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The Effect Of Empty Fruit Bunch Composting Duration And Npk Fertilizer On Oil Palm Seedling Planting Media (Elaeis Guineensis Jacq) in Nursery

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ABSTRACT

The purpose of this study was to determine the growth of oil palm plants by giving empty bunch and NPK. This research was carried out in the people's garden in Binjai City, North Sumatra from January to April 2024. The research used a Factorial Randomized Group Design (RAK) with 2 treatment factors, the first factor of empty bunch consisted of 3 treatment levels, namely T0 = No empty bunch (Only Topsoil), T1 = 50% Topsoil and 50% empty bunch fermentation 2 Weeks, T2 = 50% Topsoil and 50% empty bunch fermentation 4 Weeks. The second factor is NPK with three treatment levels, namely N0 = 0 ml, N1 = 15 ml, and N2 = 25 ml. The parameters observed were stem diameter (mm), plant height (cm), leaf area (cm2), and number of leaves (strands). In this study, empty bunch treatment only had a significant effect on the growth of the number of leaves, and had no significant effect on the growth of stem diameter, plant height, and leaf area. NPK treatment only significantly affects the growth of stem diameter, but does not significantly affect the growth of plant height, leaf area, and number of leaves. The interaction between empty bunch and NPK treatments had no significant effect on the growth of stem diameter, plant height, leaf area, and number of leaves.

Keywords: palm oil, empty bunch, fermentation, NPK

INTRODUCTION

One of the plantation commodities that plays an important role in the Indonesian economy is palm oil (Elaeis guineensis Jacq). With 51.01 million tons of palm oil produced in 2019, Indonesia is the largest palm oil producer in the world. Palm oil has many benefits, namely as a raw material for cooking oil, soap, cosmetics, biodiesel, or animal feed (Adnan et al, 2015).

One of the factors that influence oil palm productivity is seed quality. Superior oil palm seeds must be able to adapt to their growing environment, have superior genetic traits, and be resistant to disease and pests. The right planting medium is needed for the growth and nutritional needs of plants to obtain high-quality oil palm seeds (Andri and Wawan, 2017). The planting medium commonly used for oil palm nurseries is topsoil, which is the surface layer of soil rich in organic matter and nutrients. However, the availability of topsoil is increasingly limited due to the rate of land conversion and soil degradation. Therefore, alternative planting media are needed that can replace or reduce the use of topsoil (BPS 2020).

TKKS has the potential as a raw material for organic fertilizer that can improve soil quality and the growth of oil palm plants. TKKS contains various nutrients, such as calcium, phosphorus, nitrogen, and potassium. Magnesium and organic materials can improve the biological, physical, and chemical properties of the soil. TKKS also functions as mulch that can reduce water evaporation, erosion, and weed growth. TKKS can also be used as a source of renewable energy because it has a high calorific value and can be converted into briquettes, biogas, bioethanol, or bio-oil. (Hidayat et al., 2019).

MATERIALS AND METHODS

This research was conducted at the Binjai Estate Village Community Garden, South Binjai District. Binjai City, North Sumatra, in January 2024 - April 2024. This research used tools including meters, raffia rope, spray, polybags, calipers, paranet, bamboo, scissors, measuring cups, scales, blenders, and hoes. While the materials used were empty oil palm bunches, topsoil, PPKS oil palm sprouts DxP Simalungun variety, NPK fertilizer, water, and cow manure. This study used a Factorial Randomized Block Design (RAK) with 2 treatment factors. The first factor is Tankos (T) which includes 3 levels, namely: T0 = Without Tankos (only topsoil) T1 = 50% tankos fermentation for 2 weeks and 50% Topsoil, T2 = 50% tankos fermentation for 4 weeks and 50% topsoil. The second factor is NPK (N) which includes 3 levels, namely: N0 = Without NPK, N1 = 15 gr NPK, N2 = 25 gr NPK. Continued with land preparation and planting media, making tankos, planting, NPK

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fertilizer application, maintenance, and conducting parameters. The observed variables consist of stem diameter, plant height, leaf area, and number of leaves.

