# GROWTH RESPONSE AND PRODUCTION OF ONION CROPS RED (Allium ascalonicum L.) ON BIOCHAR AND ECOENZYME ADMINISTRATION

**Dara Jelita Br Siregar[1], Najla Lubis[2]*, Armaniar[3]**
[1,2,3]Agrotechnology study program, Universitas Pembangunan Panca Budi
Corresponding Author: najlalubis@dosenpancabudi.ac.id

**Abstract**

*Shallots (Allium ascalonicum L.) are horticultural plants that can be used as raw materials for the food seasoning and pharmaceutical industries. People highly appreciate their unique flavor and aroma. In addition, shallots contain minerals, potassium, phosphorus, and vitamins B and C. This research was conducted to determine the effect of biochar and ecoenzymatic treatments on the growth response and production of shallots (Allium ascalonicum L.). The research method used a Factorial Randomized Block Design (RAK) with two treatment factors. The first factor was biochar application with 4 levels: A0 = control, A1 = 650 grams/plot, A2 = 750 grams/plot, A3 = 850 grams/plot. The second factor was ecoenzymatic application with 3 levels: B = control, B1 = 500 ml/plot, B2 = 1000 ml/plot. This resulted in 12 treatment combinations and 3 replications. The observed parameters were plant height (cm), number of leaves (sheets), number of offsets per plot (bulbs), fresh bulb weight per plot (g), dry bulb weight per sample (g), and dry bulb weight per plot (g). The results showed that biochar and ecoenzymatic treatments had a significant effect on plant height (cm), number of leaves (sheets), number of offsets per plot (bulbs), and dry bulb weight per sample (g). However, these treatments did not significantly affect the fresh bulb weight per plot and dry bulb weight per plot (g).*

***Keywords: Shallots, Biochar, Ecoenzym***

## INTRODUCTION

Shallots (Allium ascalonicum L.) are a type of horticultural vegetable which is used as a basic ingredient in the food and medicine industries. Very well liked because of its unique taste and aroma. Apart from that, shallots contain lots of minerals, potassium, phosphorus, vitamins B and C. For many years, shallots have become a superior commodity that is widely grown by farmers (Triana, et al., 2023). Due to the many benefits of shallots, market demand for shallot products is increasing. Indonesia's shallot production reached 1,229,189 tonnes in 2015, increasing to 1,503,446 tonnes in 2020, according to statistics on the country's seasonal vegetable and fruit crops from 2015 to 2020. To increase the country's foreign exchange, shallot production was increased to meet market demand and increase the value of national exports. North Sumatra produced 16,337 tonnes of shallots in 2020, with shallot consumption per person being 2.57 kg per year.

With a population of 14,262,147 people, the need for shallots is 36,653.7 tons. Shallot production in North Sumatra is still far from meeting local needs. Around 30% of supplies come from other regions, such as Central Java, West Sumatra, West Nusa Tenggara and parts of Malaysia (Central Statistics Agency, 2020). Excessive use of chemical fertilizers by farmers can reduce soil fertility, resulting in a decrease in the physical, chemical and biological quality of the soil. To improve soil conditions and achieve optimal shallot production targets, it is recommended to use organic fertilizer to increase overall soil fertility. Biochar is activated carbon which contains minerals such as calcium (Ca), magnesium (Mg), and carbon (C). Biochar is often used to improve soil quality because it has organic and inorganic compounds in it (Berutu, et al., 2019). The high surface area structure of biochar, which contains carbon, hydrogen, sulfur, and oxygen, protects bacteria and influences the binding of important nutrient cations and anions (Rawat, et al., 2019). One way to increase soil fertility and onion production is to use fertilizer derived from agricultural waste, such as ecoenzymes. Ecoenzymes are organic liquids made by simple fermentation of vegetable and fruit residues with sugar and water as well as selected microorganisms. If used on shallot plants, ecoenzymes can reduce levels of heavy metals, ions and soil acidity. In addition, ecoenzymes can increase shallot production. Liquids called ecoenzymes have many benefits for human life, including increasing the productivity of soybean and shallot plants (Lubis, et al., 2022). They can also be used to make biopesticides and biofertilizers (Rita Noveriza & Melati, 2022). Providing Ecoenzymes (EE) has proven to be very effective in increasing crop production and fertilizing the soil. Ecoenzymes contain nitrate and carbon dioxide, which are important nutrients for soil (Hemalatha & Visantini, 2020).

## METHOD

### Time and Place of Research

This research was conducted from December 2023 to March 2024 at the Panca Budi Development University freelance laboratory in Gelugur Rimbun, Pancur Batu District, Deli Serdang Regency, North Sumatra Province. Located at an altitude of approximately 28 meters above sea level, the climate is tropical.

### Tools and materials

In this research, the materials used included shallot bulbs of the Bima Sanren variety, water, fertilizer, ecoenzymes, biochar, and vegetable garlic pesticides. Hoes, machetes, buckets, gembors, hand sprayers, meters, ropes, scales, plywood, writing instruments, documentation tools and other tools are used to carry out research.

### Research methods

The research used an experimental method with a Factorial Randomized Group Design (RAK) consisting of 2 treatment factors and 3 replications, namely:

Factor I: Giving Biochar with the symbol "A" which consists of 4 levels, namely as follows: A0 = No treatment

A1 = Biochar 650 grams/plot

A2 = Biochar 750 grams/plot

A3 = Biochar 850 grams/plot

Factor II: Providing Ecoenzymes with the symbol "B" which consists of 3 levels, namely as follows: B0 = Without treatment

B1 = 500ml/plot

B2 = 1000ml/plot

The F test at the 5% and 1% levels is used to check the observation data. Next, Duncan's multiple range test (DMRT) at the 5% and 1% levels was used to determine whether the treatment interaction showed a real effect.

### Making Biochar and Ecoenzymes

Biochar is made from rambutan tree charcoal, which requires 1.2 kilograms of wood charcoal to make 1 kilogram of biochar. The biochar taken is still in the form of charcoal chunks, so it must first be crushed by pounding it and filtering it using a sieve. After that, fine charcoal can be used for plant plots. Ecoenzymes are made using vegetable or fruit waste, or both at once. Since vegetable waste smells like orange, pineapple and papaya, it is better to use it. Results will be better with more waste variety. With an ingredient composition of 1:3.10, Kepok banana weevils are rich in "phosphorus (P)" and are part of organic waste. The way to make it is to mix and stir all the ingredients above, then cover tightly. After that, it is opened for the first ten days to release gas and stir again. Fermentation times range from eleven to ninety days, and it is best not to open the fermentation vessel or anaerobic system. The fermentation vessel may be closed for up to ninety days, and in large vessels, re-stirring or release of gas is not necessary because the vessel is elastic enough to expand.

