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The Composting Technique of Empty Palm Oil Bunches Waste by The Applicaton of Diverse Moles to Increase Quality of Compost and Chili Growth

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ABSTRACT: *The process of palm oil bunches in the factory produces abundant wastes, both solid and liquid wastes, whereas the processing of 1 ton palm oil bunches will produce 21-23% empty bunches and 0.4-0.7 tons liquid wastes. However, it is the biggest problem that must be faced by the palm oil industries and it creates environmental pollution due to it contains pollutant, and some solutions are required to overcome these problems. Composting technique is the right solution for the problems by turning the wastes into organic fertilizer (compost). Naturally, it takes longer time for the organic wastes to decompose into organic fertilizer so that an activator is required to accelerate the decomposition by adding MOL or local microorganism, which is made from the wastes of shrimp heads, fish bones, and banana humps, and according to the preliminary research, they are very effective to accelerate the composting and fermenting process. Objectives of the research were: 1) analyzing physical properties of the compost (color, odor, shape, texture, temperature, and the day when the compost is ready to be used), 2) analyzing the nutrient content of the compost based on the treatments that include C/N Ratio, phosphor, nitrogen, calcium, potassium, sulfur, magnesium, and pH, 3) finding out quality of the compost resulted from the research by comparing it with the compost standard based on the standard of SNI 19-7030-2004, and 4) measuring the best vegetative growth of chili after being treated. Results of the research showed that 1) the compost is well-done at the 37th day as marked by the physical properties, for instance, loose texture, crushed-shape, brownish black, odorless, and the temperature is stable close to room temperature, 2) Compared to standard of SNI 19-7030-2004, the resulted compost has met the standard for pH H_2O, N, P, and K, but it has not met the standard for C Organic and C/N ratio, 3) The growth of chili, the plant height and leaf width, did not show significant difference by the treatment of P0, P1, P2, and P3, but it showed significant difference on number of leaves, leaf length, and diameter. However, P3 is the best treatment based on average value of the increase plant height of 11.40 cm, number of leaves is about 10.75, leaf width of 2.35 cm, leaf length of 0.50 cm, and stem diameter of 3.99 mm.*

KEYWORDS: activator, compost, MOL, physical property, chemical property, Chili

INTRODUCTION

Palm oil is a leading plantation commodity in East Kalimantan with areas suitable for palm oil as seen in 2020, ± 393 companies have operated plantations with a total of 94 palm processing factories with capacities up to 5,005 tons and 4,337 tons used with a total FFB (fresh fruit bunch) production of 17,723,864 tons or equivalent to 3.8 million tons Crude Palm Oil (Anonymous, 2021).

During FFB processing, the oil palm factories produce a large amount of solid and liquid wastes, whereas 1 ton FFB processing produced 21-23% solid waste of empty bunch and 0.4-0.7 tons liquid waste. However, if the wastes are left untreated, they will cause pollution and endanger human beings (Rahmadi, et al., 2014). So, it requires proper handling to overcome the problem, and the solution is processing the wastes into compost and returning it to the soil through fertilization (Purba and Sipayung, 2017). According to Hannum (2014) based on the previous research, if compost is applied to damaged and nutrient-poor soil, the physical properties of the soil can be improved, such as increasing the pores in the soil, loosen the soil, increasing the cation exchange capacity, and the ability of the soil to hold water. Chemically, the addition of organic matter increases the nutrient content in the soil; and biologically, it increases microorganism population in the soil.

The effective composting technique is a quick composting process that is made of inexpensive materials, odorless or smell like soil and good quality. Natural composting takes a relatively long time. During the study, MOL is applied as activator to accelerate the composting, which is made of banana humps, shrimp heads, and fish bones.

As a test plant, chili plants were used where the presence of chili in Samarinda depended on supplies from outside the region, Java Island, so that the price of chili is relatively high. In addition, it is also affected by the transport fleet, weather, and certain conditions. For this reason, a technological breakthrough is needed so that the price of chili becomes normal by self-cultivation so that the supply of chili will always be available and the price is stable.