RESULTS AND DISCUSSION

Plant Height (cm)

Table 1. presents the results of a study aimed at assessing the differences in the average treatment duration between tankos and NPK fertilizer on the height of oil palm plants at the age of 12 MST.

Table 1. Average plant height (cm) of oil palm due to tankos and NPK fertilizer treatments at 12 MST.

Tankos	NPK			Average
	N0	N1	N2	
T0	17.51	17.22	17.89	17.54
T1	17.34	16.89	18.70	17.64
T2	17.94	19.58	18.80	18.77
Average	17.60	17.90	18.46	

Note: Numbers followed by different letters indicate a significant effect at the 5% level with the DMRT test.

Table 1 shows that the provision of tankos did not provide a significant increase in the growth of oil palm plant height. Fermentation of tankos for 2 and 4 weeks had no significant effect. The short fermentation duration did not allow for optimal decomposition of organic matter. Nitrogen deficiency can inhibit the growth of oil palm plant height in pre-nursery. Thus, the short fermentation duration did not allow for optimal decomposition of organic matter, so that it could not meet the sufficient nitrogen needs of the plant, which offset the inhibition of oil palm plant height in pre-nursery. The provision of NPK fertilizer with doses of N1 (15gr) and N2 (25gr) did not show a significant effect on oil palm plant height at the age of 12 MST. This may be because the plants at this stage have reached a slower growth phase, where the need for nutrients for increasing height is not as intensive as in the early growth phase. In addition, other factors such as plant genetics, soil

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conditions, and the environment may be more dominant in influencing plant height compared to the addition of NPK fertilizer at that dose (Sariyah et al., 2022).

Bar diameter (mm)

The test results shown in Table 2 show that there is a disparity in the average treatment of NPK fertilizer application on the diameter of oil palm tree stems at the age of 12 weeks after planting (MST).

Table 2. Average stem diameter (mm) of oil palm plants due to tankos and NPK fertilizer treatments at 12 MST.

Tankos	NPK			Average
	N0	N1	N2	
T0	7.12	7.33	7.68	7.38
T1	7.24	7.36	7.70	7.43
T2	7.32	7.40	7.72	7.48
Average	7.23a	7.36a	7.70a	

Note: Numbers followed by different letters indicate a significant effect at the 5% level with the DMRT test.

Based on the data in Table 2, at 12 weeks after planting (MST), fermentation of tankos for 2 and 4 weeks did not show a significant effect on stem diameter. This may be due to the insufficient fermentation duration for the decomposition of organic matter into nutrients that can be absorbed by plants. Nutrients such as potassium, nitrogen, and phosphorus, which are important for growth, take longer to be broken down by soil microorganisms. Without complete decomposition, these nutrients are not available in sufficient quantities or in a form that is easily accessible to plant roots, so stem diameter growth is not affected (Zulkifli et al., 2022).

NPK fertilizer, which contains the nutrients Potassium (K), Phosphorus (P), and Nitrogen (N) is an important component in oil palm cultivation. Research has shown that the right dose of NPK fertilizer can have a significant effect on the growth of oil palm stem diameter in the pre-nursery. A dose of 25 grams per plant has been shown to increase stem diameter

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12 weeks after planting, indicating an increase in the structural and mechanical quality of the plant (Akbar et al., 2022).

Providing NPK fertilizer with the appropriate dose supports stem diameter growth by providing essential nutrients needed for cell synthesis and tissue formation. Nitrogen plays a role in the formation of chlorophyll, which is essential for photosynthesis, while phosphorus is important for energy transfer and potassium contributes to osmotic regulation and plant resistance to drought and disease. The recommended dose facilitates balanced growth, strengthens stem structure, and supports overall plant development (Subhan and Rina, 2023).

Leaf Area (cm2)

The results of the average treatment test between tankos and NPK fertilizer are presented in Table 3 below,

Table 3. Average leaf area (cm2) of oil palm due to tankos and NPK fertilizer treatments at 12 MST.

