

# EFFECTS OF MANURE AND UREA FERTILIZER ON COCOA GROWTH (THEOBROMA CACAO L.)

**Sudarma J. A.\*, Masdar Hidayat**

Faculty of Agriculture, Universitas Gunung Leuser, Aceh, Indonesia

Email: sudarmaza@gmail.com\*

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## ABSTRACT

This research was conducted in Cingkam Mekhanggun Village, Lawe Alas District, Southeast Aceh Regency with a height of  $\pm$  250 meters above sea level. This research will be carried out from September 2020 to December 2020 with the aim of being able to determine the effect of manure and the correct dose of urea fertilizer in order to obtain the growth of cocoa plants. This research aims to find out the influence of Interaction Between Manure and Urea Fertilizer Treatment on Cocoa Plant Growth. This research used a factorial randomized block design (RBD) consisting of 2 treatment factors and 2 replications, namely the first factor of manure (K) with treatment K1 = 100 gr / polybag, K2 = 200 gr / polybag and K3 = 300 gr / polybag. The second factor was Urea (U) fertilizer with 3 treatment levels U1 = 1 g / polybag, U2 = 2 g / polybag and U3 = 3 g / polybag, so that 9 treatment combinations were obtained. The results showed that manure could not increase the growth of cocoa seedlings, plant height, leaf area, stem diameter and biomass weight. The application of urea fertilizer cannot stimulate the growth of cocoa seedlings in the nursery. The treatment combination between manure and urea fertilizer cannot stimulate the growth of cocoa plants in the nursery.

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## INTRODUCTION

Cocoa (*Theobroma cacao* L.) is one of the many plants that have considerable opportunities for trade, both at home and abroad (Samudra, 2005). Cocoa commodities in the future are expected to be able to occupy a place equal to rubber and oil palm commodities. Cocoa commodities have opportunities for export markets, so it can increase the country's foreign exchange (Zaenudin, 2004). Moreover, when processed as liquor or butter, cocoa bean is a key ingredient in chocolate products (Idowu et al., 2022). In addition, the total area of cacao plantations in Indonesia increased from 1,709,284 Ha in 2015 to 1,691,334 Ha in 2017, putting Indonesian cacao output in fourth place with an average production of 0.47 tons/ha (Eris et al., 2022).

Increasing the area of cocoa requires a lot of seeds, so good seeds are needed (Desiana et al., 2013). Several ways to increase the growth of cacao seedlings are by applying manure and also applying urea fertilizer (Prawoto & Erwiyono, 2008). Urea fertilizer is a chemical fertilizer that contains high levels of nitrogen (N). Nitrogen is an indispensable nutrient for

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plants. Urea fertilizer in the form of white crystalline grains, with the chemical formula  $\text{NH}_2\text{CONH}_2$ , is a fertilizer that is easily soluble in water and is very easy to absorb water (hygroscopic) (Handayani, 2009).

Nitrogen is a macronutrient which is a fundamental unit in proteins, amino acids, chlorophyll and other organic compounds (Fahmi et al., 2010). Protein is the main constituent of protoplasm. Nitrogen plays an important role as a constituent of chlorophyll, which makes leaves green. The high nitrogen content makes the leaves greener and lasts longer (Handayani, 2009).

The nitrogen nutrients contained in Urea fertilizer are very useful for plants for growth and development, including: making plant leaves greener and fresher and containing lots of grains (chlorophyll) which has a very important role in the process of photosynthesis, accelerating plant growth (height, number of tillers, branches), increase the protein content of plants, and can be used by all types of plants, both food crops, horticulture, plantation crops, livestock and fishery businesses (Handayani, 2009).

Manure is the best soil improvement material, the nutrients contained in organic fertilizers are generally low and highly variable (Oktavianti et al., 2017). Giving organic matter can increase soil moisture and help in building soil fertility, especially if it is done in a relatively long time (Sutanto, 2002). The addition of manure to the soil has an influence on several chemical properties, which will then affect the plant (Kurnia, 2008). Sources of organic fertilizers can come from animal manure, plant material and waste, such as manure, forage grass plants, shrubs and trees. In addition, for instance, Raw sheep manure outperforms digested sheep manure in terms of stimulating wheat growth and productivity. The addition of urea increased digested manure performance but added no substantial value to raw manure (Abubaker et al., 2020).