Problem to be Researched

1. Utilizing banana humps, shrimp heads, and fish ones to be used as local microorganism to accelerate the composting process.
2. Utilizing the waste of palm oil processing such as empty palm oil bunches as useful product by making it into compost.
3. Improving physical and chemical properties of the nutrient-poor soil so that the plants will grow well and increase the production value by the application of compost.

Special Purposes:

1. Producing MOL that made of the banana humps, shrimp heads, and fish bones wastes.
2. Analyzing physical properties of the compost (color, odor, shape, texture, temperature, and the day when the compost is ready to be used).

3. Analyzing nutrient content of the compost based on each treatment (C/N Ratio, phosphor, nitrogen, calcium, potassium, sulfur, magnesium, and pH).
4. Finding out quality of the compost resulted from the research by comparing it with the standard issued by the Minister of Agriculture Regulations No.261/KPTS/SR.310/M/4/2019.
5. Measuring the best vegetative growth of chili after being treated.

Urgency of the Research

The processing of 1 ton palm oil resulted ± 20-23% waste of empty bunches and 0.4-0.7 tons liquid wastes, and if the wastes are left untreated, of course, they will create pollution and have negative impact on the surrounding environment. These are what the researchers consider to maximize waste management so that its productivity can be utilized optimally.

Special Specification

Producing MOL formula to accelerate decomposition of palm oil bunches waste.

METHOD OF THE RESEARCH

A. Time and Location of the Research

The research was planned to be carried out for 4 months from August to November 2022 that comprises of making MOL, compost, analysis on nutrient contained in MOL, compost and soil, as well as application of the chili plants in marginal land.

The research has been conducted at the laboratory of Production (making of MOL and compost), laboratory of soil science (chemical analysis of compost, MOL, and soil), in the pilot garden of chili planting.

B. Tools and Materials

Tools of the research include: bucket, dipper, calibrated beaker, box, blender, machete, knife, hoe, shovel, scales, arco chopping machine, and sieve, glass bottle, stationeries, and camera.

The materials include: fish bones, banana humps, shrimp heads, water, waste water of rice, sugar, empty palm oil bunches, manure, chili plants, bucket, polybags, tarpaulin, label paper, and tissue.

C. Procedures of the Research

1. Making MOL

There are 3 treatments of raw materials that include banana humps (M1), shrimp heads (M2), and fish bones (M3):

a. Prepare materials for MOL: 25 kg fish bones, 25 kg shrimp heads, and 100 kg banana humps are blend till they are smooth and mixed evenly.

b. Make a sugar solution for each treatment, 2.5 kg sugar are put into 50 l water, and 100 l waste water of rice.

c. Procedures:

Blend the whole materials in accordance with the treatment, then put them into a drum, and add the sugar solution and waste water of rice, stir thoroughly, and then close the drum tightly. For aeration, make a small hole in the lid then give a hose and connect it with a bottle filled with water. After 14 days, the bacterial proliferation has been well done and sieved, and then put it into the bottle. MOL is well-done when odorless white spots emerge. The

physical properties observed are as follow: color, odor, temperature, and the day when white spots emerge. MOL can be applied directly as activator.

d. MOL Analysis

Results of data on the change of color, odor, temperature, and the day when the spots emerge, and the nutrients, are presented in tabulation table.

2. Making Compost

Steps in making compost:

a. Empty palm oil bunches are chopped using a chopping machine.

b. MOL activator resulted from the research, which was made of banana humps, shrimp heads, and fish bones with ratio of each 1 l MOL is dissolved in 15 l water and 150 g sugar.

c. Procedures:

Empty palm oil bunches were finely chopped using the chopping machine (chopper), and then added with MOL activator TKS in accordance with the treatment and then stirred evenly and diluted to reach 30% with characteristics when the mixture of materials is held by hand, it will agglomerate and water will come out of the grip and if the grip is opened, the mixed material remains the same in an agglomerated condition. The compost dough is placed on the floor and then covered with a tarpaulin by the terms that the pile is not exposed to direct sunlight and rain.

d. Observation

During the composting process, physical properties of the compost are observed everyday that include the changes in temperature, shape, color (discoloration), odor, and humidity by comparing the outcomes between pre-and-post composting. The compost is well-done if the color turns into blackish brown, odorless, crumb texture, easy to crumble, and the temperature has stabilized close to room temperature.