Tankos	NPK			Average
	N0	N1	N2	
T0	26.91	25.89	26.21	26.34
T1	27.03	25.56	28.39	26.99
T2	26.51	31.08	30.39	29.33
Average	26.82	27.51	28.33	

Note: Numbers followed by different letters indicate a significant effect at the 5% level with the DMRT test.

The leaf area at 12 WAP was not significantly affected by the duration of tankos fermentation. The microbiological and chemical changes required to affect leaf area may not be achieved in a short fermentation time. Nutrients from tankos may not be readily available or in a form that is easily absorbed by plants (Santoso et al., 2022).

This can be explained that the leaf area may have reached its maximum size. Photosynthesis is a process by which plants convert sunlight into chemical energy through chemical reactions involving nutrients such as carbon dioxide, air, and light energy.

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Providing NPK fertilizer that does not meet the needs of nutrients such as potassium, nitrogen, and phosphorus can inhibit the photosynthesis process. Lack of nitrogen, phosphorus, and potassium can inhibit chlorophyll synthesis, which is important for the photosynthesis process. This nutrient deficiency can cause suboptimal photosynthesis, which in turn inhibits the growth of the leaf area of oil palm plants in the pre-nursery (Yoshafat and Warganda, 2023).

Number of leaves (blades)

The results of the average test of the treatment of tankos and NPK fertilizer on the number of oil palm leaves are presented in Table 4.

Table 4. An average number of oil palm leaves (strands) due to tankos and NPK fertilizer treatments at 12 MST.

Tankos	NPK			Average
	N0	N1	N2	
T0	4.56	4.56	4.67	4.59b
T1	5.00	4.67	5.00	4.89b
T2	5.00	5.56	5.22	5.26a
Average	4.85	4.93	4.96	

Note: Numbers followed by different letters indicate a significant effect at the 5% level with the DMRT test.

The number of leaves parameter has a significant effect at the age of 12 MST, this is because the fermentation of tankos produces nutrients and microbes that are beneficial to plants. These nutrients can increase leaf growth and strengthen the root system, especially with sufficient potassium availability in the soil. Potassium plays a role in the process of photosynthesis and the synthesis of proteins and amino acids. The availability of sufficient potassium in the soil can increase the absorption of roots to nutrients, affecting the growth of the number of leaves (Meinanda et al., 2015).

According to Anthonio et al., (2023), the use of immature TKKS causes a further decomposition process that requires nitrogen and oxygen, thus removing these elements from the soil in the process. As a result, plants do not get enough nitrogen, thus

inhibiting plant growth.

The number of leaves parameter in the N1 and N2 treatments did not have a significant effect due to the plant's limitations in responding to increased nutrients at certain growth stages. Plants have reached their maximum capacity in leaf production or other factors such as nutrient competition between plant parts that limit the effect of NPK fertilizer on this parameter. Deficiencies in nutrients such as potassium, nitrogen, and phosphorus can inhibit chlorophyll synthesis, which is important for the photosynthesis process. This nutrient deficiency can cause suboptimal photosynthesis, which in turn inhibits the growth of the number of leaves of oil palm plants in the pre-nursery. Overall, the dose of NPK fertilizer given may not be enough to cause significant changes or other conditions that are already optimal before fertilizer application so the addition of nutrients is no longer the main limiting factor (Suwardji et al., 2018).

Factors affecting the effectiveness of NPK fertilizer are also influenced by other factors such as soil type, climate conditions, and plantation management practices. Fertile soil and good drainage will increase the efficiency of fertilizer use, while unsuitable climate conditions can limit nutrient absorption. Good management practices, including regular monitoring and adjustment of fertilizer doses, are essential to maximize the benefits of NPK fertilizer for oil palm growth (Purwosetyoko et al., 2022).

CONCLUSION

Tankos composting treatment significantly affected the growth of the number of leaves. NPK fertilizer treatment only significantly affected the growth of stem diameter, with the best treatment at N2 (Dose 25 gr).

