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Utilization of Coconut Water Waste as Liquid Organic Fertilizer for the Growth of Mung Bean Microgreens (*Vigna radiata*)

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Abstract

Microgreens represent a novel approach to urban farming, characterized by its simplicity, straightforwardness, and cost-effectiveness. This research aims to evaluate the use of coconut water waste as a liquid organic fertilizer (LOF) in promoting the growth of green bean microgreens (Vigna radiata). The study was conducted over one week in the Kotapinang District of South Labuhanbatu Regency, utilizing analysis of variance (ANOVA) to assess four treatments with varying doses of coconut water LOF: P0 as the control, 10 ml, 20 ml, and 30 ml. The data collected were analyzed using SPSS version 25.00, and the BNT test was applied at the 5% significance level to evaluate the differences between treatments. The results of the observations indicated that at 4 days after planting (DAP), the P3 treatment yielded the greatest plant height, averaging 13.83 cm. Conversely, at 7 DAP, treatment P1 exhibited the highest growth, with an average plant height of 19.66 cm. In terms of leaf width, treatment P1 also performed the best, with an average leaf width of 1.2 cm. These findings suggest that the application of coconut water as LOF can significantly enhance the growth of green bean microgreens.

Keywords: Coconut Water LOF, Liquid Organic Fertilizer, Microgreens, Mung Beans, Waste

1. Introduction

Rapid urbanization and a growing urban population have significantly impacted land use, particularly agricultural land. According to the Central Statistics Agency, Kotapinang in the Kotapinang District of South Labuhanbatu Regency has experienced a notable population increase, rising from 64,445 people in 2021 to 65,348 people in 2022, with an estimated population of 66,418 in 2023. In this context, it is becoming increasingly urgent to find ways to meet the community's food needs as land availability continues to diminish while the population keeps growing.

This stimulates the creation of innovation in more efficient and sustainable agricultural practices. One alternative that can be taken is the practice of urban farming, where people are given the opportunity to utilize available land, especially in urban areas, to grow vegetables and other food crops. The reduction in agricultural land and the density of the residential regions have encouraged the emergence of a new concept of gardening on limited land called urban farming.

Microgreen is a new approach to implementing urban farming that is considered simpler, simpler, and cheaper. With these characteristics, microgreen is a practical choice for those who live in urban areas where land for farming is limited. One of the legume plants that can be cultivated using microgreens is mung beans. This plant was chosen because of its rapid growth and high success rate, and can grow in various environmental conditions, making it an attractive choice for new farmers.

Research on the use of cocopeat media for microgreens shows promising results. According to the study, a mixture of cocopeat and organic compost can provide similar or higher nutritional quality in microgreens than using traditional soil-based media. This finding shows that cocopeat not only provides a structure that supports good root growth but can also increase the availability of nutrients for plants. (Fairuz Muazi, 2024) also reported that red spinach microgreens using cocopeat planting media were superior to other planting media, with a germination percentage of 95% and a plant height of 3.7 cm. These observations show that the use of cocopeat media can increase plant growth efficiently, even though the number of cotyledons growing in the three planting media is the

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same, which is 2 strands.

The cultivation of green bean microgreens can be increased by providing sufficient and perfect nutrition. In addition to the role of the planting medium, nutrition also plays an essential role in supporting optimal plant growth. One of the nutrients that can encourage the growth of green bean microgreens is by providing liquid organic fertilizer (POC). Organic fertilizer is a fertilizer that is composed of biological material, such as the decomposition of plant remains; currently, there is a shortage of inorganic fertilizers, and if there are any, they are expensive for farmers. Therefore, it is necessary to find alternative fertilizers that are practical to obtain and environmentally friendly. Fertilizers available on the market are in solid and liquid form.

Organic fertilizer is an environmentally friendly fertilizer, but it generally has limitations in nutrient content. However, it still has a good effect on plants. Liquid organic fertilizer (POC) has one advantage: it is easily absorbed by plants, both through the roots and leaves. One of the ingredients that can be used as an alternative nutrient supplement for plants is coconut water. The content of coconut water consists of vitamins, amino acids, minerals, sodium (Na), calcium (Ca), magnesium (Mg), iron (Fe), sulfur (S), copper (Cu) and sugar.

