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Growth Response of Oil Palm Seedlings (Elaeis guineensis Jacq) to Administration of Planmate Organic Fertilizer in Main Nurseries

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ABSTRACT

The objective of the experiment was to determine the growth response of oil palm (Elaeis guineensis Jacq) seedlings to the application of planmate organic fertilizer in the main nursery. The experiment used a completely randomized design (CRD) with 5 treatment levels consisting of; P0 = without applying planmate fertilizer, P1 = 300 g per polybag, P2 = 350 g per polybag, P3 = 400 g per polybag, P4 = 450 g per polybag. Each treatment level was repeated 3 (three) times, so that there were experimental units, each plot consisting of 3 (three) polybags of oil palm seeds, so that a total of 45 polybags, all plants were sampled. Parameters observed were soil pH, plant height, seedling stem diameter, plant dry weight, and root dry weight. The results of the study showed that the application of planmate fertilizer had a significant effect on soil pH, plant height, stem diameter, shoot dry weight, and root dry weight. The best dose of planmate fertilizer is 450 g per polybag (P4) to give yields on shoot height, stem diameter, dry weight of plants and dry weight of roots of oil palm seedlings.

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1. INTRODUCTION

The oil palm (Elaeis guineensis Jacq) is an important oil producer and grows naturally in the lowland, wet climates of West Africa from Cape Verde to Angola. This plant is grown commercially on plantations in West Africa, Zair, Southeast Asia and Central America, and is generally considered to be the largest oil producer of all other types of crops (Sastrahidayat and Soemarno, 2001).

Palm oil is one of the foundations for the growth and development of the industrial palm oil agribusiness system which is believed to be able to help the government to alleviate poverty in Indonesia. Oil palm is the most productive with the highest oil production per hectare of all other vegetable oil producing plants (Pahan, 2006).

Oil palm cultivation is one of the agricultural businesses that attracts investors. High land productivity and highly prospective market aspects are driving high investment in this field. Palm oil as a plant that produces palm oil and palm kernel is one of the prima donnas of plantation crops which is a source of non-oil and gas foreign exchange for Indonesia. The bright prospects for the commodity palm oil in the world vegetable oil trade have encouraged the Indonesian government to spur the development of oil palm plantation areas (Hartanto, 2011).

To achieve good fresh fruit bunches (FFB) production, fertilization is one of the important investments in oil palm cultivation, and this should be considered from an early age (nursery stage). Nutrient supply at this stage is very important because it is a critical period which greatly determines the success of plants in achieving good growth in nurseries (Rosmarkan and Yuwono (2002) in Kelpitna (2007).

Plant fertilization aims to provide the nutrients needed by plants for growth so that maximum results are obtained. However, fertilization also needs to consider the relationship between nutrients and plant growth, because fertilization that does not go through the correct procedure will be in vain, and even have a negative effect on soil conditions. Therefore, in addition to the dose of fertilizer, it is also necessary to pay attention to the type of fertilizer used.

Organic materials or fertilizers are beneficial for increasing agricultural production both in quality and quantity, reducing environmental pollution, and improving land quality in a sustainable manner. The use of organic fertilizers is very diverse so that the effect of organic fertilizers on land and plants can vary (Simanungkalit, Didi, Rati, Diah, and Wiwik. 2006). The application of organic matter around oil palm plants stimulates the growth of feeding roots near the soil surface, so that nutrient absorption is easier and more optimal (Meori Agro, 2009).

One of the organic fertilizers is planmate organic fertilizer, which is artificial organic fertilizer, through a biological process, which functions to ensure a balanced mixture of organic nutrient content, such as protein, amino acids, organic acids, carbohydrates and minerals which are useful for increasing plant growth and production (Sunarko , 2008).

To offset the negative effects of using chemical fertilizers, it is necessary to use organic fertilizers. The addition of planmate organic fertilizer will increase soil fertility, increase CEC so that the absorption of nutrients (macro and micro) is more optimal. Planmate is also able to balance the physical, chemical and biological soil conditions in the soil, thereby increasing optimal and sustainable yields.

The advantages of using planmate organic fertilizers are 1). Planmate fertilizers provide maximum results for vegetative and generative plant growth, 2). Save costs because it reduces the use of chemical fertilizers by up to 50%, 3). Reducing environmental pollution, and improving land quality in a sustainable manner.

Organic fertilizers contain micro elements such as. Boron (B), Copper (Cu), Zinc (Zn), Iron (Fe), Molybdenum (Mo), Manganese (Mn), Chlorine (Cl), Colbalt (Co), Selicone (Si), Nickel (Ni). more complete than chemical fertilizers. To obtain optimal results, recommendations for fertilizing applications are given by HTI companies that have used planmate fertilizer, in the pre-nursery, amounting to 50 grams per polybag which is given every two weeks (Setyamidjaja, 2006).

