Journal of Information Technology, computer science and Electrical Engineering (JITCSE)
Vol. 2, No. 1, February 2025, pp. 47~56
ISSN: 3046-4900

Production of *Lactuca sativa* with Variations in Liquid Organic Fertilizer Concentration as an Ecoenzyme Derivative in a Hydroponic System

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ABSTRACT

Lettuce (Lactuca sativa L.) is a type of horticultural plant that has high nutritional content and economic value, with good prospects for development. Lettuce is an annual plant that is easy to cultivate in various types of land and has a wide market. The research was conducted to determine the response of lettuce plant production (Lactuca sativa L.) to the application of lemna leaf compost enriched with goat manure and the use of variations of liquid organic fertilizer as ecoenzymes derivative in a hydroponic system. This research used a factorial Randomized Complete Block Design (RCBD) consisting of 2 factors with 5 treatments and 3 replications. The first factor was the variation of liquid organic fertilizer from ecoenzymes at 5 levels: P0 = AB Mix (control), P1 = POC 1 (Pure EE), P2 = POC 2 (EE + egg shells + pineapple), P3 = POC 3 (EE + moringa leaves + insulin leaves), P4 = POC 4 (EE + guava leaves + sweet potato leaves + long bean leaves), P5 = POC 5 (EE + water spinach + baby corn). The second factor was the concentration of ecoenzyme at 3 levels: E0 = 0%, E1 = 25%, E2 = 50%. The observed parameters in this research included plant height (cm), number of leaves (leaves), fresh weight per plant (g), stem diameter (cm), plant weight per plot (g), and root length (cm). The results showed that POC 5 (EE + Water Spinach + Baby corn) provided fairly good results, ranking second after AB Mix, in terms of plant height (cm), fresh weight per plant (g), stem diameter (cm), plant weight per plot (g), and root length (cm). This indicates that a combination of more diverse and natural organic materials can optimally support plant growth.

Keywords: AB Mix; Ecoenzyme; Lettuce; Liquid_Organic_Fertilizer; re-fermented

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Article history:
Received Jan 20, 2025
Revised Jan 27, 2025
Accepted Feb 02, 2025

1. INTRODUCTION

Lettuce (*Lactuca sativa* L.) is a type of horticultural plant that has high nutritional content and economic value, and has good prospects for development. Lettuce is a seasonal plant, which is easy to cultivate on various types of land and has a wide market

According to data from the Central Statistics Agency 2019–2021, the production of curly lettuce in Indonesia experienced growth during the specified time period. In 2019, production was 1,413,060 tons, in 2020 production was 1,406,985 tons, and in 2021 production was 1,434,670 tons. Lettuce plants are increasing because more and more people know about and consume them, this has led to an increasing need for a healthy lifestyle among the Indonesian population. In addition, more and more new types of diseases are emerging due to various products being produced with simpler processes, so there is an opportunity to increase production to meet the national lettuce consumption level (Dasgan et al., 2023). The demand for lettuce commodities continues to increase in Indonesia, including from supermarkets, large restaurants, or five- star hotels . Therefore, lettuce cultivation has a fairly promising market opportunity, seen from the low production of lettuce plants and the high demand for lettuce, thus opening up greater opportunities for the community to increase lettuce production.

Increasing lettuce production in Indonesia can be done intensively through a hydroponic cultivation system. The productivity and quality of hydroponic plants are generally higher compared to

conventional agricultural products, so they are widely applied to leafy vegetable cultivation. One of the widely used hydroponic cultivation systems is *the Nutrient Film Technique* (NFT) (Siregar et al., 2018).

Hydroponic systems have various types, one of which is the wick system. The wick hydroponic system is a plant cultivation without using soil media, where nutrients will reach the roots of the plant without using a pump, so the wick hydroponic system is known as an economical hydroponic system (Chowdhury et al., 2024). According to Chowdhury, 2024, the hydroponic system has several advantages, including: the success of plants to grow and produce is more guaranteed, easier maintenance, dead plants are easier to replace with new plants, and the selling price of hydroponics is higher than non-hydroponic products.