Coconut water is a natural liquid found in young coconuts and is known to be rich in nutrients. Coconut water contains potassium, sodium, magnesium, and calcium, which help maintain the body's fluid balance and prevent dehydration. In addition to being a refreshing drink, coconut water also has various other benefits, such as in agriculture and beauty. In agriculture, coconut water is often used as a liquid organic fertilizer because it contains natural growth hormones such as cytokinins and auxins that can stimulate plant growth. Meanwhile, in the world of beauty, coconut water is used as a natural ingredient to maintain skin moisture, treat acne, and provide a refreshing effect on the body.

Zahra Al Banna et al. (2023) reported that the application of old coconut water with a concentration of 300 ml had a positive effect on plant height parameters, number of leaves, and leaf area in mustard plants. This finding confirms that the use of old coconut water can increase agricultural productivity, especially in vegetable plants. In addition to mustard greens, the impact of administering old coconut water was also studied in green grape plants of the Jestro Ag-86 variety, where green grape plants that were not given old coconut water treatment experienced a lack of nutrients, which resulted in slow growth.

This indicates that the use of old coconut water not only reduces waste but also provides significant agronomic benefits. This illustrates that coconut water can be a crucial additional source of nutrients for plants, especially when their growth is not optimal. Coconut water can hypnotize plant growth when given at optimum doses. Therefore, it is essential to ensure the appropriate dosage so that the potential benefits of coconut water can be optimized.

According to (Afifah Mergiana, 2021), The growth hormone in coconut water can increase plant growth by 20-70%. The nutritional content of coconut water is quite complete, so when applied to plants in optimal doses, it certainly has a positive effect on plants. Pakchoy mustard plants that were given a concentration of 300 ml of old coconut water received the highest value in the category of plant height, wet weight and dry weight of pakchoy mustard plants.

Based on the background description above, it is necessary to conduct research with the aim of determining the use of coconut water waste as liquid organic fertilizer for the growth of green bean microgreens (*Vigna radiata*).

2. Material and Methods

2.1. Place and Time

The research was conducted for one week on Jl. Bukit Kotapinang, Kotapinang District, South Labuhanbatu Regency, with coordinates 1 ° 45'27.1 "LU, 100 ° 07'01.2" BT, with an altitude of approximately ± 25 meters above sea level. This research on January 1 - January 7, 2025. The object of the study was green beans (Vigna *radiata*), the observed parameters of which were the height and diameter of the microgreen stem.

2.2. Tools and Materials

Tools: Saw, hammer, drill, nails, caliper, plywood, planting container, sprayer, jerry can, measuring cup, ruler, scissors, bucket, label paper, camera, white tape, 10-watt LED lights (2), and stationery. Materials: Mung bean seeds, old coconut water, EM4, white sugar, well water, and cocopeat.

2.3. Research Methods

Analysis of variance (ANOVA) is used to test the effect of therapy. If the F-test results show a significant difference at the 5% level, you can identify which treatment gives the best results (Xie & Yan, 2023). Furthermore, data analysis will be continued by conducting the Least Significant Difference (LSD) test at the same level, namely 5% (Kustiani et al ., 2021).

2.4. Work Procedures

Making Shelves and Installing LED Lights, Preparation of Coconut Water POC, Preparation of Planting Media, Labeling, Seed Preparation, Planting, Watering, Use of POC applied according to the specified dose every 2 days after planting.

2.5. Observation

The height of Mung Bean Microgreen was observed at 4 HST and 7 HST, and Leaf Width was observed at 7 HST.

This data processing uses the SPSS 25 application.