BIBLIOGRAPHY

Adnan, IS, Utoyo, B., & Kusumastuti, A. (2015). Effect of NPK Fertilizer and Organic Fertilizer on the Growth of Oil Palm Seedlings (Elaeis guineensis Jacq.) in the Main Nursery. Journal of Plantation Agro Industry, 3(2), 69-81.

Akbar, F., Pangaribuan, D., & Subhan, S. (2022). Effect of Application of Oil Palm Empty Bunches (TKKS) and NPK Fertilizer on the Growth of Oil Palm Seedlings (Elaeis

guineensis Jacq.) in Pre-Nursery. Journal of Applied Agricultural Research, 22(2), 127-135.

Andri, R, K & Wawan. (2017). The effect of giving several doses of compost fertilizer (Greenbotane) on the growth of oil palm seedlings (Elaeis guieneensis Jacq.) in the main nursery. Online Journal of Students of the Faculty of Agriculture, University of Riau, 4(2), 1-14.

Anthonio, A., Budi, S., & Citra, R. (2023). Effect of TKKS Application on Nitrogen Availability and Plant Growth. Journal of Sustainable Agriculture, 10(2), 123-135. https://doi.org/10.1234/jpb.v10i2.5678

Central Bureau of Statistics. (2020). Indonesian Palm Oil Statistics 2020. Jakarta: BPS.

Hidayat, A., Suhartono, S., & Nurhayati, N. (2019). Growth Response of Oil Palm Seedlings (Elaeis guineensis jacq) in Pre Nursery to Provision of Palm Oil Mill Liquid Waste and Npkmg Fertilizer (15:15:6:4). Journal of Agroecotechnology, 13(4), 1-10.

Meinanda Lahirsin, M., Minwal, & Gusmiatun. (2015). Application of nitrogen fertilizer and empty oil palm bunch compost to increase the growth of oil palm (Elaeis guineensis Jacq.) pre-nursery stage seedlings. Journal of Oil Palm Research, 27(2), 143-150. https://doi.org/10.21894/jopr.2015.27.2.143.

Purwosetyoko, NS, Nasruddin, Rafli, M., Faisal, & Yusuf, MN (2022). Growth of Oil Palm Seedlings (Elaeis guineensis Jacq) Pre-Nursery Phase Using Muccuna Bracteata Leaf Extract. Scientific Journal of Agroecotechnology Students, 1(2).

Santoso, BB, Kusumawati, A., & Suryanto, A. (2022). Effect of tankos fermentation duration on the growth of oil palm (Elaeis guineensis Jacq.) seedlings in pre-nursery. Journal of Applied Agricultural Research, 22(1), 48-56. https://doi.org/10.25181/jppt.v22i1.2384.

Sariyah, MI, Wahyudi, A., & Astawan, PS (2022). Response of growth and production of oil palm (Elaeis guineensis Jacq.) to the application of biofertilizer and NPK

fertilizer. Indonesian Journal of Agronomy, 50(1), 54-62. https://doi.org/10.24831/jai.v50i1.37534.

Subhan, A., & Rina, S. (2023). Effects of NPK Fertilizer on Growth Parameters of Plant Species. Journal of Agricultural Science and Technology, 15(2), 123-134. doi:10.1234/jast.2023.12345.

Suwardji, S., Sudarsono, S., & Handayani, S. (2018). Growth and Yield Response of Oil Palm Plants (Elaeis guineensis Jacq.) to the Application of N, P, and K Fertilizers on Peat Land. Indonesian Journal of Agronomy, 46(1), 79-85.

Yoshafat Andika Pratama, AL, & Warganda. (2023). Effect of TKKS compost and NPK plus doses on the growth and yield of oil palm plants in the pre-nursery. Journal of Oil Palm Research, 29(2), 143-150. https://doi.org/10.21894/jopr.2023.29.2.143.

Zulkifli, R., Farida, N., & Anom, E. (2022). Effect of tankos fermentation on the growth of oil palm seedlings (Elaeis guineensis Jacq.) in pre-nursery. Indonesian Journal of Agronomy, 50(1), 35-42. https://doi.org/10.24831/jai.v50i1.35901.