Oktarini (2021) found that the application of organic fertilizer with urea has a very significant effect on plant growth. Moreover, the experimental results show that there is an effect of fertilizer cocoa pod skin compost and NPK fertilizer tablets on the number of wilted nipples studied (Suprpto et al., 2018). Thus, the study aims to analyze the Effects of Manure and Urea Fertilizer on Cocoa Growth (*Theobroma cacao* L.). Based on the background above, the study aims to find out the influence of Interaction Between Manure and Urea Fertilizer Treatment on Cocoa Plant Growth

## **METHOD**

This research will be carried out in Cingkam Mekhanggun Village, Lawe Alas District, Southeast Aceh Regency with an altitude of  $\pm$  250 meters above sea level. This research will be carried out from September 2020 to December 2020.

The materials used in this research are 100 seeds of cocoa seeds taken from the people's plantation of Southeast Aceh Regency, urea fertilizer, cow manure, polybags with a diameter of 18 cm x 25 cm.

The tools used in this study were hoe, gembor, meter, scales, oven, leaf area meter, hand sprayer, plastic rope, bucket, bamboo, beaker glass, knife, sample pacak, signage, calculator and other tools that support the research. this.

### **A. Experimental Design**

The design used in this study was a Factorial Randomized Block Design (RAK) (Sugiyono, 2011), consisting of 2 treatment factors and 2 replications, namely: First Factor Manure (K) with 3 treatment levels, namely: K1 = 100 gr/ polybag, K2 = 200 gr/ polybag and K3 = 300 gr/ polybag. The second factor is Urea Fertilizer (U) with 3 treatment levels,

namely: U1 = 1 g/polybag, U2 = 2 gr/ polybag and U3 = 3 gr/ polybag, thus 9 treatment combinations were obtained.

### B. Maintenance

Maintenance is carried out to provide good conditions for cocoa plants in the growing process. Activities carried out include watering and controlling pests and diseases. Pest control is carried out by spraying insecticides with the Decis trademark, this spraying is carried out 1 time in 1 month. Watering is done 2 times a day, morning and evening.

### C. Observations

Observations were made at the end of the study at the age of 3 weeks after planting. Plant height was measured when the plant was 2 weeks old in polybags with a measurement interval of once every two weeks. Plant height was measured from the root neck to the growing point.

Measurement of leaf area was only carried out at the last observation at the last observation, namely in the 2nd week after planting. Leaf area measured was leaf that was fully opened. Measurements can be made using the formula:  $\text{Log } Y = -0.495 + 1.904 \text{ Log } x$ , where y is leaf width and x leaf length.

Stem diameter was measured after the plant was 2 weeks after planting. The stem diameter was measured using a clipper.

Cocoa plant biomass was measured at the end of the study by air drying for 2 weeks after extracting the juice from the nursery. The plant biomass that has been air-dried is weighed using an ordinary scale.

## RESULTS AND DISCUSSION

### A. The Effect of Manure on Cocoa Plant Growth

#### 1. Plant Height

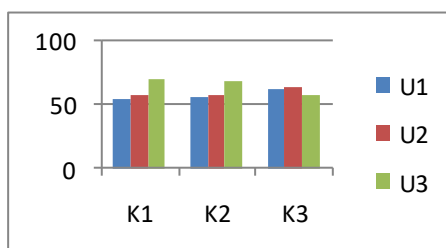
To determine the difference in plant height is presented in table 1 in the form of a mean difference test.

**Table 1**  
**Mean difference test results**

<b>Treatment</b>	<b>U1</b>	<b>U2</b>	<b>U3</b>	<b>Total</b>	<b>Average</b>
K1	54.16	58.16	70.63	182.95	60.98 a
K2	56.93	58.03	68.03	182.99	61.00 a
K3	61.85	64.76	58.16	184.77	61.59 a
Total	172.94	180.95	196.82	550.71	-
Average	57.65 a	60.32 a	65.61 a	-	

From Table 1, it can be seen that the effect of manure treatment on K1 was a high growth of 70.63 cm which was significantly different from the effect of K2 and K3 treatments, while the effect of urea fertilizer did not show a significant effect on the growth of cocoa seedlings.

From the results of the analysis of the effects of manure to the height of cocoa seedlings aged 2 weeks, it can be seen in the following figure.