The process of providing nutrients is an important thing that can help the productivity of lettuce plants. The nutrient solution used in hydroponics must be in accordance with plant needs, namely containing macro and micro nutrients. Lettuce plants require macro nutrients consisting of C, H, O, N, P, K, Ca, Mg, S and micro nutrients namely Mn, Cu, Fe, Mo, Zn, B, Cl, Co (Lubis et al., 2024a).

AB mix nutrients contain macro and micro nutrients that can meet the nutritional needs of hydroponic plant growth. AB mix nutrients on the market have relatively high prices, so other alternatives are needed with more economical prices. One alternative that can be done is to use homemade Liquid organic fertilizer (POC) (Lubis et al., 2024b). Lettuce production using a hydroponic system is considered more efficient, especially for the environment (Sapkota et al., 2019).

In addition to the use of AB mix as hydroponic nutrients, the use of liquid organic fertilizers can be used to reduce the use of inorganic fertilizers. Providing organic fertilizers can increase the availability of nutrients and if the organic fertilizers given are correct, it will increase the number of leaves, leaf area, plant height and increase the total fresh weight (Purnama *et al.* , 2013). Liquid organic fertilizers are pure organic materials in liquid form from livestock and poultry waste, natural and plant waste, and certain natural substances that are processed naturally. Liquid organic fertilizers can be given by dissolving them in water and applying them through the plant roots (Bergstrand, 2022).

Developed by Thai researcher and environmental observer Dr. Rosukon Poompanvong, ecoenzyme (EE) is a fermentation product of organic waste in the form of fruits or vegetables. The country's distribution of this innovation is rather wide. The fermentation of organic waste, such as fruit or vegetable waste, produces ecoenzyme (EE) (Pasalari et al., 2024). EE is a liquid with several uses that is beneficial to human life. Among its various uses is to boost the yield of shallot and soybean plants (Lubis et al., 2022). It can also be utilized to make biopesticides and biofertilizers (Dondo et al., 2023), and as a nature disinfectant (Ginting & Prayitno, 2022). However, no one has used ecoenzymes that have undergone 21 days of refermentation to examine the output of lettuce plants. However, no one has tested lettuce plant production using ecoenzymes that have been re-fermented for 21 days. Based on this background, the author is interested in conducting research on "Production of Lettuce plant *(Lactuca Sativa)* with variations in concentration of liquid organic fertilizer derived from ecoenzymes".

2. RESEARCH METHOD

The research was conducted in the Glugur Rimbun area, Sampu Cita village, Kutalimbaru sub-district, Langkat Regency, from May to August 2024.

The tools used in this study include rulers, styrofoam, flannel, barrels, measuring cups, scissors, stationery, buckets, cups, scales, and cameras.

The materials used include lettuce seeds, Liquid Organic Fertilizer (POC), AB mix. POC 1 (Pure EE), POC 2 (EE + egg shell + Pineapple), POC 3 (EE + Moringa leaves + kipahit leaves / insulin), POC 4 (F2 EE + guava leaves + sweet potato leaves + long bean leaves), POC 5 (EE + water spinach + baby corn) and rockwol.

The experimental method used in this study was a Completely Randomized Design (CRD) with 5 POC treatments and 3 replications. The following is the experimental design:

Factor I: Ecoenzyme mixed with various types of organic materials

P0 : AB mix (Control)
P1 : POC 1 (Pure EE)
P2 : POC 2 (EE+egg shells + pineapple)
P3 : POC 3 (EE + moringa leaves + kipahit leaves/insulin)
P4 : POC 4 (EE + guava leaves + sweet potato leaves + long bean leaves)
P5 : POC 5 (EE + water spinach + baby corn)

Factor II: Ecoenzymes and organic materials in the treatment will be fermented for 21 days.

E0 : 0%
E1 : 25%
E2 : 50%

The data obtained were analyzed using analysis of variance (F test with a level of 5%) to determine the effect of the repetition and treatment given. If there are significantly different results, it is continued with the smallest significant difference test (LSD) with a level of 5%.