2. METHOD

2.1 Place and time

This research was conducted in the Bahar River, Muaro Jambi Regency, Jambi Province, which was carried out for approximately 3 months, from April 2018 to July 2018.

2.2 Tools and materials

The materials used in the implementation of this research were: Topaz type of oil palm seeds aged 3 months, organic fertilizer Planmate, and Ultisol soil. While the tools used are 5 kg polybags, calipers, analytical scales, meters, electric ovens, pH meters and stationery.

2.3 Research methods

The design used was a completely randomized design (CRD) with planmate treatment with 5 treatment levels, as follows: P0 = without planmate or control, P1 = 300 g planmate per polybag, P2 = 350 g planmate per polybag, P3 = 400 g planmate per polybag , P4 = 450 g of planmate per polybag. Each treatment level was repeated 3 times, so that there were 15 experimental unit plots, each plot consisting of 3 polybags of oil palm seeds, so that a total of 45 polybags, all plants were sampled.

2.4 Research Implementation

2.4.1 Preparation of Research Sites

The area where the study was plowed was cleared of weeds and remaining plant roots. Then the plots were leveled according to the size of the trial plot that had been determined and fenced around the area to avoid animal disturbance.

2.4.2 Seed Selection

Prior to being given treatment, selection of seeds was carried out first. The seeds in the polybags used had good and uniform growth, were not attacked by pests and diseases, the seeds used were 3 months old.

2.4.3 Giving Treatment

Provision of planmate fertilizer by making holes around the roots, given 2 times a month with a frequency of 3 times, then the planmate fertilizer is added according to the treatment dose, then the hole is closed again with soil.

2.4.4 Maintenance

Weed control is done manually by removing and removing all weeds that grow in each polybag. Watering the oil palm seedlings is done every day with the same volume, in the morning and evening, if it is raining and the media is expected to be damp, watering is not done. To prevent pests and diseases, it is carried out by maintaining cleanliness and monitoring the nursery area regularly. If there is an attack, it is immediately controlled mechanically, if necessary, it is carried out chemically.

2.5 Observed Variables

2.5.1 soil pH

Soil pH parameters were measured at the beginning of the study before being given planmate fertilizer, and subsequent measurements were made at the end of the study. Soil pH measurements were carried out using a tool, namely a soil pH meter.

2.5.2 Plant Height (cm)

Plant height is measured from the base of the stem above the ground surface to the tip of the longest leaf midrib, by straightening the leaf midrib upwards, assisted with a stake for stability. Measurements were made at the end of the study when the seedlings were 12 WAP.

2.5.3 Seedling Stem Diameter(mm)

The diameter of the stem of the seedling was measured by measuring the diameter of the seedling at a height of 2 cm from the base of the seedling using a caliper. The measurement was carried out at the end of the study when the seedling was 12 MST.

2.5.4 Plant Dry Weight (g)

Plant dry weight was measured by weighing all the dried plant parts. Drying is done using an oven at 800C for 2x24 hours. Drying was carried out at the end of the study when the seedlings were 12 WAP.

2.5.5 Root Dry Weight (g)

Root dry weight was calculated at the end of the study, measured by weighing all parts of the plant roots which had been oven-dried at 800C for 2x24 hours.

2.6 Data analysis

To determine the effect of treatment, data were analyzed by analysis of variance (Anova). and continued with the Duncan Multiple Range Test (DNMRT) at α level of 5%.

3. RESULTS AND DISCUSSION

3.1 Research result

3.1.1 Soil pH

From measuring soil acidity (soil pH) before being given treatment and calculated again on the last day after planting (12 WAP), the results are shown in Table 1.

Table 1. Initial pH and final pH of the study

initial pH	final pH	
	treatment	soil pH
3,5	P0	3,5
	P1	4.0
	P2	5.0
	P3	5,5
	P4	6.0

From table 1 it can be seen that there was an increase in the pH value when using planmate. Where the highest pH value was in the P4 treatment, which was 6.0 and the lowest pH value was in the P0 treatment (control), which was 3.5.

3.1.2 Plant height

Based on observations and the results of the analysis of variance, it was shown that the application of Planmate to the planting medium in the main nurseries had a significant effect on the height of the oil palm seedlings. The results of the DNMRT follow-up test at the α level of 5% for each treatment are presented in Table 2.

Table 2. The average height of oil palm plants at various doses of Planmate in main nurseries

Treatment	Average plant height (cm)
P4	48,77a
P3	46,88a
P2	45,42ab
P1	43,38bc
P0	31,4d

Note: the numbers followed by the same lowercase letter show no significant difference at the α level of 5% DNMRT follow-up test.

