EFFECT OF BLOTONG (SUGARCANE WASTE) AND UREA FERTILIZER APPLICATION ON THE GROWTH OF OIL PALM SEEDLINGS (*ELAEIS GUINEENSIS* JACQ.) IN POLYBAGS

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Abstract. Blotong is a problematic waste for sugar factories and the community because wet blotong causes a foul odor. The specific nutrient content in the blotong is quite high, so it can improve the physical properties of the soil and as a source of nutrients that can benefit plants. The purpose of this study was to determine the effect of giving blotong and urea fertilizer on the growth of palm oil seedlings. This research was conducted in Sidodadi, Kisaran Barat Subdistrict, Asahan Regency, North Sumatra Province, with the elevation of ± 25 meters above sea level, flat topography, and climate type C. This research was conducted in January to April 2019. This research was conducted using a factorial randomized block design with the first treatment factor giving blotong, namely B0 = without giving blotong (0 g / polybag), B1 = 150 g / polybag, B2 = 300 g / polybag and B3 = 450 g / polybag. Whereas the second treatment factor for urea fertilizer is U0 = without urea (0 g / polybag), U1 = 100 g / polybag and U2 = 200 g / polybag. The parameters observed were seedling height, stem diameter and leaf area. The results showed that the administration of blotong significantly affected seedling height, stem diameter and leaf area of oil palm seedlings; and urea fertilizer treatment showed significant effect on seedling height and stem diameter of oil palm seedlings.

Keywords: blotong (sugarcane waste), urea fertilizer, oil palm seedlings

INTRODUCTION

Oil palm plantations in Indonesia based on their operations can be categorized into 3, namely community plantations, state plantations, and private plantations. The total area of oil palm plantations in Indonesia in 2018 is 14.3 million ha, consisting of community plantations covering 5.8 million ha (± 41% of the total area), state plantations covering 715,000 ha (± 5% of the total area), and private plantations covering 7.7 million ha (± 54% of the total area). The area continues to increase with an average growth in the area of oil palm plantations for the 2015-2018 period reaching 10.31% / year (Directorate General of Plantations, 2018). Along with the development of the area, the production of palm oil in the form of crude palm oil (CPO) also tends to increase during the years 2015-2018. If in 2015 Indonesia's palm oil production was only 31.07 million tons, then in 2018 it would increase to 40.56 million tons. The increase in palm oil production mainly occurred in private large estates and smallholder estates, while palm oil produced by the national large estates was relatively constant, and even tended to decline. For 2018, palm oil production from

private large estates will reach 26.5 million tons of CPO (± 51%), while National Large Estates and Smallholders will each produce 2.5 million tons of CPO (± 6%) and 14 million tons of CPO (± 33%) (Agricultural Data and Information Center, 2018).

The problem that is often faced by oil palm farmers is the availability of less-quality seeds, which is indicated by low growth. This is closely related especially in terms of nutrient availability. Nutrient is very important for planting media, its availability can affect plant growth. Generally the fulfillment of nutrients in planting media is done by fertilizing (Khasanah, 2012).

Soil fertility is a condition of ability where the soil can provide nutrients in sufficient quantities and balanced, so as to support the growth and production of plants according to their potential (Munawar, 2011). Soil fertility can be sought through fertilization that plays a role in providing nutrients and amelioration of the soil. Plant growth is influenced by many factors one of which is the adequacy of macronutrients N, P, and K (Rahardjo and Ekwas, 2010). In general, fertilization in oil palm plantations is carried out based on location-specific recommendations. According to Duan et al., (2007), to support the vegetative growth of oil palm seedlings, Nitrogen (N) is the most important nutrient. Plant needs for N are higher compared to other nutrients. Besides that N is a limiting factor for crop productivity. N deficiency will cause plants not to grow optimally, while excess N besides inhibiting plant growth will also cause pollution to the environment. One of the N fertilizers that can be used is Urea fertilizer with ± 45% N.