**Figure 1. The effects of manure to the height of cocoa seedlings aged 2 weeks**

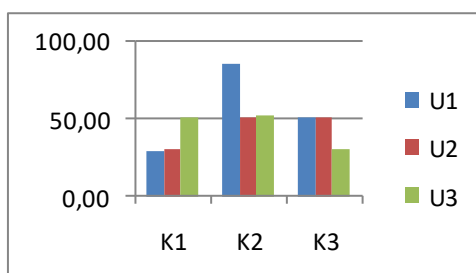
**2. Leaf area (cm<sup>2</sup>)**

To affect the difference in leaf area in each combination of manure and urea fertilizer treatment can be seen in table 2.

**Table 2  
Combination of manure and urea fertilizer treatment**

Treatment	U1	U2	U3	Total	Average
K1	30.00	30.33	51.33	111.66	37.22
K2	86.53	50.67	52.00	189.2	63.07
K3	51.00	50.67	31.00	132.67	44.22
Total	167.53	131.67	134.33	433.53	-
Average	55.84	43.89	44.78	-	-

From Table 2, it can be seen that the effect of manure treatment on K2 was the widest growth of 86.53 cm<sup>2</sup> which was significantly different compared to the effect of K1 and K3 treatments.



**Figure 2. The effect of manure on on the leaf of 2-week-old cocoa seedlings**

From Figure 2, it can be seen that the manure has an effect on the leaf of 2-week-old cocoa seedlings which is indicated by the quadratic equation.

**3. Rod diameter (mm)**

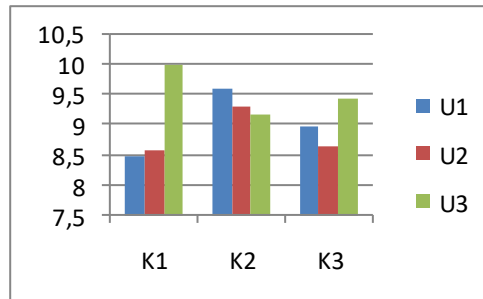
To find out the difference in stem diameter due to the effect of manure and urea fertilizer application to plants can be seen in table 3.

**Table 3  
Effect of manure and urea fertilizer application to plants**

Treatment	U1	U2	U3	Total	Average
K1	133.49	142.60	153.20	429.29	143.10
K2	141.20	141.97	151.63	434.8	144.93
K3	145.64	148.66	142.67	436.97	145.66
Total	420.33	433.23	447.5	1301.06	-
Average	140.11	144.41	149.17	-	-

From table 3, it can be seen that the application of manure in the K1 treatment had a significant effect, namely 9.99 mm compared to the K2 and K3 treatments, while in the urea fertilizer treatment there was no significant difference in the diameter of the cacao seedling stems.

The results of the analysis of the application of manure on the diameter of cocoa stems 2 weeks after planting can be seen in Figure 3.



**Figure 3. The effect of manure on cocoa height**

From Figure 3, it can be seen that the manure treatment had a significant effect on the height of cocoa plants at 2 weeks after planting.

#### 4. Weight of Biomass

To determine the difference in weight of biomass due to the application of manure and urea fertilizer can be seen in table 4.

**Table 4**  
**Biomass weight due to the of manure and urea fertilize**

Treatment	U1	U2	U3	Total	Average
K1	8.50	8.60	9.99	27.09	9.03
K2	9.60	9.30	9.19	28.09	9.36
K3	8.99	8.66	9.43	27.08	9.03
Total	27.09	26.56	28.61	82.26	-
Average	9.03	8.85	9.54	-	-

Because there was no real response or effect from the treatment of manure application, there was no need for further testing with Duncan's Test.

The insignificant effect of this manure treatment was probably caused by environmental factors that did not support the absorption of nutrients in the manure. Other factors that can cause an insignificant effect on the growth of cocoa plants include:

- a) Cocoa plants are not suitable for manure
- b) Little rainfall, high temperatures (dry season) so that with higher temperatures, high evaporation is likely to occur so that fertilizers also participate. evaporate.
- c) And other factors that cause no effect of manure application on cocoa growth include: first; Concentration of foliar fertilizers or doses that are not in accordance with plant needs. Second; time of application or time interval, if the application time of fertilization is not right it will cause no significant effect on the application of fertilizer, for example during the hot sun, where evaporation is faster than the absorption of nutrients by plant stomata or fertilization when the stomata are more closed, namely when certain moment. The three types of fertilizers (nutrients) needed by plants. Fertilizing plants with the condition of the plant being sufficient with nutrients, so even if fertilizer is

given it will not affect it anymore. Fourth, right on target, namely the application of fertilizers must be right on target.