A. Production of Liquid Organic Fertilizer (POC) ecoenzymes derivative

Prepare the harvested EE, then prepare the fruit peel and vegetable waste, and molasses as sugar/carbohydrate. Molasses can be replaced with brown sugar or brown cane sugar, with a ratio of 2:1 compared to organic materials. Then collect all the prepared organic kitchen waste, make sure there are no chemicals mixed in. Cut the peel and remaining fruit flesh into small slices so that the fermentation process does not take too long. Put the fruit pieces and sugar into a container such as a plastic bottle, and pour clean water until all the ingredients are submerged. Close the container tightly using a loose lid or a hollow cloth cover so that the liquid can breathe. Place the container in a cool and dark place (Fig 1), away from direct sunlight. Leave the liquid for 21 or 45 days, stir the liquid regularly, for example once a week. After the fermentation process is complete, the POC is filtered.

Fig 1. Production of Liquid Organic Fertilizer

B. Production of EE with various concentration

To make POC EE 25%, dissolve 125 mL of POC in 5000 mL of water. Likewise, to make POC EE 50%, dissolve 500 mL of POC in 5000 mL of water.

C. Observed Parameters

The parameters observed included plant height (cm), number of leaves (strands), fresh weight per plant (g), stem diameter (cm), plant weight per plot (g), root length (cm).

3. RESULTS AND DISCUSSION

A. Results

The results of the recapitulation of the analysis of variance showed that the provision of variations in liquid organic fertilizer in the hydroponic system did not have a significant effect on plant height (cm), number of leaves (strands), fresh weight per plant (g), stem diameter (cm), plant weight per plot (g), root length (cm).

The following are the results of observations on characteristics such as plant height parameters (cm), number of leaves (strands), fresh weight per plant (g), stem diameter (cm), plant weight per plot (g), root length (cm) of lettuce plants, which are influenced by the application of variations in liquid organic fertilizer in the hydroponic system.

Plant Height (cm)

Observational data, which has been analyzed statistically, regarding the height of lettuce plants (cm) due to the provision of variations in liquid organic fertilizers in the hydroponic system. From the results of the observation and statistical analysis, it can be concluded that the application of variations in liquid organic fertilizers in the hydroponic system does not have a very significant effect on the height of lettuce plants (cm). Details regarding the average height of lettuce plants (cm) due to the provision of variations in liquid organic fertilizers in the hydroponic system can be seen in table 1.

Table 1. Average Plant Height (Cm) of Lettuce Against Application of Various Liquid Organic Fertilizers in Hydroponic Systems

Treatment	Plant Height (cm)				
	10 days	15 days	20 days	25 days	30 days
Treatment P					
P0 = AB Mix (Control)	20.01 a	21.39 a	23.47 a	25.32 a	27.50 a
P1 = POC 1 (Pure EE)	17.48 a	18.97 a	21.06 a	23.18 a	25.85 a
P2 = POC 2 (EE + Egg shell + Pineapple)	17.06 a	18.85 a	20.77 a	23.10 a	25.87 a
P3 = POC 3 (EE + Moringa leaves + Kipahit leaves)	16.39 a	17.99 a	20.17 a	22.52 a	25.42 a
P4 = POC 4 (EE + Guava leaves + Potato leaves + Long bean leaves)	17.16 a	18.61 a	20.56 a	23.06 a	26.14 a
P5 = POC 5 (EE + Water spinach + Baby corn)	17.99 a	19.49 a	21.69 a	23.89 a	26.70 a
Treatment E					
E0 = 0%	17.56 a	19.13 a	21.16 a	23.43 a	26.21 a
E1 = 25%	17.46 a	18.97 a	21.08 a	23.51 a	26.21 a
E2 = 50%	17.99 a	19.55 a	21.58 a	23.59 a	26.33 a

Note: Numbers followed by the same letter in different columns indicate no significant difference at the 5% level (lowercase letters).

Table 1 shows that the highest plants in the treatment of liquid organic fertilizer variations were in the P treatment (eco enzyme mixed with various types of organic materials), namely P0 (Control) with an average of 27.50 cm and the lowest were in the P3 treatment (EE + Moringa leaves + Kipait leaves) with an average of 25.42 cm. In the E treatment (ecoenzyme concentration), the highest was in the E2 concentration (50%) with an average of 26.33 cm and the lowest was in the E0 concentration (0%) with an average of 26.21 cm.

