung has a high nitrogen content. Meanwhile, the tankos + fronds + LCC compost materials, when averaged, has a C/N ratio of 27, the lowest compared to all compost materials. Tankos compost has an average C/N ratio of 27.25. The frond compost has an average C/N ratio of 80.5. The tankos + frond compost has an average C/N ratio of 34.

This is presumably due to the high nitrogen content in the compost material, especially LCC. The high nitrogen content causes the LCC material to decompose easily so that microorganisms quickly multiply. Microorganisms use soil nitrogen as a source of energy and to reproduce(Widiyawati et al., 2014). The hope is that with the large number of microorganisms from the decomposition of LCC, it is also able to decompose the tankos and midrib which are classified as difficult to decompose quickly. Something similar is done in research Hasibuan et al., (2012)that the C/N ratio of 60% tankos compost material + 40% LCC has a significant effect compared to 100% empty palm fruit bunches (tankos) compost material.

B. Compost temperature

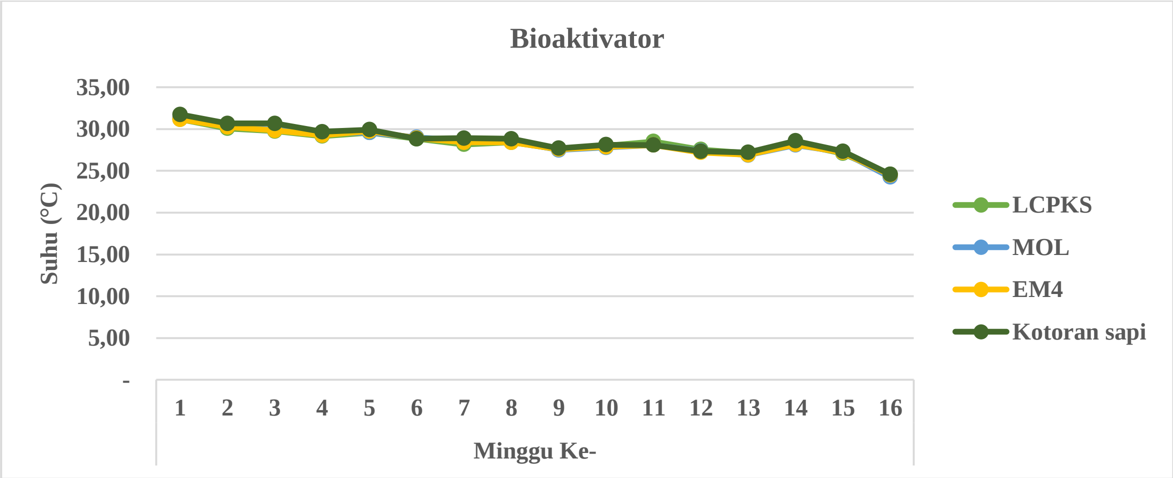
The results of variance at week 16 showed that the type of compost material and the type of bioactivator and the interactions between the two did not significantly affect compost temperature. The results of the analysis can be seen in Table 2.

Table 2. Effect of types of bioactivators and types of compost materials on compost temperature at week 16

Bioactivator	Compost material				Average
	Tankos	Midrib	Tankos + midrib	Tankos + midrib + LCC	
LCPKS	24.00	24,67	24,67	25.00	24.58 a
MOL	24.00	24.00	24.00	25.00	24,25a
EM4	24,33	24.00	25.00	24,67	24.50a
Cow dung	24,33	24,67	24,67	24,67	24.58 a
Average	24.16 p	24.33 p.m	24.58 p.m	24.83 p.m	(-)