The data presented in Table 3 shows that the treatment of giving Planmate to the planting medium in the main oil palm nursery had a significantly different effect on the height of the oil palm seedlings between treatments. The highest oil palm plant height was in the P4 treatment, which was 48.77 cm and the lowest oil palm plant height was in the P0 treatment, which was 31.4 cm. The treatment also showed an effect that was not significant but significantly different from P1 and P0.

3.1.3 Seedling Stem Diameter

Based on observations and the results of the analysis of variance, it was shown that the application of Planmate to the planting medium in the main nurseries had a significant effect on the diameter of the stems of the oil palm seedlings. The results of the DNMRT follow-up test at the α level of 5% for each treatment are presented in Table 3.

Table 3. The average stem diameter of oil palm seedlings at various doses of Planmate in main nurseries.

Treatment	Average seedling diameter (cm)
P4	3,22a
P3	3.03b
P2	2,61c
P1	2,41d
P0	2.02e

Note: the numbers followed by the same lowercase letter show no significant difference at the α level of 5% DNMRT follow-up test.

The data presented in Table 3 shows that the treatment of giving Planmate to the planting medium in the main oil palm nursery had a significantly different effect on the stem diameter of the oil palm seedlings between treatments. The highest diameter of the stem of the oil palm seedlings was in the P4 treatment, which was 3.22 cm and the lowest oil palm plant height was in the P0 treatment, which was 2.02 cm. The treatments also showed no significant but significantly different effects with P1 and P0.

3.1.4 Dry Weight of Oil Palm Plants (g)

Based on the results of observations and analysis of variance, it was shown that the application of planmate to the planting medium in the main nurseries had a significant effect on the dry weight of the oil palm plants. Further test results for the average dry weight value of oil palm plants at the α level of 5% for each treatment are presented in Table 4.

Table 4. Average dry weight loss of oil palm plants at various plantmate doses in main nurseries

Treatment	Average dry weight of faded (g)
P4	67.68a
P3	62.08b
P2	51.11c
P1	43.73d
P0	38.33e

Note: the numbers followed by the same lowercase letter show no significant difference at the α level of 5% DNMRT follow-up test.

Based on the data in Table 4, it can be seen that the application of planmate organic fertilizer to the planting media in the main nursery had a significantly different effect between the treatments. The highest dry weight of oil palm seedlings was found in the P4 treatment, namely 67.68 g. These results were significantly different when compared to other treatments. The lowest dry weight of oil palm seeds was found in treatment P0, namely 38.33 g.

3.1.5 Root Dry Weight (g)

Based on observations and the results of the analysis of variance, it was shown that the application of Planmate to the planting medium in the main nurseries had a significant effect on the dry weight of the roots of the oil palm. The results of the DNMRT follow-up test at the α level of 5% for each treatment are presented in Table 5.

Table 5. Average dry weight of oil palm roots at various doses of Planmate in main nurseries

Treatment	Average root dry weight (g)
P4	21.03a
P1	16,39a
P3	16,36 a
P2	10,92b
P0	9,84b

Note: the numbers followed by the same lowercase letter show no significant difference at the α level of 5% DNMRT follow-up test.

The data presented in Table 5 shows that the Planmate treatment of the growing media in the main nurseries has a significant effect on the dry weight of the oil palm roots. The highest dry weight was found in the K4 application, which was 21.03 g, and the lowest dry weight was found in K0, which was 9.84 g.

3.2 Discussion

Based on the results of the analysis of variance, it was shown that the application of planmate organic fertilizer to the planting medium of oil palm seedlings in the main nurseries had a significant effect on plant height, stem diameter, dry weight of the shoots and dry weight of the roots of the oil palm seedlings. Of these parameters, all treatments given planmate had better values than the control treatment and the higher the dose of planmate given to the planting medium, the higher the value of seedling height, stem diameter, plant dry weight and root dry weight. This means that the higher the dose of planmate given onmediaplants it will further increase the growth of oil palm seedlings in the main nursery.

The results of this study showed that the administration of 450 g/polybag (P4) planmate gave better results on plant height, stem diameter, plant dry weight and root dry weight of oil palm seedlings. These conditions presumably mean that the planmate is able to provide the macro nutrients, namely N, P and K, which are needed by oil palm seeds. As well as micro nutrients such as. Boron (B), Copper (Cu), Zinc (Zn), Iron (Fe), Molybdenum (Mo), Manganese (Mn), Chlorine (Cl), Colbalt (Co), Selicone (Si), Nickel (Ni). more complete than chemical fertilizers. Which has the ability to mobilize or bridge nutrients in the soil so that it will form ionic particles that are easily absorbed by plants, Has the ability to release soil nutrients very slowly and continuously Able to keep moisture from the soil,

Nutrient N is used by plants to form amino acids which will be converted into protein and form chlorophyll. Protein is an element used for growth after fulfilling energy. N compounds also play a role in improving plant vegetative growth.