The table of results of observations of plant height in various treatments shows that the P0 treatment (AB Mix/Control**)** showed the highest growth compared to other treatments at all observation times (10 days to 30 days). This indicates that AB Mix fertilizer as a control provides more optimal nutrients for plant growth than liquid organic fertilizer (POC) based on ecoenzyme (EE).

Inorganic nutrients are more readily available compared to organic nutrients. Complete nutrition and the availability of N nutrients affect plant height growth, number of leaves, leaf area and root length (Nurrohman *et al* ., 2014). According to Megasari (2020), in the process of forming vegetative leaf organs, plants require large amounts of nitrogen nutrients. Compared to Kipahit POC, AB Mix nutrients have higher nitrogen (N) nutrients.

At 30 days after planting, P5 (EE + Water Spinach + baby Corn) showed the highest plant height (26.70 cm) compared to other POC treatments, indicating that this combination can provide better nutrition. In contrast, P3 (EE + Moringa leaves + Kipahit leaves) had the lowest growth (25.42 cm), which is likely due to the secondary metabolite content in kipahit leaves that can inhibit plant growth. POC formulations with certain additional ingredients, such as water spinach and baby corn (P5), tend to be better than other formulations.

Number of leaves (strand)

Observational data, which has been analyzed statistically, regarding the number of lettuce leaves (strand) due to the provision of variations in liquid organic fertilizers in the hydroponic system.

From the results of the observation and statistical analysis, it can be concluded that the application of variations in liquid organic fertilizers in the hydroponic system does not have a very significant effect on the number of lettuce leaves (strand). Details regarding the average number of lettuce leaves (cm) due to the provision of variations in liquid organic fertilizers in the hydroponic system can be seen in table 2.

Table 2. Average Number of Lettuce Leaves (Sheets) Against Application of Various Liquid Organic Fertilizers in Hydroponic Systems

Treatment	Number of Leaves (cm)				
	10 days	15 days	20 days	25 days	30 days
Treatment P					
P0 = AB Mix (Control)	5.89 a	6.86 a	7.72 a	8.75 a	9.69 a
P1 = POC 1 (Pure EE)	5.81 a	6.81 a	7.61 a	8.81 a	9.64 a
P2 = POC 2 (EE + Egg shell + Pineapple)	5.75 a	6.75 a	7.61 a	8.61 a	9.64 a
P3 = POC 3 (EE + Moringa leaves + Kipahit leaves)	5.89 a	6.89 a	7.69 a	8.69 a	9.69 a
P4 = POC 4 (EE + Guava leaves + Potato leaves + Long bean leaves)	5.56 a	6.53 a	7.42 a	8.42 a	9.53 a
P5 = POC 5 (EE + Water spinach + Baby corn)	5.69 a	6.69 a	7.39 a	8.39 a	9.45 a
Treatment E					
E0 = 0%	5.69 a	6.67 a	7.50 a	8.52 a	9.56 a
E1 = 25%	5.82 a	6.81 a	7.64 a	8.62 a	9.66 a
E2 = 50%	5.79 a	6.79 a	7.58 a	8.69 a	9.61 a

Note: Numbers followed by the same letter in different columns show no significant difference at the 5% level (lowercase letters)

Table 2 shows that the highest number of leaves in the treatment of liquid organic fertilizer variations was in the P treatment (ecoenzyme mixed with various types of organic materials), namely P3 (EE + Moringa leaves + Kipait leaves) with an average of 9.69 leaves, and the lowest was in the P5 treatment (EE + Water Spinach + Baby corn) with an average of 9.45 leaves. In the E treatment (ecoenzyme concentration), the highest was in the E1 concentration (25%) with an average of 9.66 leaves, and the lowest was in the E0 concentration (0%) with an average of 9.56 leaves.

Based on the observation results of the number of leaves in various treatments, it can be seen that P0 (AB Mix/Control) has the largest number of leaves at all observation times (10 days to 30 days). This shows that AB Mix fertilizer can provide optimal nutrition for leaf growth compared to liquid organic fertilizers based on ecoenzymes (EE). AB Mix nutrition has complete nutrients for plant growth, especially leaf growth. Leaf growth will grow optimally if the nutrients contained in a fertilizer are sufficient to encourage plant metabolism in leaf growth (Ahmed et al., 2021).