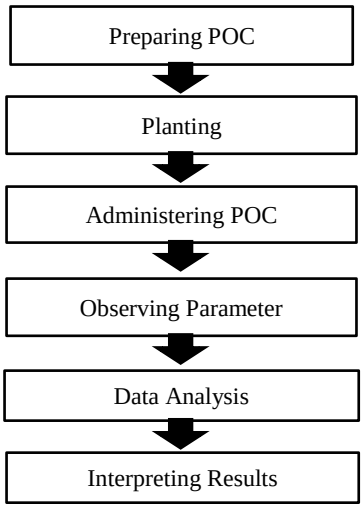

Figure 1. Research Flow Diagram

3. Results and Discussion

3.1. Plant height

Plant height measurements for each treatment (4 treatments) for each replication (3 replications) of plants were measured 2 times, where measurements were taken at 4 HST and 7 HST. By measuring each treatment starting from the surface of the planting medium to the highest leaf. The image of plant height 4 HST when taking measurements is seen in Figure 2.

The results of the 5% BNT test in Table 1 show the height of green bean microgreens at the age of 4 HST with the provision of control coconut water POC, namely 13 cm, 10 ml (13.26 cm), 20 ml (13.33 cm) and 30 ml (13.83 cm) stating that there is no significant difference in all treatments. The effect on plant height 4 HST is thought to be due to the concentration given to the plants being sufficient in the plant growth process, where coconut water contains ZPT in the form of auxin, cytokinin and gibberellin. This is in accordance with the statement (Ratna Nurhayati & Sita Sari, 2023) that coconut water can encourage plant growth through the content of auxin, cytokinin and gibberellin.

Figure 2. Plant height at 4 HST

Table 1. The results of plant height 4 HST with the 5% BNT test

Percentage	Average	Notation
Control	13 ± 0.20	a
20 ml POC	13.26 ± 0.20	a
10 ml POC	13.33 ± 0.20	a
30 ml POC	13.83 ± 0.20	a

Description: Numbers followed by the same letter in the same column show no significant difference in the 5% BNT test.

The microgreen growth process is also influenced by the characteristics of the cocopeat planting medium, which contains nitrogen (N) and potassium (K) at fairly good levels and has a high organic carbon content. All of this contributes to optimal microgreen growth (Ramadhan, 2017) . According to (Alrifai, et al 2019), the most important macronutrient to support physiological processes and the growth of roots, leaves and stems is nitrogen.

This is in line with research conducted by, which shows that the use of cocopeat planting media has a significant effect on plant height, number of leaves, leaf width, and fresh weight.

The image of the plant height 7 HST when the measurement was carried out can be seen in Figure 2. After observing the height of plants 7 HST on the control, 10 ml, 20 ml, and 30 ml. The measurement results can be seen in Table 2.

The results of the 5% BNT test of the effect of giving liquid organic fertilizer coconut water on plant height 7 HST showed differences. As for the growth parameters of the height of microgreen green bean plants, treatment P1 was the provision of 10 ml coconut water POC/planting

container with an average height of 19.66 cm, stating that it was significantly different in all treatments, namely control (18.16 cm), 20 ml (18.66 cm) and 30 ml (19 cm). The effect on plant height 7 HST is thought to be due to the concentration given to plants being sufficient in the plant growth process where coconut water contains ZPT in the form of auxin, cytokinin and gibberellin. In line with research (Ramli et al ., 2023) the application of 100 ml of coconut water per tray and cocopeat planting media on the height, number of leaves and wet weight of mustard green microgreens showed the most optimal results among all treatments. The results of measuring the average plant height 4 HST and 7 HST in control observations, 10 ml, 20 ml, and 30 ml, can be seen in Figure 4.

Figure 3. The height of plant at 7 HST

Table 2. The results of plant height 7 HST with the 5% BNT test

Percentage	Average	Notation
Control	18.16 ± 0.36	a
20 ml POC	18.66 ± 0.36	b
30 ml POC	19 ± 0.36	b
10 ml POC	19.66 ± 0.36	c

Description: Numbers followed by the same letter in the same column show no significant difference in the 5% BNT test.

