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Response to the Vegetative Growth of Arabica Coffee Plants (*Coffea Arabika*) Due to Seed Depth Test and Application of Eco Enzyme

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Abstract

The purpose of this study was to determine the vegetative growth response of Arabica coffee (Coffea arabica) resulting from different seed planting depths and eco-enzyme application, as well as their interaction effects. The research was conducted in Sei Sikambing B Village, Medan Sunggal District, Medan City, North Sumatra Province, at an altitude of approximately ±25 meters above sea level. The study took place from July to October 2025. This research used a Factorial Randomized Block Design (RBD). The first factor was seed depth, denoted as "K," consisting of K0 = 0 cm, K1 = 0.5 cm, K2 = 1.0 cm, and K3 = 1.5 cm. The second factor was eco-enzyme application, denoted as "E," consisting of E0 = 0 ml/liter of water, E1 = 100 ml/liter of water, E2 = 200 ml/liter of water, and E3 = 300 ml/liter of water. The observed parameters included germination percentage (%), germination time (days), plant height (cm), number of leaves (leaves), and stem diameter (mm). The results showed that seed depth and eco-enzyme application significantly affected several parameters, including germination percentage, germination time, plant height, number of leaves, and stem diameter. However, the interaction between seed depth and eco-enzyme application did not have a significant effect on germination percentage, germination time, plant height, number of leaves, or stem diameter.

Keywords: Arabica; seeds; eco-enzyme; coffee; seed_depth.

I. INTRODUCTION

Coffee plants are found in Africa. After the discovery of the coffee plant, this plant began to be cultivated and spread throughout the world (Siswanto et al., 2024). History records that coffee was first invented by Ethiopians about 3000 years ago (Luta, 2020). At that time there was a goat herder who was bringing his cattle to the field. While tending his cattle, he saw his pet goat eating a berry-like seed on the tree and then the goat remained awake and hyperactive even after sunset. Then the shepherd tried to process and eat the seeds. And he felt refreshed again (M. Siregar et al., 2021). In the past, people did not pound coffee and then brew it. At first, coffee was only dried and then brewed, only after 500 years of discovery, a tool to crush coffee beans appeared. At that time, coffee processing was also still very simple (Gayatri, 2019).

The history of coffee in Indonesia began when the Dutch Governor in Malabar (India) sent Yemeni coffee seeds or Arabica coffee to the Dutch Governor in Batavia (now Jakarta) in 1696. This first seed failed to grow due to flooding in Batavia. The shipment of the two coffee beans to Batavia is reported to have occurred in 1699. The crop grew, and in 1711 the first exports were sent from Java to Europe by a Dutch trading company, known as the VOC (*Verininging Oogst Indies Company*) which was founded in 1602. Over the course of 10 years, exports increased to 60 tons per year. Indonesia is the first place where coffee is widely cultivated outside of Arabia and Ethiopia. The VOC monopolized the coffee trade from 1725 to 1780 (Gayatri, 2019).

Coffee nurseries aim to provide high-quality coffee seedlings. Quality seeds are the main investment in determining plant productivity (D. J. S. Siregar et al., 2022b, 2022a; Wahyuni et al., 2022). Some of the things that must be considered in coffee nurseries include the use of superior planting materials, determination of the location and place of the nursery, containers and growing media, moving sprouts to the nursery place, which is close to the water source, relatively flat, close to the planting planting plant, good drainage, not a strong wind area that is safe and easy to supervise (Rahardjo, 2012).

The North Sumatra Plantation Service (North Sumatra) noted that coffee bean production in North Sumatra reached 1,000 tons per month. Coffee land in North Sumatra itself until now covers an area of 80 thousand hectares (Abdillah et al., 2012; Fitri & Amrul, 2022). Our production is from 80 thousand hectares to an average productivity of 1000 tons. The demand for coffee beans in North Sumatra continues to increase. However, the area of coffee land in North Sumatra is increasingly limited (North Sumatra Plantation Office, 2022).

The depth of planting holes in planting seeds in plant cultivation is also one of the efforts to increase plant growth and production. The regulation of the depth of seeding in the planting hole greatly affects the growth and early development of seedlings, determines the quality of the root system and affects the number of seedlings that successfully grow (Purba, 2020).

The development of the root system is influenced by environmental factors. Environmental factors that affect the root system in the soil are soil moisture, soil temperature, soil acidity, soil aeration, soil mechanical resistance, competition and root interactions. A factor that influences the success in crop germination is the depth of planting (Irmawan et al., 2025; D. J. S. Siregar et al., 2018; Wahyuni et al., 2024). The deeper the planting depth, the more difficult it will be for the seeds to grow, while if the seeds are planted at a shallow planting depth, the seeds will grow easily, namely with a planting depth of 10-15 cm. This is because the oxygen level in the soil will decrease as the soil gets deeper and deeper (Fatchullah, 2016).

It is recommended to increase plant fertility and production, one way that can be done is to fertilize using organic fertilizers. The benefits of organic fertilizer are to improve soil structure that makes the soil loose and makes it easier for plant roots to absorb nutrients (Budianto, *et.al*, 2015)

Every day, human activities are inseparable from the activity of producing waste or waste, both organic and non-organic waste. It is necessary to process these two types of waste so that it does not have a negative impact on public health and the environment, organic waste can be used to make eco enzymes (Hadisuwito, 2015).

