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A Test Of Ecoenzymes And Liquid Organic Fertilizer Waste Coconut Water On Growth And Production Green Beans (Vigna Radiata)

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ABSTRACT
The aim of this research is to determine the response of applying multifunctional fertilizer and organic coconut water fertilizer to the growth and production of Mung Bean (Phaseolus radiatus.) plants and their interactions. This paper was carried out in Klambir Lima Hamparan Perak Village, Deli Serdang Regency, North Sumatra from January to March 2024, using a factorial Randomized Block Design (RAK), with two blocks, 16 combinations. Factor I: Coconut water 4 practices A0= 0 ml/liter of water, A1= 50 ml/liter of water; A2= 100 ml / liter of water; A3= 150 ml / liter of water; Factor II: Ecoenzyme administration with 4 levels, namely: E0 = No Ecoenzyme administration (0 ml/liter of water); E1= 5 ml/liter of water; E2= 10 ml/liter of water; E3= 15 ml/liter of water. Parameters observed: 1. Plant height (cm), 2. Number of productive branches, 3. Number of pods per sample, 4. Weight of pods per plot, 5. Weight of 100 seeds and 6. Production per plot. The results of observations on the coconut water treatment showed that the parameters Plant Height, Number of Pods per sample, Number of Branches per sample showed very real results, but the parameter Weight of 100 seeds did not show a significant difference, while the interaction between giving Coconut Water and Ecoenzymes had no real effect on all observed parameters.

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INTRODUCTION

Green beans are a food crop that has high carbohydrate and protein content. Many people process green beans as an alternative food to rice. These processed green beans are also used as a complementary food for breast milk to meet the nutritional needs for growing babies and toddlers. Green beans are a legume plant that plays an important role as a source of vegetable protein for society. The nutritional value of green beans in 100 g of seeds contains 345 g calories, 22.2 g protein, 1.2 g fat, 62.9 g charcoal hydrate, 0.125 g calcium, 0.320 g phosphorus, 0.006 g iron, 157 SI vitamins, B vitamins 0.006 g, vitamin C 0.006 g, and water 10 g (Anti, 2018). Purwono and Hartono (2008) also added that green beans have a vegetable protein content of 22%, which ranks third after soybeans and peanuts.

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In technical implementation of cultivation, green beans are a plant that can be cultivated on various types of land. This is because green bean plants are plants that are tolerant of drought stress. This results in this plant not being given special attention in its cultivation techniques. One thing that is not given enough attention is the act of fertilization. Fertilization in green bean cultivation plays a very important role in increasing the growth rate and production of plants. This action also has an impact on the amount of production from the plant. Fertilization can also increase soil fertility, especially if organic fertilizer is used. Organic fertilizer derived from plant residues or forage plants can restore soil organic matter that is lost when plants grow on the land.

Ecoenzymes are solutions resulting from the fermentation of complex organic compounds originating from organic waste such as vegetables and fruit with a mixture of sugar and water (Hemalatha and Visantini, 2020). The ecoenzyme liquid produced from the fermentation process is dark brown in color and has a sour and sweet odor typical of fermentation (Verma et al., 2019). Ecoenzymes have many benefits and applications that can be used in households, agriculture and livestock because they can be used as cleaning agents or organic fertilizers and even effective pesticides and disinfectants (Dhiman, 2017; Rasit et al., 2019; Vama and Cherekar, 2020 in Salsabila , R,2023).

Alternative materials that can be used as POC are coconut water and shallot skin waste, because coconut water and shallot skin waste are thought to have high organic content, but before being used, this POC must be fermented with the help of microorganisms so that the organic material will be degraded and produce nutrients that are needed. ready for use by plants. Based on the results of the ZPT analysis carried out by (Savitri, 2005 in Zuhro, Hasanah, and Sukadi, 2017) it turns out that coconut water contains several ZPT contents, including: Cytokinin, Auxin and a small amount of Gibberellin. Other compounds contained in coconut water are protein, fat, minerals, carbohydrates, even complete with vitamins C and B complex (Marpaung and hutabarat, 2015 in Uman, J, 2023)

The growth of mung bean plants is influenced by internal plant factors, namely phytohormones (Sun et al., 2014) and genetics (Jiao et al., 2019), as well as external factors, in the form of water, temperature, humidity, light, soil, and the fulfillment of nutrients. nutrients (Azhari et al., 2018). The macro nutrients needed by this plant include C, O, N, P, S, K, Ca, and Mg. Like other plants in general, green bean plants absorb nutrients from the atmosphere, soil, through leaves and roots.