**Observed Parameters**

Plant height (cm), number of leaves (strands), number of tillers (tubers) per plot, wet tuber weight per plot (g), dry tuber weight per sample (g), and dry tuber weight per plot (g) are the parameters used observed.

**RESULTS AND DISCUSSION**

The recapitulation results of the analysis of variance showed that the application of biochar had a significant effect on plant height parameters at 2 weeks after planting (WAP), whereas at 4.6 and 8 WAP it showed no significant effect. The number of leaves had a real and very significant effect at 4 and 6 WAP, while at 2 and 8 WAP there was no significant effect. The number of tillers per plot had a real and very significant effect at all weeks, namely 4.6 and 8 WAP. Wet tuber weight per plot, dry tuber weight per plot did not have a significant effect, whereas dry tuber weight per sample had a very significant effect.

For the results of administering ecoenzymes, there was no significant effect on plant height parameters at all weeks, namely 2, 4, 6 and 8 WAP. The number of leaves had no significant effect at 2.6 and 8 WAP, whereas at 4 WAP the effect was very significant. The number of tillers per plot had a significant effect at 6 WAP, while 4 and 8 WAP had no significant effect. Wet tuber weight per plot, dry tuber weight per plot and dry tuber weight per sample showed the same results, namely no significant effect.

The results of the interaction of biochar and ecoenzymes show that this interaction has no real effect on plant height parameters at 2 and 8 WAP, but has a significant effect at 4 and 6 WAP. The number of leaves had a significant effect at weeks 2 and 4 WAP, had no significant effect at 6 WAP and had a very significant effect at 8 WAP. The number of tillers per plot had no significant effect at 4 and 8 WAP, while 6 WAP had a very significant effect. Wet tuber weight per plot, dry tuber weight per plot and dry tuber weight per sample showed the same results, namely no significant effect.

The data in Table 1 shows that the use of biochar and ecoenzymes together interacts significantly with shallot yield. This indicates that each treatment has a significant impact on plant growth, while on production, the interaction between combination treatments is not significant. This is likely caused by response variations which can be influenced by errors and residues, so that the interactions between these factors become irrelevant to each other (Tenaya, 2015).

**Table 1.**Recapitulation of the results of various biochar and ecoenzyme treatments on growth And shallot production

| Parameter | Biochar (A) | Ecoenzyme (B) | Interaction (AxB) | Diversity Coefficient (%) |
|---|---|---|---|---|
| Plant Height (cm) | | | | |
| 2 mst | 3.46* | 0.49 tn | 1.56 tn | 15.81 |
| 4 mst | 2.46 mn | 0.72 tn | 2.74* | 7.4 |
| 6 mst | 0.34 tn | 3.04 mn | 2.60* | 10.3 |
| 8 mst | 0.56 tn | 0.13 tn | 1.06 tn | 37.54 |
| Number of Leaves (pieces) | | | | |
| 2 mst | 1.79 tn | 1.38 tn | 2.87* | 15.12 |
| 4 mst | 4.04* | 7.60 ** | 3.03* | 8.34 |
| 6 mst | 8.49 ** | 0.75 tn | 1.95 tn | 13.61 |
| 8 mst | 1.57 tn | 0.60 tn | 3.96 ** | 47.81 |
| Number of Saplings Per Plot (tubers) | | | | |

| | | | | |
|---|---|---|---|---|
| 4 mst | 3.21* | 0.03 tn | 0.59 tn | 14.52 |
| 6 mst | 5.33 ** | 4.04* | 3.77 ** | 13.27 |
| 8 mst | 0.04* | 0.09 tn | 1.69 tn | 22.24 |
| Wet Tuber Weight Per Plot (g) | 1.23 tn | 0.43 tn | 0.40 tn | 39.64 |
| Dry Tuber Weight Per Plot (g) | 1.26 tn | 0.05 tn | 0.59 tn | 35.67 |
| Dry Tuber Weight Per Sample (g) | 6.64 ** | 0.17 tn | 2.42 tn | 16.75 |

Description: **(very real influence); *(real influence); tn (no real effect)

Overall, although biochar and ecoenzymes show potential to increase plant growth, the inconsistent results in some observations indicate the need for further research to understand the mechanism of action and optimize the use of both treatments in plant cultivation. The interaction between biochar and ecoenzyme treatments was very significant on the number of leaves and tillers, indicating that the combination of the two treatments could increase plant growth synergistically. This shows the importance of exploring treatment combinations in research. The following are the results of observations on characteristics such as plant height, number of leaves, number of tillers, wet bulb weight per plot, dry bulb weight per plot and dry bulb weight per shallot plant sample, which are influenced by the application of biochar and ecoenzymes.

**Plant Height (cm)**

Statistically analyzed observation data regarding shallot plant height (cm) as a result of the use of biochar derived from rambutan tree charcoal and ecoenzymes derived from the remaining fruit skin. Based on the results of these observations and statistical analysis, it can be concluded that the application of biochar and ecoenzymes has a significant influence on shallot plant height (cm).

Table 2 shows that the highest plants in the biochar treatment were in treatment A1 (650 grams/plot) with an average of 29.01 cm and the lowest were in treatment A2 (750 grams/plot) with an average of 11.74 cm. The highest plant ecoenzyme treatment was B2 (1000 ml/plot) with an average of 28.22 cm and the lowest treatment was B0 (no treatment) with an average of 12.64 cm. Detailed information regarding the average height of shallot plants (in cm) due to the application of biochar and ecoenzymes can be found in Table 2.