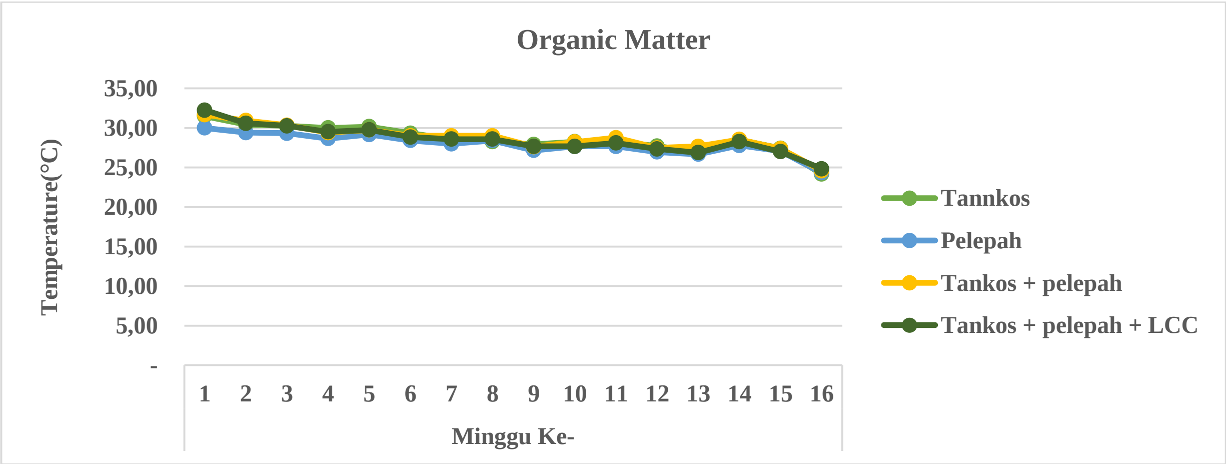
Note: The mean number followed by the same letter in a column or row is not significantly different based on the DMRT level of 5% (-) : No interaction

Temperature observations were carried out every week for 16 weeks. The observation results show that there is a change in temperature during the decomposition process which can be seen in Figure 1.



Picture1. Effect of bioactivator types on compost temperature

Figure 1 shows that all types of bioactivator treatments on compost temperature in week 1 showed an increase, but weeks 2-13 tended to decrease. Meanwhile, in the 14th week, all types of bioactivator treatments showed an increase in compost temperature, especially in cow dung which had the highest temperature, then the temperature decreased until the 16th week.



Picture2. Effect of various organic matter on compost temperature

In Figure 2 it shows that the treatment of all kinds of compost material week 1 showed an increase. The highest temperature increase in the tankos + midrib + LCC compost material. Furthermore, all compost materials experienced a decrease in temperature until week 13. The temperature began to increase again at week 14, but not significantly.

The results of temperature analysis showed that the increase in temperature at the beginning of composting was not significant and did not reach the thermophilic n phase (45-65°C) in all treatments. Aerobic composting has a fairly strong increase in temperature during the first 3-5 days and can reach 55-70°C(Irianti & Suyanto, 2017). The composting process in week 1 experienced the highest temperature increase of 32.25°C with a variety of tankos compost + fronds + LCC. While the composting process in week 16 experienced the highest temperature of 24.83°C for the type of tankos compost + fronds + LCC. Types of bioactivators also have the same effect on compost temperature. The increase in temperature which did not reach the thermophilic phase was thought to be due to the low compost pile of only 20-30 cm and the presence of a leak in the compost chamber at the start of composting (week 2) so that the material was too wet.

The optimum compost heap height is 1-2.2 m. The height of the heap of organic matter has an effect on the composting process. If the height of the pile of organic matter in composting is low, heat in the pile is difficult to form and an increase in temperature does not occur. High temperatures during composting are very effective for pasteurization of pathogenic microorganisms and regulate evaporation, and can accelerate the degradation of organic matter from the composted material.(Saraswati & Praptana, 2017). Material that is too wet shows increased moisture content. Moisture content affects the compost decomposition rate and temperature. Excess water will cover the air voids in the compost pile so that oxygen in the pile will decrease which will cause aerobic microorganisms to die. This causes the population of microorganisms to decrease. Microorganism activity will decrease, energy/heat will also be reduced and composting will be hampered.

In the 14th week of composting, the temperature increased again in all treatment combinations. This indicates the presence of microbial activity in decomposing organic matter to produce energy in the form of heat, CO2 and water vapor(Asyerem, 2012). C. Compost pH