3. Nutrient Content Analysis

Analyze the nutrient contains in compost and MOL: Nitrogen, Phosphor, Potassium, Calcium, Magnesium, Sulfur, pH, and C/N ratio. Data is presented in tabulation table.

4. Analysis of Nutrients Contained in Marginal Land

The soil used for the research must be analyzed at first to find out the nutrient contents that include: C/N Ratio, phosphor, nitrogen, calcium, potassium, sulfur, magnesium, and pH.

5. The mature compost can be applied to marginal land with chili plant test.

a. The applied compost is the best compost resulted from the research. The application comprises of 3 treatments of compost: P0 (control), P1 (ratio of 25% compost : 75% soil), P2 (ratio of 50% compost : 50% soil), and P3 (ratio of 75% compost : 25% soil) and repeated 30 times (replications).

b. Parameters of the observation include: the increase of plant height, number of leaves, leaf length, leaf width, and stem diameter, which are observed every 2 weeks.

c. Data analysis used statistics with each treatment is repeated 30 times (replications).

RESULTS AND DISCUSSIONS

Physical Analysis of the Compost

During the composting process for 40 days, physical properties of the compost were observed such as color, odor, shape, and temperature of the compost. Observation was

conducted pre-and-post composting process. Temperature is measured everyday to find out the dynamics of temperature increase during the decomposition process takes place until it becomes compost. Results of the observation on the speed of the composting period which is known from duration of the compost raw materials turn into compost that is ready to be applied. Results of the observation on speed of the composting period are tabulated in Table 1.

Table 1. Speed of the Composting Period

Day	Observation			Temperature		Description
	Color	Odor	Shape	Space	Compost	
1	Yellowish brown	Odorless	Intact	32	36	Immature
2	Yellowish brown	Odorless	Intact	32	38	Immature
3	Yellowish brown	Odorless	Intact	33	37	Immature
4	Yellowish brown	Odorless	Intact, a bit withered	34	37	Immature
5	Brownish yellow	Odorless	Intact, a bit withered	34	38	Immature
6	Brownish yellow	Odorless	Intact, a bit withered	30,5	37	Immature
7	Deep brown	Odorless	Intact, withered	33	37	Immature
8	Deep brown	Odorless	Start to crumble	37	38	Immature
9	Blackish brown	Odorless	Start to crumble	34	39	Immature
10	Blackish brown	Odorless	Start to crumble	32	40	Immature
11	Blackish brown	Odorless	A bit crumble	34	36	Immature
12	Blackish brown	Odorless	A bit crumble	34	38	Immature
13	Blackish brown	Odorless	A bit crumble	36	39	Immature
14	Blackish brown	Odorless	A bit crumble	33	36,5	Immature
15	Dark brown	Odorless	A bit crumble	34	37	Immature
16	Dark brown	Odorless	A little crumb	34	38	Start to mature
17	Dark brown	Odorless	A little crumb	34	37	Immature
18	Dark brown	Odorless	A bit crumble	33	37	Immature
19	Blackish brown	Odorless	A bit crumble	34	36	Immature
20	Black	Odorless	A bit crumble	33	35	Immature
21	Blackish	Odorless	A bit crumble	33	36	Immature