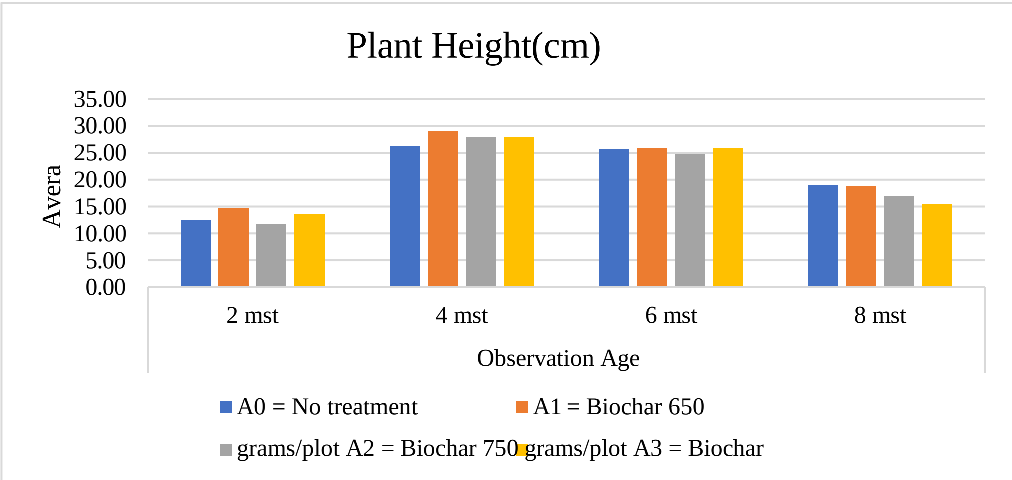
**Table 2.**Average plant height (cm) with biochar and ecoenzyme treatment at 2, 4, 6 and 8 WAP

| Treatment | Tall Plant (cm) | | | |
|---|---|---|---|---|
| | 2 mst | 4 mst | 6 mst | 8 mst |
| Providing Biochar | | | | |
| A0 = No treatment | 12.53 aA | 26.30 aA | 25.72 aA | 19.01 aA |
| A1 = Biochar 650 grams/plot | 14.72 bB | 29.01 bA | 25.92 aA | 18.77 aA |
| A2 = Biochar 750 grams/plot | 11.74 aA | 27.88 abA | 24.82 aA | 17.00 aA |
| A3 = Biochar 850 grams/plot | 13.51 abAB | 27.89 abA | 25.86 aA | 15.50 aA |
| Administration of Ecoenzymes | | | | |
| B0 = No treatment | 12.64 aA | 27.22 aA | 24.22 aA | 18.33 aA |
| B1 = 500 ml/plot | 13.30 aA | 27.87 aA | 26.87 aA | 17.01 aA |
| B2 = 1000 ml/plot | 13.43 aA | 28.22 aA | 25.64 aA | 17.37 aA |

Note: Numbers followed by the same letter in different columns are not significantly different at the 5% (lower case) and 1% (upper case) levels. Previous studies, Lelu, et al. (2018) showed that corn plants using bamboo waste biochar grew better than those without biochar. Studies on shallots also show that the use of biochar and native shallot seeds significantly increases growth components, including plant height (Firmansyah, et al., 2021). The carbon dioxide content in the experimental field was very low (1.45%), and the content was low in N, P, and K. Biochar can increase the carbon dioxide content because it attracts carbon dioxide from the atmosphere to the soil (Kalus, et al., 2019). In addition, it has been shown that biochar improves the physical and chemical properties of soil, which in turn improves plant growth (Sánchez Reinoso, et al., 2020).

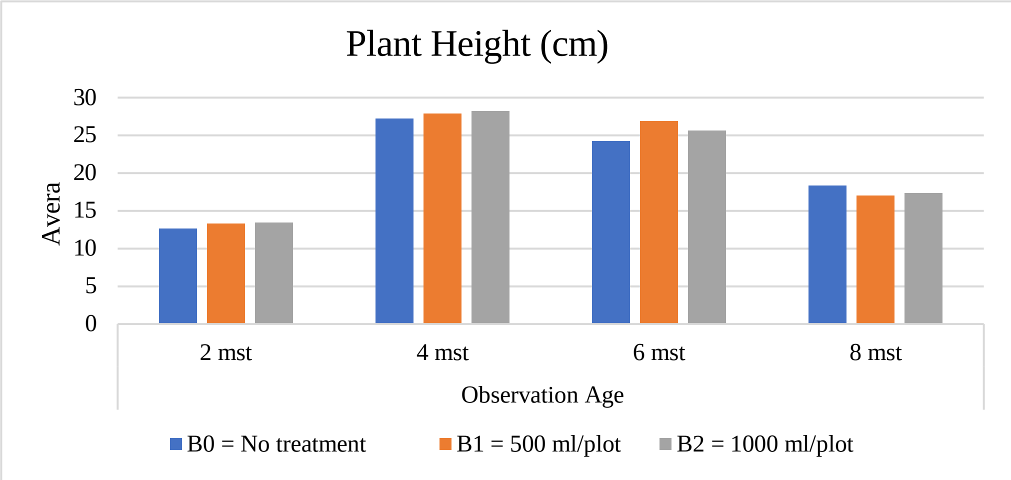
Previous studies showed that administering ecoenzymes did not really affect the height and production parameters of soybean plants. However, when compared with other plant varieties, the results are better (Lubis, et al., 2022). The availability of nutrients in the soil must be sufficient and provided appropriately to achieve optimal growth and production. By increasing the availability of nutrients in the soil, ecoenzymes promote growth, but more research needs to be done to find out how to combine ecoenzymes and biochar to achieve optimal results. Besides that, as a biocatalyst, ecoenzymes have the ability to decompose soil and improve the physical properties of polluted soil. By improving the physical properties of the soil, increasing cation exchange capacity, increasing soil biological activity, and increasing nutrient absorption more efficiently, organic matter has been proven to play a role in increasing plant growth (Lubis, et al., 2022).

**1.**Diagram of average plant height (cm) with biochar treatment at ages 2, 4, 6 and 8 WAP




The average increase in shallot plant height due to biochar treatment at the ages of 2, 4, 6 and 8 WAP can be seen in the bar diagram in Figure 1. The bar diagram shows that the application of biochar with A1 treatment (650 grams/plot) has the highest average , but the lowest average was in treatment A2 (750 grams/plot)

**Figure 2.**Diagram of average plant height (cm) with ecoenzyme treatment at ages 2, 4, 6 and 8 WAP




The average increase in shallot plant height due to ecoenzyme treatment at the ages of 2, 4, 6 and 8 WAP can be seen in the bar diagram in Figure 2. The bar diagram shows that the administration of ecoenzyme with B2 treatment (1000 ml/plot) has the highest average , but the lowest average was in treatment B0 (no treatment).