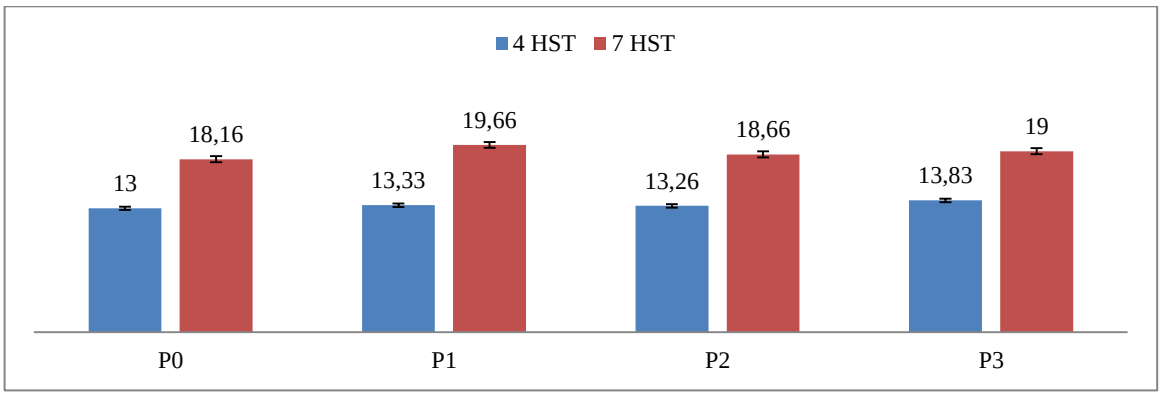

Figure 4. Graph of Plant Height 4 and 7 HST

Afifah Mergiana (2021) stated that old coconut water has several benefits, one of which is as a natural ZPT because it contains hormones that can increase plant growth. In addition to coconut water POC fertilizer, planting media plays an essential role in the plant development process. The use of cocopeat planting media shows a high ability to absorb water, which is very effective in storing moisture with a neutral pH. In addition, cocopeat also contains natural nutrients that support plant growth (Hafizah et al ., 2019). This is in line with the opinion of (Vira Yunia et al ., 2013) that cocopeat planting media is better than other planting media in supporting the quality of microgreens.

3.2. Leaf Width

Leaf width measurement for each treatment (4 treatments) for each replication (3 replications) of plant leaves was measured at the age of 7 HST. By measuring from the right side of the leaf to the left side of the leaf using a ruler. The image of the leaf width 7 HST when taking measurements is seen in Figure 5. After observing the leaf width 7 HST on the control, 10 ml, 20 ml, and 30 ml, the measurement results can be seen in Table 3.

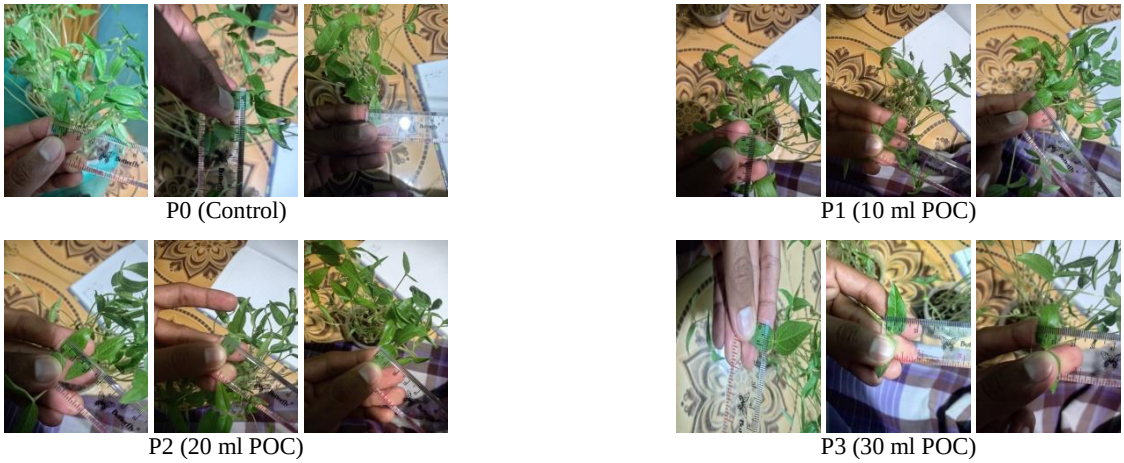

Figure 5. Leaf width 7 HST

Table 3. Leaf width 7 HST with the BNT test at 5% level

Percentage	Average	Notation
Control	1.06 ± 0.034	a
20 ml POC	1.13 ± 0.034	ab
30 ml POC	1.16 ± 0.034	b
10 ml POC	1.2 ± 0.034	b

Description: Numbers followed by the same letter in the same column show no significant difference in the 5% BNT test.

