

Character of Cacao Seedling Growth (*Theobroma cacao* L.) by Compost Application of Palm Oil Leaves at Different Age of Transplanting Seeds

Wan Arfiani Barus, Rita Mawarni CH dan Muhammad Idam Khalid

Abstract—The best of Cocoa plant growth and production are inseparable from quality of seeds. Quality seeds are obtained when sufficient nutrient availability and vigorous sprouts. The priority of sprouts is related to the age-appropriate for transplanting. This study aims to determine the character of cacao seedling growth towards the provision of oil palm leaf compost fertilizer and the age of sprouts. This study used factorial randomized block design with 2 factors, the first factor is Palm Oil Leaf Compost Fertilizer with 4 levels, namely: K_0 = Without Treatment/Control, K_1 = 50 g/polybag, K_2 = 100 g/polybag, K_3 = 150 g/polybag and the second factor is the age of sprouts with 3 levels, namely: U_1 = 7 days, U_2 = 14 days, U_3 = 21 days. The results showed that the effect of oil palm leaf compost application had no significant effect on all parameters. While the age of transplanting was gave the significant effect on all parameters. The best age of sprouts was 7 days..

Keywords: Age of Sprouts, Cocoa Plants, Growth, Oil Palm Leaf Compost

1 INTRODUCTION

The cocoa plant is one of the mainstays of plantation commodities that plays an important role in the Indonesian economy. In 2010 Indonesia became the second largest cocoa producer in the world with production of 844,630 tons, under the Ivory Coast state with a production of 1.38 million tons. The volume of Indonesian cocoa exports in 2009 was 535,240 tons with a value of Rp. 1,413,535,000 and import volume of 46,356 tons worth 119.32 thousand US \$^[1]. Utilization of plantation waste as a source of nutrients for nurseries has begun to become a concern. For example, the waste produced by oil palm plantations can be in the form of solid waste, one of which is palm fronds. In order to overcome various problems arising from midrib waste, various emerging utilization ideas have emerged that aim to reduce the impact of midrib waste. Several studies have been carried out to utilize oil palm frond waste, namely as a base material for composite panels, pulp, bio-ethanol and gas capable of burning with the gasification process. One of the other uses of palm oil leaf waste is to convert it into organic fertilizer. This is more likely to remember a fairly easy process and relatively inexpensive costs^[2].

In plants that are propagated through seeds and need seedlings, one of the factors that can affect seedling growth is the age of transplanting. Moving plants should be done on the right plant stage. Moving plants early will accelerate the adaptation of plants to the environment, so that plant growth is not hampered and can produce better vegetative parts. If the transplanting is late, the plant does not have enough time to

complete its vegetative growth, plants age faster and quickly enter the generative stage. The exact time of transplanting is determined, apart from the type of plant, it is also determined by the type of environment in which the plants are moved to plant as well as the techniques in cultivation. Planting in a controlled environment under the shade allows the transfer of plants earlier than planting on open land^[3].

2. MATERIALS AND METHODS

This research was carried out at the Growth Center in Kopertis Wilayah I on Jalan Peratun 1, Percut Sei Tuan, Deli Serdang Regency, North Sumatra Province with the altitude of \pm 27 meters above sea level. This research was conducted on April, 2018, until September, 2018. This study used factorial randomized block design with 2 factors, the first factor is Palm Oil Leaf Compost Fertilizer with 4 levels, namely: K_0 = Without Treatment / Control, K_1 = 50 g/polybag, K_2 = 100 g/polybag, K_3 = 150 g/polybag and the second factor is sprouts age with 3 levels, namely: U_1 = 7 days, U_2 = 14 days, U_3 = 21 days. To see the difference in each treatment, the DMRT test was performed at the level of 5%.

3 RESULTS AND DISCUSSION

Plant height

Based on the analysis of variance (ANOVA) with factorial randomized block design (RBD) showed that the age of sprouts had a significant effect on plant height at age 2, 8 and 10 WAP, while the application of palm oil leaf compost fertilizer and treatment interaction had no significant effect. In Table 1, the data on plant height averages of 10 WAP is presented.