**Number of Leaves (pieces)**

Statistically analyzed observation data regarding the number of red onion leaves as a result of the use of biochar derived from rambutan tree charcoal and ecoenzymes derived from the remaining fruit skins. Based on the results of these observations and statistical analysis, it can be concluded that the application of biochar and ecoenzymes has a significant influence on the number of shallot leaves.

Table 3 shows that the highest number of leaves in the biochar treatment was in treatment A0 (without treatment) with an average of 12.78 strands and the lowest was in treatment A3 (850 grams/plot) with an average of 4.74 strands. The highest plant ecoenzyme treatment was B0 (without treatment) with an average of 12.93 strands and the lowest treatment was B2 (1000 ml/plot) with an average of 4.78 strands. Detailed information regarding the average number of shallot leaves due to the application of biochar and ecoenzymes can be found in Table 3.

**Table 3.**Average number of leaves (strands) with biochar and ecoenzyme treatment at 2, 4, 6 and 8 WAP

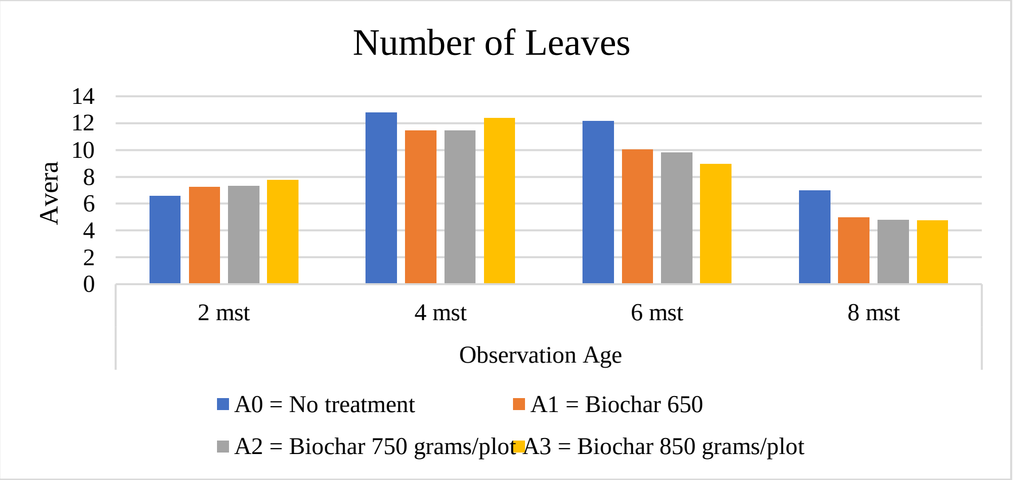
| Treatment | Amount Leaves (strands) | | | |
|---|---|---|---|---|
| | 2 mst | 4 mst | 6 mst | 8 mst |
| Providing Biochar | | | | |
| A0 = No treatment | 6.57 aA | 12.78 bB | 12.14 bB | 6.96 aA |
| A1 = Biochar 650 grams/plot | 7.25 abA | 11.44 aA | 10.03 aA | 4.96 aA |
| A2 = Biochar 750 grams/plot | 7.31 abA | 11.44 aAB | 9.80 aA | 4.79 aA |
| A3 = Biochar 850 grams/plot | 7.75 bA | 12.36 abAB | 8.96 aA | 4.74 aA |
| Administration of Ecoenzymes | | | | |
| B0 = No treatment | 7.02 aA | 12.93 bB | 10.24 aA | 5.93 aA |
| B1 = 500 ml/plot | 6.99 aA | 11.51 aA | 10.57 aA | 5.38 aA |
| B2 = 1000 ml/plot | 7.65 aA | 11.58 aA | 9.88 aA | 4.78 aA |

Note: Numbers followed by the same letter in different columns are not significantly different at the 5% (lower case) and 1% (upper case) levels.

This is in line with previous research findings showing that leaves function as the main organ in photosynthesis. Photosynthate production will increase with more leaves, which impacts onion yield. It has been proven that biochar can improve the physical and chemical properties of soil, including increasing the soil's capacity to store water, increasing organic carbon content, reducing nitrogen leaching, and increasing the availability of calcium (Ca) and magnesium (Mg) in the soil. The ideal growing environment supports the growth of leeks (Simbolon, et al., 2020).

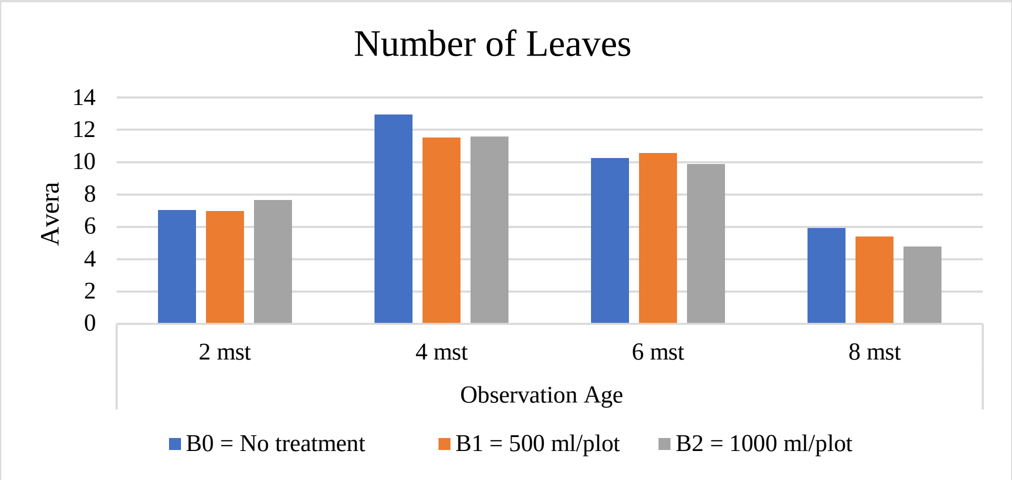
Biochar is activated carbon which contains minerals such as calcium (Ca), magnesium (Mg), and carbon (C). Made from agricultural waste such as rice husks, coconut shells and cocoa shells, biochar is often used to improve soil quality because it contains organic and inorganic compounds (Berutu, et al., 2019). Therefore, additional macro and micro nutrients are needed, even in small amounts, which are applied directly to plants. This method allows plants to absorb nutrients directly, which supports processes such as photosynthesis, transpiration, and respiration. Ultimately, this can improve overall plant growth and yield.

