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Response to Applying Vegetable Liquid Organic Fertilizer (POC) on Cucumber Plants (*Cucumis sativus* L.) Growth and Production

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ABSTRACT

The horticultural plant *Cucumis sativus* L., commonly known as the cucumber plant, is highly favored and extensively grown in different regions across the globe. This study aims to establish the most effective concentration of liquid organic fertilizer for enhancing the growth and yield of cucumber crops and to offer valuable guidance for farmers seeking to enhance the efficiency and productivity of cucumber cultivation by employing liquid organic fertilizer. The study adopts a non-factorial randomized block design and includes 5 variance tests to determine whether there is a significant difference in further testing using BNT at the 5% significance level. The findings indicated that the 100-dosage treatment yielded consistently superior outcomes regarding fresh fruit weight, fruit length, and the quantity of fruit per harvest compared to alternative treatments. The administration of the 100 doses resulted in a significant increase in the fruit's fresh weight, with the most favorable outcomes observed at Harvest 3. Conversely, the 0 dose exhibited lower results across all measured parameters. The dosis 50 treatment demonstrated favorable outcomes, although not to the same extent as the Dosis 100. Conversely, the dosis 75 treatment yielded suboptimal results in enhancing fruit production.

Keywords: *Cucumber Growth, Cucumber Plants, Cucumber Production, POC, Vegetable Waste*

1. INTRODUCTION

Cucumis sativus L., commonly known as the cucumber plant, is a highly favored horticultural plant extensively grown in different regions across the globe. Belonging to the Cucurbitaceae family, this plant is characterized by its elongated, green fruit. With a water content of approximately 95%, cucumbers are widely appreciated for their hydrating properties and are frequently used as a refreshing ingredient in various culinary preparations. Moreover, cucumbers are a good source of essential nutrients such as vitamin C, vitamin K, potassium, and magnesium, which contribute to overall health by promoting hydration, supporting skin health, and aiding in managing blood pressure (Tampinongkol & Tamod, 2021).

Cultivating cucumbers is a straightforward process that can be carried out in various environmental settings, including open fields and greenhouses. This plant thrives best in warm temperatures and requires ample sunlight exposure and nutrient-rich soil high in organic matter. When cultivating cucumbers, it is essential to sow the seeds directly into the soil and ensure they receive adequate watering, particularly during the initial growth phase and fruit development. Moreover, ample nutrients in the soil are crucial for supporting the optimal growth of cucumber plants. Nutrients like nitrogen, phosphorus, and potassium must be present in sufficient quantities to facilitate photosynthesis, root growth, and the production of healthy fruits. Typically, cucumber harvests can be expected within 50-70 days after planting, depending on the specific variety and growing conditions. Cucumbers offer agronomic advantages as they can be harvested relatively quickly, enabling farmers to achieve rapid and consistent results. (Sebastianus, 2021).

Liquid Organic Fertilizer (POC) obtained from vegetable waste is a novel approach in sustainable farming that repurposes leftover vegetable materials. Unused parts of vegetables, like leaves and stems, can undergo fermentation to create POC. This method entails the breakdown of organic substances by microorganisms, resulting in a liquid fertilizer packed with vital nutrients like nitrogen, phosphorus, and potassium. Using POC derived from vegetable waste minimizes waste generation and enhances soil quality and plant well-being (Daryanto et al., 2020).

POC from vegetable waste has various benefits for plants. Nutrients contained in POC help to increase vegetative and generative growth of plants, such as an increase in plant height, number of leaves, and flower and fruit production. In addition, POC also helps increase the activity of soil microorganisms that play an important role in the decomposition of organic matter and the provision of nutrients for plants. The use of POC from vegetable waste is also more environmentally friendly compared to chemical fertilizers, as it reduces the risk of soil and water pollution. Thus, POC from vegetable waste is an effective and sustainable solution to increase agricultural productivity while preserving the environment (Daryanto, et al , 2020).