P3 (EE + Moringa leaves + Kipahit leaves) had the highest number of leaves after P0 (9.69 leaves at 30 days), indicating that this combination was quite effective in supporting leaf development. In contrast, P5 (EE + Water Spinach + Baby Corn) had the least number of leaves at 30 days (9.45 leaves), indicating that this combination was less supportive of leaf development compared to other treatments.

Leaves are where photosynthesis occurs. Good photosynthesis will produce many photosynthesis products and will later be used for the formation of organs and tissues in plants (Shi et al., 2023). The elements of N and micronutrients act as chlorophyll components. The greater the amount of chlorophyll, the photosynthesis activity will produce more photosynthate which plays a role in the development of leaf meristematic tissue. Micronutrients are needed in small amounts, but if the plant lacks these elements, it can cause leaf growth to be less than optimal. Lack of micronutrients can affect vegetative growth. Overall, although EE-based POC is able to support the growth of the number of leaves, its effectiveness is still lower compared to AB Mix fertilizer (P0).

Stem Diameter (cm)

Observation data, which has been analyzed statistically, regarding the diameter of lettuce stems (cm) due to the provision of variations in liquid organic fertilizers in the hydroponic system. From the results of the observation and statistical analysis, it can be concluded that the application of variations in liquid organic fertilizers in the hydroponic system does not have a very significant effect on the diameter of lettuce stems (cm). Details regarding the average diameter of lettuce stems (cm) due to the provision of variations in liquid organic fertilizers in the hydroponic system can be seen in table 3.

Table 3. Average Stem Diameter (Cm) of Lettuce Against Application of Various Liquid Organic Fertilizers in Hydroponic Systems

Treatment	Stem Diameter (cm)				
	10 days	15 days	20 days	25 days	30 days
Treatment P					
P0 = AB Mix (Control)	2.02 a	2.85 a	3.24 a	3.49 a	3.71 a
P1 = POC 1 (Pure EE)	2.40 a	3.19 a	3.43 a	3.57 a	3.69 a
P2 = POC 2 (EE + Egg shell + Pineapple)	2.49 a	3.23 a	3.38 a	3.49 a	3.55 a
P3 = POC 3 (EE + Moringa + Kipahit leaves)	2.46 a	3.29 a	3.46 a	3.59 a	3.59 a
P4 = POC 4 (EE + Guava leaves + Potato leaves + Long bean leaves)	2.36 a	3.29 a	3.42 a	3.57 a	3.65 a
P5 = POC 5 (EE + Water spinach + Baby corn)	2.53 a	3.39 a	3.54 a	3.65 a	3.65 a
Treatment E					
E0 = 0%	2.24 a	3.09 a	3.44 a	3.57 a	3.65 a
E1 = 25%	2.48 a	3.29 a	3.45 a	3.59 a	3.64 a
E2 = 50%	2.44 a	3.23 a	3.36 a	3.53 a	3.62 a

Note: Numbers followed by the same letter in different columns show no significant difference at the 5% level (lowercase letters)

Table 3 shows that the highest stem diameter in the treatment of liquid organic fertilizer variation was in the P treatment (ecoenzyme mixed with various types of organic materials), namely P0 (AB Mix/Control) with an average of 3.71 cm, and the lowest was in the P2 treatment (EE + Eggshell + Pineapple) with an average of 3.55 cm. In the E treatment (ecoenzyme concentration), the highest was in the E0 concentration (0%) with an average of 3.65 cm, and the lowest was in the E2 concentration (50%) with an average of 3.62 cm.

Based on the results of observations of plant stem diameter in various treatments, it can be seen that P0 (AB Mix/Control) has a smaller stem diameter compared to the EE-based POC treatment at almost all observation times. This shows that the administration of eco enzyme (EE)-based POC is able to increase the diameter of plant stems compared to AB Mix, which may be due to the influence of organic compounds in POC, which can stimulate stem tissue growth.