**Figure 3.**Diagram of the average number of leaves (strands) with biochar treatment at the ages of 2, 4, 6 and 8 WAP




The average increase in the number of red onion leaves due to biochar treatment at the ages of 2, 4, 6 and 8 WAP can be seen in the bar diagram in Figure 3. The bar diagram shows that giving biochar with A0 treatment (without treatment) had the highest average, however The lowest average was in treatment A2 (750 grams/plot).

**Figure 4.**Diagram of the average number of leaves (strands) with ecoenzyme treatment at the ages of 2, 4, 6 and 8 WAP




The average increase in the number of red onion leaves due to ecoenzyme treatment at the ages of 2, 4, 6 and 8 WAP can be seen in the bar diagram in Figure 4. The bar diagram shows that the administration of ecoenzyme with B0 treatment (without treatment) has the highest average, however The lowest average was in treatment B1 (500 ml/plot).

**Number of Saplings (tubers)**

Observational data has been statistically analyzed regarding the number of shallot seedlings (bulbs) as a result of the use of biochar derived from rambutan tree charcoal and ecoenzymes derived from the remaining skin of the fruit. Based on the results of these observations and statistical analysis, it can be concluded that the application of biochar and ecoenzymes has a significant influence on the number of shallot shoots (bulbs). Table 4 shows that the highest number of tillers in the biochar treatment was in the A3 treatment (850 grams/plot) with an average of 4.19 tubers and the lowest was in the A3 treatment (850 grams/plot) with an average of 2.73 tubers. The highest plant ecoenzyme treatment was B0 (without treatment) with an average of 4.13 tubers and the lowest treatment was B1 (500 ml/plot) with an average of 3.03 tubers. Detailed information regarding the average number of shallot tillers due to the application of biochar and ecoenzymes can be found in Table 4.

**Table 4.**Average number of tillers per plot (tubers) with biochar and ecoenzyme treatment at ages 2, 4, 6 and 8 WAP

| Treatment | Amount Saplings Per Plot (tubers) | | |
|---|---|---|---|
| | 4 mst | 6 mst | 8 mst |
| Providing Biochar | | | |
| A0 = No treatment | 3.26 aA | 4.10 ch | 3.50 bA |
| A1 = Biochar 650 grams/plot | 3.40 abA | 3.47 aA | 3.38 abA |
| A2 = Biochar 750 grams/plot | 3.38 aA | 3.48 aA | 2.76 aA |
| A3 = Biochar 850 grams/plot | 3.94 bA | 4.19 bB | 2.73 aA |
| Administration of Ecoenzymes | | | |
| B0 = No treatment | 3.47 aA | 4.13 bA | 3.10 aA |
| B1 = 500 ml/plot | 3.53 aA | 3.73 abA | 3.03 aA |
| B2 = 1000 ml/plot | 3.49 aA | 3.56 aA | 3.15 aA |

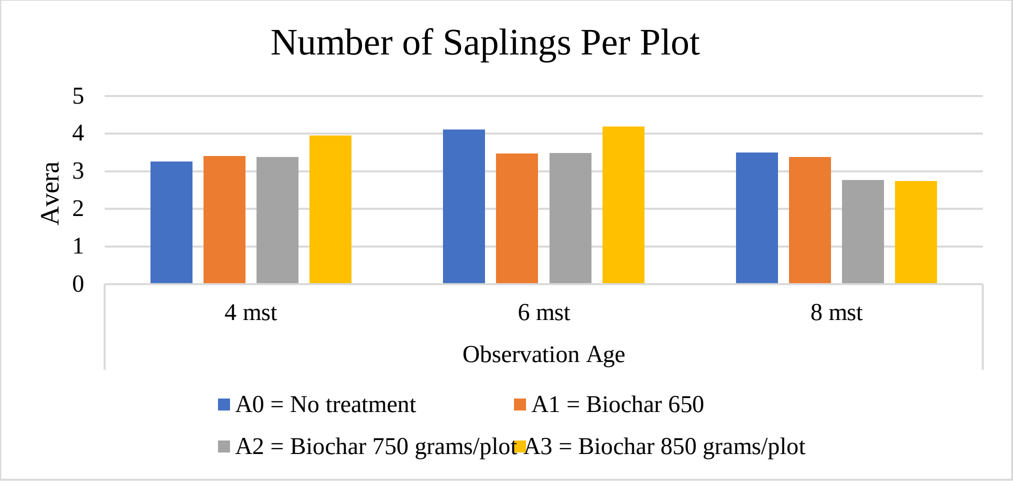
Note: Numbers followed by the same letter in different columns are not significantly different at the 5% (lower case) and 1% (upper case) levels.

The results showed that biochar and ecoenzyme treatment could increase the number of tillers significantly. However, the impact of treatment is not always the same in each growth phase; the best treatment in the early phase may not provide the same results in the final phase. This suggests that many variables influence plant response; these include climate conditions, humidity, and soil health. Biochar increases organic carbon retention and soil water content and helps remediate contaminated soil. In addition, biochar helps control inappropriate acidity, alkalinity, or salinity of soil (Palansooriya, et al., 2019).

The number of shallot tillers showed significant variations from 2 WAP to 6 WAP. The decrease in the number of tillers in the late phase suggests that the plants may be starting to focus their energy on tuber formation, rather than on tiller growth. This is a common phenomenon in the plant life cycle, where the plant switches from the vegetative to the generative phase.