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Table 1. The height of Cocoa Plant on 10 (WAP) by Application of Palm Oil Leaves Compost Fertilizer and Age of Sprouts

Treatment	K ₀	K ₁	K ₂	K ₃	Average
.....cm.....					
U ₁	87,67	93,67	110,33	95,67	96,83 b
U ₂	76,50	89,33	98,67	99,33	90,96 b
U ₃	75,83	84,00	76,17	83,00	79,75 a
Average	80,00	89,00	95,06	92,67	89,18

Description: Numbers followed by the same letters in the same column are not significantly different according to the 5% DMRT test

Based on Table 1, it can be seen that the plant height with the highest mean is found in treatment U₁ which is 96.83 which is significantly different from the treatment of U₃ which is 79.75 and not significantly different from the treatment of U₂ which is 90.96. The relationship between the number of leaves of cocoa plants at the age of 10 weeks after planting with the treatment of Sprouts Age can be seen in Figure 1.

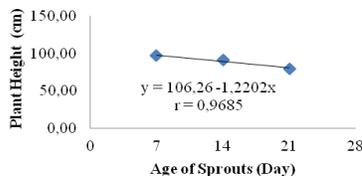


Figure 1. Plant Height of Cocoa Plants on 10 WAP (Week After Planting) with Age of Sprouts 10 Days

Based on Figure 1, The height of Cocoa plant of sprouts age has decreased with the Age of Sprouts which shows a negative linear relationship with the regression equation: $y = 106.26 - 1.2202x$ with a value of $r = 0.9685$. This is related to the adaptability of the plant after being transferred from the nursery to the polybag. Where the Age of Sprouts 7 days is better able to adjust to new conditions from 14 and 21 days. This is in accordance with the statement [3], early transplanting will accelerate the adaptation of plants to the environment, so that plant growth is not hampered and can produce better vegetative parts. Moving plants late makes plants not have enough time to complete their vegetative growth.

Number of Leaves

Based on the analysis of variance (ANOVA) with factorial Randomized Block Design (RBD) showed that the Age of Sprouts significantly affected the number of leaves at ages 2, 6, 8 and 10 WAP, while the administration of Palm Oil Leaf Compost Fertilizer and Treatment Interactions had no significant effect. Table 2 presents data on the average number of leaves aged 10 WAP.

Table 2. Leaf Number of Cocoa Plant on 10 (WAP) by Application of Palm Oil Leaves Compost Fertilizer and Age of Sprouts

Treatment	K ₀	K ₁	K ₂	K ₃	Average
.....helai.....					
U ₁	49,33	44,67	48,67	41,67	46,08 c
U ₂	41,67	39,00	45,33	45,00	42,75 b
U ₃	35,33	42,67	43,33	36,67	39,50 a
Average	42,11	42,11	45,78	41,11	42,78

Description: Numbers followed by the same letters in the same column are not significantly different according to the 5% DMRT test

Based on Table 2, it can be seen that the number of leaves with the highest mean is found in treatment U₁, which is 46.08

which is significantly different from the treatment of U₂ and U₃, namely 42.75 and 39.50. The relationship between the number of leaves of Cocoa plants at the age of sprouts in 10 WAP with the treatment of Age of Sprouts can be seen in Figure 2.

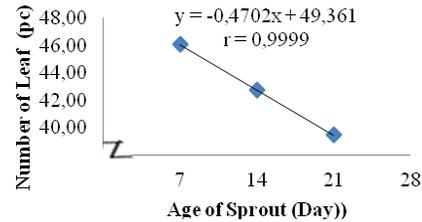


Figure 2. Plant Height of Cocoa Plants on 10 WAP (Week After Planting) with Age of Sprouts 10 Days

Based on Figure 2, it can be seen that the number of leaves of a sample of moving age seedlings has decreased with increasing age of sprouts which shows a negative linear relationship with a regression equation $y = 49,361 - 0,4702x$ with a value of $r = 0,9999$. This is presumed by the better adaptability of the plants at the age of 7 days of seedlings affecting the vegetative growth of plants, one of which is the growth in the number of leaves. In accordance with the opinion [4], which states that vegetative growth is the increase in volume, number, shape and size of vegetative organs such as leaves, stems and roots starting from the formation of leaves in the germination process until the initial formation of generative organs. The process of transferring cacao seedlings to large polybags is a stage of plant adaptation which includes two ways, namely, physiological adaptation and morphological adaptation. This was also stated by [4], who stated that physiological adaptation involves slowly changing physiological processes of plants towards a better direction and can adapt to their environment. This process can be in the form of pest and disease resistance. In this study, the plants were attacked by Vascular Streak Dieback (VSD), which greatly affected the number of leaves. This is in accordance with the opinion [5], which states that the most characteristic initial symptoms of VSD attack are necrosis followed by symptoms of leaf ageing in the second or third leaf. Then xylem blackening occurs on infected leaves and eventually leaves fall like toothless symptoms.