Blotong or filter cake is sugar cane juice waste from the process of making sugar. The percentage of blotong produced per hectare of sugar cane is 4-5%. Blotong is a problematic waste for sugar factories and the community because wet blotong causes a foul odor. However, blotong can be used as organic fertilizer. In the blotong contained several nutrients, namely 1.51% N, 5.63% P_2O_5, 0.26% K_2O and 32.38% C-organic. The utilization of blotong as organic fertilizer is expected to reduce the use of inorganic fertilizers and reduce the impact of environmental pollution. Blotong is suitable to be used as an organic fertilizer because it has nutrient content of C-organic 32.28%, C/N 21.44, pH 8.03, N-total 1.51%, P-total 5.63%, and K-total of 0.26% (Astuti et al., 2015). This means that in addition to improving soil physical properties, blotong compost is also useful as a nutrient source that can benefit plants. In addition to saving on expenses for inorganic fertilizer needs, the use of blotong waste is also an effort to utilize waste towards zero waste industry. The purpose of this study was to determine the effect of giving blotong and urea fertilizer on the growth of oil palm seedlings.

MATERIAL AND METHODS

This research was conducted in Sidodadi, Kisaran Barat Subdistrict, Asahan Regency, North Sumatra Province, with the elevation of ± 25 meters above sea level, flat topography, and climate type C. This research was conducted in January to April 2019.

This research was conducted using a factorial randomized block design with the first treatment factor giving blotong, namely B0 = without giving blotong (0 g / polybag), B1 = 150 g / polybag, B2 = 300 g / polybag and B3 = 450 g / polybag.

Whereas the second treatment factor for urea fertilizer is U0 = without urea (0 g / polybag), U1 = 100 g / polybag and U2 = 200 g / polybag. The parameters observed were seedling height, stem diameter and leaf area.

RESULTS AND DISCUSSION

Plant Height (cm)

From the results of observations and analysis of variance, it can be seen that the administration of blotong showed no significant effect on the height of oil palm seedlings at 4 weeks after planting, but showed a very significant effect at 8 and 12 weeks after planting. Urea fertilizer treatment showed no significant effect on the height of oil palm seedlings at the age of 4 weeks after planting and showed a significant effect at the age of 8 and 12 weeks after planting. While the interaction between the administration of blotong and urea fertilizer also showed no significant effect on oil palm seedling height at all observations. The results of the different tests of the effect of blotong and urea fertilizer on oil palm seedling height at 12 weeks after planting can be seen in table 1.

Table 1

Average difference test results of the effect of giving blotong and urea fertilizers on oil palm seedling height (cm) at 12 weeks after planting

Treatment	U_0	U_1	U_2	Average
B_0	35.33	34.73	36.33	**35.47 b**
B_1	35.17	35.00	35.17	**35.11 b**
B_2	34.67	35.83	35.50	**35.33 b**
B_3	35.53	37.83	39.67	**37.68 a**
Average	**35.18 b**	**35.85 b**	**36.67a**	**CV = 3.73 %**

Note: Numbers followed by the same letter in the same row or column show no significant difference at the 5% level using the Least Significant Difference test.

From Table 1 it can be seen that the administration of blotong with a treatment of 450 g / polybag (B3) has the highest height of oil palm seedlings, namely 37.68 cm; significantly different from the control treatment (0 g / polybag / B0) with a seedling height of 35.47 cm. Whereas the treatment of urea fertilizer with a treatment of 200 g / polybag (U2) had the highest height of oil palm seedlings, 36.67 cm; significantly different from the control treatment (0 g / polybag / U0) with a seedling height of 35.18 cm. The effect of blotong on oil palm seedling height at 12 weeks after planting, can be seen in the response curve of Figure 1.

Plant height is an indicator of plant growth, as well as parameters used to measure the influence of the environment or the effect of the treatment being applied. The application of blotong to the height of oil palm seedlings shows a significant effect because blotong compost has a high N content. According to Hidayat et al (2016), the availability of essential macro and micronutrients will help the process of plant physiology so that it can run well. Increased plant physiology processes such as

the rate of photosynthesis will make the growth of plant height also increases. Growth in seedling height is an implication of the physiological process, with cell division and cell extension dominated by shoots.