In the EE based POC treatments (P1–P5), P5 (EE + Water Spinach + Baby Corn) showed the largest stem diameter (3.65 cm at 30 days), followed by P3 (EE + Moringa Leaves + Kipahit Leaves) and P4 (EE + Guava Leaves + Broad Cassava Leaves + Long Bean Leaves), which had almost the same stem diameter (3.59–3.65 cm at 30 days). In contrast, P2 (EE + Egg Shells + Pineapple) had the smallest stem diameter among the POC treatments (3.55 cm at 30 days), indicating that this combination may be less than optimal in increasing stem growth compared to other organic material combinations.

In the POC concentration treatment (E0 – E2), it was seen that E1 (24%) had the largest stem diameter (3.64 cm at 30 days), followed by E0 (3.65 cm) and E2 (3.62 cm). This shows that increasing the concentration up to 50% does not always provide a significant increase in stem diameter. In fact, at some growth stages, E1 (24%) was superior to E2 (50%), which shows that too high a concentration does not always provide better results and may cause an imbalance in nutrient availability. Overall, EE-based liquid organic fertilizer was able to increase stem diameter better than AB Mix (P0), with the combination of EE + Water Spinach + Baby corn (P5) showing the best results.

Length (cm)

Observational data, which has been analyzed statistically, regarding the length of lettuce roots (cm) due to the provision of variations in liquid organic fertilizers in the hydroponic system. From the results of the observation and statistical analysis, it can be concluded that the application of variations in liquid organic fertilizers in the hydroponic system does not have a very significant effect on the length of lettuce roots (cm). Details regarding the average length of lettuce roots (cm) due to the provision of variations in liquid organic fertilizers in the hydroponic system can be seen in table 4.

Table 4. Average Root Length (Cm) of Lettuce Against Application of Various Liquid Organic Fertilizers in Hydroponic Systems

Treatment	Root Length (cm)
Treatment P	
P0 = AB Mix (Control)	21.87 a
P1 = POC 1 (Pure EE)	19.63 a
P2 = POC 2 (EE + Egg shell + Pineapple)	19.46 a
P3 = POC 3 (EE + Moringa leaves + Kipahit leaves)	18.97 a
P4 = POC 4 (EE + Guava leaves + Potato leaves + Long bean leaves)	18.68 a
P5 = POC 5 (EE + Water spinach + Baby corn)	20.87 a
Treatment E	
E0 = 0%	19.78 a
E1 = 25%	20.86 a
E2 = 50%	19.11 a

Note: Numbers followed by the same letter in different columns show no significant difference at the 5% level (lowercase letters)

Table 4 shows that the highest root length in the treatment of liquid organic fertilizer variation was in the P treatment (ecoenzyme mixed with various types of organic materials), namely P0 (AB Mix/Control) with an average of 21.87 cm and the lowest was in the P4 treatment (EE + Guava Leaves + Broad Cassava Leaves + Long Bean Leaves) with an average of 18.68 cm. In the E treatment (ecoenzyme concentration), the highest was in the E1 concentration (25%) with an average of 20.86 cm and the lowest was in the E2 concentration (50%) with an average of 19.11 cm.

Based on the results of root length observations, it can be seen that P0 (AB Mix/Control) has the highest root length (21.87 cm) compared to all other treatments. This shows that AB Mix fertilizer is more effective in supporting root growth compared to ecoenzyme (EE)-based POC.

In the EE-based POC treatment (P1 – P5), P5 (EE + Water Spinach + Baby corn) showed the highest root length (20.87 cm) among all POC treatments, which was close to the results of P0. This indicates that the combination of water spinach and baby corn in POC can have a positive effect on root growth. In contrast, P4 (EE + Guava Leaves + Broad Cassava Leaves + Long Bean Leaves) had the shortest root length (18.68 cm), indicating that this combination was less than optimal in stimulating root growth.

In the EE-based POC treatments (P1–P5), P5 (EE + Water Spinach + Baby Corn) showed the largest stem diameter (3.65 cm at 30 days), followed by P3 (EE + Moringa Leaves + Kipahit Leaves) and P4 (EE + Guava Leaves + Broad Cassava Leaves + Long Bean Leaves), which had almost the same stem diameter (3.59–3.65 cm at 30 days). In contrast, P2 (EE + Egg Shells + Pineapple) had the smallest stem diameter among the POC treatments (3.55 cm at 30 days), indicating that this combination may be less than optimal in increasing stem growth compared to other organic material combinations.