Leaf Area

Based on the analysis of variance (ANOVA) with factorial Randomized Block Design (RBD) showed that the Age of Sprouts significantly affected leaf area at the age of 10 WAP, while the application of Palm Oil Leaf Compost Fertilizer and Treatment Interactions had no significant effect. In Table 3, data on the average leaf area of 10 WAP are presented.

Table 3. Average Area of Cocoa Leaves by Application of Palm Oil Leaves Compost Fertilizer and Age of Sprouts in 10 WAP

Treatment	K ₀	K ₁	K ₂	K ₃	Average
.....cm ²					
U ₁	194,70	206,87	280,69	208,31	222,64 c
U ₂	139,71	156,36	227,99	170,47	173,63 b
U ₃	127,46	150,58	136,18	174,54	147,19 a
Rataan	153,96	171,27	214,96	184,44	181,16

Description: Numbers followed by the same letters in the same column are not significantly different according to the 5% DMRT test

Based on Table 3, it can be seen that the area of cocoa leaves plants with the highest average is found in U_1 treatment, namely 222.64 which is significantly different from U_2 and U_3 treatments, namely 173.63 and 147.19. The relationship between leaf area of cocoa plants at the age of 10 WAP and treatment of Age sprouts can be seen in Figure 3.

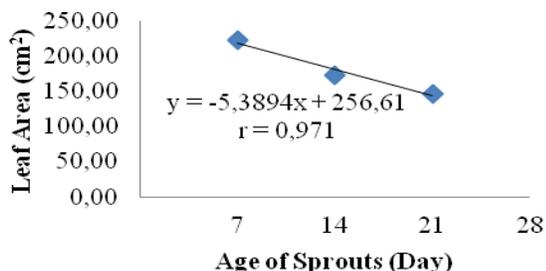


Figure 2. Plant Height of Cocoa Plants on 10 WAP (Week After Planting) with Age of Sprouts 10 Days

Based on Figure 3, it can be seen that sprouts age of Seeds 7 days gives the highest leaf area results with an average value of 222.64 cm² and shows a negative linear relationship with a regression equation $y = 256.61 - 5.3894x$ with a value of $r = 0.971$. This is presumably because the plants are more adaptable after being transferred to polybags at the age of 7 days in the nursery. Plants can adapt morphologically which also affects the development of leaf area. In accordance with the opinion^[4], which states that morphological adaptation in the form of plant growth and development (roots, stems, leaves) when the plants are moved from the nursery to the field. In this study the plants were also attacked by plant pest organisms, namely, *Grayak* caterpillar pests (*Spodoptera litura*), thus affecting leaf area on plants. This is in accordance with the^{[6][7][8]}, young *Grayak* caterpillars eat leaves by leaving remnants of the upper epidermis and leaf bone, while caterpillars in the elderly or adult caterpillars eat leaves and leaf bones.

Stem Diameter

Based on the analysis of variance (ANOVA) with factorial Randomized Block Design (RBD) showed that the Sprouts Age of Seeds significantly affected the stem diameter at age 2, 4, and 10 WAP, while the administration of Palm Oil Leaf Compost Fertilizer and Interaction treatment did not have a significant effect. In table 4, the data on the average stem diameter of 10 WAP was presented.

4 CONCLUSION

Based on the research it can be concluded:

- Application of Oil Palm Leaves Compost Fertilizer had not significant effect on all plant parameters.
- Age of sprouts had the significant effect on plant height (96.83 cm), number of leave (46.08 strands), Leaf area (222.64 cm²), Stem diameter (2.22 cm), the upper wet weight (42.75 g), lower wet weight (10.0 g), upper dry weight (16.29 g) and lower dry weight (4.35 g). The best treatment was U_1 (7 Days).
- There is no interaction between palm oil leaf compost fertilizer application and age of sprouts to all parameters.

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