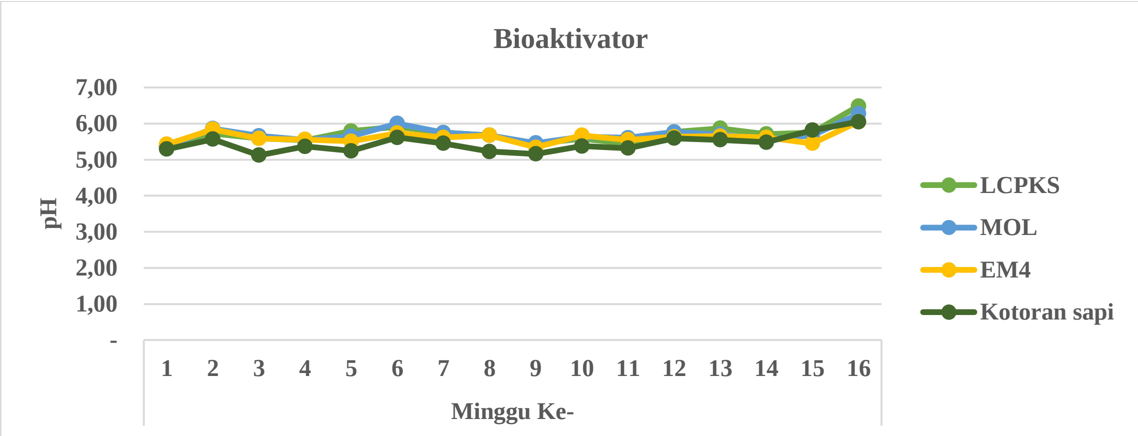
The results of variance at week 16 showed that the compost material had a significant effect on the pH while the bioactivator and the interactions between the two did not have a significant effect on the compost pH. The results of the analysis can be seen in Table 3.

Table3. Effect of types of bioactivators and types of compost materials on compost pH at week 16

Bioactivator	Compost material				Average
	Tankos	Midrib	Tankos + midrib	Tankos + midrib + LCC	
LCPKS	6,53	6,53	6,20	6,67	6,48 a
MOL	6,67	6,47	5,73	6,20	6,26 a
EM4	6.00	6,20	5,60	6,40	6.05a
Cow dung	5.87	6,13	6.00	6,20	6.05a
Average	6.26 p	6.33 p.m	5.88 q	6.36 p	(-)

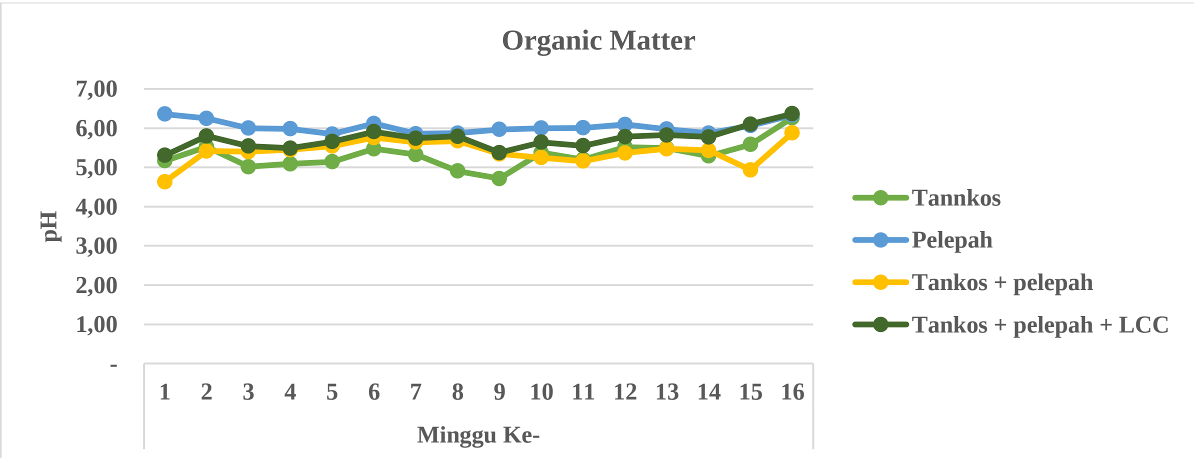
Note: The mean number followed by the same letter in a column or row is not significantly different based on the DMRT level of 5% (-) : No interaction

Table 3 shows that the various types of tankos, frond, and tankos + frond + LCC compost materials have a better effect on the pH of the compost compared to the tankos + frond compost material. While the type of bioactivator has the same effect on the pH of the compost. LCPKS bioactivator shows a higher pH value than other bioactivators. pH observations were carried out every week for 16 weeks. The observations showed that there was a change in pH during the decomposition process which can be seen in Figure 3.



Picture3. Effect of bioactivator types on compost pH

In Figure 3 it can be seen that the EM4 type of bioactivator showed the highest pH in week 2, then all bioactivators experienced fluctuations, the lowest pH occurred in week 3 in the cow dung bioactivator. Then all bioactivators increased until week 16. LCPKS bioactivator showed the highest pH at the end of composting.



