

The Influence of Dosage and Frequency of Turi Leaf Liquid Organic Fertilizer (*Sesbania grandiflora*, L.) Application on the Growth and Yield of Land Spinach Plants (*Ipomoea reptans* Poir)

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Abstract

This study aims to determine the effect of dosage and frequency of liquid organic fertilizer made from Turileaves on the growth and yield of land spinach plants (*Ipomoea reptans* Poir). The study used a factorial randomized block design (RBD) consisting of 2 factors. The first factor is the dosage of turi leaf liquid organic fertilizer consisting of 4 levels, namely, Turi Leaf LOF 0 ml/l (P0), Turi Leaf LOF 1.5 ml/l (P1), Turi Leaf LOF 3 ml/l (P2), Turi Leaf LOF 4.5 ml/l (P3). The second factor is the frequency of application consisting of 3 levels, namely application of LOF once a week (F1), application of LOF twice a week (F2), and application of LOF three times a week (F3). The results showed that the application of a dosage of 4.5 ml/l liquid organic fertilizer 3 times a week application gave the best results for plant height (30.60 cm), Number of Leaves (14 leaves), Stem Diameter (8.36 mm), Root Length (16.76 cm), and Harvest Weight (11.86 gr).

Keywords: Land Spinach, Turi Leaf LOF, Dosage, Dosage Frequency.



A. INTRODUCTION

Land spinach (*Ipomoea reptans* Poir) in Indonesia is a vegetable that is highly favored by the public. In addition to being consumed as a vegetable, land spinach can also be used as an herbal remedy for ailments such as gastritis, insomnia, and headaches (Soelistianto and Atmadja, 2019). This plant is suitable for cultivation in both lowland and highland areas. It is classified as an annual plant with a short lifespan (Amalia et al., 2024). Land spinach (*Ipomoea reptans* Poir) is considered a weed (Jeanine Arana et al., 2022) but can also be utilized as a vegetable. It contains protein and minerals, particularly iron. In 2022, the Central Bureau of Statistics (BPS) recorded land spinach production in Indonesia at 331,478 tons. This amount decreased by 2.8% compared to 2021, which was 341,196 tons. The BPS survey in 2022 noted an increase in land spinach consumption by 4.44% (Kementrian Pertanian RI, 2022).

The increase in household consumption of land spinach necessitates the implementation of sustainable cultivation methods. Vegetable farmers in Indonesia typically use inorganic fertilizers to meet the nutritional needs of land spinach plants. However, the continuous use of inorganic fertilizers can reduce soil productivity. Therefore, the use of organic fertilizers is recommended as a better option. Organic fertilizers have a complete composition of nutrients, but each type of nutrient is present in small amounts. Organic fertilizers can be beneficial as a source of organic matter and nutrients for plants (Syolikhat and Nufus, 2023). One of the advantages of organic fertilizers is their ability to increase land productivity and prevent soil degradation. Liquid organic fertilizers, even when used regularly, do not cause damage to the soil and plants. Additionally, they can provide nutrients that meet the specific needs of plants (Putra and Ratnawati, 2019).

Turi leaves (*Sesbania grandiflora* L.) have the potential to be used as raw material for compost and green manure because they contain various important macro and micronutrients. Liquid organic fertilizer (LOF) made from turi leaves has not been widely used by farmers to enhance land spinach production, and there is limited research on the use of LOF from turi leaves for improving the growth and yield of land spinach, particularly regarding the dosage and frequency of its application.

The objectives of this research are to determine the effect of the interaction between the dosage and frequency of turi leaf liquid organic fertilizer (LOF) application on the growth and yield of land spinach (*Ipomoea reptans* Poir), to assess the impact of different dosages of turi leaf LOF on the growth and yield of land spinach, and to evaluate the effect of the frequency of turi leaf LOF application on the growth and yield of land spinach.

B. METHOD

This research was conducted from April to May 2023 at the garden of Dukuh Bima Housing Complex, Bekasi Regency. This research used a factorial Randomized Block Design (RBD). The first factor, the dosage of turi leaf Liquid Organic Fertilizer (LOF), consisted of 4 levels: 0 ml/l (P0), 1.5 ml/l (P1), 3 ml/l (P2), and 4.5 ml/l (P3). The second factor, the frequency of LOF application, consisted of 3 levels: once per week (F1), twice per week (F2), and three times per week (F3). The data collected during observations were then processed using analysis of variance (ANOVA) (F-test) at a 5% significance level. If the ANOVA results showed a significant effect, further analysis was conducted using the Duncan Multiple Range Test (DMRT) at a 5% significance level.

