The Influence Of Plant Age On Growth And Quality Of Plant Nilam Oil (Pogostemon Cablin Benth.) Under The Improvement Of Palm Oil Plant

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Abstract, This study aims to determine the effect of plant age on the growth and quality of patchouli plant essential oil (Pogostemon cablin Benth.) under oil palm plantations. Experiments using a randomized block design were arranged factorially with two factors consisting of 16 treatments with six replications. P1U1 = NPK fertilizer 20 g with 4 months plant life, P1U2 = NPK 20 g fertilizer with 5 month plant life, P1U3 = NPK 20 g fertilizer with 6 month plant life, P1U4 = NPK fertilizer 20 g with age 7 months, P2U1 = Fertilizer patchouli waste compost 150 g with 4 month old plant, P2U2 = 150 g patchouli compost fertilizer with 5 month old plant, P2U3 = 150 g patchouli compost fertilizer with 6 month old plant, P2U4 = 150 g patchouli compost with age plant 7 months, P3U1 = Ciseritic fertilizer 30 g with 4 month old plants, P3U2 = Ciserit fertilizer 30 g with 5 month old plants, P3U3 = Ciserit fertilizer 30 g with plants aged 6 months, P3U4 = Ciserit fertilizer 30 g with 7 month old plants, P4U1 = NPK Fertilizer 10 g + patchouli compost 75 g + kiserit fertilizer 25 g with 4 month old plant, P4U2 = NPK fertilizer 10 g + compost patchouli 75 g + kiserit fertilizer 25 g with plant age 5 months, P4U3 = NPK fertilizer 10 g + patchouli compost 75 g + kiserit fertilizer 25 g with age plants 6 months, P4U4 = NPK fertilizer 10 g + patchouli compost 75 g + 25 g kiserit fertilizer with 7 month old plants. The variables observed included plant height, number of branches, number of leaves and oil content. The results of the research data were statistically analyzed using analysis of variance with further DMRT testing at the level of 5%. The best plant growth on 150 g patchouli compost with 7 months of age, 10 g NPK fertilizer treatment + 75 g + Kiserit compost 25 g produces the highest levels of essential oils.

1 Introduction
Patchouli (Pogostemon cablin Benth.) Is one of the important essential oil-producing plants, contributing more than 50% of Indonesia's total exports of essential oils. Almost all patchouli plantations in Indonesia are smallholder crops involving 36,461 heads of farm households (Ditjen Bina Produksi Perkebunan, 2004). Patchouli production centers in Indonesia are in Bengkulu, West Sumatra, North Sumatra and Nanggroe Aceh Darussalam, then developed in the provinces of Lampung, West Java, Central Java, East Java and other regions. Patchouli planting area in 2002 was around 21,602 ha, but the oil productivity was still low at an average of 97.53 kg / ha / year (Ditjen Bina Produksi Perkebunan, 2004). The results of testing at various cropping locations of farmers, oil
content ranged from 1 - 2% of dry matter (Rusli et al., 1993). The low productivity and quality of oil is partly due to the low genetic quality of plants, the cultivation technology that is still simple, the development of various diseases, and improper harvest and post-harvest techniques. The level of nutrient availability for plants must be optimal to obtain high growth and productivity. Balanced soil nutrients and sufficient amounts are needed by plants to support good growth and high yields. The provision of organic fertilizers and inorganic fertilizers is the best alternative for improving soil biological, chemical and physical properties. The provision of organic fertilizers and inorganic fertilizers is expected to improve the efficiency of nutrient utilization by plants and can reduce the provision of inorganic fertilizers for patchouli plants. This efficient nutrient uptake will support the plant growth of high and low quality patchouli plant essential oils.

