

Effect Of Liquid Organic Fertilizer Dosage From Waste Effect Of Kepok Banana Peel (*Musa paradisiaca L.*) On Growth And Yield Of Basil (*Ocimum basilicum L.*)

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ABSTRACT

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Basil (*Ocimum basilicum L.*) is a horticultural plant widely used as a vegetable and food additive. Efforts to improve the growth and yield of basil can be carried out through fertilization, one of which is the application of liquid organic fertilizer (LOF) derived from kepok banana peel waste (*Musa paradisiaca L.*), which is rich in nutrients and environmentally friendly. This study aimed to determine the effect of liquid organic fertilizer doses from kepok banana peel waste on the growth and yield of basil plants. The experiment was conducted using a randomized block design (RBD) with several dosage treatments, namely P0 (0 ml/1 L water/control), P1 (100 ml/1 L water), P2 (200 ml/1 L water), P3 (300 ml/1 L water), P4 (400 ml/1 L water), and P5 (500 ml/1 L water), with four replications. Observed variables included plant height, number of leaves, number of branches, fresh leaf weight, fresh plant weight, dry leaf weight, and total plant dry weight. The application of liquid organic fertilizer from kepok banana peel waste at a dose of 500 ml (P5) resulted in the best growth and yield of basil plants, as indicated by the highest values in all observed parameters, with the highest plant height of 67.68 cm, the highest number of leaves of 99.25 leaves, 14.25 primary branches, fresh leaf weight of 19.90 g, fresh plant weight of 39.13 g, oven-dried leaf weight of 2.34 g, and total oven-dried plant weight of 4.78 g.

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1. Introduction

Basil (*Ocimum basilicum L.*) is a horticultural plant widely used as a food ingredient, fresh vegetables, and traditional medicine due to its bioactive compounds such as flavonoids, essential oils, and antioxidants. Demand for basil continues to increase in line with growing public awareness of healthy and natural foods (Rukmana, 2014; Taiz *et al.*, 2015).

According to 2023 data from the Central Statistics Agency (BPS), the agricultural sector in Indonesia continues to experience increasing demand for various horticultural commodities, including basil (*Ocimum basilicum L.*). This increase is in line with the growing public demand for functional and natural food ingredients used as fresh vegetables, cooking spices, and raw materials for the food and traditional medicine industries, thus driving the need for good cultivation techniques to produce quality leaves free from harmful chemical residues (Rahayu *et al.*, 2019). Basil plant productivity is greatly influenced by the availability of nutrients in the soil. Fertilization is an important factor in increasing plant growth and yield. However, the continuous use of chemical fertilizers can cause degradation of soil fertility and environmental pollution (Sutedjo, 2010; Hadisuwito, 2012).

Liquid organic fertilizer (POC) is an environmentally friendly fertilizer alternative derived from organic materials and easily absorbed by plants. POC contains macro and micro nutrients and microorganisms that can improve the physical, chemical, and biological properties of the soil (Hadisuwito, 2012; Sundari *et al.*, 2020).

Kepok banana peels are an abundant agricultural waste product that has not been optimally utilized. Banana peels contain nutrients such as nitrogen, phosphorus, potassium, calcium, magnesium, and iron, which have the potential to be used as raw materials for organic fertilizer (Putri *et al.*, 2022). Utilizing banana peel waste as organic fertilizer (POC) is expected to improve plant growth while reducing environmental pollution.

According to Handayani and Elfarisna (2021), the application of liquid organic fertilizer (POC) from kepok banana peels affects the growth and production of bok choy plants. The results showed that the treatment, dose P2 (40 mL of kepok banana peel POC/plant) gave the best results compared to other POC doses. Research conducted by Risa (2020) showed that the application of liquid organic fertilizer (POC) from kepok banana peel waste affected the growth and production of tomato plants. The results showed that the dose P3 (450 ml/bed) gave the best results in terms of leaf weight and root weight. In addition, the combination of a dose of 450 ml with a planting distance of 40 × 60 cm gave the highest results in terms of fruit number and weight, while the combination of a dose of 250 ml with a planting distance of 40 × 40 cm was most effective in increasing the vegetative growth of tomato plants..

2. Method

This research was conducted in Br. Sanding Serongga, Sanding Village, Tampaksiring District, Gianyar Regency, Bali Province. The research took place from October 30, 2025 to January 6, 2026 at an altitude of approximately 600 meters above sea level. The materials used in this study included 10 kg of kepok banana peels, 1 kg of brown sugar/molasses, EM4, 10 liters of clean water, and Tidore variety basil seeds. The tools used included knives, measuring cups, buckets, fermentation bottles, stirrers, cloth filters, 35 × 35 cm polybags, scales, as well as books and stationery. The study was conducted using a Randomized Block Design (RAK) with one treatment factor in the form of a dose of liquid organic fertilizer (POC) from kepok banana peels consisting of six treatment levels, namely P0 (without POC), P1 (100 ml POC per liter of water), P2 (200 ml POC per liter of water), P3 (300 ml POC per liter of water), P4 (400 ml POC per liter of water), and P5 (500 ml POC per liter of water), each with four replications to obtain 24 experimental units. The implementation of the study included the preparation of liquid organic fertilizer, preparation of planting media, planting seeds, application of POC according to treatment, plant maintenance, and harvesting. Observation data were analyzed statistically using analysis of variance (ANOVA). If the treatment had a significant effect, it was continued with the Least Significant Difference (LSD) test at the 5% level..