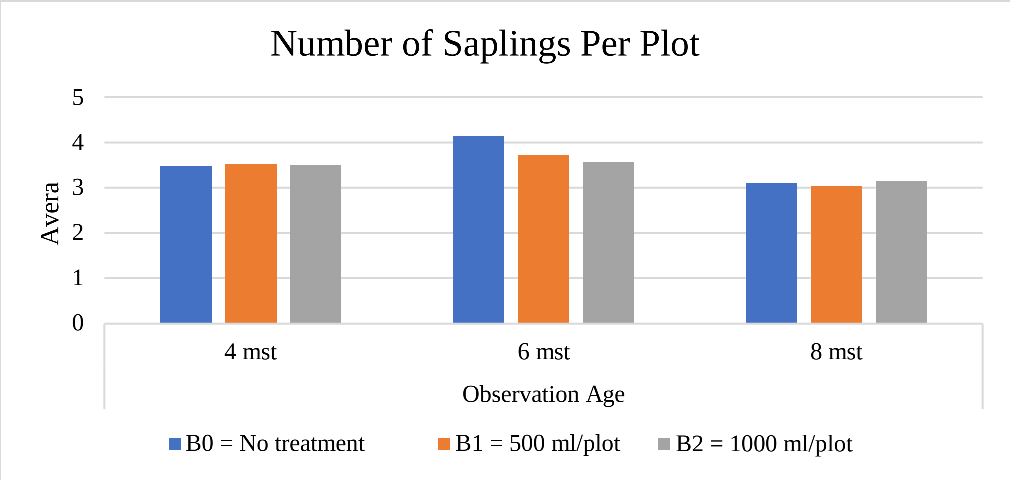
This analysis shows that, although not always consistently predictable, the combination of fertilizer dose and water volume significantly influences the number of tillers. According to the statement (Tarjiyo, et al., 2023), the amount of nutrients needed by plants to grow well is associated with insufficient nutrient availability, which inhibits plant growth, and conversely, excessive nutrient availability can poison plants, inhibiting growth. To get the best results, further research may be needed to determine how fertilizer dosage and water volume interact best.

**Figure 5.**Diagram of the average number of tillers per plot (tubers) with biochar treatment at 4, 6 and 8 WAP




The average increase in the number of shallot seedlings due to biochar treatment at the age of 4.6 and 8 WAP can be seen in the bar diagram in Figure 5. The bar diagram shows that the application of biochar with A3 treatment (850 grams/plot) has the highest average, however The lowest average was in treatment A2 (750 grams/plot).

**Figure 6.**Diagram of the average number of tillers per plot (tubers) with ecoenzyme treatment at the age of 4, 6 and 8 WAP




The average increase in the number of shallot seedlings due to ecoenzyme treatment at the age of 4.6 and 8 WAP can be seen in the bar diagram in Figure 6. The bar diagram shows that the administration of ecoenzyme with B0 treatment (without treatment) has the highest average, but the average The lowest average was in treatment B1 (500 ml/plot).

**Wet Tuber Weight Per Plot (g)**

Observational data that has been analyzed statistically regarding wet bulb weight per shallot plot (g) as a result of the use of biochar derived from teak wood charcoal and ecoenzymes derived from remaining fruit skins. Based on the results of these observations and 10 statistical analysis, it can be concluded that the application of biochar and ecoenzymes has an insignificant effect on the wet bulb weight per shallot plot (g).

Table 5 shows that the highest wet tuber weight per plot in the biochar treatment was in treatment A1 (650 grams/plot) with an average of 152.89 g and the lowest was in treatment A3 (850 grams/plot) with an average of 112.67 g. The highest plant ecoenzyme treatment was B2 (1000 ml/plot) with an average of 142.42 g and the lowest treatment was B0 (no treatment) with an average of 123.42 g. Detailed information regarding the average weight of wet bulbs/shallot plots due to the application of biochar and ecoenzymes can be found in Table 5.

**Table 5.**Average wet tuber weight per plot (g) with biochar and ecoenzyme treatment

| Treatment | Wet Tuber Weight Per Plot (g) |
|---|---|
| Providing Biochar | |
| A0 = No treatment | 142.11 aA |
| A1 = Biochar 650 grams/plot | 152.89 aA |
| A2 = Biochar 750 grams/plot | 117.89 aA |
| A3 = Biochar 850 grams/plot | 112.67 aA |
| Administration of Ecoenzymes | |
| B0 = No treatment | 123.42 aA |
| B1 = 500 ml/plot | 128.33 aA |
| B2 = 1000 ml/plot | 142.42 aA |

Note: Numbers followed by the same letter in different columns are not significantly different at the 5% (lower case) and 1% (upper case) levels.

For plants to grow well, sufficient and balanced nutrients are needed (Lubis et al., 2022). If the amount of nutrients in the soil is balanced, without excess or deficiency, photosynthesis will run well. This means that the amount of nutrients in the soil must be balanced, so that plant growth and production are optimized. As stated by Iskandar and Rofiatin (2017), the quality and characteristics of the biochar made will be influenced by the type of organic material used. Ultimately, this will affect its functional properties. Shallot production is influenced by many factors, including plant pests and diseases, as well as the quality of agricultural land. Providing soil amendments can improve the quality of agricultural land (Dariah, et al., 2015). It is important to note that further analysis, such as more in-depth statistical tests, is needed to understand the interactions between biochar and ecoenzymes and their effects on wet tuber weight.

**Dry Tuber Weight Per Plot (g)**

Observational data has been statistically analyzed regarding the weight of dry bulbs per shallot plot (g) as a result of the use of biochar derived from rambutan tree charcoal and ecoenzymes derived from the remaining fruit skin. Based on the results of these observations and statistical analysis, it can be concluded that the application of biochar and ecoenzymes has an insignificant effect on the weight of kerimg tubers per shallot plot (g).

Table 6 shows that the highest dry tuber weight per plot in the biochar treatment was in treatment A1 (650 grams/plot) with an average of 88.11 g and the lowest was in treatment A0 (without treatment) with an average of 66.89 g. The highest plant ecoenzyme treatment was B2 (1000 ml/plot) with an average of 75.25 g and the lowest treatment was B1 (500 ml/plot) with an average of 71.92 g. Detailed information regarding the average dry tuber weight per shallot plot due to the application of biochar and ecoenzymes can be found in Table 6.

**Table 6.**Average dry tuber weight per plot (g) with biochar and ecoenzyme treatment

| Treatment | Dry Tuber Weight Per Plot (g) |
|---|---|
| Providing Biochar | |
| A0 = No treatment | 66.89 aA |
| A1 = Biochar 650 grams/plot | 88.11 aA |
| A2 = Biochar 750 grams/plot | 71.22 aA |
| A3 = Biochar 850 grams/plot | 68.33 aA |
| Administration of Ecoenzymes | |
| B0 = No treatment | 73.75 aA |
| B1 = 500 ml/plot | 71.92 aA |
| B2 = 1000 ml/plot | 75.25 aA |

Note: Numbers followed by the same letter in different columns are not significantly different at the 5% (lower case) and 1% (upper case) levels.