All parts of patchouli plants such as roots, stems, branches and leaves contain essential oils, but the content is different. The highest oil content is found in patchouli leaves. In order to obtain optimum results from both patchouli oil yield and quality, certain standard comparisons between leaves and branches are required: 1: 1 (Wikardi et al., 1991), and 2: 1 (Rusli and Hasanah, 1977), while patchouli distillers used to use a ratio of 70: 30% (Yuhono and Suherman, 2007). The quality of patchouli oil has the characteristics of high levels of patchouli alcohol, which is more than 30%. Whereas the highest patchouli alcohol content is located in the stem or root. This study aims to obtain information on the effect of a mixture of organic and inorganic fertilizers and plant age appropriate to the growth and quality of essential oils under oil palm stands.

2 Method
The experiment will be conducted in Penerokan Village, Batang Hari Regency, and the experiment will last for eight months starting from January to October 2018. The materials and tools used in this experiment are Aceh Patchouli Plant (Pogostemon cablin Benth.) Aged 4, 5, 6 and 7 months, NPK fertilizer, patchouli waste compost, and kiserit fertilizer, as well as materials for analysis in the laboratory.

Experiment design in this research is Complete Random Design (RAK) with two factors. The treatments were organic and inorganic fertilizers with various plant age with 16 treatments: P1U1 = NPK fertilizer 20 g with 4 month age, P1U2 = NPK fertilizer 20 g with 5 month age, P1U3 = NPK fertilizer 20 g with Age 6 month, P1U4 = NPK fertilizer 20 g with Age 7 months, P2U1 = Nilam lumpy compost 150 g with 4 month age, P2U2 = Nilam lumpy fertilizer 150 g with 5 month age, P2U3 = Nilam lumpy fertilizer 150 g with 6 month age, P2U4 = Nilam lumpy fertilizer 150 g with 7 month age, P3U1 = Fertilizer Kiserit 30 g with 4 month age, P3U2 = Fertilizer Kiserit 30 g with 5 month age, P3U3 = Fertilizer Kiserit 30 g with 6 month age, P3U4 = Fertilizer Kiserit 30 g with Age 7 months, P4U1 = NPK 10 g + Syrup waste patch 75 g + Kiserit 25 g with 4 month age, P4U2 = NPK 10 g + Syrup waste patch 75 g + Kiserit 25 g with 5 month age, P4U3 = NPK 10 g + Syringe waste 75 g + Kiserit 25 g with 6 months of age, P4U4 = NPK 10 g + Syringe waste 75 g + Kiserit 25 g with 7 month age. Each treatment was repeated 6 times, resulting in 96 experimental plot. Each combination of treatments consisted of a plant, so the total number of plants was 96 plants. The observed variables include increase in plant height (cm), increase in number of branches (branch), increase in leaf volume (leaf) and volatile oil content (%). Data obtained in this study will be analyzed statistically using variance analysis with DMRT test at 5% level.

3 Results And Discussion
3.1. Plant Growth Height (cm)
Based on the results of the analysis of variance showed the provision of various kinds of fertilizers and various ages of plants for the variable height increase of plants had no significant effect on patchouli plants. The results of the DMRT significant difference test at the 5% level are presented in Table 1.
Table 1. High growth of plants in various types of fertilizer with various ages of patchouli plants.

| Fertilizer | Age of plant | Average |
|------------|--------------|---------|
|            | 4 months     | 5 months | 6 months | 7 months |
| NPK (20 g) | 95.00        | 95.50    | 79.17    | 90.50    | 90.04 A |
| Compost (150 g) | 98.33 | 74.17 | 83.17 | 92.67 | 87.08 A |
| Krisit (30 g) | 95.17 | 90.67 | 78.17 | 87.67 | 87.92 A |
| NPK 10 g + Compost 75 g + Krisit 25 g | 83.33 | 82.83 | 78.50 | 82.17 | 81.71 A |
| Average    | 92.96 A      | 85.79 A  | 79.75 A  | 88.25 A  | 86.69 A |

Description: The numbers followed by the same letter are not significant according to the Duncan New Multiple Range Test at the level of α = 5%. Large letters are read vertically and small letters are read horizontally.