	brown					
22	Blackish brown	Odorless	A little crumb	31	36	Immature
23	Blackish brown	Odorless	A little crumb	32	35	Immature
24	Blackish brown	Odorless	A bit crumble	31	35	Immature
25	Blackish brown	Odorless	A bit crumble	32	34	Immature
26	Blackish brown	Odorless	A bit crumble	33	35	Immature
27	Blackish brown	Odorless	A bit crumble	33	35	Immature
28	Blackish brown	Odorless	A little crumb	32	34	Immature
29	Blackish brown	Odorless	A little crumb	30	35	Immature
30	Blackish brown	Odorless	A little crumb	33	34	Immature
31	Blackish brown	Odorless	A little crumb	32	33	Immature
32	Blackish brown	Odorless	A bit crumble and little crumb	32	34	Immature
33	Blackish brown	Odorless	A bit crumble and little crumb	33	35	Immature
34	Blackish brown	Odorless	A bit crumble and little crumb	34	34	Immature
35	Blackish brown	Odorless	A bit crumble and little crumb	32	35	Immature
36	Blackish brown	Odorless	A bit crumble and little crumb	33	34	Immature
37	Blackish brown	Odorless	A bit crumble and little crumb	33	34	Mature (Well-done)
38	Blackish brown	Odorless	A bit crumble and little crumb	34	34	Mature (Well-done)
39	Blackish brown	Odorless	A bit crumble and little crumb	33	34	Mature (Well-done)
40	Blackish brown	Odorless	A bit crumble and little crumb	33	34	Mature (Well-done)

Based on results of the research in Table 1, they show that mature or well-done compost takes place at 37th day, which is marked by discoloration of compost that turns into black like soil, odorless, crumb texture (crumble when squeezed) and temperature of the compost in the composting room as shown by the Figure below.

a  b

Figure 1. Materials of Compost at the beginning, processing, and end of composting (a and b)

Based on results of the research, the mature compost is well-done at the 37th day as marked by black compost, odorless, crumb texture, and stable temperature that close to room temperature. Composting has taken place for 40 days, and visually, maturity of the compost can be found out as follow:

1. Odor

In early composting process, it smells bad but following the decomposition process, the mature compost smells like a soil. It was presumed that aeration inhibition causes anaerobic processes which produce an unpleasant odor. Anaerobic process will produce compounds that smell bad, such as organic acids, ammonia, and H_2S (Hardiatmi, S. 2011). Aeration can be increased by turning over the pile of compost.

2. Color

Mature/well-done compost is blackish brown (Figure 1), the change of color from urban wastes which is still fresh (greenish) at the beginning of early composting to blackish brown at the end of composting due to the organic materials were decomposed by activities of various microorganisms. The aerobic decomposition process is shown by the change of color into blackish (Sahil. J, 2016).

3. Temperature

Temperature of mature compost closes to the initial composting temperature or composting room temperature. Temperature increased at the initial composting more than 30^0C and kept high for certain period. According to (Sahil J, 2016), it showed that the decomposition process of organic matters is very active. By using oxygen, the microbes in the compost will decompose the organic matters to become CO_2, moisture and heat. After most of the materials were decomposed, the temperature will gradually decrease. At that time, the compost was well-done by the formation of clayey humus.

According to (Sahil J., 2016), temperature highly affects on the composting process because it correlates to type of the involved microorganisms. Optimal temperature for composting ranges 40-60^{0}C, and maximum temperature is 75^{0}C. When the composting temperature reaches 40^{0}C, activities of the mesophyll microorganisms will be replaced by the thermophyll microorganisms. When temperature reaches 60^{0}C, the fungus will stop working and the decomposition process will be continued by *actinomyces* and spore-forming bacterial strains.

4. Shape/Texture

The mature compost is crumbly, feel soft when crushed, easily crushed when kneaded and shrinks in volume as the compost matures. In this study, volume of the compost decreased 20%. According to (Nurlela, 2017), organic materials in composting undergo various biological changes carried out by microorganisms, these changes include: (1) decomposition of carbohydrate, cellulose, hemicelluloses, and etc. into CO_2 and water, (2) the breakdown of fats and waxes into CO_2 and water, (3) decomposition of egg whites through amides and amino acids into ammonia, CO_2 and water, (4) there is a binding of several types of nutrients in microorganismns, especially N, P and K, and these elements will be released again when the microorganism dies, and (5) the release of nutrients from organic compounds into inorganic compounds that are useful for plants.