This eco-enzyme or commonly known as environmentally friendly enzyme was discovered by Dr. Rosukon Poompanvong from Thailand more than 30 years ago. It is said to be an eco-enzyme because it is made from residues or household waste such as vegetable waste or fruit peels that are widely discarded by the community (Susanto, 2020).

This enzyme is a liquid fermented from natural ingredients that is dark brown in color with a pungent fruity aroma. Eco-enzyme liquids are highly functional, easy to use, and easy to produce. This is because the materials used are simple and easy to obtain. The manufacture of this product only requires water, sugar as a source of carbon, and organic waste from vegetables and fruits (Win, 2013).

II. RESEARCH METHODOLOGY

This study will use a Factorial Group Random Design (RAK) consisting of 2 factors, 16 treatments, and consisting of 3 blocks/replicates, so that there are 48 treatment plots.

The first factor is that the seed depth test is given the symbol "K" which consists of 4 levels of treatment, namely;
K0 = 0.00 cm (above ground level)
K1 = 0.50 cm
K2 = 1.00 cm
K3 = 1.50 cm
The second factor is the provision of eco enzymes given the symbol "E" which consists of 4 levels of treatment, namely;
E0 = 0 ml/liter of water
E1 = 100 ml/liter of water
E2 = 200 ml/liter of water
E3 = 300 ml/liter of water
Block(n) ;
$(t - 1)\quad (n - 1) \geq 15$
$(16 - 1)\ (n - 1)\quad \geq 15$
$15\ (n - 1) \geq 15$
$15n - 15 \geq 15$
$15n \geq 15 + 15$
$15n \geq 30$
$n \geq 30 / 15$
$n \geq 2$ blocks, made into 3 blocks

III. RESULTS AND DISCUSSION

Growth Percentage (%)

The data from the calculation of the percentage (%) of growth of Arabica coffee plant seedlings due to seed depth testing and application of eco enzymes is presented in Table 1 below.

The results of the variegated fingerprint analysis showed that the seed depth test and the application of eco enzyme had an influence on the percentage (%) of growth of Arabica coffee plant seedlings.

The seed depth test and the application of eco enzyme to the percentage (%) of arabica coffee plant seedlings, after a statistical test using the Duncant distance test can be seen in Table 1

Table 1. Average Percentage (%) of Arabica Coffee Plant Seedlings Growth Due to Seed Depth Test (K) and Application of Eco Enzyme (E).

Treatment	Sprout Percentage (%)	
Seed Depth (K)		
K0 = 0.0 cm	43.608	d D
K1 = 0.5 cm	57.417	c C
K2 = 1.0 cm	66.583	b B
K3 = 1.5 cm	82.778	a A
Eco Enzyme (E)		
E0 = 0 ml/liter of water	54.222	c C
E1 = 100 ml/liter of water	57.555	bc bc
E2 = 200 ml/liter of water	59.777	b B
E3 = 300 ml/liter of water	78.833	a A

Remarks: Numbers in the same column followed by different letters mean that they are significantly different at the level of 5% (lowercase) and very real differences at the level of 1% (uppercase)

From Table 1, it can be explained that the seed depth test has an effect on the percentage (%) of growth of Arabica coffee plant seedlings, where, the highest percentage (%) of growth is found in the K3 treatment = 1.5 cm which is 82.778 %, which is very different from the K2 treatment = 1.0 cm which is 66.583 %, the K1 treatment = 0.5 cm which is 57.417 %, and the K0 treatment = 0.0 cm which is 43.68 %. K2 = 1.0 cm which is 66.583%, which is very different from the treatment of K1 = 0.5 cm which is 57.417%, and the treatment of K0 = 0.0 cm which is 43.68%. The K1 treatment = 0.5 cm is 57.417 %, which is very different from the K0 treatment = 0.0 cm, which is 43.68 %.

More details on the effect of seed depth test on the percentage (%) of growth of Arabica coffee plant seedlings can be seen in Figure 1.

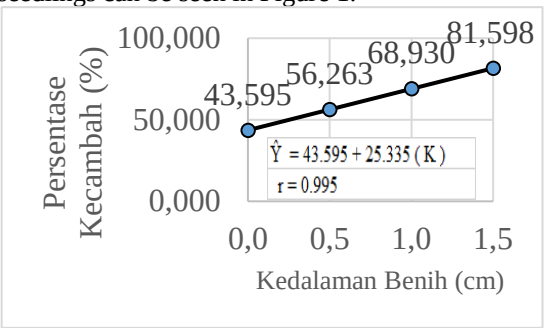

Figure 1. Graph of the relationship of percentage (%) of Arabica coffee plant seedlings due to seed depth test.

Figure 1 can be explained that the deeper the planting, the higher the percentage (%) of growth of Arabica coffee plant seedlings, where the equation is obtained $\bar{Y}$ = 43,595 + 25,335 (K), with a value of r = 0.995, meaning that the deeper the seeds are planted, the higher the percentage (%) of coffee plant seedlings, which forms a positive linear relationship.

Table 1 can be explained that the application of eco enzymes affects the percentage (%) of growth of Arabica coffee plant seedlings. Where the highest percentage (%) of arabica coffee seeds was found in the E3 treatment = 300 ml/liter of water, which is 78.833 %, which is very different from the E2 treatment = 200 ml/liter of water, which is 59.777 %, the E1 treatment = 100 ml/liter of water, which is 57.555%, the treatment. E0 = 0 ml/liter of water which is 54.222 %. The treatment of E2 = 200 ml/liter of water is 59.777 %, different from the treatment of E1 = 100 ml/liter of water which is 57.555 %, but it is very different from the treatment. E0 = 0 ml/liter of water which is 54.222 %. The E1 treatment = 100 ml/liter of water is 57.555%, which is very noticeable from the treatment. E0 = 0 ml/liter of water which is 54.222 %.