METHODS

The method used in this research is the factorial randomized block design (RAK) with 2 factors, 16 treatments and 2 blocks.
Factor I: Coconut water 4 actions
A0= 0 ml/liter of water
A1= 50 ml / liter of water
A2= 100 ml / liter of water
A3= 150 ml / liter of water
Factor II: Providing Ecoenzymes with 4 levels, namely:

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E0 = Without Ecoenzyme Administration (0 ml/liter of water)
E1= 5 ml/liter of water
E2= 10 ml/liter of water
E3= 15 ml/liter of water

Parameters that are measured or observed

1. Plant height (cm)
2. Number of Productive Branches
3. Number of pods per sample plant
4. Pod Weight per Plot
5. Weight of 100 Seeds

RESULTS AND DISCUSSION

Research result Plant Height (cm)

Measurement of the average plant height (cm) as a result of giving Coconut Water at the age of 6 WAP and Ecoenzymes can be seen in table 1 below;

Table1. Average Plant Height (cm) Due to Giving Coconut Water and Ecoenzymes at the Age of 6 Weeks After Planting.

Treatment	Plant Height at 6 WAP	
Coconut Water Treatment		
A0	166.10	a A
A1	169.20	AB AB
A2	174.12	b B
A3	181.40	c C
Ecoenzyme Treatment		
E0	164.90	a A
E1	171.10	b B
E2	175.65	BC BC
E3	179.20	c C

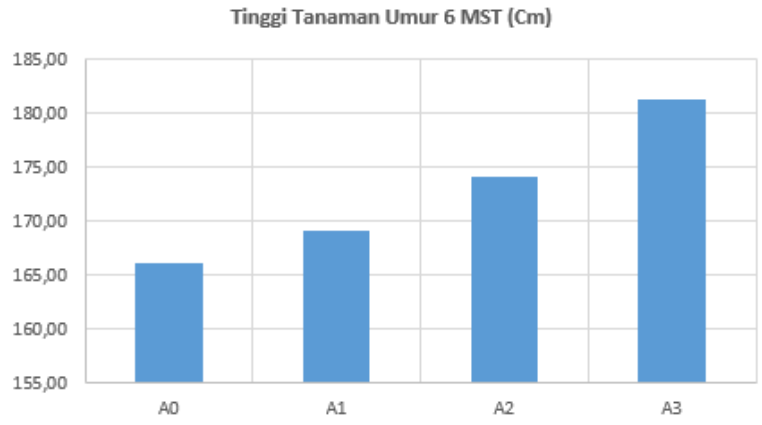

Figure 1. Shows the relationship between plant height aged 6 WAP due to giving coconut water

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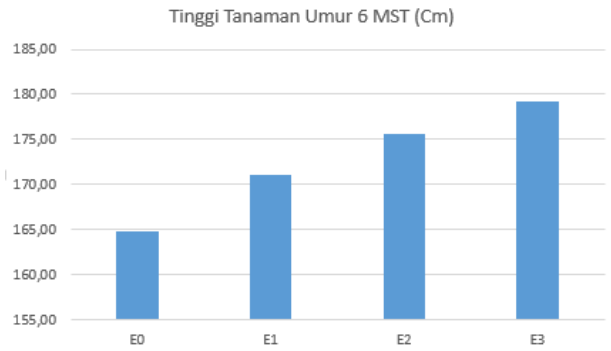

Figure 2. Shows the relationship between plant height aged 6 WAP due to administration of ecoenzymes

Number of Pods Per Sample (pods)

Measurement of the average number of pods per sample (pods) resulting from the administration of Coconut Water and Ecoenzymes can be seen in table 2 below;

Table 2. Average Number of Pods Per Sample (Pods) Due to Water Application Coconuts and Ecoenzymes After Harvest

Treatment	Number of Pods Per Sample (Pods)	
Coconut Water Treatment		
A0	56.30	a A
A1	58.55	ab A
A2	58.80	ab A
A3	59.60	b A
Ecoenzyme Treatment		
E0	57.60	a A
E1	58.65	a A
E2	58.00	a A
E3	59.00	a A

Note: Numbers in the same column followed by letters that are not the same are significantly different at the 5% level (lowercase letters) and very significantly different at the 1% level (uppercase letters).