C. RESULT AND DISCUSSION

1. Plant Height

Based on the analysis of variance, the dosage and frequency of turi leaf liquid organic fertilizer application had a significant effect on plant height at 8 Days After

Planting (DAP), 16 DAP, and 24 DAP. However, the interaction between these factors did not show a significant effect on plant height at 8 DAP, but it did have a significant effect on plant height at 16 DAP and 24 DAP.

Table 1. Results of the Follow-up Test on the Main, Single, and Interaction Effects on Plant Height

Observation Time	Dosage of LOF (ml/l)	Frequency of Application			Average
		F1	F2	F3	
8 DAP	(P0)	5.30	5.50	5.20	5.33 a
	(P1)	6.10	5.93	6.33	6.12 b
	(P2)	5.56	6.10	6.83	6.16 b
	(P3)	6.13	6.03	7.13	6.43 b
Average		5.77 a	5.89 a	6.37 b	(-)
16 DAP	(P0)	6.00 a	6.03 a	5.90 a	5.98 a
	(P1)	8.96 b	12.66 c	15.73 d	12.45 b
	(P2)	16.36 de	17.66 e	19.33 f	17.78 c
	(P3)	19.63 f	21.96 g	24.13 h	21.91 d
Average		12.74 a	14.58 b	16.28 c	(+)
24 DAP	(P0)	6.63 a	6.76 a	6.66 a	6.68 a
	(P1)	10.33 b	15.00 c	18.63 d	14.65 b
	(P2)	19.60 d	24.30 e	26.36 f	23.42 c
	(P3)	26.53 f	27.10 f	30.60 g	28.08 d
Average		15.78 a	18.3 b	20.57 c	(+)

*Numbers followed by the same letter in the same row and column do not show significant differences at the 5% DMRT level. (-): No interaction between factors.

In Table 1, plants at 8 days after planting (DAP) showed the highest plant height (6.43 cm) in treatment P3. The main effect of treatment F3 showed the highest plant height (6.37 cm) compared to treatments F1 and F2. At 16 DAP, the main effect of treatment P3 showed the highest plant height (21.91 cm), which was significantly different from the plant height in treatments P1 and P2. The main effect of treatment F3 resulted in the highest plant height (16.28 cm). At 24 DAP, the main effect of treatment P3 showed the highest plant height (28.08 cm). The main effect of treatment F3 showed the highest plant height (20.57 cm) compared to treatments F1 and F2.

The results of Noviana's (2022) research show that the height of water spinach plants increased in line with the increase in the amount of liquid organic fertilizer (LOF) applied. The nutrient content in LOF can promote plant growth. The amount of nutrients absorbed will affect plant height; if the plant receives the right amount of nutrients, its growth will be optimal. However, an excessive dosage of nutrients

can also be detrimental to the plant (Puspawati et al., 2016). At 24 days after planting (DAP), the water spinach plants reached their highest growth, as the plants were able to absorb nutrients well because parts such as roots and leaves had developed properly.

2. Number of Leaves

Based on the results of the analysis of variance, the treatment dosage, frequency of turi leaf liquid organic fertilizer (LOF) application, and their interaction did not have a significant effect at 8 days after planting (DAP). However, at 16 DAP and 24 DAP, they showed a significant effect on the number of leaves.

Table 2. Results of the Follow-up Test on the Main, Single, and Interaction Effects on the Number of Leaves

Observation Time	Dosage of LOF (ml/l)	Frequency of Application			Average
		F1	F2	F3	
8 DAP	(P0)	4.33	4.33	4.67	4.44
	(P1)	4.67	4.67	4.67	4.67
	(P2)	4.67	4.67	5.00	4.78
	(P3)	4.67	5.00	5.33	5.00
Average		4.58	4.66	4.92	(-)
16 DAP	(P0)	5.00 a	5.33 b	5.33 b	5.22 a
	(P1)	6.33 c	7.33 cd	6.67 cd	6.78 b
	(P2)	7.67 d	8.67 e	10.67 g	9.00 c
	(P3)	9.67 f	11.00 h	11.67 h	10.78 d
Average		7.16 a	8.08 b	8.58 b	(+)
24 DAP	(P0)	5.67 a	6.67 ab	6.33 ab	6.22 a
	(P1)	7.00 c	7.67 c	8.67 de	7.78 b
	(P2)	8.33 d	9.33 e	11.33 g	9.66 c
	(P3)	10.00 f	11.67 g	14.00 h	11.89 d
Average		7.75 a	8.83 b	10.04 c	(+)

*Numbers followed by the same letter in the same row and column do not show significant differences at the 5% DMRT level. (-): No interaction between factors.