More details on the effect of eco enzyme administration on the percentage (%) growth of Arabica coffee plant seedlings can be seen in Figure 2'

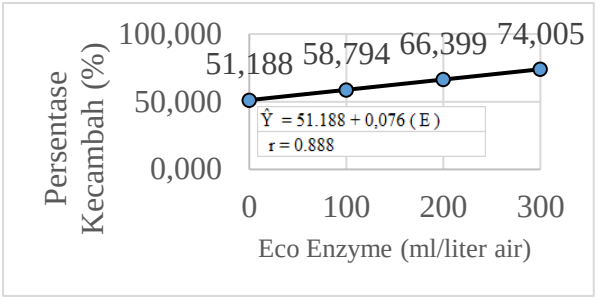

Figure 2. Graph of the relationship of the percentage (%) of growth of Arabica coffee plant seedlings due to the application of eco enzyme.

Figure 2 can be explained that the higher the concentration of eco enzyme, the higher the percentage (%) of growth of coffee plant seedlings where the equation is obtained $\bar{Y}$ = 51.185 + 0.076 (E), with a value of r = 0.888, meaning that the higher the concentration of eco enzyme, the higher the percentage (%) of coffee plant seedlings, which forms a positive linear relationship.

Germination Time (days)

Data from the calculation of germination time (days) of arabica coffee plant seedlings due to seed depth test and application of eco enzymer are presented in Table 2.

The results of the variegated fingerprint analysis showed that the seed depth test and the application of eco enzyme had an influence on the germination time (days) of Arabica coffee plant seedlings.

The seed depth test and the application of eco enzyme to the germination time (days) of Arabica coffee plant seedlings, after a statistical test using the Duncant distance test can be seen in Table 2.

Table 2. Average Germination Time (days) of Arabica Coffee Plant Seedlings Due to Seed Depth Test (K) and Application of Eco Enzyme (E)

Treatment	Germination Time (days)	
Seed Depth (K)		
K0 = 0.0 cm	34.903	a A
K1 = 0.5 cm	29.943	b B
K2 = 1.0 cm	27.545	c B
K3 = 1.5 cm	21.669	d C
Eco Enzyme (E)		
E0 = 0 ml/liter of water	36.798	a A
E1 = 100 ml/liter of water	26.224	b B
E2 = 200 ml/liter of water	26.033	b B
E3 = 300 ml/liter of water	25.004	b B

Remarks: Numbers in the same column followed by different letters mean that they are significantly different at the level of 5% (lowercase) and very real differences at the level of 1% (uppercase)

From Table 2, it can be explained that the seed depth test has an influence on the germination time (harI) of arabica coffee plants, where the fastest germination time (days) is found in the K3 = 1.5 cm treatment which is 21,669 days, which is very noticeable from the K2 = 1.0 cm treatment which is 27,545 days, the K1 treatment = 0.5 cm which is 29,943 days, and the K0 treatment = 0.0 cm which is 34,903 days. The K2 treatment = 1.0 cm is 27,545 days, which is very different from the K1 = 0.5 cm treatment which is 29,943 days, and the K0 treatment = 0.0 cm which is 34,903 days. The treatment of K1 = 0.5 cm is 29,943 days, which is very different from the treatment of K0 = 0.0 cm, which is 34,903 days.

More details on the effect of seed depth test on germination time (days) of arabica coffee plant seedlings can be seen in Figure 3.

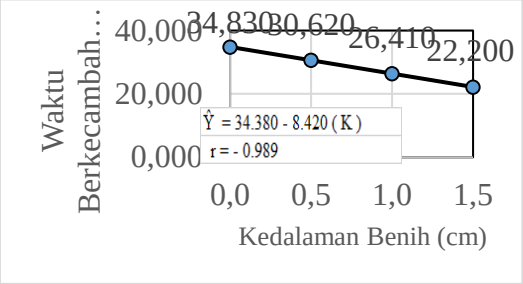

Figure 3. Graph of the Relationship of Germination Time (Day) of Arabica Coffee Plant Seedlings Due to Seed Depth Test.

Figure 3 can be explained that the deeper the planting depth, the germination time (day) of the coffee plant seedlings the faster where the equation is obtained Ŷ = 34.360 – 8,420 (K), with a value of r = - 0.989, meaning that the deeper the seeds planted, the germination time (days) of the coffee plant seedlings is faster.which forms a negative linear relationship.

Table 2 can be explained that the application of eco enzyme affects the germination time (days) of Arabica coffee plant seedlings, where the fastest germination time (day) of coffee plant seedlings is found in the treatment E3 = 300 ml/liter of water which is 25,004 days which is not real from the treatment of E2 = 200 ml/liter of water which is 26,033 days, the treatment of E1 = 100 ml/liter of water which is 26,224 days, However, the difference is very real with treatment E0 = 0 ml/liter of water which is 36,798 days. The treatment of E2 = 200 ml/liter of water is 26,033 days, the difference is not real the treatment of E1 = 100 ml/liter of water, which is 26,244 days, but the difference is very real with the treatment E0 = 0 ml/liter of water which is 36,798 days. The E1 treatment = E100 ml/liter of water is 26,244 days, which is very different from the treatment. E0 = 0 ml/liter of water which is 36,798 days.