Issues related to the development and yield of cucumber plants treated with vegetable POC may differ based on various factors, including the concentration of POC utilized, the frequency of application, and the environmental conditions in which the plants are grown. A prevalent problem that frequently occurs is nutrient imbalance. Even though POC from vegetable waste contains essential nutrients, improper concentration can lead to deficiencies or excesses of certain nutrients in plants. For instance, excess nitrogen from POC can result in excessive vegetative growth and suboptimal fruit production. Conversely, deficiencies in specific nutrients can impede growth and diminish crop yields (Mading et al., 2021).

An additional issue is the risk of pathogenic microorganisms becoming contaminated from poorly fermented point-of-care (POC) samples. If the fermentation process is not conducted accurately, the plant origin compost (POC) may harbor pathogenic microorganisms that can potentially induce diseases in cucumber plants. Furthermore, the incorporation of partially decomposed organic matter can obstruct soil pores, diminish aeration, and impede plant roots' uptake of water and nutrients. As a result, it is crucial to guarantee the appropriate processing and application of POC at the correct dosage in order to maximize the growth and yield of cucumber plants while minimizing any adverse impacts (Daryanto et al., 2020).

Prior research has indicated that the utilization of POC has the potential to enhance the production of cucumber plants through the improvement of soil fertility and the increase in nutrient availability. A study by Dr Sutrisno in 2018 demonstrated that using POC derived from agricultural waste led to a significant increase in cucumber yields, with an improvement of up to 20% (Sutrisno, 2018). Furthermore, Dr. Lestari's 2019 research revealed that applying POC obtained from fermented organic materials also enhanced cucumber growth and production (Lestari, 2019). This particular study differs from previous research as it focuses on utilizing POC derived from banana stems and measuring specific growth parameters such as plant height, number of leaves, and leaf area. With its comprehensive approach, this study is anticipated to offer practical recommendations for farmers.

The author will investigate the effects of liquid organic fertilizer (POC) application on vegetable plants, specifically cucumbers (*Cucumis sativus* L.), based on the problem outlined earlier. This study aims to identify the most effective dosage of liquid organic fertilizer for enhancing cucumber growth and yield. Additionally, it offers practical suggestions to farmers on improving the efficiency and productivity of cucumber cultivation by utilizing liquid organic fertilizers.

2. MATERIAL AND METHODS

2.1 Research Site and Time

This research will be conducted in Teluk Sentosa, Panai Hulu District, Labuhanbatu Regency, North Sumatra, with 2º27'09.6" N 100º11'09.6" E coordinates. The research activities are scheduled to take place from May to June 2024. The research site is located at an altitude of approximately 30 meters above sea level (asl).

2.2 Research Tools and Materials

This research was conducted with several preparations including materials and tools. The materials used are Zatavy F1 cucumber seeds, vegetables as the base for making liquid organic fertilizer, EM4, sugar/molasses, water, and soil. The tools provided include a hoe, polybags, wood for supports, a watering can paint buckets, raffia string, label boards, measuring cups, scales, rulers or measuring tapes, and writing instruments.

2.3 Experimental Design

The method employed in this study utilizes a Randomized Block Design (RBD) (Hairuddin & Ariani, 2017) Non-Factorial with 4 treatments and 6 replications, resulting in a total of 24 experimental units.

The treatments in this research consist of four different applications on plants using Liquid Organic Fertilizer (LOF) derived from vegetable waste. The treatment T0 serves as a control without LOF, whereas T1, T2, and T3 use LOF from vegetable waste at varying doses of 50 ml, 75 ml, and 100 ml, respectively.

2.4 Data Analysis

The observation data obtained were analyzed using the F-test and organized in an Analysis of Variance (ANOVA) table at a 5% significance level (Xie & Yan, 2023). If a significant effect is found, the Least Significant Difference (LSD) test at the 5% level will be followed to examine the differences among the treatment groups (Irwansyah *et al*., 2019).