The results of the 5% BNT test of the effect of giving liquid organic fertilizer coconut water on the width of leaves 7 HST showed a difference. As for the growth parameters of the height of the microgreen green bean plants, treatment P1 was the provision of 10 ml coconut water POC/planting container with an average leaf width of 1.2 cm, stating that there was a significant difference between the control treatment of 1.06 cm, Dose 20 with a value of 1.13 cm, while in the treatment of dose 30, there was no significant difference.

There is a difference in leaf width between treatments P1, P0 and P2, this is in line with research (Afifah Mergiana, 2021) in her study on the provision of liquid organic coconut water fertilizer on the growth of green grape plants; there is an effect on leaf width and healthy leaf growth. Because coconut water (*Cocos nucifera*) is rich in vitamins that play an essential role as stimulants in the process of tissue development, metabolism, and plant respiration, in addition, coconut water can also support the process of cell division and differentiation in plants (Marsono, 2022). S Lazuardi (2024) stated that fertilizers used in the right concentration can increase chlorophyll synthesis and photosynthesis processes, which are essential. The results of measuring the average leaf width at 7 HST can be seen in Figure 6.

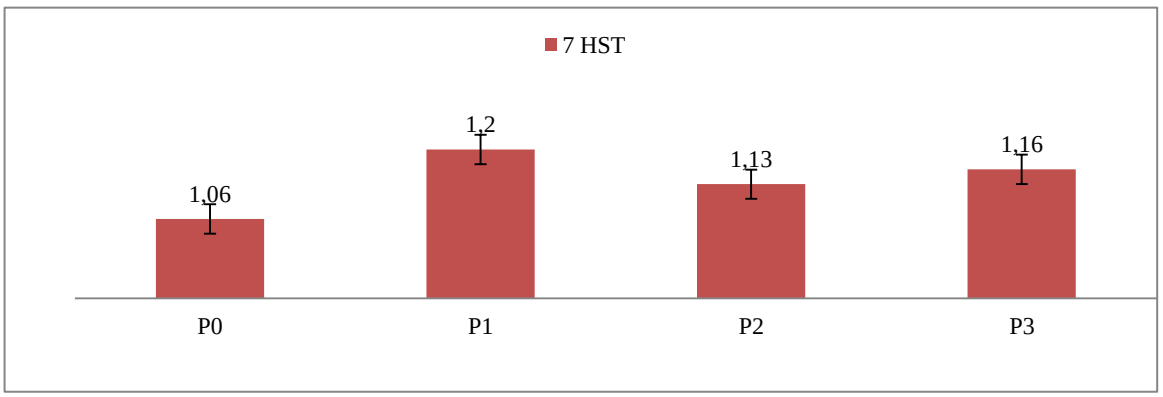

Figure 6. Leaf Width Graph 7 HST

From the analysis of the average leaf width graph, the applied treatment had a positive effect on the development of leaf width, with the 10 ml dose treatment showing the best results with an average of 1.2 cm, followed by the 30 ml dose 1.16 cm and the 20 doses 1.13 cm, while the control dose had the lowest value 1.06 cm.

4. Conclusion

The use of coconut water as a liquid organic fertilizer has proven to be highly effective in promoting the growth

of green bean microgreens (*Vigna radiata*) due to its content of plant growth regulators (PGRs) such as auxins, cytokinins, and gibberellins. Research indicates that a dosage of 30 ml of coconut water POC per planting container results in the greatest plant height at 4 days after planting (DAP). Conversely, a dosage of 10 ml yields the best results in plant height at 7 DAP, highlighting the significance of optimal fertilizer concentration. Additionally, treatment with a dosage of 10 ml also produces the widest leaf width at 7 DAP. These findings support sustainable urban farming practices by utilizing coconut water waste as a natural nutrient source, providing an environmentally friendly and cost-effective fertilizer alternative for farmers.

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