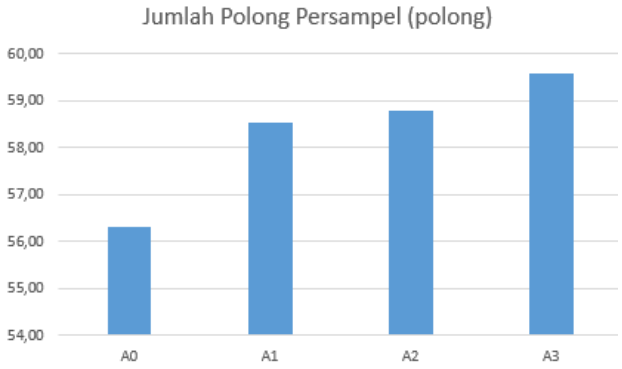

Figure 3. Shows the relationship between the number of pods per sample (pods) As a result of giving Coconut Water

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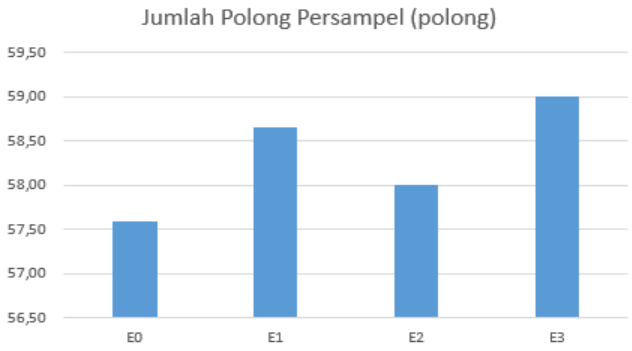

Figure 4. Shows the relationship between the number of pods per sample (pods) As a result of administering Ecoenzymes

Number of Productive Branches (branches)

Measurement of the average number of productive branches (branches) resulting from the provision of coconut water and ecoenzymes can be seen in table 3 below;

Table 3. Average Number of Productive Branches (branches) Due to Water Provision Coconuts and Ecoenzymes After Harvest

Treatment	Number of Productive Branches (Branch)	
Coconut Water Treatment		
A0	6.45	a A
A1	7.00	ab A
A2	7.15	b B
A3	7.65	c C
Ecoenzyme Treatment		
E0	6.70	a A
E1	6.95	ab A
E2	7,10	b A
E3	7.50	c A

Note: Numbers in the same column followed by letters that are not the same are significantly different at the 5% level (lowercase letters) and very significantly different at the 1% level (uppercase letters).

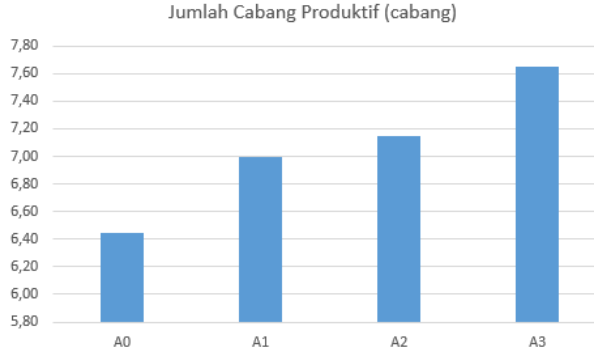

Figure 5. Shows the relationship between the number of productive branches (branches) As a result of giving Coconut Water

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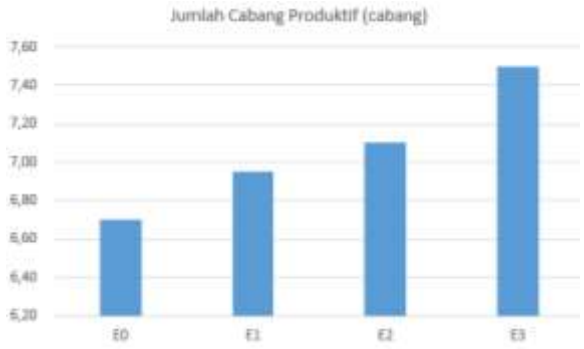

Figure 6. Shows the relationship between the number of productive branches (branches) As a result of administering Ecoenzymes

Weight of 100 Seeds (g)

Measurement of the average weight of 100 seeds (g due to administration of coconut water and ecoenzymes can be seen in table 4 below;

Table 4. Average weight of 100 seeds (g) due to water application Coconuts and Ecoenzymes After Harvest

Treatment	Weight of 100 Seeds (g)	
Coconut Water Treatment		
A0	25.25	a A
A1	28.50	a A
A2	28.50	a A
A3	28.75	a A
Ecoenzyme Treatment		
E0	28.25	a A
E1	28.00	a A
E2	28.75	a A
E3	29.00	a A

Note: Numbers in the same column followed by letters that are not the same are significantly different at the 5% level (lowercase letters) and very significantly different at the 1% level (uppercase letters).