In previous research involving treatment without eloenzyme treatment, every observed variable tended to decrease. According to research conducted by Yuliandewi, et al. (2018), giving ecoenzymes to lettuce plants really affects root growth, stem diameter and dry weight. The results of research on nutritional balance emphasize how important it is to maintain a balance of biochar and ecoenzymes to increase agricultural yields.

**Dry Tuber Weight Per Sample (g)**

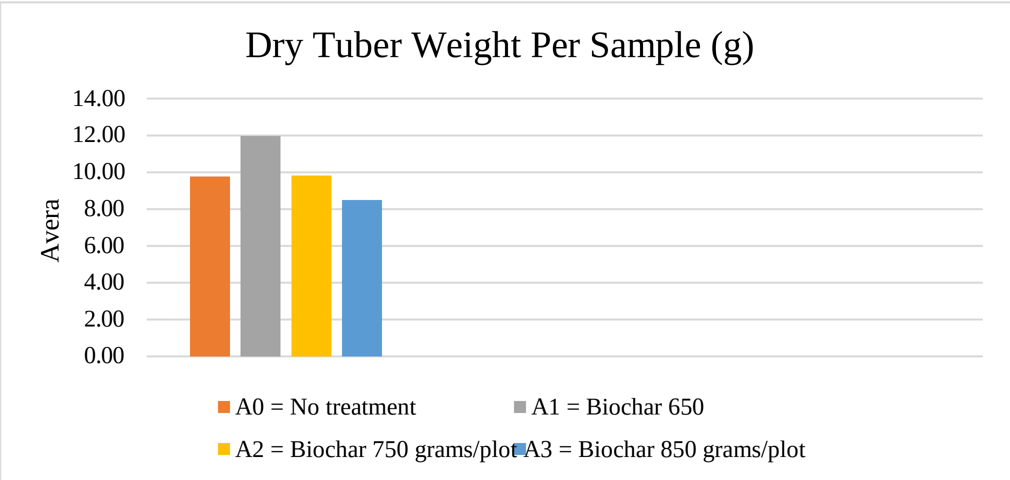
Observational data has been statistically analyzed regarding the weight of dry bulbs per shallot sample (g) as a result of the use of biochar derived from rambutan tree charcoal and ecoenzymes derived from the remaining fruit skin. Based on the results of these observations and statistical analysis, it can be concluded that the application of biochar and ecoenzymes has a significant influence on the weight of kerimg tubers per shallot sample (g). Table 7 shows that the highest dry tuber weight per sample in the biochar treatment was in treatment A2 (750 grams/plot) with an average of 9.81 g and the lowest was in treatment A3 (850 grams/plot) with an average of 8.49 g. The highest plant ecoenzyme treatment was B1 (500 ml/plot) with an average of 10.18 g and the lowest treatment was B0 (no treatment) with an average of 9.78 g. Detailed information regarding the average weight of dry bulbs/shallot samples due to the application of biochar and ecoenzymes can be found in Table 7.

**Table 7.**Average dry tuber weight per sample (g) with biochar and ecoenzyme treatment

| Treatment | Dry Tuber Weight Per Sample (g) |
|---|---|
| Providing Biochar | |
| A0 = No treatment | 9.76 aAB |
| A1 = Biochar 650 grams/plot | 11.96 bB |
| A2 = Biochar 750 grams/plot | 9.81 aAB |
| A3 = Biochar 850 grams/plot | 8.49 aA |
| Administration of Ecoenzymes | |
| B0 = No treatment | 9.78 aA |
| B1 = 500 ml/plot | 10.18 aA |
| B2 = 1000 ml/plot | 10.05 aA |

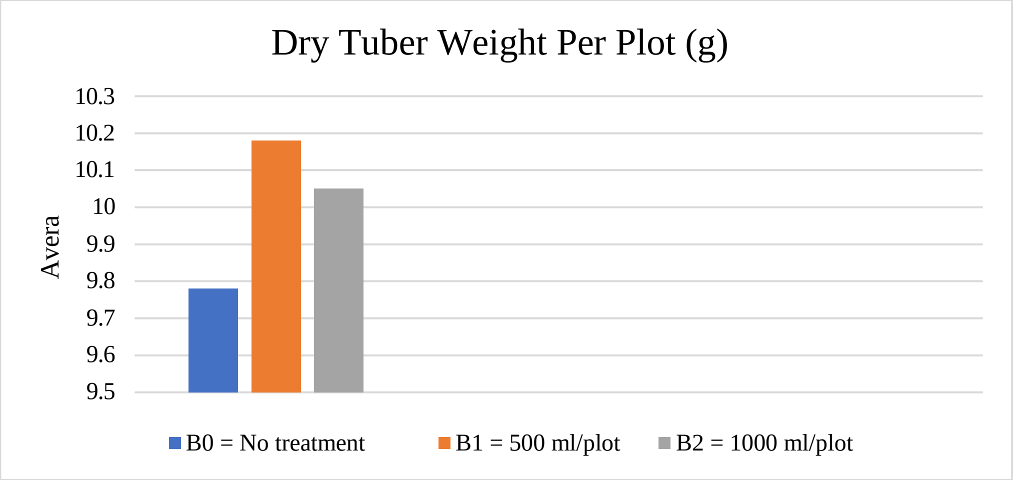
Note: Numbers followed by the same letter in different columns are not significantly different at the 5% (lower case) and 1% (upper case) levels.

**Figure 7.**Diagram of average dry tuber weight per sample (g) with biochar treatment




The average increase in dry tuber weight per shallot sample due to biochar treatment at harvest can be seen in the bar diagram in Figure 7. The bar diagram shows that the application of biochar with A1 treatment (650 grams/plot) had the highest average, but the average The lowest average was in treatment A3 (850 grams/plot).