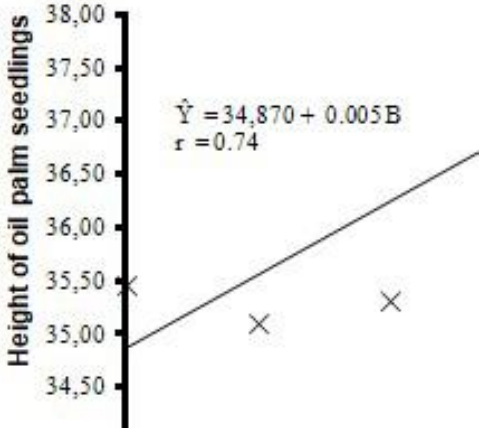

Fig. 1. Influence of Blotong Provision on the Height of Oil Palm Seedlings at 12 Weeks After Planting

The results of the regression analysis (Figure 1) show that there is a relationship between increasing the dose of Blotong compost and increasing the height of oil palm seedlings. A regression coefficient of 0.74 indicates the effect of blotong compost dose on the height of oil palm seedlings, which means that an increase in blotong compost dose of 450 g / polybag will produce oil palm seedling height of 37.68 cm. The effect of urea fertilizer on oil palm seedling height at 12 weeks after planting can be seen in the response curve (Figure 2).

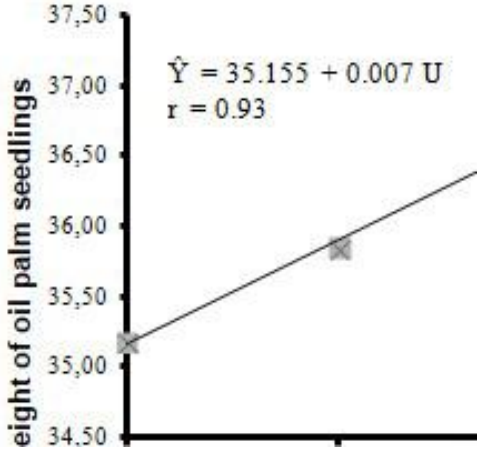

Fig. 2. Influence of Urea Fertilizing on the Height of Oil Palm Seedlings at 12 Weeks After Planting

The influence of urea fertilizer on oil palm seedling height, due to nutrients contained in urea fertilizer, especially N can be absorbed by plants and plants are needed in the vegetative phase. This is in accordance with the opinion of Pasaribu (2018), which states that the role of N (Nitrogen) for oil palm plant seeds is to

stimulate overall plant growth, especially stems, leaves and encourage the formation of chlorophyll so that the leaves turn green, which is useful for photosynthesis. This is also in line with the opinion of Risnawati (2010), which states that plant growth can be interpreted as an increase in plant size or the result of adding plant cells. The emergence of new plant cells begins with the occurrence of mitosis (cell nucleus division) and continued with cytokinesis (cell division). This means that in the formation of new cells, protein and protein constituents are needed, one of which is Nitrogen.

The results of the regression analysis (Figure 2) show that there is a relationship between an increase in the dose of urea fertilizer and an increase in oil palm seedling height. A regression coefficient of 0.93 indicates the influence of urea fertilizer dose on the height of oil palm seedlings which means that an increase in urea fertilizer dose of 200 g / polybag will produce a palm oil seedling height of 36.67 cm.

The Diameter of Stem (cm)

From the results of observations and analysis of variance can be seen that the administration of blotong showed no significant effect on the stem diameter of oil palm seedlings at 4 and 8 weeks after planting, but showed a very significant effect at 12 weeks after planting. Urea fertilizer treatment showed no significant effect on the stem diameter of oil palm seedlings at 4 weeks after planting and showed a significant effect at 8 and 12 weeks after planting. The results of the different tests of the effect of blotong and urea fertilizer on the stem diameter of oil palm seedlings at 12 weeks after planting can be seen in Table 2.

Table 2

Average difference test results of the effect of giving blotong and urea fertilizers on the stem diameter of oil palm seedling (cm) at 12 weeks after planting

Treatment	U_0	U_1	U_2	Average
B_0	12.00	12.08	12.08	12.06 b
B_1	10.85	11.85	11.92	11.54 b
B_2	12.17	13.00	12.47	12.54 b
B_3	11.75	13.67	15.27	13.56 a
Average	**11.69 b**	**12.65 a**	**12.93 a**	**CV = 9.12 %**

Note: Numbers followed by the same letter in the same row or column show no significant difference at the 5% level using the Least Significant Difference test.