2.5 Observation Parameter

2.5.1 Plant Height

Plant height observations are carried out by measuring from the soil surface to the highest point of the plant at 10, 20, and 30 days after planting. The height measurements are conducted using a measuring tape.

2.5.2 Number of fruits (pieces)

Fruit observations were conducted 35 to 38 days after planting, with fruit samples collected twice a week. The quantity of fruit was recorded for each polybag/sample.

2.5.3 Fruit Length (cm)

Fruit length observations were measured at harvest by measuring the fruit per sample using a ruler.

2.5.4 Fruit weight per sample (g)

Observation of fruit weight per sample was carried out by weighing using a scale per sample and performed with 2 times a week harvesting.

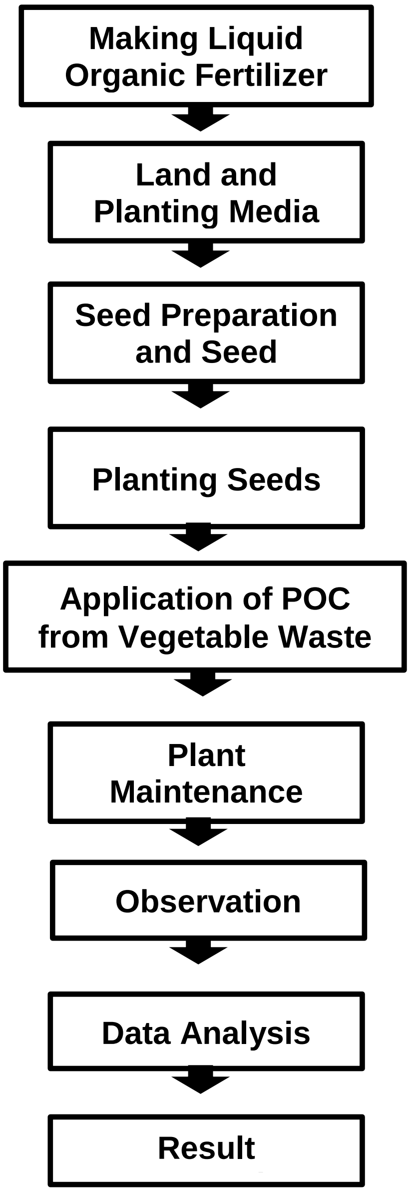

Figure 1*.* Research Flow Diagram

3. RESULT AND DISCUSSION

Based on observations and analyses, the height of cucumber plants is presented in Table 1. The DMRT was utilized to compare measurement results across five distinct treatment groups at a

5% significance level. The analysis revealed significant differences between treatments within each data group. For instance, the first treatment group's data exhibited markedly different outcomes when compared to the second and third treatment groups. Values such as 14.96b, 28.92b, and 42.28c indicate significant disparities with values denoted by different letters (a, b, c) in the DMRT test, signifying notable distinctions in the treatments applied. Conversely, values assigned the same letter in the DMRT test results did not display significant differences from one another. This research aligns with Purnamasari and Sumiati's (2021) study on the Impact of Liquid Organic Fertilizer on Cucumber Plant Growth and Yield. Their research evaluated the impact of POC application on plant height, leaf count, and cucumber fruit yield. The findings suggest that POC utilization can enhance cucumber growth and yield, akin to the various treatments affecting the measured parameters in the data mentioned above. In contrast, Hartono et al.'s (2020) study focused on the Efficacy of Chemical Fertilizers Versus Organic Fertilizers in Tomato Plant Production. This research compared the effects of chemical and organic fertilizers on tomato plant growth and yield, concentrating on factors like fruit size and fruit quantity per plant. Unlike the study on cucumbers and POC usage, this study centered on tomato plants and comparing different fertilizers (Hartono et al., 2020).

3.1 Total Fruit

Based on observations in the field, the number and results of the analysis are presented in Table 2.