Element P plays a role in the process of breaking down carbohydrates in the form of ADP and ATP to meet energy needs. In addition, element P also plays a role in cell division through the role of nucleoprotein in the cell nucleus, so that it can accelerate the growth of plant roots. According to Leiwakabessy and Sutandi (2004) in Dewi (2009), element P determines root growth, accelerates maturity and fruit and seed production.

According to Dewi (2009), potassium plays a role in cell division, opening of stomata, photosynthesis (carbohydrate formation), sugar translocation, nitrate reduction and further protein synthesis and enzyme activity. Potassium regulates the osmotic pressure in plant cells thereby allowing movement of water into the roots. Planmate organic fertilizers that are applied to the soil are thought to be absorbed and stored by plants so that the nutritional needs for growth can be met.

Boron (B) plays a role in the metabolism of Potassium (K) and Calcium (Ca). Copper (Cu), manganese (Mn) and iron (Fe) play an important role in the formation of green leaves (chlorophyll). Zinc (Zn) and Molybdenum (Mo) Act as catalysts in the formation of proteins and in very small amounts can promote plant growth. Chlorine (Cl) Plays a role in the process of photosynthesis, especially directly related to osmosis in plant cells and improves the quality of dry yields in plants.

Cobalt (C0) plays an important role in nitrogen fixation. Silicon (Si) can increase yields through increasing photosynthetic efficiency and inducing resistance to pests and diseases. Nickel (Ni) Necessary for the enzyme urease to decompose urea in liberating nitrogen into usable forms for plants. Nickel is necessary for the absorption of iron. (Rahman, 2014)

According to Dewi (2009), potassium plays a role in cell division, opening of stomata, photosynthesis (carbohydrate formation), sugar translocation, nitrate reduction and further protein synthesis and enzyme activity. Potassium regulates the osmotic pressure in plant cells thereby allowing movement of water into the roots. Planmate organic fertilizers that are applied to the soil are thought to be absorbed and stored by plants so that the nutritional needs for growth can be met. The results of this study indicate that the control treatment for each parameter observed has the lowest value both plant height, stem diameter, dry weight of plants, and dry weight of roots of oil palm seedlings. This condition is suspected because the control treatment was not given planmate. The planting medium in the control treatment was an ultisol soil type which generally had poor properties. Judging from its physical properties, ultisol soil is unable to retain water which carries nutrients into the soil because the pores of ultisol soil are very few, this causes leaching of soil nutrients due to watering and rain. According to Bondansari and Susilo (2011), ultisol soil type is not very supportive for agricultural development because physically ultisol soil has very low soil permeability, poor drainage, very little macro pore space so soil aeration is very low. The planting medium in the control treatment was an ultisol soil type which generally had poor properties. Judging from its physical properties, ultisol soil is unable to retain water which carries nutrients into the soil because the pores of ultisol soil are very few, this causes leaching of soil nutrients due to watering and rain. According to Bondansari and Susilo (2011), ultisol soil type is not very supportive for agricultural development because physically ultisol soil has very low soil permeability, poor drainage, very little macro pore space so soil aeration is very low. The planting medium in the control treatment was an ultisol soil type which generally had poor properties. Judging from its physical properties, ultisol soil is unable to retain water which carries nutrients into the soil because the pores of ultisol soil are very few, this causes leaching of soil nutrients due to watering and rain. According to Bondansari and Susilo (2011), ultisol soil type is not very supportive for agricultural development because physically ultisol soil has very low soil permeability, poor drainage, very little macro pore space so soil aeration is very low. This causes leaching of soil nutrients due to watering and rain. According to Bondansari and Susilo (2011), ultisol soil type is not very supportive for agricultural development because physically ultisol soil has very low soil permeability, poor drainage, very little macro pore space so soil aeration is very low. This causes leaching of soil nutrients due to watering and rain. According to Bondansari and Susilo (2011), ultisol soil type is not very supportive for agricultural development because physically ultisol soil has very low soil permeability, poor drainage, very little macro pore space so soil aeration is very low.

If viewed from its chemical properties, ultisol soil tends to be acidic, low in nutrients and high in aluminum content. Excess aluminum in the soil can poison plants, especially the damage to the roots which ultimately affects the low growth of oil palm seedlings. The application of planmate can increase the soil pH to 6.5 (close to normal). This condition is indicated by the low growth of plants without the application of planmate fertilizer which was seen in the P0 treatment.

4. CONCLUSION

Based on the results of the study, the following conclusions can be formulated: Administration of planmate at different doses in the planting medium of oil palm seedlings has a significant effect on plant height, stem diameter, dry weight of the shoots and dry weight of the roots of the oil palm seedlings. The dose of planmate 450g per polybag is the best dose for growing oil palm seedlings in main nurseries.

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It is necessary to carry out further research on the ability of planmate to the efficiency level of fertilizer use in oil palm nurseries.

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