More details on the effect of eco enzyme administration on germination time (days) of Arabica coffee plant seedlings can be seen in Figure 4.

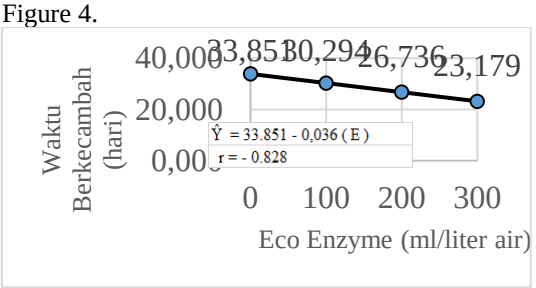

Figure 4. Graph of the Relationship of Germination Time (Day) of Arabica Coffee Plant Seedlings Due to Eco Enzyme Application.

Figure 4 can be explained that the higher the concentration of eco enzyme, the faster the germination time (days) of coffee plant seedlings where the equation is obtained Ŷ = 33.851 - 0.036 (E), with a value r = - 0.828, meaning that the higher the concentration of eco enzyme, the germination time (days) of coffee plant seedlings is faster.

Plant Height (cm)

Data from the measurement of plant height (cm) of arabica coffee plant seedlings due to seed depth test and application of eco enzyme are presented in Table 3.

The results of the variegated fingerprint analysis showed that the seed depth test and the application of eco enzyme had an effect on the plant height (cm) of Arabica coffee plant seedlings.

The seed depth test and the application of eco enzyme to the plant height (cm) of Arabica coffee seedlings, after a statistical test using the Duncant distance test can be seen in Table 3.

Table 3. Average Plant Height (cm) of Arabica Coffee Plant Seedlings Due to Seed Depth Test (K) and Application of Eco Enzyme (E)

Treatment	Plant Height (cm)	
Seed Depth (K)		
K0 = 0.0 cm	5.217	d C
K1 = 0.5 cm	9.055	c B
K2 = 1.0 cm	10.282	b B
K3 = 1.5 cm	11.247	a A
Eco Enzyme (E)		
E0 = 0 ml/liter of water	8.058	c C
E1 = 100 ml/liter of water	8.336	bc bc
E2 = 200 ml/liter of water	8.701	b B
E3 = 300 ml/liter of water	10.705	a A

Remarks: Numbers in the same column followed by different letters mean that they are significantly different at the level of 5% (lowercase) and very real differences at the level of 1% (uppercase)

From Table 3, it can be explained that the seed depth test affects the plant height (cm) of arabica coffee plant seedlings, where the highest height of coffee plant seedlings is found in the K3 treatment = 1.5 cm which is 11,247 cm, which is very noticeable from the K2 treatment = 1.0 cm which is 10,282 cm, the K1 treatment = 0.5 cm which is 9,055 cm, and the K0 treatment = 0.0 cm which is 5,217 cm. The K2 treatment = 1.0 cm is 10,282, significantly different from the K1 treatment = 0.5 cm which is 9,055 cm, but the difference is very real with the K0 = 0.0 cm treatment which is 5,217 cm. The K1 treatment = 0.5 cm is 9,055 cm, which is very different from the K0 treatment = 0.0 cm, which is 5,217 cm.

More details on the effect of seed depth test on plant height (cm) of arabica coffee seedlings can be seen in Figure 5.

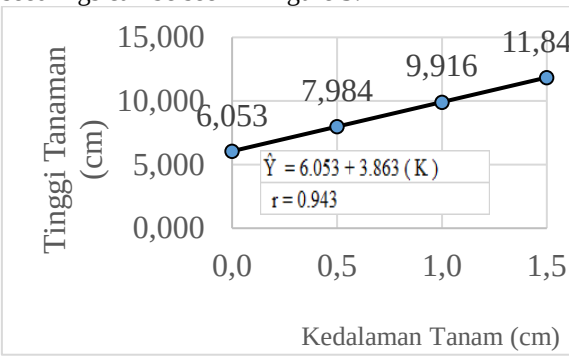

Figure 5. Graph of Plant Height (cm) Seedlings of Arabica Coffee Plant Seedlings Due to Seed Depth Test.

Figure 5 can be explained that the deeper the planting, the higher the plant height (cm) of coffee plant seedlings, where the equation is obtained $\bar{Y}$ = 6.053 + 3.863 (K), with a value r = 0.943, meaning that the deeper the seeds planted, the higher the plant height (cm) of coffee plant seedlings, which forms a positive linear relationship.

Table 3. It can be explained that the application of eco enzyme affects the plant height (cm) of Arabica coffee plant seedlings, where the highest plant height (cm) of coffee plant seedlings is found in the treatment E3 = 300 ml/liter of water which is 10,705 cm which is very different from the treatment of E2 = 200 ml/liter of water which is 8,701 cm, treatment E1 = 100 ml/liter of water which is 8,336 cm, and treatment. E0 = 0 ml/liter of water, which is 8,038 cm. The treatment of E2 = 200 ml/liter of water is 8,701 cm, the difference is not real the treatment of E1 = 100 ml/liter of water which is 8,336 cm, but it is very real with the treatment. E0 = 0 ml/liter of water, which is 8,058 cm. The treatment of E1 = 100 ml/liter of water is 8,336 cm, which is not real from the treatment. E0 = 0 ml/liter of water, which is 8,058 cm.