In the POC concentration treatment (E0–E2), it was seen that E1 (24%) had the largest stem diameter (3.64 cm at 30 days), followed by E0 (3.65 cm) and E2 (3.62 cm). This shows that increasing the concentration up to 50% does not always provide a significant increase in stem diameter. In fact, at some growth stages, E1 (24%) was superior to E2 (50%), which shows that too high a concentration does not always provide better results and may cause an imbalance in nutrient availability. Overall, EE-based liquid organic fertilizer was able to increase stem diameter better than AB Mix (P0), with the combination of EE + Water Spinach + Baby Corn (P5) showing the best results.

Roots are plant organs that function in the process of absorption and obtaining nutrients as food substances which are then translocated to all parts of the plant. The length of the roots in P5 is the highest compared to other treatments. Nutrient deficiency causes plant roots to become longer. This is because the distribution of assimilates is greater so that the roots will grow faster and longer so that the roots can supply nutrients for plant growth (Krisna et al., 2017).

Fresh Weight Per Plant (g)

Observation data, which has been statistically analyzed, regarding the fresh weight per lettuce plant (g) due to the provision of variations in liquid organic fertilizers in the hydroponic system. From the results of the observation and statistical analysis, it can be concluded that the application of variations in liquid organic fertilizers in the hydroponic system does not have a very significant effect on the fresh weight per lettuce plant (g). Details regarding the average fresh weight per lettuce plant (g) due to the provision of variations in liquid organic fertilizers in the hydroponic system can be seen in table 5.

Table 5. Average Fresh Weight Per Plant (g) of Lettuce Against Application of Various Liquid Organic Fertilizers in Hydroponic Systems

Treatment	Fresh Weight Per Plant (g)
Treatment P	
P0 = AB Mix (Control)	40.04 a
P1 = POC 1 (Pure EE)	27.25 a
P2 = POC 2 (EE + Egg shell + Pineapple)	29.42 a
P3 = POC 3 (EE + Moringa leaves + Kipahit leaves)	29.50 a
P4 = POC 4 (EE + Guava leaves + Potato leaves + Long bean leaves)	27.79 a
P5 = POC 5 (EE + Water spinach + Baby corn)	33.26 a
Treatment E	
E0 = 0%	33.29 a
E1 = 24%	30.38 a
E2 = 50%	29.96 a

Note: Numbers followed by the same letter in different columns show no significant difference at the 5% level (lowercase letters)

Table 5 shows that the highest fresh weight per plant in the treatment of liquid organic fertilizer variation was in the P treatment (ecoenzyme mixed with various types of organic materials), namely P0 (AB Mix/Control) with an average of 40.04 g and the lowest was in the P1 treatment (Pure EE) with an average of 27.25 g. In the E treatment (ecoenzyme concentration), the highest was in the E0 concentration (0%) with an average of 33.29 g and the lowest was in the E2 concentration (50%) with an average of 29.96 g.

Treatment P0 (AB Mix/Control) showed the highest fresh weight per plant, which was 40.04 g. This shows that the control treatment with AB Mix gave the best results compared to the use of other POC. POC 5 (EE + Water Spinach + Baby corn) showed a result of 33.26 g, which was higher than most other treatments, but still below AB Mix/Control. This shows that certain plant combinations can have a positive effect on plant growth.

Treatment E0 (0%) gave a fresh weight of 33.29 g, indicating that the plants could grow quite well even without additional fertilizer. This could be due to the presence of sufficient nutrients from the soil or other naturally available sources.

Plants will grow and have a high level of production if the nutrients needed by plants are sufficient and balanced. The nutrients N, P and K are macro elements that are very much needed by plants. Based on Table 5, P0 gives the best wet weight results, because AB Mix nutrients contain essential nutrients that support plant growth and production. Meanwhile, the P1-P5 treatments have not given good results on the wet weight of plants. This is because the POC content is higher than the AB Mix

nutrients. This is in accordance with Lubis (2022), which states that organic fertilizers only contain a lot of organic matter and a little nutrient content.