From Table 2 it can be seen that the administration of blotong with the treatment of 450 g / polybag (B3) has the highest stem diameter of the oil palm seedling which is 13.56 cm; significantly different from the control treatment (0 g / polybag / B0) with a stem diameter of 12.06 cm. Giving urea fertilizer with a treatment of 200 g / polybag (U2) has the highest stem diameter of oil palm seedlings which is 12.93 cm; significantly different from the control treatment (0 g / polybag / U0) with a stem diameter of 11.69 cm. The effect of blotong on the stem diameter of oil palm seedlings at 12 weeks after planting, can be seen in the response curve (Figure 3).

The influence of giving blotong compost on stem diameter, because it has a lot of mineral content, so the nutrient content available in the soil such as macro and

micronutrients also increases. This is in accordance with Pasaribu (2018), which states that blotong contains minerals needed by the soil and plants with the highest total elemental composition, namely Ca, Na, K, and Mg; other macro elements in the form of P and S; while the microelements consist of Fe, Mn, Zn, Cu. The mineral has the potential to increase soil mineral reserves to enrich nutrient chemical composition and improve soil physical properties so that it can be used as material to improve nutrient-poor soils or weathered soils that will be used by plants for stem diameter growth. The N element contained in Blotong compost contributes to increasing the growth of the stem diameter of oil palm seedlings (Gunawan et al, 2014).

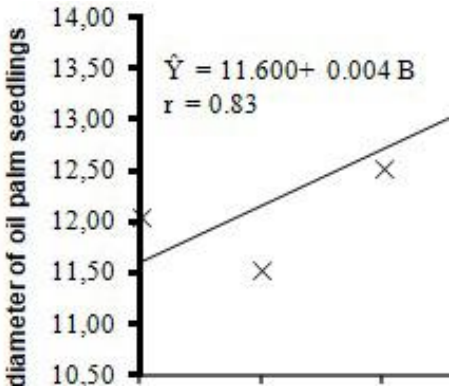

Fig. 3. Effect of Blotong Provision on the Stem Diameter of Oil Palm Seedlings 12 Weeks After Planting

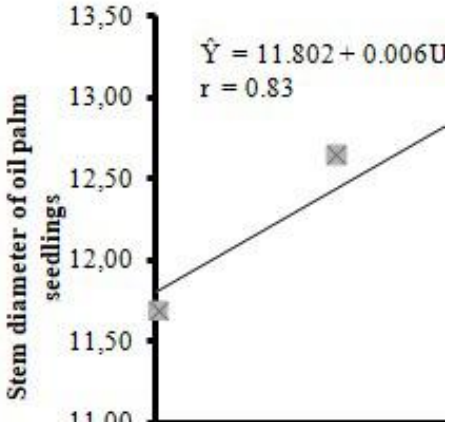

Fig. 4. Effect of Urea Fertilizing on the Stem Diameter of Oil Palm Seedlings 12 Weeks After Planting

The results of the regression analysis (Figure 3) show that there is a relationship between increasing the dose of Blotong compost with increasing stem diameter of oil palm seedlings. The regression coefficient of 0.83 indicates the effect of blotong compost dose on the stem diameter of oil palm seedlings, which means that increasing the dose of blotong compost by 450 g / polybag will produce a stem

diameter of oil palm seedlings of 13.56 cm. The effect of urea fertilizer on the stem diameter of oil palm seedlings at 12 weeks after planting, can be seen in the response curve (Figure 4).

Nitrogen fertilization (urea) acts as a basic constituent of proteins and the formation of chlorophyll which functions to stimulate plant growth in the vegetative phase. This was confirmed in the study of Darmawan (2005), showing that the use of urea at a dose of 10 gr/plant given to oil palm seedlings can increase height, number of leaves, and stem diameter. Nurseries are an important phase in the growth and further development of plants. Risnawati (2010), also added that the function of Nitrogen nutrients for plants is to stimulate vegetative growth of plants, especially roots, stems, and leaves. The effect of urea fertilizer will influence the increase in stem diameter. According to Astutik et al (2011), plant growth is a process of development of plant constituent organs through cell division and enlargement by requiring the synthesis of proteins formed from nitrogen. The development of cells in the apical meristems of plants will produce new cells at the ends of stems and roots that cause the organs to grow taller and longer.

The results of the regression analysis (Figure 4) show that there is a relationship between an increase in the dose of urea fertilizer and an increase in stem diameter of oil palm seedlings. The regression coefficient of 0.83 indicates the influence of the dose of urea fertilizer on the stem diameter of oil palm seedlings which means that increasing the dose of urea fertilizer by 200 g / polybag will produce a stem diameter of oil palm seedlings of 12.93 cm.