For more details, the effect of applying eco enzyme on plant height (cm) of Arabica coffee seedlings can be seen in Figure 6'

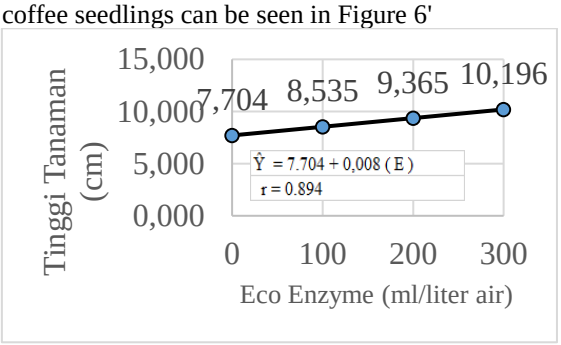

Figure 6. Graph of Plant Height (cm) Seedlings of Arabica Coffee Plants Due to Eco Enzyme Administration.

Figure 6. It can be explained that the higher the concentration of eco enzyme, the higher the plant height (cm) of coffee plant seedlings where the equation is obtained $\bar{Y}$ = 7.704 + 0.008 (E), with a value of r = - 0.894, meaning that the higher the concentration of eco enzyme, the higher the plant height (cm) of coffee plant seedlings, which forms a positive linear relationship.

Number of Leaves (strands)

The data from the calculation of the number of leaves (strands) of Arabica coffee plant seedlings due to the seed depth test and the application of eco enzymers are presented in Table 4.

The results of the variegated fingerprint analysis showed that the seed depth test and the application of eco enzyme had an effect on the number of leaves (strands) of Arabica coffee plant seedlings.

The seed depth test and the application of eco enzyme to the number of leaves (strands) of arabica coffee plant seedlings, after a statistical test using the Duncant distance test can be seen in Table 4.

Table 4. Average Number of Leaves (Strands) of Arabica Coffee Plant Seedlings Due to Seed Depth Test (K) and Application of Eco Enzyme (E)

Treatment	Number of Leaves (strands)	
Seed Depth (K)		
K0 = 0.0 cm	4.883	C
K1 = 0.5 cm	5.217	B
K2 = 1.0 cm	5.417	B
K3 = 1.5 cm	6.692	A
Eco Enzyme (E)		
E0 = 0 ml/liter of water	4.858	C
E1 = 100 ml/liter of water	5.142	B C
E2 = 200 ml/liter of water	5.450	B
E3 = 300 ml/liter of water	6.758	A

Remarks: Numbers in the same column followed by different letters mean that they are significantly different at the level of 5% (lowercase) and very real differences at the level of 1% (uppercase)

From Table 4, it can be explained that the seed depth test affects the number of leaves (strands) of arabica coffee plant seedlings, where the highest number of leaves (strands) of coffee plant seedlings is found in the K3 treatment = 1.5 cm which is 6,692 leaves, which is very noticeable from the K2 = 1.0 cm treatment which is 5,417 leaves, the K1 treatment = 0.5 cm which is 5,217 leaves, and the K0 treatment = 0.0 cm which is 4,883 leaves. The K2 treatment = 1.0 cm is 5,417 pieces, different from the K1 treatment = 0.5 cm which is 5,217 pieces, but it is very real with the K0 treatment = 0.0 cm, which is 4,883 pieces. The K1 treatment = 0.5 cm is 5,217 pieces, which is very different from the K0 treatment = 0.0 cm, which is 4,883 pieces.

More details on the effect of seed depth test on the number of leaves (strands) of arabica coffee plant seedlings can be seen in Figure 7.

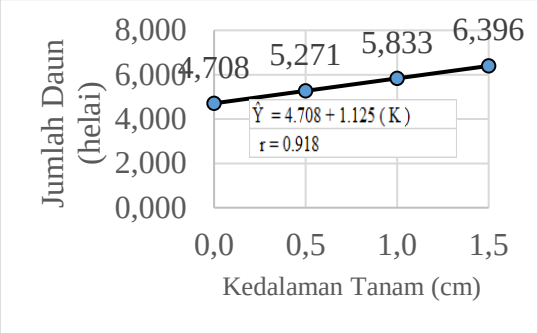

Figure 7. Graph of the relationship between the number of leaves (strands) of Arabica coffee plant seedlings due to the seed depth test.

Figure 7 can be explained that the deeper the planting, the more leaves (strands) of coffee plant seedlings, the more number of leaves, where the equation is obtained $\bar{Y} = 4.708 + 1.125$ (K), with a value r = 0.918, meaning that the deeper the seeds planted, the more leaves (cm) of coffee plantation seedlings, which forms a positive linear relationship.

Table 4. It can be explained that the application of eco enzyme affects the plant height (mm) of Arabica coffee plant seedlings, where the highest number of leaves (strands) of coffee plant seedlings is found in the E3 treatment = 300 ml/liter of water, which is 6,758 pieces, which is very different from the treatment of E2 = 200 ml/liter of water, which is 5,450 pieces, the treatment of E1 = 100 ml/liter of water, which is 5,142 pieces, and treatment. E0 = 0 ml/liter of water, which is 4,858 sheets. The E2 treatment = 200 ml/liter of water is 5,450 pieces, the real difference is the treatment E1 = 100 ml/liter of water, which is 5,412 pieces, but it is very different from the treatment. E0 = 0 ml/liter of water, which is 4,858 sheets. The E1 treatment = 100 ml/liter of water is 5,412 pieces, which is significantly different from the treatment. E0 = 0 ml/liter of water, which is 4,858 sheets.