During the study, the composting process took 37 days to produce mature compost due to the compost materials come from hard empty palm fruit bunches waste so that it is difficult to rot and the composting process runs slowly. According to Indriani, Y.H. (2011), the variety of raw materials used is very influential, the more varied the raw materials used in composting, the decomposition is relatively faster than similar raw materials.

Compost matures faster affected by raw materials of the compost as well as other factor, for instance, the activator, which accelerate the composting process. In this study, the activator used MOL, which is made of fish bones, shrimp heads, and banana humps, so that the MOL contains microorganisms as organic decomposer that could accelerate the composting process. According to Suhastyo (2011), banana humps contain microbes of organic decomposer. Such decomposer microbes are located on both outside and inside of the banana humps, while microbes that have been identified in MOL of the banana humps are *Bacillus* sp., *Aeromonas* sp., and *Aspergillus* nigger. These microbes are used to decompose organic matters. Microbes in MOL of banana humps will act as decomposer of organic materials, which are going to be composted.

Maspary (2012) suggested that banana humps contain gibberellins and cytokinin as growth regulators, and 7 microbes that are useful for the plants are *Azospirillium, Azotobacter, Bacillus, Aeromonas, Aspergillus*, phosphate solubilizing microbes, and cellulotic microbes that can be utilized as MOL. For MOL materials, not only fish bones, shrimp heads, and banana humps, there are also other ingredients, such as sugar and waste water of rice that could assist the composting process. Palm sugar is used as glucose source, the energy source

for microorganisms to proliferate. Waste water of rice is used as source of carbohydrate and additional nutrient because it contains some nutrients, which are required by the plants and it could promote the root growth (Jumriani *et al*. 2017).

Results of the Chemical Analysis on Compost

The mature compost resulted from the research will be analyzed, in relation to the nutrients contained in compost, such as: pH, C/N ratio, N, P, and K in laboratory, and then compared to the standard of SNI 19-7030-2004, and presented in a comparative tabulation table.

Table 2. Comparison of nutrients content in compost with the Standard of SNI

Parameter	Standard of SNI 19-7030-2004	Compost Resulted from the Research	Description
pH H_2O	6.80-7.49	7.01	Meet the standard
C-Organic (%)	9.8-32	46.5238	Has not met the standard
C/N ratio	10-20	66.6221	Has not met the standard
N (%)	>0.40	0.6983	Meet the standard
P (%)	>0.1	0.1133	Meet the standard
K (%)	>0.2	0.8357	Meet the standard

Based on Table 2 above, compared to the standard of SNI19-7030-2004, pH H_2O, N, P and K contained in compost resulted from the research have met the standard. But, C organic and C/N ratio have not met the standard. Moreover, pH H_2O in compost has met the standard due to raw materials used could increase pH. In this case, (Rao N. S. S, 2010) suggested that the composting process will cause a change in the pH of the material itself, for instance, temporal acid releasing process will decrease pH, while ammonia produced from compounds, which contain nitrogen, will increase pH in early phases of composting. This proves the occurrence of bacterial activities during the composting and MOL could decompose the available nutrients, so that pH would be better and suitable with the needs of the plants to grow. The increase pH may also be caused the increase of Calcium and Phosphor levels. It is due to phosphor contained in the fish bones will be bound to be a compound of Calcium phosphate or Ca_3 $(PO_4)_2$ (Mazaya,M., 2013). The higher the phosphorus level, the higher the calcium level and cause the change in pH because calcium has alkaline property. (Adiningsih. Y and Sitorus.S., 2017).