Table 1 shows that the treatment of plant age with fertilizer on the variable of height increase of plants after further testing is different is not significant. The highest increase in plant height was shown in the combination of P2U1 treatment of 98.33 cm while the lowest in P2U5 treatment was 74.17 cm.

3.2. Number of branches (branches)

Based on the results of the analysis of variance showed the provision of various types of fertilizers had no significant effect on the increase in the number of branches, but at various ages the plants significantly affected the number of branches and there were interactions in various kinds of fertilizers with various ages of plants. The results of the DMRT significant difference test at the 5% level are presented in Table 2.

Table 2. Increase in the number of branches in various types of fertilizer with various ages of patchouli plants.

| Fertilizer | Age of plant | Average |
|------------|--------------|---------|
|            | 4 months     | 5 months | 7 months |
| NPK (20 g) | 28.83 B      | 25.00 A  | 34.67 C  | 39.67 A  | 32.04 A |
| compost 150 (g) | 26.67 AB | a | bc | c | 28.54 A |
| Krisit (30 g) | 21.67 A  | 25.50 A  | 23.00 A  | 42.00 A  | 28.04 A |
| NPK 10 g + compost 75 g + Krisit 25 g | 22.00 A | 23.50 A  | 30.67 BC | 38.33 A  | 28.62 A |
| Average    | 24.79 a      | 24.25 b  | 28.58 b  | 39.63 b  |

Description: The numbers followed by the same letter are not significant according to the Duncan New Multiple Range Test at the level of α = 5%. Large letters are read vertically and small letters are read horizontally.

Table 2 shows that giving plant age treatment with fertilizer on variable number of branches after further testing is significantly different. The highest increase in the number of branch plants was shown in the combination of P3U4 treatments as many as 42.00 branches, while the lowest in the P3U1 treatment was 21.67 branches.

3.3. Growth of Leaf (strand)

Based on the results of the analysis of variance showed that each administration of various types of fertilizers and various ages in patchouli had no significant effect on the increase in the number of leaves, but there were interactions in various kinds of fertilizers with various ages of plants. The results of the significant difference in DMRT at the 5% level are presented in Table 3.
Table 3. Increase in the number of leaves in various types of fertilizer with various ages of patchouli plants.

| Fertilizer                  | 4 months (average) | 5 months | 7 months | average |
|-----------------------------|--------------------|----------|----------|---------|
| NPK (20 g)                  | 120.50 A           | 97.67 B  | 67.33 A  | 134.00 C |
| compost 150 (g)             | 97.83 A            | 67.17 A  | 98.00 A  | 108.33 BC |
| Kiserit (30 g)              | 93.83 A            | 58.17 A  | 91.67 A  | 67.00 A  |
| NPK 10 g + compost 75 g +   | 90.17 A            | 71.50 A  | 85.83 A  | 84.50 AB |
| Kiserit 25 g                |                    |          |          | 83.00 A  |
| average                     | 100.58 a           | 73.63 a  | 85.71 a  | 98.46 a  |

Description: The numbers followed by the same letter are not significant according to the Duncan New Multiple Range Test at the level of \( \alpha = 5\% \). Large letters are read vertically and small letters are read horizontally.

Table 3, after further testing shows that the single factor giving various kinds of fertilizer and various ages of patchouli plants is not significantly different from the increase in the number of leaves, but the interaction between various types of fertilizer with various ages of patchouli gives a real difference. The highest number of leaves added to P1U4 treatment was 134.00 leaves.

![Essential Oil Levels (%)](image)

Fig 1. Essential Oil Levels (%)

Fig 1 shows that the results of the essential oils content in patchouli plants with the treatment of 10 grams of NPK fertilizer + 75 grams + Kiserit 25 grams of patchouli compost with 7 months old plants (P4U4) showed the best results.