Plant Weight Per Plot (g)

Observation data, which has been statistically analyzed, regarding the weight of lettuce plants per plot (g) due to the provision of variations in liquid organic fertilizers in the hydroponic system. From the results of the observation and statistical analysis, it can be concluded that the application of variations in liquid organic fertilizers in the hydroponic system does not have a very significant effect on the weight of lettuce plants per plot (g). Details regarding the average weight of lettuce plants per plot (g) due to the provision of variations in liquid organic fertilizers in the hydroponic system can be seen in Table 6.

Table 6. Average Plant Weight Per Plot (g) of Lettuce Against Application of Various Liquid Organic Fertilizers in Hydroponic Systems

Treatment	Fresh Weight Per Plot (g)
Treatment P	
P0 = AB Mix (Control)	160.13 a
P1 = POC 1 (Pure EE)	108.97 a
P2 = POC 2 (EE + Egg shell + Pineapple)	117.67 a
P3 = POC 3 (EE + Moringa leaves + Kipahit leaves)	118.00 a
P4 = POC 4 (EE + Guava leaves + Potato leaves + Long bean leaves)	111.19 a
P5 = POC 5 (EE + Water spinach + Baby corn)	133.02 a
Treatment E	
E0 = 0%	133.15 a
E1 = 24%	121.50 a
E2 = 50%	119.82 a

Note: Numbers followed by the same letter in different columns show no significant difference at the 5% level (lowercase letters)

Table 6 shows that the highest fresh weight per plot in the treatment of liquid organic fertilizer variation was in the P treatment (ecoenzyme mixed with various types of organic materials), namely P0 (AB Mix/Control) with an average of 160.13 g, and the lowest was in the P1 treatment (Pure EE) with an average of 108.97 g. In the E treatment (ecoenzyme concentration), the highest was in the E0 concentration (0%) with an average of 133.15 g, and the lowest was in the E2 concentration (50%) with an average of 119.82 g.

Treatment P0 (AB Mix/Control) produced the highest fresh weight per plot, which was 160.13 g, indicating that the control with AB Mix gave the best results compared to other treatments. POC 5 (EE + Water Spinach + Baby Corn) produced a fresh weight per plot of 133.02 g, indicating better results compared to several other treatments, although still below AB Mix/Control. This indicates that the combination of organic materials used in POC 5 has a positive effect on plant growth.

Treatment E2 (50%) produced a fresh weight per plot of 119.82 g, which was slightly lower compared to E1. This shows that higher fertilizer application does not always provide better results and may be excessive for certain crops.

AB Mix (P0) was proven to provide the best results in terms of fresh weight per plot, followed by POC 5 (EE + Water Spinach + Baby Corn), which shows that several combinations of organic materials can provide quite good results.

4. CONCLUSION

Treatment with AB Mix (P0) showed the most optimal results for 6 variables, namely plant height (cm), number of leaves (strands), fresh weight per plant (g), stem diameter (cm), plant weight per plot (g), root length (cm). This indicates that AB Mix as a control provides the best results for plant growth and production compared to other liquid organic fertilizer treatments.

POC 5 (EE + Water spinach + Baby corn) gave quite good results, ranked second after AB Mix, both for plant height (cm), fresh weight per plant (g), stem diameter (cm), plant weight per plot (g), and root length (cm). This shows that a more diverse and natural combination of organic materials can support optimal plant growth.

Based on the table data that has been presented, the variation of POC does not have a significant effect on the growth and production of lettuce because AB Mix still dominates in meeting the nutritional needs of lettuce plants. Thus, it can be concluded that the use of liquid organic fertilizer with the right composition and the provision of fertilizer in moderate amounts can increase plant growth results, while excessive fertilizer administration can actually inhibit its growth. Further research is still needed on the use of liquid organic fertilizers from ecoenzyme derivatives in hydroponic systems, and analysis tests are carried out for the content of macro and micronutrientsFurther research is still needed on the use of liquid organic fertilizers from ecoenzyme derivatives in hydroponic systems and analysis tests are carried out for the content of macro and micro nutrients from liquid organic fertilizers. also the manufacture of POC using other organic materials or at different concentration variations from liquid organic fertilizers.

ACKNOWLEDGEMENTS

We would like to thank the Rector of Universitas Pembangunan Panca Budi (UNPAB) and the Living Laboratory of the Agrotechnology Study Program, UNPAB

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