One of compost maturity criteria is C/N ratio, compost resulted from the research has C/N ratio 66.6221, and it has not met the standard of SNI. This is due to the raw material for compost, empty palm fruit bunches, which are hard and rather difficult to rot, so it takes a long time to completely decompose. High C/N ratio in compost resulted from the research indicates that the compost has not been ready to be applied to the plant as fertilizer because compost in the soil will be further decomposed in order to be absorbed by the roots for the plant growth (Firmansyah, 2011), so that compost can be utilized directly by the plant to grow. Based on result of the research on compost, N, P, and K have met the standard, and

indicate that the compost material, empty palm fruit bunches, contains nutrients N, P, and K, which are affected by the time the composting process has run optimally with the addition of MOL activator that could accelerate the composting process so that the nutrients can be utilized by the plants. In general, the mature compost is dark in color (blackish brown) and the texture is crumbly and the original shape is no longer visible. The addition of mature compost will contribute N N in the soil and the plant gets additional N from the compost (Firmansyah, 2011).

Total nitrogen obtained from sample of the compost, which was resulted from the research, has met the standard of SNI, and the activator used MOL resulted from the research, which was presumed that the microorganism content used as an activator is not known for the type of microorganism because it has not been tested for the type of organism content. In accordance to Rusvita (2012), the application of diverse decomposers with different concentrationmay cause different level of N, P, K and C/N Ratio of compost. It is presumed to be caused by the raw material of the compost, the fineness of the media in chopping, and turning over the compost was not optimal so that it significantly affects on Nitrogen level in the compost. Besides that, lignin content in the compost is not matched by the availability of nitrogen content where the correlation between C and N lost in the composting process shows that 85% of the initial total N compost is available for microbes to grow so that the use of *M. bracteata* bacteria which contin high nitrogen in composting will affect nitrogen availability as the important factor in composting (Hasibuan, et al., 2012).

Organic material or compost and liquid organic fertilizer is one of determining factors for the availability of nutrients in the soil, even though in small quantity but complete. Besides that, it could improve physical, biological, and chemical properties of the soil, and one of them is able to supplement P availability in the soil (Novriani, 2010). Moreover, organic fertilizer has double function, not only add nutrients in the soil, but also increase organic matters in the soil, which is required to improve physical properties of the soil. By increasing organic matters of the soil, its structure will be more stable and the ability to hold water will improve. Such physical properties improvement has positive effect on root growth and nutrient absorption (Rozy et al., 2013).

Even though compost resulted from the research contain low N, P, and K, but if it is applied in the soil, it will be able to fertilize the soil and improve physical properties of the soil. According to Hannum, et al. (2014), compost could increase nutrients and decrease Al in the soil that will be able to improve P intake. In accordance to Supriyadi (2008), organic materials (compost) do not only affect on N and bases, but also affect on ability of the soil to hold and release nutrients in cation form. Organic feetilizer (compost) applied in the soil is source of organic matter of the soil, which is useful for 1) improving physical properties of the soil, such as soil aggregates, permeability, soil aeration, ability to hold ground water, reducing erosion, the soil would not crust and crack when dry, 2) improving chemical properties, such as Cation Exchange Capacity, soil buffer, suppress poisoning, efficient fertilizer application, increasing nutrients in the soil, forming chelate to increase

micronutrients, 3) improving biological properties of the soil, such as energy source of the microorganisms (Firmansyah, 2011).

Compost Applied on Chili Plant

Based on results of the research on growth of chili plants, the increase of height, number of leaves, leaf length and leaf width, as well as stem diameter showed that all treatments did not show significant difference on observation from the 1st-month to the 4th-month, except the observation on number of branches at the 1st-month which showed significant difference.

Table 3. The Increase of Chili Plant

Treatment	Observation				
	Height	Number of Leaves	Leaf Width	Leaf Length	Diameter
P0	6,98^{tn}	4,25*	1,75^{tn}	0,25*	1,99*
P1	7,88^{tn}	6,00*	1,59^{tn}	0,46*	2,70*
P2	7,38^{tn}	10,50*	1,83^{tn}	0,40*	2,93*
P3	11,40^{tn}	10,75*	2,35^{tn}	0,50*	3,99*

Notes :
P0 = Control
P1 = Ratio of 25% compost and 75% soil
P2 = Ratio of 50% compost and 50% soil
P3 = Ratio of 75% compost and 25% soil


a


b


c

d

Figure 2. The treatment of compost applied on chili.