**Figure 8.**Diagram of average dry tuber weight per sample (g) with ecoenzyme treatment




The average increase in dry tuber weight per shallot sample due to ecoenzyme treatment at harvest can be seen in the bar diagram in Figure 8. The bar diagram shows that the application of biochar with B1 treatment (500 ml/plot) has the highest average, but the average The lowest average was in treatment B0 (no treatment).

## CONCLUSION

1. Providing biochar treatment had a significant effect on plant height (cm), number of leaves (strands), number of tillers per plot (tubers), dry tuber weight per sample (g) and the best average was found in treatment A1 (Biochar 650 grams/plot)
2. Ecoenzyme treatment had a significant effect on plant height (cm), number of leaves (strands), number of tillers per plot (tubers), dry tuber weight per sample (g) and the best average was found in treatment B2 (1000 ml/plot)
3. The interaction between biochar and ecoenzymes did not have a significant effect on wet tuber weight per plot (g) and dry tuber weight per plot (g).

## REFERENCES

Badan Pusat Statistik (BPS), 2020. Statistik Tanaman Sayuran dan Buah-buahan Semusim. Badan Pusat Statistik Jenderal Hortikultura. Indonesia.

Berutu, R. K., Aziz, R., & Hutapea, S. (2019). Pengaruh Pemberian Berbagai Sumber Biochar dan Berbagai Pupuk Kandang terhadap Pertumbuhan dan Produksi jagung hitam (*Zea mays* L.). Jurnal Ilmiah Pertanian (JIPERTA), 1(1), 16-25.

Dariah, A., S. Sutono, Neneng L. Nurida, W. Hartatik, E. Pratiwi. 2015. Pembenah Tanah untuk Meningkatkan Produktivitas Lahan Pertanian. J. Sumberdaya Lahan, Vol. 9(2), 67-84. Doi: http://dx.doi.org/10.21082/jsdl. v9n2.2015.%25p.

Firmansyah, I., R. Nurlaily, Sutoyo, A. Hermawan, R. K. Jatuningtyas, & A. C. Kusumasari. 2021. The Effect of Organic Fertilizer, Biochar, and Hormones on Bulb Splitting in The Cultivation of True Seed Shallot. IOP Conference Series: Earth and Environmental Science. 653 (1): 1–6.

Hemalatha, M., & P. Visantini. 2020. "Potential Use of Eco-Enzyme for the Treatment of Metal Based Effluent." IOP Conference Series: Materials Science and Engineering 716(1).

Iskandar, T., & U. Rofiatin. 2017. Karakterisitik Biochar Berdasarkan Jenis Biomassa dan Parameter Pyrolisis. Jurnal Teknik Kimia. 12 (1): 28–34.

Kalus, K., J. A. Koziel, & S. Opaliński. 2019. A Review of Biochar Properties and Their Utilization in Crop Agriculture and Livestock Production. in Applied Sciences (Switzerland). 9 (17):1–16.

Lelu, P. K., Y. P. Situmeang & M. Suarta. 2018. Aplikasi Biochar dan Kompos terhadap Peningkatan Hasil Tanaman Jagung (*Zea mays* L.). GEMA AGRO. 23(1): 24–32.

Lubis, N., Wasito, M., Marlina, L., Ananda, S. T., & Wahyudi, H. (2022). Potensi ekoenzim dari limbah organik untuk meningkatkan produktivitas tanaman. Seminar Nasional UNIBA Surakarta 2022, ISBN : 978-979-1230-74-2, 182–188.

Lubis, N., Wasito, M., Marlina, L., Ananda, S. T., & Wahyudi, H. (2022b). Potensi ekoenzim dari limbah organik untuk meningkatkan produktivitas tanaman. Seminar Nasional UNIBA Surakarta 2022, ISBN : 978-979-1230-74-2, 182–188.

Lubis, N., Wasito, M., Marlina, L., Girsang, R., & Wahyudi, H., (2022). Respon Pemberian Ekoenzim dan Puouk Organik Caiir Terhadap Pertumbuhan dan Produksi Bawang Merah (*Allium ascalonicum* L.). Agrium ISSN 0852-1077 (Print) ISSN 2442-7306.

Palansooriya, K. N., Y. S.Ok,Y. M. Awad, S. S. Lee, J. K. Sung, A. Koutsospyros, & D. H. Moon. 2019. Impacts of Biochar Application on Upland Agriculture: a Review. Journal of Environmental Management. 234: 52–64.

Rawat, J., Saxena, J., & Sanwal, P. (2019). Biochar: A Sustainable Approach for Improving Plant Growth and Soil Properties. https://doi.org/DOI: 10.5772/intechopen.82151.

Rita Noveriza, R. N., & Melati, M. (2022). Potensi Pemanfaatan Ekoenzim Air Cucian Beras (Acb) Sebagai Biopestisida Dan Biofertilizer. Prosiding Seminar Nasional MIPA UNIPA, 2022, 44–54. https://doi.org/10.30862/psnmu.v7i1.7.

Sánchez-Reinoso, A. D., E. Á. Ávila-Pedraza, & H. Restrepo-Díaz. 2020. Use of biochar in agriculture. In Acta Biologica Colombiana. 25 (2): 327–338.

Simbolon, B., L. Mawarni, & J. Ginting. 2020. The Effect of Various Sources of Biochar and Kieserite Fertilizer Application on Growth and Production of Shallots (*Allium ascalonicum* L.) Plant. Jurnal Online Agroteknologi. 8 (1): 63–68.

Tarjiyo, & Elfis. (2023). Respon Pertumbuhan Dan Produksi Tanaman Bawang Merah (*Allium Ascalonicum* L.) Terhadap Biochar Dan Pupuk Organik Cair (POC) Bonggol Pisang. Vol. 3 No. 2.

Tenaya, I. M. N. (2015). Pengaruh interaksi dan nilai interaksi pada percobaan faktorial. Agrotrop, 5(1), 9-20.

Triana N, Ediwirman., dan Ernita M. (2023). Respon Pertumbuhan dan Hasil Bawang Merah Pada Pemberian Ekoenzim dan Pupuk NPK. Jurnal Embrio (15) (2) (23-42).

Yuliandewi, W.Y.N., Sumerta, I.M., Wiswara, A. IGN. 2018. Utilization of Organic Garbage as " Eco Garbage Enzyme" for Lettuce Plant Growth (*Lactuca sativa* L.). International Journal of Science and Research (IJSR) (7): 1521-1525.