Effects of Oil Palm Residues as Bio-Compost on Growth Performance of Oil Palm Seedling

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Abstract: Oil palm reach to uneconomical stage at 25 years old and replanting process will be carried out by felling the entire tree. Zero burning technique that been practices during replanting process contributed to the abundance of oil palm residue. The concept of zero burning is left the chipping and windrowed of oil palm residues to decay. Improper management of zero burning contribute to the breeding of *Orycytes rhinoceros*. Converting of oil palm residue to become valuable product through the composting process is one of the methods in managing the oil palm waste in the field. Compost of oil palm waste can be applied as the organic fertilizer especially in the growing of oil palm seedling. The objective of this study was to determine the effect of oil palm residues as bio compost to the growth performance of oil palm seedling. This study used 12 treatments and one control with designing by using Randomize Complete Block Design. Data collection on growth performance of oil palm seedlings were observes in terms of plant height, number of leave and stem girth for 12 weeks. Data were analysing by using Minitab version 16. The treatment of mixing empty fruit bunch and indigenous microorganism (T9) give the best result on plant height, plant girth and number of leaves. So this organic fertilizer can be suggested to be used in the field in improving the growth performance of oil palm seedling.

Key Words: bio-compost, oil palm residue, seedling

1. Introduction

Oil palm or known as *Elaeisguinensis* was originated from West Africa tropical forest. It is non woody trees that comprise one stem without any branches. It can grow up to 35 meters in high when reach at maturity stage. Oil palm fronds consist of leaves and petiole where leaf was produced from leaf meristem in spiral succession. Oil palm fruit that consist of exocarp, mesocarp, and endocarp has weight per fruits is about 3 to 30 gram with 1 to 2.5 cm length (Fandomet al., 2010). Trunk, fronds and bunch are the main component of the oil palm that illustrate in Figure 1 (Mohideen et al., 2011).

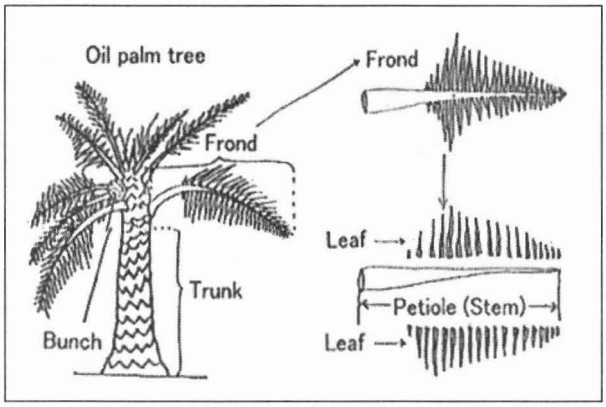

Fig. 1 Anatomy of an oil palm tree and oil palm frond

Oil palm reach to uneconomical stage at 25 years old and replanting process will be carried out by felling the entire tree. There is an abundance of oil palm residue in the field without any specific usage. As usual, farmer just burns those residues to clear all the area but nowadays the new regulations was prohibit open burning system in order to keep the environmental and human health. By practicing zero burning technique, chipping and windrowed of oil palm residues were left to decay in the field. If improper management of chipping and windrowed of oil palm residue in zero burning process, it can contributed to the breeding of pest such as *Orycytes rhinoceros*. This is one of the challenges that our farmer needs to face in practicing zero burning technique during replanting of oil palm (Siti Ramlah, 2010).

Empty fruit bunches (EFB)was contribute 9 percent out of 90 million mt of biomass that was constantly produced by oil palm industry especially in mill area. It is the product after the pressed process of fresh fruit bunches and the oil extraction process. It is usually produced in larger quantities where it took an enormous space of mill area.Nowadays, EFB commonly used as mulch in plantation compared to the past it was only used as fuel at the mills. It was placed around the young palm to control the weeds, helps to avert erosion and retain the soil moisture content (Suhaimi and Ong, 2001).