Table 1. Plant height

Treatment	10 HST	20 HST	30 HST	40 HST	50 HST
0	14,96±0,69b	28,92±0,69b	42,28±0,69c	58,5±0,69b	72,6±0,69b
50	16,2±0,86a	31,34±0,86a	45,88±0,86a	62,3±0,86a	76,8±0,86a
75	14,56±0,63c	26,76±0,63c	39,68±0,63a	55,4±0,63c	69,5±0,63c
100	16,94±0,80a	32,3±0,80a	47,38±0,80b	65±0,80a	79,4±0,80a

Table 2. Total fruits

	average number of fruits		
Treatment	Harvest 1	Harvest 2	Harvest 3
0	3,6±0,17a	5,4±0,17a	8,4±0,17a
50	3,6±0,23a	5,6±0,23a	8,6±0,23a
75	2,4±0,11b	3,4±0,11b	5,4±0,11b
100	3,4±0,20a	5,4±0,20a	8,4±0,20a

The data from harvests 1, 2, and 3 indicate variations in fruit production treatment, as evidenced by the results of the DMRT test at a significance level of 5%. According to the DMRT test results, treatments 0, dose 50, and dose 100 exhibited an average number of fruits that were not significantly different from each other, denoted by the letter "a". This suggests that treatments 0, dose 50, and dose 100 yielded a similar number of fruits across all harvest stages (harvests 1, 2, and 3). Conversely, the dose 75 treatment showed a significantly lower average number of fruits than the other treatments, as indicated by the letter "b". This significant disparity implies that the 75-dose treatment is less effective in enhancing fruit production than treatments 0, 50, and 100. This finding aligns with Subekti et al.'s (2022) research on the impact of different fertilizers on cucumber plant fruit production. Their study revealed that certain fertilizer treatments improved fruit production, mirroring the discrepancies observed in the aforementioned data (Subekti et al., 2020). In contrast, Rahayu and Hadi's (2021) study on the efficacy of nursery techniques and planting distances on tomato fruit production offers a distinct perspective. This research focuses on the influence of nursery techniques and planting distances on tomato fruit yields, omitting fertilizer or POC treatments while examining growth parameters and fruit yields in tomato plants rather than cucumbers (Rahayu, S., & Hadi, 2021).

3.2 Fruit Length

Based on field observations, Fruit length and analysis results are presented in Table 3.

Table 3. Fruit length

Treatment	Fruit Length		
	Harvest 1	Harvest 2	Harvest 3
0	11,92±0,28b	13,8±0,28b	14,36±0,28a
50	12,8±0,34a	14,1±0,34a	14,32±0,34a
75	10,7±0,23c	12,7±0,23c	13,88±0,23a
100	13,44±0,28a	13,94±0,28a	14,2±0,28a

Fruit length data collected at three different harvests exhibited significant variations among treatments according to the DMRT test at a 5% significance level. The analysis indicated that the 50 and 100 dose treatments resulted in fruit lengths that were not statistically different at harvests 2 and 3, denoted by the same letter "a" in the DMRT test outcomes. Specifically, the 50 dose treatment displayed significantly longer fruit lengths than other treatments at harvests 1 and 2, while the 100 dose treatment consistently maintained fruit length across all harvest stages. Conversely, treatments with 0 and 75 doses yielded lower fruit length results than the 50 and 100 dose treatments, with letters "b" and "c" signifying significant differences. This study aligns with Yadi's 2012 research on the Impact of Organic Fertilizer on Cucumber Fruit Length and Quality, which demonstrated that certain organic fertilizer treatments led to a notable increase in fruit length, mirroring the findings mentioned earlier (Yadi et al., 2012). In contrast, Listari's 2020 study on the Influence of Leaf Pruning and Organic Fertilizer Application on Baby Cucumber Production in Sayang-Sayang Village, West Nusa Tenggara, explores pruning methods and their effects on cucumber fruit length, excluding organic fertilizer involvement and focusing on cucumber plant observations (Listari, 2020).