Leaf Area (cm)

From the results of observations and analysis of variance, it can be seen that the application of blotong shows a very significant influence on the leaf area of oil palm plantations, while the administration of urea fertilizer shows no significant effect on the leaf area of oil palm plantations. The interaction between blotong and urea fertilizer showed no significant effect on the leaf area of oil palm seedlings. The results of the different tests of the effect of blotong and urea fertilizer on the leaf area of oil palm seedlings at 12 weeks after planting can be seen in Table 3.

Tabel 3

Average difference test results of the effect of giving blotong and urea fertilizers on leaf area of oil palm seedling (cm) at 12 weeks after planting

Treatment	U_0	U_1	U_2	Average
B_0	131.55	122.71	143.54	**132.60 b**
B_1	139.43	126.87	117.62	**127.97 b**
B_2	123.75	132.88	130.88	**129.17 b**
B_3	143.17	153.67	170.11	**155.65 a**
Average	**134.47**	**134.03**	**140.54**	**CV = 9.12 %**

Note: Numbers followed by the same letter in the same row or column show no significant difference at the 5% level using the Least Significant Difference test.

From Table 3 it can be seen that the administration of blotong with a treatment of 450 g / polybag (B3) has the highest leaf area of a palm oil seedling which is 155.65

cm; significantly different from the control treatment (0 g / polybag / B0) with leaf area that is 132.60 cm. Giving urea fertilizer with a treatment of 200 g / polybag (U2) has the highest leaf area of palm oil seedlings that is 140.54 cm; not significantly different from the control treatment (0 g / polybag / U0) with a leaf area of 134.47 cm. The effect of blotong on leaf area of oil palm seedlings at the age of 12 weeks after planting, can be seen in the response curve (Figure 5).

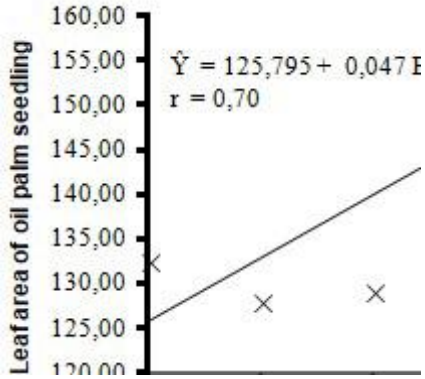

Fig. 5. Effect of Blotong Provision on Leaf Area of Oil Palm Seedlings 12 Weeks After Planting

Leaf area is a large surface that allows more effective capture of light and CO_2, so the rate of photosynthesis increases. The results of photosynthesis are transplanted to vegetative use areas, namely roots, stems, and leaves that affect plant growth and development (Wahyu et al, 2013). According to Suwarsono et al (2011), the leaf area index is one of the important parameters to identify plant productivity. The higher leaf area index value indicates that the plant canopy is wider than the area of land covered, so the plant's ability to photosynthesize is higher. The increase in leaf area is closely related to the role of nitrogen, thus affecting the process of photosynthesis (Elisabeth et al, 2012). According to Sudartiningsih et al (2002), Nitrogen is a constituent of all proteins and nucleic acids. Plants that are adequately supplied with N will form large leaf strands with high chlorophyll content so that plants can produce assimilates in sufficient quantities to support their vegetative growth (Wijaya, 2008).

The absence of influence from the application of urea fertilizer on plant leaf area, allegedly because the development of seedlings during the nursery phase requires nutrient reserves that are met by nutrient reserves stored in the seed, the rest can be obtained from the nursery media with the role of developing roots. It is also influenced by genetic factors, so the number of leaves of each individual plant is not too different. The number of leaves is strongly influenced by genetic traits, where oil palm seedlings form 1-2 leaves each month (Reksa, 2008).

CONCLUSIONS

1. Blotong administration significantly affected the height, stem diameter, and leaf area of oil palm seedlings, where the best dose was found in the B3 treatment which was 450 g / polybag.

2. The application of urea fertilizer has a significant effect on the height and diameter of the stem of oil palm seedlings, where the best dose is found in the U2 treatment which is 200 g / polybag.

3. There is no interaction between blotong and urea fertilizer application on the growth of oil palm seedlings.

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