3. Results and Discussion

Based on the statistical analysis results (Table 1), it was found that the application of liquid organic fertilizer (LOF) derived from kepok banana peel had a highly significant effect ($P < 0.01$) on all observed variables, namely plant height (cm), number of leaves (leaves), number of branches (branches), fresh leaf weight (g), fresh plant weight (g), oven-dried leaf weight (g), and oven-dried plant weight (g).

Table 1. Significance of the kepok banana peel LOF test on the growth and yield of basil plants.

No	Variabel	Signifikansi
1	Plant Height (cm)	**
2	Number of leaves per plant (leaves)	**
3	Number of primary branches (branches)	**

4	Fresh leaf weight (g)	**
5	Fresh plant weight (g)	**
6	Oven dry leaf weight (g)	**
7	Oven dry plant weight (g)	**

Note: ** : Highly significant effect ($p < 0.01$)

Table 2. Mean Values of Observation Parameters of Basil Plants in the Kepok Banana Peel Test

Treatment	Observation Parameters						
	Plant Height (cm)	Number of leaves per plant (leaves)	Number of primary branches (branches)	Fresh leaf weight (g)	Fresh plant weight (g)	Oven dry leaf weight (g)	Oven dry plant weight (g)
P0	44,63e	60,00d	10,00c	12,00d	26,93e	1,38d	3,29e
P1	49,00d	62,25d	10,50bc	15,73c	30,30de	1,79c	3,72d
P2	55,48c	63,75d	12,75ab	17,68b	32,00cd	2,09b	3,91cd
P3	61,33b	75,50c	13,50a	18,45ab	34,20bc	2,14b	4,18bc
P4	65,18a	87,25b	13,75a	19,10ab	36,60ab	2,20ab	4,47ab
P5	67,68a	99,25a	14,25a	19,90a	39,13a	2,34a	4,78a
BNT 5%	2,82	5,28	2,33	1,93	3,59	0,18	0,43

Note: Mean values followed by the same letter are not significantly different at the 5% LSD test

The results of this study indicate that the application of liquid organic fertilizer (POC) from kepok banana peel waste to basil plants (*Ocimum basilicum L.*) has a very significant effect on all observed growth and yield parameters. This effect is seen in plant height, number of leaves, number of primary branches, fresh leaf weight, fresh plant weight, oven dry leaf weight, and oven dry plant weight. The treatment of kepok banana peel POC with the highest dose, namely P5 (500 ml/L water), gave the best results compared to other treatments. The P5 treatment produced the highest plant height of 67.68 cm, the highest number of leaves, namely 99.25 pieces, the number of primary branches 14.25 branches, fresh leaf weight of 19.90 g, fresh plant weight of 39.13 g, oven dry leaf weight of 2.34 g, and total oven dry plant weight of 4.78 g. On the other hand, the lowest yield was obtained in the P0 treatment, with a plant height of 44.63 cm, a number of leaves of 60.00, a number of branches of 10.00, a fresh leaf weight of 12.00 g, a fresh plant weight of 26.93 g, a leaf oven dry weight of 1.38 g, and a plant oven dry weight of 3.29 g. Kepok banana peels are known to contain macronutrients such as nitrogen (N), phosphorus (P), and potassium (K), as well as micronutrients such as magnesium (Mg) and calcium (Ca) which play an important role in plant growth (Rambitan and Sari, 2013). In addition, organic matter in POC can increase the activity of soil microorganisms so that the nutrient mineralization process runs more effectively (Lingga and Marsono, 2013).

Plant Height, The results showed that the height of basil plants increased along with the increasing dose of kepok banana peel POC. Treatment (P0) produced the lowest plant height, while treatment P5 produced the highest plant height and was significantly different from the other

treatments. This increase in plant height indicates that the nutrients contained in kepok banana peel POC are able to support the vegetative growth of basil plants. Nitrogen plays a role in the formation of proteins and chlorophyll which support the process of photosynthesis and cell division, thereby accelerating the growth of plant stems (Lingga and Marsono, 2013). Phosphorus plays a role in the formation of energy needed for tissue growth, while potassium plays a role in regulating osmotic pressure and plant enzyme activity (Sutedjo, 2010). The results of this study are in line with Risa's research (2020) which stated that the administration of kepok banana peel POC can significantly increase plant height due to the increased availability of macronutrients in the planting medium.