The abundance waste in oil palm field makes it was appropriate used as raw material for recycling purposes. The recycling of this waste can bring benefits to oil palm plantation. Converting of oil palm residue to become valuable product through the composting process is one of the methods in managing the oil palm waste in the field (Yusof and Chan, 2004). Oil palm residues that recycled can return the nutrient to the soil where one ton of pruned fronds can return an equivalent of 7.5 kg nitrogen, 106 kg phosphorus, 9.81 kg potassium and 2.79 kg magnesium to the soil. The nutrient reserves and recycling from oil palm trunks at replanting stage show that oil palm trunks residue is nearly 70 tons per hectare where the residues contained a massive pool of nutrient that equivalent to 189 kg nitrogen, 22 kg phosphate, 769 kg potassium, 106 kg calcium and 44 kg magnesium per hectare (Kee, 2004).

According to James and Rafiq(2010), composting is the best way to treat wastes that include the natural microbial activities. In this process it will kill the pathogens, stabilized the ammonia to stable organic forms. Besides that, composting is known as environmental waste management where it is practically returning the organic matter to the soil. Several factors that affecting the composting effectiveness are temperature, moisture, oxygen content, air circulation, and present of microorganism. Catalyst is the additive on the compost pile to help accelerate the composting process. One of the factors that can encourage the decomposition process is the present of microorganism. It is because the decomposition of organic matter serves two purposes for microorganisms, providing energy and carbon for the development of microorganism (Ncube et al., 2011).Decomposer subsystem need soil microbial biomass pools as an essential component to regulate nutrient cycle, energy flow and plant ecosystem productivity. Associating beneficial microorganism with organic matter can lead to more rapid mineralization of organic matter

The utilization of oil palm residues may overcome the problem in managing waste and at the same time it will contribute the increasing of nutrient in the soil. Compost of oil palm waste can be applied as the organic fertilizer especially in the growing of oil palm seedling. Thus, this study was conducted with the aim to determine the effect of oil palm residues as bio compost to the growth performance of oil palm seedling.

2. Methodology

2.1 Materials preparation

This study was conducted in open field area at Universiti Teknologi MARA (Pahang). Soil mixture was used as planting medium and filled in polybag size of 40cm x 35cm. Three month

years old of oil palm seedling from the Dura x Pisifera variety was used as planting material in this study. Empty fruit bunch (EFB), oil palm fronds and oil palm trunk were used as residues in producing compost (**Fig. 2**). All this materials was shredded into the smaller size to increase the decomposition process. Beneficial Indigenous Microorganism (BIM), Effective Microorganism (EM), Indigenous Microorganism (IMO) and Plant Booster were used as catalyst in accelerate the decomposition process of residues. 250 g of compost materials was mixed well with the catalyst and applied directly to the planting medium.

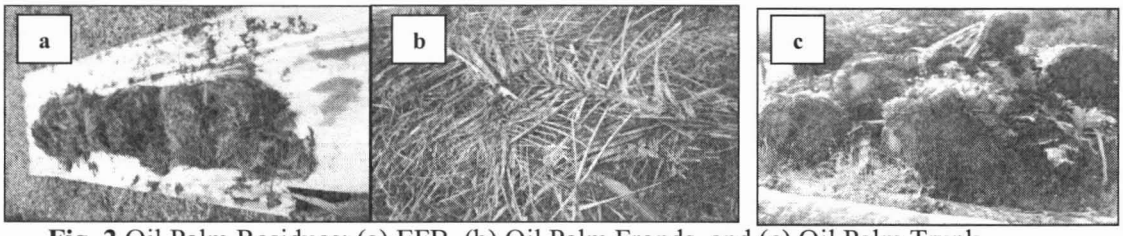

Fig. 2 Oil Palm Residues; (a) EFB, (b) Oil Palm Fronds, and (c) Oil Palm Trunk.

2.2 Treatment and experimental design

Thirteen (13) treatments including control were used in this study (**Table 1**).The experiment was arranged in Randomized Complete Block Design (RCBD) with five replications.

Table 1. Treatments of Study

Treatment	Code
Oil Palm Frond + IMO	T1
Oil Palm Frond + EM	T2
Oil Palm Frond + BIM	T3
Oil Palm Frond + Plant Booster	T4
Oil Palm Trunk + IMO	T5
Oil Palm Trunk + EM	T6
Oil Palm Trunk + BIM	T7
Oil Palm Trunk + Plant Booster	T8
EFB + IMO	T9
EFB + EM	T10
EFB + BIM	T11
EFB + Plant Booster	T12
Control	T0

2.3 Data Collection and Statistical Analysis

Data was collected to measure the growth performance of oil palm seedling. Plant height was measured in centimeter and collected every week. Number of leaves was counted every week. Stem girth was measured once a week. Each data was collected for 12 weeks. All data were analyzed and interpreted by using Minitab. Effect of treatments on oil palm growth parameters were evaluated by ANOVA. Variances and separation of means was analyzed using Duncan New Multiple Range Test (DNMRT) for post hoc comparisons at alpha = 0.05. Values are reported as mean and standard deviation (SD).