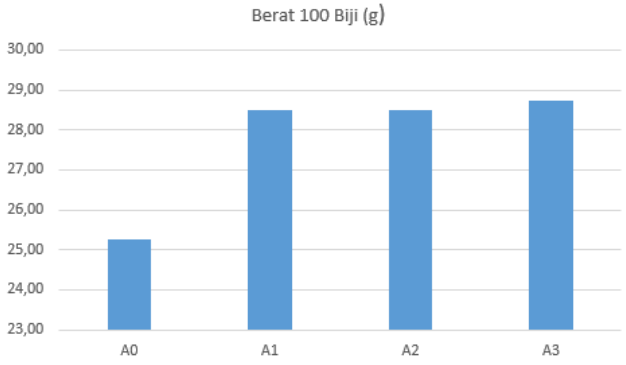

Figure 7. Shows the relationship between the weight of 100 seeds (g) due to giving coconut water

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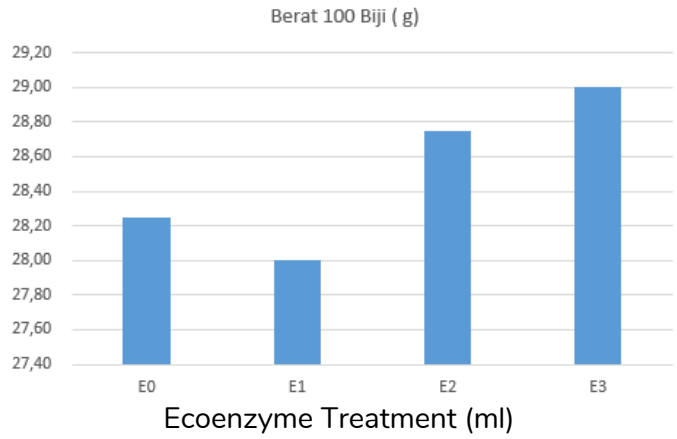

Figure 8. Shows the relationship between weight of 100 seeds (g) due to giving Ecoenzymes

Pod Weight Per Plot (g)

The average measurement of Pod Weight per plot (g) due to the provision of Coconut Water and Ecoenzymes can be seen in table 5 below;

Table 5. Average weight of pods per plot (g) due to water application Coconuts and Ecoenzymes After Harvest

Treatment	Pod Weight Per Plot (g)	
Coconut Water Treatment		
A0	972.00	a A
A1	1040.25	b B
A2	1056.50	c C
A3	1037.25	b B
Ecoenzyme Treatment		
E0	1,026.00	a A
E1	1,025.50	a A
E2	1,008.00	a A
E3	1,045.50	a A

Note: Numbers in the same column followed by letters that are not the same are significantly different at the 5% level (lowercase letters) and very significantly different at the 1% level (uppercase letters).

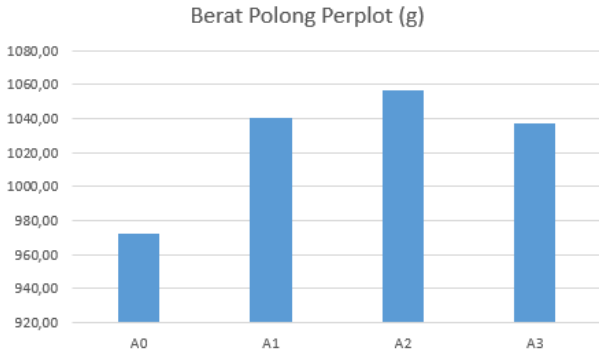

Figure 9. Shows the relationship between pod weight per plot (g) due to giving coconut water

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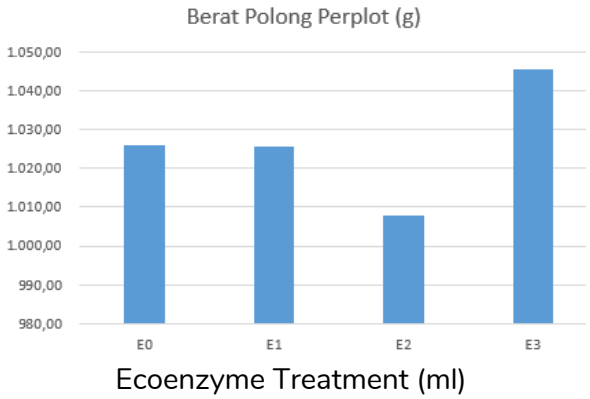

Figure 10. Shows the relationship between pod weight per plot (g) due to giving Ecoenzymes

Test Coconut Water liquid organic fertilizer on growth and production of green beans (Vigna radiata)

The results of the statistical analysis show that the Coconut Water treatment on the parameters Plant Height, Number of Pods per sample, Number of Branches per sample showed very real results, but on the parameter Weight of 100 seeds did not show any significant differences.