More details on the effect of eco enzyme administration on the number of leaves (strands) of arabica coffee plant seedlings can be seen in Figure 8'

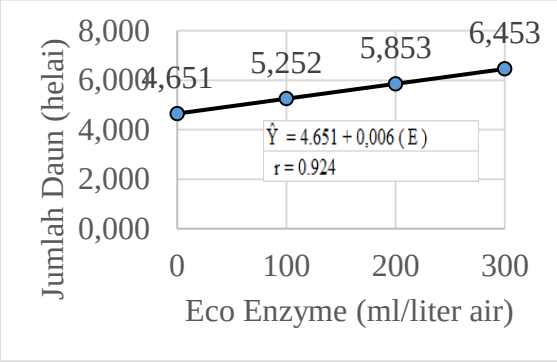

Figure 8. Graph of the relationship between the number of leaves (strands) of Arabica coffee plant seedlings due to the application of eco enzyme.

Figure 8 can be explained that the higher the concentration of eco enzyme, the more leaves (strands) of coffee plant seedlings where the equation is obtained $\bar{Y} = 4.651 + 0.006$ (E), with a value r = - 0.924, meaning that the higher the concentration of eco enzyme, the more leaves (strands) of coffee plant seedlings are increased, which forms a positive linear relationship.

Daimeter Rod (mm)

The data from measuring the stem diameter (mm) of Arabica coffee seedlings due to seed depth testing and eco enzyme application are presented in Table 5.

The results of the variegated fingerprint analysis showed that the seed depth test and the application of eco enzyme had an effect on the stem diameter (mm) of Arabica coffee plant seedlings.

The seed depth test and the application of eco enzyme to the stem diameter (mm) of Arabica coffee seedlings, after a statistical test using the Duncant distance test can be seen in Table 5.

Table 5. Average Stem Diameter (mm) of Arabica Coffee Plant Seedlings Due to Seed Depth Test (K) and Application of Eco Enzyme (E)

Treatment	Rod Diameter (mm)	
Seed Depth (K)		
K0 = 0.0 cm	2.712	d C
K1 = 0.5 cm	2.836	c C
K2 = 1.0 cm	3.158	b B
K3 = 1.5 cm	3.338	a A
Eco Enzyme (E)		
E0 = 0 ml/liter of water	2.884	b B
E1 = 100 ml/liter of water	2.914	b B
E2 = 200 ml/liter of water	2.922	b B
E3 = 300 ml/liter of water	3.223	a A

Remarks: Numbers in the same column followed by different letters mean that they are significantly different at the level of 5% (lowercase) and very real differences at the level of 1% (uppercase)

From Table 5, it can be explained that the seed depth test has an influence on the stem diameter (mm) of Arabica coffee seedlings, where the stem diameter (mm) of the largest plant seedlings is found in the K3 treatment = 1.5 cm which is 3,338 mm, which is very noticeable from the K2 treatment = 1.0 cm which is 3,158 mm, the K1 treatment = 0.5 cm which is 2,836 mm, and the K0 treatment = 0.0 cm which is 2,712 mm. The K2 treatment = 1.0 cm is 3,158 mm, which is very different from the K1 treatment = 0.5 cm which is 2,836 mm, and the K0 treatment = 0.0 cm which is 2,712 mm. The K1 treatment = 0.5 cm is 2,836 mm, which is very different from the K0 treatment = 0.0 cm, which is 2,712 mm.

More details on the effect of seed depth test on stem diameter (mm) of arabica coffee seedlings can be seen in Figure 9.

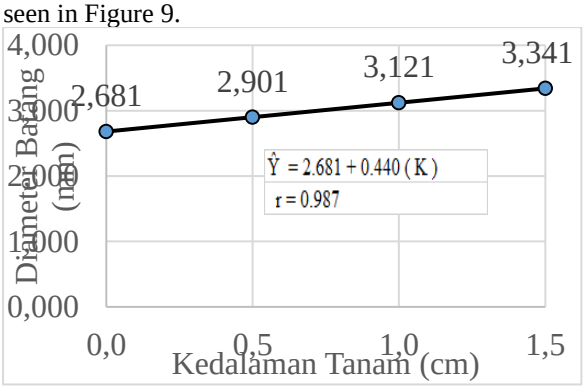

Figure 9. Graph of the Relationship of Stem Diameter (mm) of Arabica Coffee Plant Seedlings Due to Seed Depth Test.

Figure 9 can be explained that the deeper the planting of coffee plant seedlings where the equation is obtained $\bar{Y} = 2.781 + 0.440$ (K), with a value r = 0.987, meaning that the deeper the seeds planted, the larger the stem diameter (mm) of the coffee plant seedlings, which forms a positive linear relationship.

Table 5. It can be explained that the application of eco enzyme affects the stem diameter (mm) of Arabica coffee plant seedlings, where the largest stem diameter (mm) is found in the treatment of E3 = 300 ml/liter of water which is 3,323 mm which is very different from the treatment E2 = 200 ml/liter of water which is 2,922 mm, treatment of E1 = 100 ml/liter of water which is 2,914 mm, and treatment E0 = 0 ml/liter of water, which is 2,884 mm. The treatment E2 = 200 ml/liter of water is 2,922 mm, the difference is not real treatment E1 = 100 ml/liter of water which is 2,914 mm, but was found in the E3 = 0 ml/liter of water, which is 2,884 mm. Treatment E1 = 100 ml/liter of water, which is 2,914 mm, is not real from treatment E0 = 0 ml/liter of water, which is 2,884 mm.