Picture4. Effect of compost materials on compost pH

In Figure 4 it can be seen that the types of tankos compost, tankos + fronds, tankos + fronds + LCC increased in week 2, while fronds composted decreased. All compost materials showed fluctuations, tankos compost materials showed the lowest pH decrease in week 9. Furthermore, all compost materials showed an increase in week

16, the highest pH occurred in tankos + midrib + LCC compost materials at the end of composting.

The results of the analysis showed that the pH of the various types of tankos compost + fronds + LCC had the best pH value of 6.36 in the last week. This is because the mixture of compost materials contains high nitrogen, especially in LCC. The process of forming ammonia from materials containing high nitrogen will increase the pH value. The addition of various types of bioactivators did not have a significant effect on the pH of the compost. An increase in pH according to can occur due to a decrease in the activity of microorganisms(Siagian et al., 2021). This decrease in activity will release NH3, the presence of NH3 affects the pH conditions in the compost. The increase in pH until the end of composting is due to the activity of methanogenic bacteria which convert organic acids into other compounds such as CH3 and CO2. The optimum pH of composting organic matter ranges from 5.5 to 8.0. Usually the pH drops slightly at the beginning of the composting process due to the activity of bacteria that produce acid. The emergence of other microorganisms from the decomposed material causes the pH of the material to rise again after a few days and the pH is in a neutral condition.

This is consistent with research conducted at the beginning of the composting, namely week 3 on the cow dung bioactivator showing the lowest decrease in pH of 5.13 and in week 9 on the tankos compost material showing the lowest decrease in pH of 4.72 compared to other compost materials and so on. The pH starts to increase until the end of composting. The final results of the composting study with all treatment combinations had an average final pH ranging from 6.05 to 6.48 and even close to 7. These results met the quality standards of organic fertilizers based onNational Standardization Body (2018)i.e. 4-9.

C. Compost smell

Aroma observations were carried out every week for 16 weeks. The ongoing decomposition process causes a change in the aroma of compost. Observation results can be seen in Table 4.

Table4. Effect of types of bioactivators and types of compost materials on the aroma of compost at week 16

Bioactivator	Compost material			
	Tankos	Midrib	Tankos + midrib	Tankos + midrib + LCC
LCPKS	3	3	3	3
MOL	3	3	3	3
EM4	3	3	3	3
Cow dung	3	3	3	3

Scale: 1 (pungent), 2 (moderate), 3 (no smell)

From the results of the study showed that the aroma of compost at the end of the observation was no longer smelly. Meanwhile, at the beginning of composting, a pungent odor appeared in all treatment combinations, especially those with cow dung. The presence of a pungent odor is caused by the presence of ammonia which comes from the activity of microorganisms in decomposing nitrogen in the compost. As decomposition progresses, the odor changes from pungent to almost earthy. Decomposition by microbes causes the compost produced to decrease, the smell that was originally pungent will be replaced with an earthy smell which indicates the compost has matured.

D. Compost shrinkage

Table 5. The effect of the type of bioactivator and the type of compost material on the percentage of depreciation of compost material at week 16

Bioactivator	Compost material (% volume)				Average
	Tankos	Midrib	Tankos + midrib	Tankos + midrib + LCC	
LCPKS	58.00	45,33	55,33	59,33	54.50 a
MOL	56.00	48,67	58,67	52.00	53.83 a
EM4	51,33	51,33	52.00	60,67	53.83 a
Cow dung	56,41	53.85	55.90	57.95	56.02a
Average	55.43 p.m	49.79 q	55.47 p.m	57.48 p.m	(-)

Note: The mean number followed by the same letter in a column or row is not significantly different based on the DMRT level of 5% (-) : No interaction

Table 5 shows that the various types of tankos + frond + LCC compost material have a better effect on compost depreciation than the frond compost material but have the same effect on the tankos compost material, and tankos + fronds. While the type of bioactivator has the same effect on compost depreciation. However, cow dung bioactivator showed the highest shrinkage compared to other bioactivators.

The results of the analysis show that the type of compost material has a significant effect on compost shrinkage. The type of tankos + frond + LCC compost material showed the highest shrinkage of 57.48% and was the same as tankos, tankos + fronds compared to frond compost which was only 49.79%. Cow dung bioactivator also showed the highest shrinkage, namely 56.02%, but it had no significant effect on all bioactivators. The real effect of depreciation of the compost material is thought to be because the tankos material has already been milled when it is in the PKS so it is not so hard. The mixing of compost with LCC is due to its high nitrogen content and low lignin and cellulose making it softer and easier to decompose. Meanwhile, midribs containing high lignin and cellulose are only chopped manually so that they are more difficult to decompose.