In Table 2, plants 8 days after planting (DAP) showed the highest number of leaves (5.00 leaves) in treatment P3. Treatment F3 yielded the highest result (4.92 leaves), which was not significantly different from treatments F1 and F2. Plants at 16 DAP showed the highest result (10.78 leaves) in treatment P3. Meanwhile, the main effect of treatment F3 resulted in the highest number of leaves (8.58 leaves) compared to treatments F1 and F2. At 24 days after planting (DAP), the main effect of treatment P3 showed the highest number of leaves (11.89 leaves) compared to the number of

leaves in treatments P1 and P2. Meanwhile, the main effect of treatment F3 resulted in the highest number of leaves (10.04 leaves).

P1 and P2, the growth of the number of leaves appeared to be almost the same, but overall, it can be seen that the dosage treatment with a frequency of LOF application 3 times a week showed the best results compared to application 1 or 2 times a week. According to Oktaviani et al. (2022), the amount of growth factors obtained by each plant is still sufficient for life, especially during the vegetative phase

3. Steam Diameter

The results of the analysis of variance showed that the treatment dosage, frequency of application of turi leaf liquid organic fertilizer (LOF), and their interaction did not have a significant effect on the stem diameter parameter at 8 days after planting (DAP), but had a significant effect on stem diameter at 16 DAP and 24 DAP.

Table 3. Results of the Follow-up Test on the Main, Single, and Interaction Effects on Stem Diameter

Observation Time	Dosage of LOF (ml/l)	Frequency of Application			Average
		F1	F2	F3	
8 DAP	(P0)	1.70	1.86	1.90	1,82
	(P1)	1.90	1.96	1.83	1,90
	(P2)	1.80	1.90	1.76	1,82
	(P3)	1.80	2.16	1.93	1,97
Average		1,80	1,97	3,22	(-)
16 DAP	(P0)	1.23 a	2.30 a	2.63 a	2.05 a
	(P1)	3.43 b	3.83 b	4.56 c	3.94 b
	(P2)	4.80 c	5.03 c	5.56 d	5.13 c
	(P3)	5.70 d	6.73 e	7.36 f	6.60 d
Average		3.80 a	4.47 b	5.03 c	(+)
24 DAP	(P0)	2.73 a	2.86 a	3.36 b	2.98 a
	(P1)	5.53 c	5.66 c	6.53 d	5.91 b
	(P2)	6.56 d	7.00 e	7.46 e	7.01 c
	(P3)	7.50 ef	7.73 f	8.36 g	7.86 d
Average		5.58 a	5.81 a	6.43 b	(+)

*Numbers followed by the same letter in the same row and column do not show significant differences at the 5% DMRT level. (-): No interaction between factors.

In Table 3, plants at 8 days after planting (DAP) showed the highest stem diameter (1.97 mm) in treatment P3, but it was not significantly different from the stem diameter in treatments P1 and P2. Meanwhile, the main effect of treatment F3

resulted in the highest stem diameter (3.22 mm) compared to treatments F1 and F2. Plants at 16 DAP produced the highest stem diameter (6.60 mm) in treatment P3. Meanwhile, the main effect of treatment F3 resulted in the highest stem diameter (5.03 mm). At 24 DAP, the main effect of treatment P3 resulted in the highest stem diameter (7.86 mm) compared to the stem diameter in treatments P1 and P2. Meanwhile, the main effect of treatment F3 resulted in the highest stem diameter (6.43 mm) compared to treatments F1 and F2.

Stem diameter is one of the important indicators of plant growth. The stem is a crucial part of the plant, also referred to as the plant axis, due to its vital role in supporting and providing structure to the plant. According to Cahyono (2016), an appropriate concentration of liquid organic fertilizer contains nutrients in optimal levels to stimulate stem growth. Phosphorus (P) content plays a significant role in increasing the stem diameter of plants. The addition of nutrient concentrations can enhance the size of the stem because the photosynthesis results are used for the growth of the upper parts of the plant such as the canopy, stem, and leaves. The growth of stem diameter will be hindered if the photosynthesis results are only directed to the upper parts of the plant (Purnomo *et al.*, 2020).

4. Root Length

Based on the analysis of variance, the dosage, frequency of turi leaf liquid organic fertilizer (LOF) application, and their interaction showed significant effects on root length at 24 days after planting (DAP).

Table 4. Results of the Follow-up Test on the Main, Single, and Interaction Effects on Root Length

Observation Time	Dosage of LOF (ml/l)	Frequency of Application			Average
		F1	F2	F3	
24 DAP	(P0)	8.93 a	8.56 a	10.06 b	9.18 a
	(P1)	12.06 c	12.53 cd	13.53 e	12.71 b
	(P2)	13.20 d	13.80 e	14.43 f	13.81 b
	(P3)	13.96 ef	15.30 g	16.76 h	15.34 c
Average		12.03 a	12.55 a	13.70 b	(+)

*Numbers followed by the same letter in the same row and column do not show significant differences at the 5% DMRT level. (-): No interaction between factors.