More details on the effect of applying eco enzyme on the stem diameter (mm) of Arabica coffee plant seedlings can be seen in Figure 10.

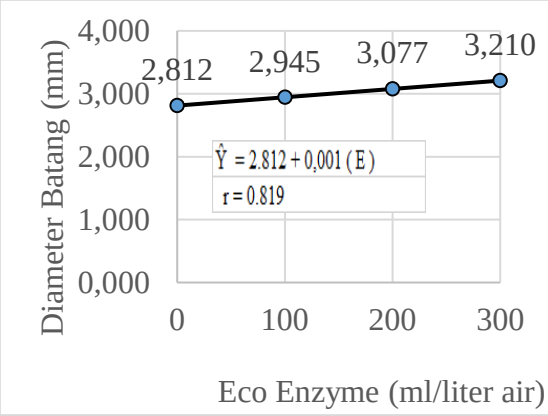

Figure 10. Graph of the Relationship of Stem Diameter (mm) of Arabica Coffee Plant Seedlings Due to the Application of Eco Enzyme.

Figure 10 can be explained that the higher the concentration of eco enzyme, the larger the stem diameter (mm) of the coffee plant seedlings where the equation is obtained $\bar{Y} = 2.812 + 0.001$ (E), with a value r = - 0.819, meaning that the higher the concentration of eco enzyme, the larger the stem diameter (mm) of the coffee plant seedlings.

Discussion

Response to Vegetative Growth of Arabica Coffee Plants (*Coffea arabica*) Due to Seed Depth Test

The results of the study after being statistically analyzed showed that the seed depth test had an influence on the vegetative growth of Arabica coffee plant seedlings such as the percentage of germination (%), germination time (days), plant height (cm), number of leaves (strands), and stem diameter (mm). This is suspected because seeds planted in shallow depths grow quickly compared to depths of 2 cm and 3 cm. This is in accordance with the research of Fachrizal (2013) who stated that the right depth of seed planting can provide easy growth to the soil surface, while planting the deeper causes the emergence of the sprouts in the soil and the sprouts will run out of energy before the seedlings reach the soil surface.

The results of the study after statistical tests showed that the planting depth had a very real effect on the germination speed (day) of Arabica coffee plant seedlings. The treatment that provided the best treatment was in the K3 (1.5 cm) treatment for 2,669 days, which was not real in the K2 (1 cm) treatment for 2,914 days. This is because the germination speed is closely related to the vigor of the seeds. Seeds with high vigor will be able to grow normally in sub-optimal conditions and above normal conditions, have the ability to grow simultaneously and quickly. According to Lesilolo, *et.al.* (2013) Growth speed indicates the vigor of seed growth strength because seeds that grow quickly are better able to face sub-optimal field conditions.

The results of the study after statistical tests showed that the planting depth had a very real effect on the time of germination (day) of coffee plant seedlings The treatment that provided the best treatment was in the K3 (1.5 cm) treatment for 2,669 days. This is because the germination speed is closely related to the vigor of the seeds. Seeds with high vigor will be able to grow normally in sub-optimal conditions and above normal conditions, have the ability to grow simultaneously and quickly. One of the external factors (germination environment) that affects seed germination is light and temperature (Muniarti, 2013).

The results of the study after statistical tests showed that planting depth had a real effect on plant height (cm) of Arabica coffee plant seedlings. The treatment that had the highest effect was the K3 treatment (1.5 cm) as high as 11,247 cm. This is because the shallow planting depth factor causes seeds to grow optimally because they absorb oxygen from the soil surface layer quickly, plant growth and development are higher. This is in accordance with Raharjo's research, 2012, which states that the increase in plant height is the result of the extension of segments due to the enlargement of cells in the intercalar meristem tissue, along with the increasing age of the plant.

The results of the study after statistical tests showed that the planting depth had a real effect on the number of leaves (strands) of Arabica coffee plant seedlings The treatment that had the best effect was found in the K3 (1.5 cm) treatment as many as 6,692 leaves. The number of leaves is closely related to the height of the best plant. Where more and more sunlight is absorbed to photosynthesize so that it produces the best number of leaves at a depth of 1.5 cm. According to Sumarno, *et. al* (2013) the vegetative phase of the sorghum plant that is actively developing is the vegetative parts such as leaves and shoots. This phase is

very important for plants because in this phase all leaves are perfectly formed which functions to produce photosynthates for growth and seed formation. The vegetative phase takes place when the plant is between 1-30 days old. According to Firda (2009) during the process of photosynthesis, plants that are able to produce higher photosynthate will have many leaves, because the results of photosynthate will be used to form organs such as leaves and stems in line with the increase in the dry weight of the plant. The more light that plants absorb, the higher the photosynthesis produced.

The results of the study after statistical tests showed that the planting depth had a significant effect on the stem diameter (mm) of Arabica coffee plant seedlings. The treatment that had the greatest effect was the K3 (1.5 cm) treatment of 3,338 mm. This is thought to be because the stem diameter of a plant is highly dependent on the genetic factors of a plant and the availability of nutrients absorbed by the plant during its life. In accordance with the opinion of Hakim, *et. al.*, (2012) that the growth of a plant is highly dependent on the lack of availability of nutrients in the soil, greatly interfering with physiological activities which will have a bad effect on overall growth.