E. Compost Crumbs

Table 6. Effect of types of bioactivators and types of compost materials on crumbling compost at week 16

Bioactivator	Compost material				Average
	Tankos	Midrib	Tankos + midrib	Tankos + midrib + LCC	
LCPKS	2.0	2.0	2,3	2.0	2.08a
MOL	2.0	2.0	2,6	2,3	2.25 a
EM4	2.0	2.0	2.0	2,3	2.08a
Cow dung	2,6	2.0	2.0	2,6	2.33 a
Average	2.0 p	2.0 p	2.25 p	2.33 p	(-)

Scale : 1 (dense), 2 (not too crumbly), 3 (crumbly)
Note: The mean number followed by the same letter in a column or row is not significantly different based on the DMRT level of 5 (-) : No interaction

The texture or crumbness at the beginning of the organic matter from tankos, fronds and LCC is still rough with a scale of 1 (dense). The composting process for 16 weeks changed the crumb scale to 2 (not too crumbly). The activity of microorganisms in decomposing organic matter will cause the density of the material to be reduced to a slightly crumbly state. Mature compost is characterized by its dark brown to black color and odorless and crumbly texture(Daryono et al., 2017).

F. Compost color

Table7. The effect of the type of bioactivator and the type of compost material on the color of the compost at week 16

Bioactivator	Compost material				Average
	Tankos	Midrib	Tankos + midrib	Tankos + midrib + LCC	
LCPKS	2,33	2.00	2,33	2,33	2.25 a
MOL	2.00	2.00	2.67	2,33	2.25 a
EM4	2.00	2.00	2.00	2,33	2.08a
Cow dung	2.00	2.00	2.00	2.00	2.0a
Average	2.08 p	2.0 p	2.25 p	2.25 p	(-)

Scale :1 (light brown), 2 (brown) and 3 (dark brown).
Information : The average number followed by the same letter in a column or row is notsignificantly different based on DMRT level of 5% (-) : No interaction

The composting process causes a change in the color of the compost material from green to brown and finally to black. The color of the compost like this shows the maturity of the compost and has been decomposed by decomposer microbes. LCPKS, MOL, EM4 and cow manure show the same blackish discoloration until the end of composting.

4. CONCLUSION

Based on the research results, the addition of bioactivator speeds up the composting process of empty palm fruit bunches (tankos), fronds and LCC. The addition of cow dung bioactivator for the composting process in empty palm fruit bunches (tankos) showed the highest C/N ratio of 23. Composting with empty palm fruit bunches (tankos) + fronds + LCC gave a better effect at a pH of 6.36

and a reduction in compost weight of 57.48%. The process of decomposition of organic matter causes the temperature to rise by an average of 32°C, with a pH of 6, the color changes to brownish, the texture becomes slightly crumbly and has no odor.

ACKNOWLEDGEMENT

The author thanks PT. SMART Tbk and the Yogyakarta Stiper Agricultural Institute for supporting and facilitating this research so that this research goes well.

REFERENCE

Ardiningtyas, TR (2013). The Effect of Using Effective Microorganism 4 (Em4) and Molasses on Compost Quality in Composting Organic Waste at Dr.R Soetrasno Hospital, Rembang. 4, 109.

Asyerem, FSJ (2012). Utilization of Trichoderma Biological Agents and Bacteria in Composting Ageratum conyzoides. L, Tithonia diversifolia (Hemsley) A. Gray and Sago pulp. Journal of Agrotek, 3(3), 15–24.

Azlansyah, BA, Silvina, F., & Murniati. (2014). Effect of Composting Time of Oil Palm Empty Bunches (EFB) on the Growth and Development of Oil Palm Seedlings (Elaeis guineensis Jacq). Online Journal of Students of the Faculty of Agriculture, University of Riau, 1(1), 1–12.

National Standardization Body. (2018). Solid Organic Fertilizer. National Standardization Body, 1–20.