3. Results and Discussion

The combination ofEFB and IMO (T9) is the highest on plant height performance after 12 weeks of growth with the value of 5.36cm (**Fig. 3**). Combination of EFB and EM (T10) shows the second highest of plant height performance with 4.52cm. Analysis of one-way ANOVA show that,F (12, 64) = 0.63, MSE = 13.39, p = 0.808, demonstrated statistically significant differences between the two groups, as theory would dictate. Based on this analysis, it shows that, there was no significant difference between treatments to the performance of plant height. The null hypothesis at significant level of 0.05 failed to be rejected. According to Suhaimi and Ong (2001), the compost from shredded EFB and chicken manure contain a reasonable amount of nutrients which are 3.3% nitrogen, 0.05% phosphate, 0.2% potassium, 1.0% calcium and 0.2% magnesium while one ton of pruned fronds can return an equivalent of 7.5 kg nitrogen, 106 kg phosphorus, 9.81 kg potassium and 2.79 kg magnesium to the soil. Kee (2004) stated that nutrient reserves and recycling from oil palm trunks at replanting stage was estimated that oil palm trunks residues is nearly 70 tons per hectare. The residues contained a massive pool of nutrient equivalent to 189 kg nitrogen, 22 kg phosphate, 769 kg potassium, 106 kg calcium and 44 kg magnesium per hectare.Catalyst such as IMO, EM, BIM and plant booster is the additive on the compost pile to help accelerate the composting process. One of the factors that can encourage the decomposition process is the present of microorganism. It is because the decomposition of organic matter serves two purposes for microorganisms, providing energy and carbon for the development of microorganism(Ncube et al., 2011).

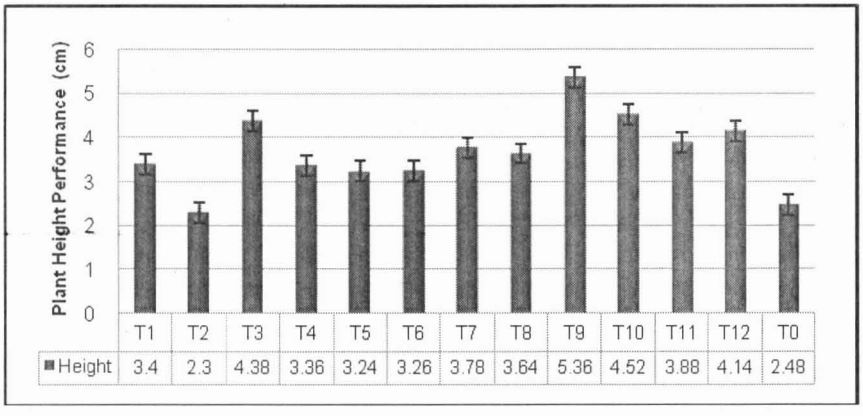

Fig. 3 Plant height performance of oil palm seedling

After 12 weeks of experiment, combination of EFB and IMO (T9) shows the highest value of stem girth development that is 2.82cm. The second highest was the combination of EFB and BIM (T12) with 2.74cm (**Fig. 4**). Analysis of one-way ANOVA show that, F (12, 64) = 2.84, MSE = 0.8412, p = 0.004, demonstrated statistically significant differences between the two groups, as theory would dictate. Based on this analysis, it shows that, there was significant difference between treatments to the development of stem girth. The null hypothesis at significant level of 0.05 had to be rejected. EFB ash can be used as fertilizer that high in potassium content. It is strongly alkaline and has ameliorative effect on very acidic soil by increasing soil pH. It was increasing microbial activities and enhancing the nitrogen that release from organic matter. EFB also can be used as sources of phosphorous, potassium, magnesium and calcium in oil palm plantation (Uwumarongie et al.,2012). The inoculation of IMO and EM as catalyst was contributed to the increase on microbial population in the soil (Zuraihah et al., 2012).