The number of basil leaves increased significantly with increasing doses of POC. The P5 treatment produced the highest number of leaves compared to the other treatments, while the control treatment produced the lowest number of leaves. A high leaf number indicates greater photosynthetic activity in the plants. The nitrogen and magnesium elements in POC from kepok banana peels play a role in the formation of chlorophyll, the main pigment in photosynthesis (Rambitan and Sari, 2013). Phosphorus also plays a role in the formation of metabolic energy in plants, thus supporting the formation of new leaf tissue (Putri *et al.*, 2022). As the rate of photosynthesis increases, the photosynthate produced by the plants also increases and is used for new leaf formation, thus increasing the number of basil leaves.

The results showed that the number of primary branches of basil plants increased along with increasing doses of kepok banana peel POC. Treatment P5 produced the highest number of primary branches compared to other treatments. Plant branching is closely related to the growth of lateral shoots which is influenced by the availability of nutrients and growth hormones. Phosphorus plays a role in the formation of meristem tissue and cell division, while calcium plays a role in cell wall formation and plant tissue growth (Prely and Feby, 2014). In addition, organic matter in POC can improve soil structure, increase aeration, and increase the activity of soil microorganisms, so that nutrient absorption by plant roots becomes more optimal (Lingga and Marsono, 2013). This causes the growth of basil plant branches to increase.

The fresh weight of basil leaves increased significantly with increasing doses of kepok banana peel POC. The P5 treatment produced the highest leaf fresh weight, while the control treatment produced the lowest. Leaf fresh weight reflects the water content and photosynthesis products accumulated in leaf organs. Potassium plays a role in the translocation of photosynthesis products from leaves to plant tissues, thereby increasing the accumulation of fresh leaf biomass (Sutedjo, 2010). Nitrogen also plays a role in the formation of vegetative tissue, which causes an increase in leaf size and number. Liquid POC is absorbed more quickly by plants than solid fertilizer, so nutrients are available in a shorter time and leaf growth is more optimal (Hadisuwito, 2012).

The total fresh weight of the plants increased with increasing doses of POC. Treatment P5 produced the highest fresh weight compared to other treatments. Fresh weight reflects the plant's ability to absorb water, nutrients, and photosynthesis. The organic matter in kepok banana peel POC can improve the physical, chemical, and biological properties of the soil, thereby increasing nutrient availability and water retention (Rahayu *et al.*, 2019). This is in line with Puspita (2015) who stated that the increase in fresh weight of plants is influenced by the availability of sufficient nutrients and water during plant growth.

Leaf oven-dry weight increased with increasing doses of kepok banana peel POC. Treatment P5 produced the highest leaf dry weight compared to other treatments. Leaf dry weight is an indicator of the accumulation of photosynthetic dry matter stored in plant tissue after water is removed. An increase in dry weight indicates optimal photosynthesis due to the availability of sufficient macro and micronutrients. Nitrogen, phosphorus, and magnesium play a role in chlorophyll formation and energy metabolism, thereby increasing photosynthetic efficiency and plant dry matter accumulation (Rambitan and Sari, 2013; Putri *et al.*, 2022).

The total oven-dry weight of plants increased with increasing doses of kepok banana peel POC. Treatment P5 produced the highest total plant dry weight compared to other treatments. Total plant dry weight reflects the accumulation of net plant biomass during the growth period. The increase in total plant dry weight indicates that the application of kepok banana peel POC can increase photosynthetic efficiency and nutrient utilization by plants. The organic matter in POC increases the activity of soil microorganisms that assist the mineralization process of nutrients, making them more easily absorbed by plants (Hidayat, 2019). This is in line with Lingga and

Marsono (2013) who stated that organic matter can increase nutrient availability and improve soil fertility.

The results of this study align with Risa's (2020) study, which found that applying liquid organic fertilizer from kepok banana peels can increase vegetative growth and yield of horticultural crops. Furthermore, Rambitan and Sari (2013) also stated that the potassium and micronutrient content in banana peels plays a role in improving the quality and quantity of crop yields. Therefore, the use of liquid organic fertilizer from kepok banana peels can be an environmentally friendly and effective alternative organic fertilizer for increasing the growth and yield of basil plants.

4. Conclusion

- a) The provision of liquid organic fertilizer (POC) from kepok banana peel waste has a very real effect on the growth and yield of basil plants (*Ocimum basilicum L.*), including plant height (cm), number of leaves per plant (strands), number of primary branches (stalks), fresh weight of plant leaves (g), fresh weight of plants (g), oven dry weight of plant leaves (g), and total oven dry weight of plants (g).
- b) The administration of liquid organic fertilizer from kepok banana peel waste with a dose of 500ml (P5) provided the best growth and yield of basil plants as indicated by the highest values in all observation parameters with the highest plant height of 67.68 cm, the highest number of leaves, namely 99.25 strands, the number of primary branches 14.25 branches, fresh leaf weight of 19.90 g, fresh plant weight of 39.13 g, dry leaf oven weight of 2.34 g, and total dry plant oven weight of 4.78 g.

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