The whole treatments did not show significant differences on parameters of height, number of branches, length and width of leaf due to the increase application of compost so that the nutrients contained in the soil were insufficient for vegetative growth of peanut plants. But, based on the highest average, K2 is the best treatment for the increase of height, stem diameter, and production, due to more dose of compost were given by ratio 1 compost and 1 soil, so that nutrients contained in the compost are able to promote vegetative and generative growth, such as the increase in height, diameter, and production of chili.

According to Kusumaningwati R. (2015), sufficient nutrients in the right time during vegetative phase will support the rate of carbohydrate formation and new cells formation, as well as the rooting system. It is presumed that the increase dose of compost provide more nutrients, particularly Nitrogen, Potassium, and Phosphate to activate the growth of peanut plants starting from vegetative to generative phases.

Even though compost resulted from the research has not met the standard of good quality according to SNI standard, but it could improve chemical properties of the soil by supplementing nutrients that could promote the peanut growth. According to Kusumaningwati R. (2015) suggested that sufficient amount of nutrients for the plant growth will be able to promote the plant growth. If the soil has sufficient nutrients of the plant growth, the plant will be able to absorb more nutrients from the soil. So, the application of compost as organic fertilizer will make the soil to be more fertile as shown by result of the research, the increase of vegetative growth.

Based on results of the research, the resulted compost has C/N ratio of 66.6221, even though it has not met the standard, but it experiences further decomposition process when it applied in the soil. It is presumed that basic materials of the compost have not completely decomposed due to the composting period was only 40 days so that it requires longer period, even though it indicated that the organic raw materials as ingredients of the compost are difficult to be crumbled, so that the decomposition process take longer period. High value of C/N shows excessive availability of carbon and limited nitrogen. If the compost with high ratio of C/N applied in the soil, microorganisms will proliferate by utilizing N available in

the soil to form protein in the body of the microorganism so that N immobilization occurs. N immobilization is the conversion of inorganic N to organic N by soil microorganisms to arrange tissues in the body. Hakim, et al. (1986). It is supported by suggestion from Darmanti, et al. (2006) who stated that the plants look like having nutrient deficiency after being given compost that has not been completely decomposed. During the decomposition process to completely decomposition process, the plants will compete with soil microorganisms for nutrients. Sutanto (2002) added that in such competition for these nutrients, it is likely that the olants will be failed to compete, so that the plants will experience nutrient deficiency as most of the nutrients are used by soil microorganisms for their metabolisms.

N is highly required for vegetative growth of the plants. N immobilization process shows that N availability has not been sufficient in the soil, so that it will inhibit vegetative growth of the plants and, of course, it will affect on sweet corns production. It is presumed that other factors have affected the increase height, number of branches, leaf length, and leaf width, even though they did not show significant difference on each treatment. It is due to properties of the organic fertilizer (compost) which is required in large amount to meet the needs of nutrients that support plant growth and production.

CONCLUSIONS

Results of the research show that :

1. The mature compost is well-done at the 37^{th} day as marked by physical properties, such as loose texture, crumble, black compost, odorless, and stable temperature that close to room temperature.
2. Compost resulted by the research has met the standard for pH H_2O, N, P, and K, compared to the standard of SNI19-7030-2004. But it has not met the standard for C organic content and C/N ratio.
3. By the treatments of P0, P1, P2, and P3, the growth of chili plants did not show significant difference for plant height and leaf width, but they showed significant differences on number of leaves, leaf length, and stem diameter. P3 is the best treatment based on average value for the increase height of plant 11.40 cm, number of leaves 10.75 leaves, leaf width of 2.35 cm, leaf length of 0.50 cm, and stem diameter of 3.99 mm.

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