**B. The Effect of Urea Fertilizer on Cocoa Plant Growth**

**1. Plant Height (cm)**

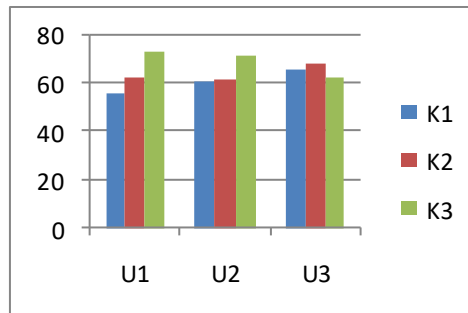
To find out the difference in plant height, it is presented in table 5 in the form of a mean difference test.

**Table 5  
Plant Height Anaysis**

Treatment	K1	K2	K3	Total	Average
U1	56.14	62.60	73.20	191.94	63.98
U2	61.20	61.97	71.63	194.8	64.93
U3	65.64	68.66	62.67	196.97	65.66
Total	182.98	193.23	207.5	583.71	
Average	60.99	64.41	69.17		

From Table 5, it can be seen that the effect of urea fertilizer treatment on U1 was a high growth of 73.20 cm which was significantly different from the effect of U2 and U3 treatments, while the effect of manure did not show a significant effect on the growth of cocoa seedlings.

From the results of the analysis of the application of urea fertilizer to the height of cocoa plants aged 4 weeks after planting, it can be seen in Figure 4 below.



**Figure 4. Plant Height Anaysis**

Based on Figure 4, it can be seen that the urea fertilizer treatment had an effect on the height of the 4-week-old cocoa seedlings as indicated by a linear equation.

It is predicted that the research location has had nutrient sediments due to soil erosion in the research media, so that the application of urea fertilizer does not seem to show maximum results in plant height growth, while the nutrient content contained in urea fertilizer or plant micro elements is needed by plants. This is a possibility that the research media is still lacking or not available soil micro elements.

**2. Stem Diameter (mm)**

To determine the difference in stem diameter due to the application of urea fertilizer and manure can be seen in table 6.

**Table 6**  
**Stem Diameter Analysis**

<b>Treatment</b>	<b>K1</b>	<b>K2</b>	<b>K3</b>	<b>Total</b>	<b>Average</b>
U1	10.57	10.53	11.96	33.06	11.02
U2	11.27	11.37	10.83	33.47	11.16
U3	11.00	10.63	11.50	33.13	11.04
Total	32.84	32.53	34.29	99.66	
Average	10.95	10.84	11.43		

The insignificant effect of urea fertilizer treatment may be due to the presence of the same amount of nutrients (percentage) in the soil even though different mixtures are carried out, if this happens then the effect of urea fertilizer treatment has no significant effect on the growth of cocoa seedlings. In general, it can be said that the type, nature and structure of the soil/media will determine the success of a crop.

### **C. The Effect of Interaction Between Manure and Urea Fertilizer Treatment on Cocoa Plant Growth**

Based on the results of statistical data analysis on the variance list, it was found that the combination of the two treatment factors did not significantly affect the parameters of plant height (cm), leaf area (cm), stem diameter (mm) and weight of cocoa plant biomass.

To find out the difference in seedling height, it is presented in Table 7 in the form of a mean difference test.

**Table 7**  
**Effect of Interaction Between Manure and Urea Fertilizer Treatment**

<b>Treatment</b>	<b>K1</b>	<b>K2</b>	<b>K3</b>	<b>Total</b>	<b>Average</b>
U1	73.49	82.60	93.20	249.29	83.10
U2	81.20	81.97	91.63	254.8	84.93
U3	85.64	88.66	82.67	256.97	85.66
Total	240.33	253.23	267.5	761.06	
Average	80.11	84.41	89.17		

The insignificant effect of this combination of treatments may be due to the absence of interactions that can encourage the growth of cocoa plants between the two treatments.

## **CONCLUSION**

Based on the results of the research that has been carried out, the following conclusions can be drawn: Manure cannot increase the growth of cocoa seedlings, plant height, leaf area, stem diameter and biomass weight, Urea fertilizer cannot stimulate the growth of cocoa seedlings in nurseries and The combination of treatment between the application of manure and urea fertilizer could not stimulate the growth of cocoa plants in nurseries.

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