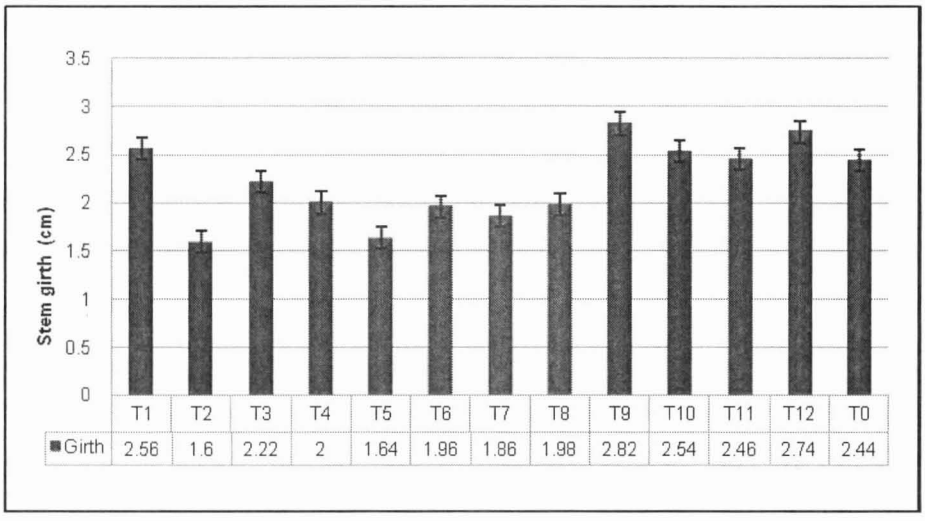

Fig. 4 Stem girth of oil palm seedling

Figure 5 shows the number of leaves of oil palm seedling. Result from T9 (EFB and IMO) shows the highest value with 4 number of leaf. Analysis of one-way ANOVA show that, $F(12, 64) = 3.86$, $MSE = 1.4538$, $p = 0.001$, demonstrated statistically significant differences between the two groups, as theory would dictate. Based on this analysis, it shows that, there was significant difference between treatments to the growth of leave. The null hypothesis at significant level of 0.05 had to be rejected.

The chemical characteristics of raw material used in this study such as EFB, oil palm fronds and oil palm trunk was supply with different amount of macronutrient. Compost from EFB material was high with nitrogen that increases the growth of plant (Suhaimi and Ong, 2001). The inoculation of IMO was accelerating the composting process than usual (Zuraihah et al., 2012).

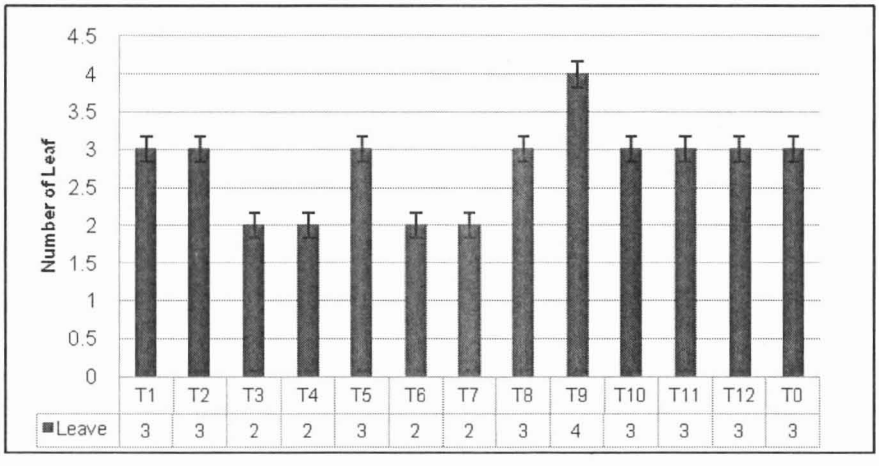

Fig. 5 Number of leaves of oil palm seedling

4. Conclusion

Oil palm seedlings can be grown with the application of different type of oil palm residues. In this study, combination of empty fruit bunch and IMO as bio-compost was contribute to the highest of growth and performance of oil palm seedling in term of plant height, number of leave and stem girth. As a conclusion, the converting of empty fruit bunch into value

added product like compost was help in the growth of oil palm itself and at the same time will reduce the residue in the field.

5. References

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