In Table 4, for treatments P0, P1, P2, and P3, it can be seen that each treatment significantly affected root length at 24 days after planting (DAP). Treatment P0 significantly differed from P1, P2, and P3 in terms of root length at 24 DAP. Treatment P3 showed the best result with a root length of 15.34 cm. For the frequency of LOF application, treatments F1, F2, and F3, each treatment significantly affected

root length, while treatments F1 and F2 significantly differed from F3 in terms of root length at 24 DAP. The application of a dosage of 4.5 ml/l with a frequency of 3 times a week (P3F3) has been effective in increasing the growth of water spinach plant roots, allowing for maximum nutrient absorption by the roots.

The interaction of dosage and frequency of turi leaf liquid organic fertilizer (LOF) application shows significant effects on root length in each treatment. This suggests that the applied LOF from turi leaves provides the necessary nutrients for water spinach plants, especially phosphorus, to support root growth. This aligns with the findings of Wasis and Ubad (2018), which indicate that phosphorus plays a crucial role in stimulating root organ formation. Phosphorus, along with nitrogen, can stimulate root and root hair growth, allowing plants to absorb nutrients optimally. This benefit was exclusive to the liquid organic fertilizer, as these nutrients are absent in chemical fertilizers. Greater root development results in improved water and nutrient absorption for the plant. (Phibunwatthanawong and Riddech, 2019).

5. Harvest Weight

Based on the analysis of variance, the dosage, frequency of turi leaf liquid organic fertilizer (LOF) application, and their interaction all showed significant effects. Each treatment had a significant impact on harvest weight at 24 days after planting (DAP).

Table 5. Results of the Follow-up Test on the Main, Single, and Interaction Effects on Harvest Weight

Observation Time	Dosage of LOF (ml/l)	Frequency of Application			Average
		F1	F2	F3	
24 DAP	(P0)	1,66 a	1,63 a	1,73 ab	1,67 a
	(P1)	1,86 ab	2,80 b	6,66 c	3,77 b
	(P2)	6,73 c	9,46 d	10,43 d	8,87 c
	(P3)	9,56 d	10,40 d	11,86 e	10,61 d
Average		4,95 a	6,07 b	7,67 c	(+)

*Numbers followed by the same letter in the same row and column do not show significant differences at the 5% DMRT level. (-): No interaction between factors.

In Table 7, treatments P0, P1, P2, and P3 each showed significantly different results in terms of harvest weight at 24 days after planting (DAP). The application of a dosage of 0 ml/l of LOF (P0) significantly differed from P1, P2, and P3 in terms of harvest weight at 24 DAP. Treatment P3 yielded the best result with a harvest weight of 10.61 grams. Treatments F1, F2, and F3 significantly differed in terms of harvest weight, with treatment F1 significantly differing from F2 and F3 in terms of harvest weight at 24 DAP. Table 7 shows that the treatment of turi leaf liquid organic

fertilizer dosage with a frequency of 3 times a week (F3) yielded better results compared to the combination of frequencies of 1 time a week (F1) and 2 times a week (F2).

Table 7 shows that the application of turi leaf liquid organic fertilizer significantly affected the harvest weight of water spinach plants. In this study, treatment P3F3 experienced a higher weight gain. This occurred because the plants absorbed water well, leading to an increase in plant weight (Tenoat, 2020). The interaction between the dosage and frequency of turi leaf liquid organic fertilizer application can stimulate the growth of water spinach plants. This aligns with the opinion of Wardiah et al. (2014), who stated that providing fertilizer doses according to plant needs is one of the factors that affect plant growth, along with the correct timing of application. Nutrients available to plants are crucial as they serve as a source of energy and formative materials for plant structure (Burhan, 2022).

D. CONCLUSION

There is an interaction between the dosage and frequency of turi leaf liquid organic fertilizer (LOF) application on the height of water spinach plants, the number of leaves, stem diameter, root length, and harvest weight. The application of turi leaf liquid organic fertilizer (LOF) at various dosages had a significant effect on the height of water spinach plants, the number of leaves, stem diameter, root length, and harvest weight. However, it did not have a significant effect on the number of leaves and stem diameter at 8 days after planting (DAP). The best dosage was found to be 4.5 ml/l. The frequency of turi leaf liquid organic fertilizer application had a significant effect on the height of water spinach plants, the number of leaves, stem diameter, root length, and harvest weight. However, it did not have a significant effect on stem diameter at 8 DAP. The best frequency of application was found to be 3 times a week.

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