Patchouli plant height variable (Table 1) shows that the application of various types of fertilizer at different ages of patchouli plants has not yet produced significant results. The application of patchouli 150 g compost fertilizer with 4 months old plants showed the highest plant height increase of 98.33 cm. According to the study (Dzajuli, 2013) the 3 kg patchouli compost fertilizer has provided good growth for plant growth. Patchouli waste compost fertilizer has benefits for the soil and plant growth, especially for increasing levels of C-organic in the soil, especially those with low carbon content. The higher the amount of patchouli waste compost given the better the growth of patchouli plants. Abdourohim (2008) stated that patchouli waste compost fertilizer is very potential to be used as high-quality compost and shows that compost provides an increase in potassium levels in the soil.

The results of the study on the number of branches of patchouli plants (Table 2) showed that the administration of P3U4 treatment, namely giving kiserit 30 with a 7-month plant life showed the highest number of branches compared to other treatment combinations, namely 42 branches. more and
more, patchouli branches contain enough water. According to Nio and Banyo (2011), that the growth and development of plants is strongly influenced by the condition of water in plant tissues. If the water content in the plant tissue is sufficient, then all processes that will affect the growth and development of the plant will run as they should.

Plants will utilize nutrients available in the soil according to their needs because the greedy patchouli plants will get nutrients, so the dosage of fertilizer that has not been optimal does not give a real difference to the number of branches due to kiserit fertilizer which can improve soil chemical properties and fertilizer Ciserit only has a role that can increase nutrient availability in the soil so that plant growth also increases. The content of kieserit which is very important in plant growth is Mg. According to Maryani and Gusmawartati (2011) this is because with the application of kieserit fertilizer can increase the availability of nutrients in the soil, the availability of kiserit content in the form of Mg can be sufficiently utilized by plants to increase the amount of chlorophyll so that photosynthesis can be optimized.

Table 3 shows that the treatment of 20 g NPK fertilizer with a 7-month plant age gives a very high number of leaves (P1U4) which has the highest average value of 134. Patchouli plants with 7 months of age increase with tip buds will extend the growth of the main axis continuously as the plant ages. According to Haryani et al., 2015 that the number of patchouli plant leaves will increase with increasing age.

Nutrients that affect plant growth are nutrients N, P and K. NPK fertilizers are very useful for plants for growth and development, including making plants more fresh green and containing a lot of leaf green (Chlorophyl) which has a role in photosynthesis (Novizan, 2002). because at the age level of plants that have entered a fairly optimal age and nutrients contained in the soil are still able to sustain plant growth, so that with the addition of NPK fertilizer can increase the number of leaves. Mustika et al., (1995) states that Nitrogen in plant tissues is used to form amino acids and nucleic acids, the constituent proteins of chloroplasts, mitochondria, and cell structures. An adequate supply of nitrogen causes optimal photosynthesis and vegetative growth. genetic factors and the environment in which the plant grows, so that it will affect the appearance of plants both physiologically and morphologically.

Fig 1 shows that the application of 10 grams of NPK fertilizer + 75 grams + Kiserit 25 grams of patchouli compost with 7 months of age plants provide the best levels of essential oils. This is because with the provision of NPK fertilizer, patchouli waste compost containing elements of N (3.59%), K (1.26%), P2O5 (0.28%) and kiserit containing 26.5% Mg has a role as regulating the physiological processes of plants such as photosynthesis, accumulation, translocation, transport of carbohydrates, opening closed stomata, or regulating the distribution of water in tissues and cells. Thus in general with high photosynthate yields at the age of 7 months plants can support the growth of secondary branches and leaves so as to provide higher essential oils. The results of the research by Singh and Rao (2008) showed that the application of nitrogen fertilizer increased the productivity of patchouly oil content and the content of the essential oil of patchouli plants.

4. Conclusion
In general, the growth of patchouli plant height under kelapasawit stands of 3 years old is not affected by fertilizer treatment and plant age, while for the growth of branches and leaves and the level of essential oils are influenced by the provision of fertilizer treatment with plant age. The treatment of 10 g NPK fertilizer + 75 g + Kiserit compost 25 g produces the highest levels of essential oils. Based on the research that has been carried out, further research is needed, namely patchouli planting under the stands of kelapasawit plantations aged 4 years.
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