Daryono, TRA, Cultivation, P., Plantation, T., Agriculture, P., & Samarinda, N. (2017). MAKING BOKASHI WASTE FROM OIL AND PALM OIL LEAVES (Elaeis guineensis Jacq) MAKING BOKASHI WASTE DISPOSAL AND PALM OIL LEAVES (Elaeis guineensis Jacq). Loupe Bulletin, 14(1), 6–12. https://www.neliti.com/publications/331124/pembuatan-bokashi-limbah-pelepah-dan-daun-kelapa-sawit-elaeis-guineensis-jacq

Directorate General of Plantations. (2021). National Leading Plantation Statistics 2019-2021, Oil Palm. Directorate General of Plantations, Ministry of Agriculture, Republic of Indonesia, 1–88.

Hasibuan, ZH, Sabrina, T., & Sembiring, M. (2012). Potential of Azotobacter Bacteria and Forage Mucuna Bracteata in Increasing Nitrogen Nutrients in Compost of Empty Palm Oil Bunches. Journal of Agroecotechnology, 1(1), 237–253.

Hety, IY, & Prasetya, WB (2017). Easy and Fast Ways to Make Compost (Y. Veronik (ed.); 1st ed.).

Irianti, ATP, & Suyanto, A. (2017). Utilization of Trichoderma sp Fungi and Aspergillus sp As Decomposers in Rice Straw Composting. Journal of Agroscience, 13(2), 1–9.

Kesumaningwati, R. (2015). Use of Banana Weevil Mol (Musa paradisiaca) as a Decomposer for Composting Empty Palm Oil Bunches. Ziraa'ah, 40(1), 40–45.

Kesumaningwati, R. (2018). Use of Banana Weevil Mol (Musa paradisiaca) as a Decomposer for Composting of Banana's Corm (Musa paradisiaca) Microorganisms as Oil Palm Empty Fruit Bunches Decomposer). Ziraa'ah, 40(1), 40–45.

Mardiana, S., Panggabean, EL, Kuswardani, RA, Usman, M., Agrotechnology, P., Agriculture, F., & Area, UM (2018). Agrotekma : Journal of Agrotechnology and Agricultural Science Utilization of Tea Powder Waste as a Substitution of Saw Powder on Mycelium Growth and White Oyster Mushroom Production Utilization of Tea Powder Waste as a Substitution of Saw Powder on Mycelium Gr. 3(1), 27–38.

PM Pardede, Armaini, SIS (2014). APPLICATION OF ORGANIC AND INORGANIC FERTILIZER FOR

MUSTARD (Brassice juncea L.) APPLICATION. 3(3), 63–77.

Rahmadanti, MS, Okalia, D., Pramana, A., & Wahyudi. (2019). Various Combinations of Empty Palm Oil Bunches (Tkks) and Cow Manure Using Cellulotic Microorganisms (Mos). Scientific Journal of Technoscience, V(2).

Saraswati, R., & Praptana, RH (2017). Acceleration of Aerobic Composting Process Using Biodecomposers. Perspective, 16(1), 44–57. https://doi.org/10.21082/psp.v16n1.2017

Siagian, SW, Yuriandala, Y., & Maziya, FB (2021). ANALYSIS OF TEMPERATURE, pH AND QUANTITY OF COMPOST RESULTS FROM MODIFIED AEROB REACTOR COMPOST FROM FOOD WASTE AND FRUIT WASTE. Journal of Environmental Science & Technology, 13(2), 166–176. https://doi.org/10.20885/jstl.vol13.iss2.art7

Suryanto, E. (2019). The Effect of Application of EM4 (Effective Microorganism 4) Dosage on the C/N Ratio and Compost Texture from Goat Manure as a Biology Learning Source for Junior High Schools. Journal of Education Lantern Research Center LPPM UM METRO, 4(1), 53–62.

Widiyawati, I., Sugiyanta, Junaedi, A., & Rahayu Widyastuti. (2014). The Role of Nitrogen Fixing Bacteria to Reduce Inorganic Nitrogen Dosage in Lowland Rice. J. Agron. Indonesia, 42(2), 96–102.

Widyastuti, L., Sulistiyanto, Y., Jaya, A., Jagau, Y., & Neneng, L. (2019). Potential of Microorganisms as Biofertilizer from Palm Oil Mill Effluent. Surya Medika Journal, 5(1), 1–12. https://doi.org/10.33084/jsm.v5i1.941

Zainudin, Z., & Rofik, A. (2019). Utilization of Palm Oil Mill Liquid Waste as a Bioactivator for Composting Empty Palm Oil Bunches. Agrifarm : Journal of Agricultural Sciences, 8(1), 7–15. https://doi.org/10.24903/ajip.v8i1.525