3.3 Fruit Weight

Based on observations in the field, fruit weight and analysis results are presented in Table 4.

Table 4. Fruit weight

Treatment	Fresh Fruit Weight		
	Harvest 1	Harvest 2	Harvest 3
0	132,2±2,88c	229,6±2,88b	230,4±2,88a
50	135±3.46b	238,2±3.46a	236,6±3.46a
75	143,6±2,30a	239±2,30a	216,2±2,30a
100	143±2,88a	241,6±2,88a	244,8±2,88a

Fresh fruit weight data collected during each harvest revealed notable variances among treatments following analysis using the DMRT Test at a significance level of 5%. During Harvest 1, treatment 0 exhibited the lowest fresh fruit weight (132.2 g), a value that was significantly distinct from the 50, 75, and 100-dose treatments. The 75 and 100 dose treatments yielded higher fresh fruit weights, with the 100-dose treatment producing the most significant weight

(143 g) and moving on to Harvest 2, treatments 0 and 50 doses displayed evident differences, with the 50-dose (238.2 g) outperforming the 0 dose (229.6 g). Furthermore, the 100-dose treatment (241.6 g) demonstrated significantly superior results compared to the other treatments. Finally, at Harvest 3, significant distinctions were observed among treatments 0, 50 dose, 75 dose, and 100 doses. The 100-dose treatment yielded the highest fresh fruit weight (244.8 g), a value that was significantly different from the 75-dose (216.2 g) and 0 dose (230.4 g) treatments, while the 50-dose treatment showed results that were not significantly different from the 100 dose treatment.

The results from the DMRT test revealed that the 100-dose treatment consistently exhibited superior outcomes at each harvest compared to the other treatments, particularly at Harvest 3, where the 100 dose treatment yielded statistically significantly distinct results from the other treatments. Conversely, treatment 0 displayed relatively lower outcomes across all harvests, notably at Harvest 1 and 3. These findings suggest that the 100-dose treatment has a notable positive impact on fresh fruit weight, while treatment 0 is less effective in enhancing fresh fruit weight. This investigation aligns with the research conducted by Sari et al. (2023) titled "The Effect of Organic Fertilizer on Fresh Weight of Tomato Fruit at Various Harvest Stages." The study also demonstrated that a specific fertilizer dosage led to superior outcomes regarding fresh weight of tomato fruit compared to the control treatment. The outcomes of this study corroborate the notion that treatments with higher dosages consistently yield better results, akin to the 100-dose treatment in this study (Sari, et al 2023). In contrast, a study by Hasan et al. (2022) titled "Effectiveness of Chemical Fertilizer Variations on Fruit Weight in Chili Plants" indicated that variations in the type of chemical fertilizer do not always result in significant disparities in fruit weight. The study discovered that certain treatments produced outcomes similar to the control, which contradicts the findings of this study that highlighted significant differences between treatments. This underscores the notion that the efficacy of treatments in enhancing fresh fruit weight can vary depending on the plant species and research conditions (Hasan, *et al* 2022).

3.4 Research Documentation

Figure 2. Seedling of plants

Figure 3. Plant growth of cucumber

Figure 4. Plant growth of cucumber

4. CONCLUSION

The application of the DMRT Test at a 5% significance level for data analysis revealed that the 100-dose treatment consistently yielded superior results regarding fresh fruit weight, fruit length, and the number of fruits harvested compared to the other treatment options. The 100-dose treatment yielded a significant increase in fresh fruit weight, particularly at Harvest 3, while treatment 0 exhibited lower results across all measured parameters. The treatment consisting of 50 doses also demonstrated favorable outcomes, albeit not to the extent of the 100-dose treatment. On the other hand, the 75 doses of treatment yielded suboptimal results in enhancing fruit production.

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