Vegetative Growth Response of Arabica Coffee Plants (*Coffea arabica*) Due to Eco Enzyme Application

The results of the study after being statistically analyzed showed that the application of eco enzymes had an influence on the vegetative growth of Arabica coffee plants such as; germination percentage (%), germination time (days), plant height (cm), number of leaves (strands), and stem diameter (mm). This happens because eco enzymes can help plant growth with all types of organic plants so that plants that are given eco enzymes have more optimal growth compared to plants that are not given eco enzymes (Dewi, *et al*. 2020).

The results of the study after statistical tests showed that eco enzyme had a very significant effect on the percentage (%) germinated of Arabica coffee plant seedlings. The treatment that had the highest effect was the E3 treatment (300 ml/liter of water) which was 78.833 %. This is because in dissolving eco enzyme water, only 1 liter of water is used, so that the acidity in the eco enzyme is an obstacle to the growth of the Arabica coffee seedlings. As said (Harahap, *et al.* 2021) Eco Enzyme can be used as a liquid fertilizer for plants, but requires enough water to use.

The results of the study after statistical tests showed that ecp enzyme had a very significant effect on the time of germination (day) of coffee plant seedlings. The treatment that had the best effect on the E3 treatment (300 ml/liter of water) was 25,004 days. This is because the elements P and K in the eco enzyme content and those decomposed from the soil have a significant influence. Element K plays a very important role in producing fruit, the function of this element is to strengthen the plant body, as well as harden the plant stem so that flowers, fruits and leaves do not fall easily. The P element in the eco enzyme solution plays an important role in the process of accelerating and strengthening the plant body, as well as hardening the plant stems so that fruits, flowers and leaves do not fall easily. In accordance with the opinion of Ayunda (2014), if the P element in the corn plant is met, the formation of corn cobs will be more perfect with a larger size and full seed rows.

The results of the study after being statistically analyzed showed that the administration of eco enzyme had an effect on the plant height (cm) of Arabica coffee plant seedlings. Where the highest plant height (cm) of coffee plant seedlings was found in the E3 treatment (300 ml/liter of water) which was 10,705 cm. This is because liquid eco enzyme can be used as liquid organic fertilizer because it contains macro and micro nutrients that are used for vegetative growth of a plant (Pakki, *et al.* 2021)

The results of the study after being statistically analyzed showed that the administration of eco enzymes had an effect on the number of leaves (strands) of Arabica coffee plant seedlings. The highest number of leaves was found in the E3 treatment (330 ml/liter of water), which was 6,758 leaves. Eco-enzyme can also be used as a plant fertilizer (helping the natural cycle such as facilitating plant growth) and also a growth factor (plant growth energy) because it contains enzyme activity including: enzymes α-amylase, maltase, and protein-breaking enzymes. The enzyme plays a role in breaking down amylum compounds found in the endosperm of food reserves into glucose compounds. Glucose is the source of energy for plant growth. Eco-enzyme also contains Nitrogen in the form of Nitrate (N03), nitrate is a nutrient that can be easily absorbed by plants without the need to undergo further conversion (Rahayu *et.al*., 2021).

The results of the study after statistical analysis showed that the application of eco enzymes had an effect on the stem diameter (mm) of Arabica coffee plant seedlings. The largest rod diameter was found in the E3 treatment (330 ml/liter of water) which was 3,323 mm. Eco enzymes are more dominant as decomposers of organic matter and the release of nutrients in the soil. Eco enzyme is a solution with low pH, as has been conveyed by previous research which explains that the tendency of eco enzyme solutions produced from organic materials such as batng in general produces chemical parameters that are acidic and have a low pH. As the results of the study for pineapples, a pH of 3.15 and papaya of 3.29 were obtained, this is what causes plants to not be able to absorb the content contained in

eco enzymes well in vegetative growth (Rochyani et al. 2020).

Vegetative Growth Response of Arabica Coffee Plants (*Coffea arabica*) Due to Interaction of Seed Depth Test and Eco Enzyme Provider

Statistical data analysis showed that the interaction of the planting depth test and the eco enzyme provider did not affect all observation parameters, namely germination percentage (%), germination time (days), plant height (cm), number of leaves (strands), and stem diameter (mm). This is because there is no relationship between the planting depth factor and eco enzymes that support each other. Hanafiah (2010) states that if there is no interaction, it means that the influence of one factor is the same for all other levels of factors and the same as the main influence. In accordance with this statement, it can be concluded that the position of the two factors is that they both support plant growth, but do not support each other if one of the factors covers the other.

This is in accordance with the opinion of Steel and Torie (2013), if the interaction of one treatment with the other does not have a real effect, then it can be concluded that these factors act independently of each other.

According to the opinion (Dwita, 2014) states that if one factor has a stronger influence than the other, the other factor will be covered and also each factor has a much different nature between its influence and the nature of its work, it will produce a different relationship in influencing the growth of a plant.

IV. CONCLUSION

From the results of the research and statistical tests, other factors can be obtained: The seed depth test affects the growth percentage (%), germination time (days), plant height (cm), number of leaves (strands), and stem diameter (mm). The application of eco enzyme affects the growth percentage (%), germination time (days), plant height (cm), number of leaves (strands), and stem diameter (mm). The interaction of seed depth test and eco enzye application did not provide a marker of strand parameters), and stem diameter (mm).

V. RECOMMENDATIONS

It is necessary to conduct further research on seed depth tests to obtain effective results for Arabica coffee seedlings, as well as optimal eco enzyme application.

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