Providing coconut water can increase plant height due to the content of growth regulators (ZPT): auxins, gibberellins and cytokinins in coconut water which have an important role in the process of cell division, elongation and differentiation, thus helping the formation of roots, shoots and stem elongation.

Cytokinin plays a role in activating cell division (cytokinesis), while auxin and gibberellin play a role in cell enlargement or elongation, thereby causing an increase in plant height. Salisbury and Ross (1995) suggested that cell growth and development results from three simple events, namely cell division, enlargement and differentiation. The functions of auxin include influencing the increase in stem length, growth, differentiation and branching of roots. Cytokinin is one of the PGRs that is widely used to stimulate growth during the vegetative period, while gibberellins are able to encourage stem elongation in intact plants. Dewi (2008) added that cytokinins stimulate cell division, shoot growth, activate genes and general metabolic activity.

Dwidjoseputro (1994) added that potassium helps convert amino acids into protein, a lack of potassium in plants causes high levels of amino acids, while protein levels are low. Protein is an important part of plasma cells, apart from being a constituent, protein is also a food reserve, especially in grains. Apart from potassium, coconut water contains phosphorus which can cause plant growth to be hampered if it is deficient in this element, as stated by Dwidjoseputro (1994), that the growth of plants lacking phosphorus will be stunted and their leaves will become dark green. Apart from phosphorus, coconut water contains other elements necessary for plant growth and development, namely Na, Ca, Mg, Fe, Cu, and S

Ecoenzyme Test on Growth and Production of Green Beans (Vigna radiata)

In the treatment of giving Ecoenzymes on the parameters Plant Height, Weight of pods per plot and Number of Branches sampled showed very real and real results, however

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on the parameters Number of pods per plot were not significantly different. The result of ecoenzyme production is a brownish orange ecoenzyme solution, sweet and sour aroma, and a pH in the range of 3. The low pH value is caused by the high content of organic acids in it. According to Etienne et al. (2013), ecoenzyme solutions made from organic materials in the form of fruit waste tend to have a low pH value, causing acidic chemical parameters. This is because in fruit waste there are microorganisms which naturally metabolize to produce organic acids and alcohol which ultimately can respond to the growth and yield of green bean plants.

Ecoenzymes have very low levels of N, P and K, but when applied they can provide significant growth data on pak choy plants and produce real differences when compared to control treatments. This is because the application of ecoenzymes to pakchoy mustard plants is 2 weeks from taking the test samples so that the fermentation process is still running during the test, but it is possible that when ecoenzymes are given to pakcoy mustard plants the levels of N, P and K nutrient criteria will be better.

Like other living creatures, plants also need adequate nutrition for life. These nutrients are nutrients, both macro and micro, which can support the production and growth process. Some of the nutrients needed by plants and found in ecoenzymes are Nitrogen (N), Phosphorus (P), and Potassium (K). Nitrogen is a type of nutrient that is important to stimulate vegetative growth, the formation of protein, chlorophyll and nucleic acids so it must be available to plants (Rahmah, 2018). Phosphorus (P) for plants can encourage root development, flower emergence, fruit ripening, seed formation and plays an important role in storing and distributing energy to all plant cells (Jalaluddin and Syafrina, 2017; Suwardiyono and Harianingsih, 2017). Potassium (K) plays a role in plant vegetative growth to improve the transport of assimilate, regulate the opening and closing of stomata to reduce water consumption, and increase plant immunity to avoid pest or disease attacks (Mahdiannoor et al., 2016)

Interaction of Ecoenzyme Test and liquid organic fertilizer Coconut water on growth and production of green beans (vigna radiata)

The interaction between giving Coconut Water and Ecoenzymes did not have a significant effect on all observed parameters. The interaction of Coconut Water fertilizer and Ecoenzymes given to green bean plants had no significant effect on all parameters. If one factor has a stronger influence than another factor, then the other factor will be covered and each factor has characteristics that have a greater influence. According to Gomez and Gomez (2000), two factors are said to interact if the influence of a treatment factor changes when the level of another treatment factor changes. Steel and Torrie (1991) stated that if the influence of different interactions is not significant then the treatment factors act independently of each other.

CONCLUSION

The application of eco-enzyme and liquid organic fertilizer made from coconut water waste has a positive impact on the growth and yield of mung beans (Vigna radiata). The results demonstrate that these treatments can enhance vegetative growth, improve the overall

health of the plants, and increase the production of mung beans. The study suggests that using eco-enzyme and liquid organic fertilizer derived from coconut water waste is an effective and sustainable agricultural practice, offering a viable alternative to chemical fertilizers for cultivating mung beans.

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