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Effect of Application of Liquid Organic Fertilizer from Vegetable and Fruit Waste on Lettuce Plants (*Lactuca Sativa L.*)

Eko Abadi Novrimansyah
Universitas Muhammadiyah Kotabumi, Indonesia
Corresponding Email: eko.abadi.novrimansyah@umko.ac.id*

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Abstract

Sustainable agriculture is an agricultural system that has the LEISA (Low External Input Sustainable Agriculture) principle, namely by preserving the environment and preserving ecosystem space. The use of fruit and vegetable waste to make liquid organic fertilizer contains N, P and K which are good for plant growth. Liquid organic fertilizer formula from a mixture of vegetable waste, fruit waste and fish waste to enrich the content of macro nutrients and micro nutrients, so that it becomes a complete fertilizer for plants. This research aims to test the application of liquid organic fertilizer from urban organic waste on the growth and production of lettuce plants. The research method used was a Randomized Block Design (RAK) with one factor, with 5 treatments and repeated 3 times. The treatment given was a dose of liquid organic fertilizer derived from vegetable and fruit waste, namely P0 0 ml/ L, P1 20 ml/ L, P2 40 ml/ L, P3 60 ml/ L, P4 80 ml/ L. Observations included element content macro nutrients N, P, K, pH, Mo, and Fe in liquid organic fertilizer, plant height (cm), number of leaves (strands), and harvest weight (gr). The results of this research show that the liquid organic fertilizer content of vegetable and fruit waste analyzed is in accordance with SNI Kepmentan 261 of 2019. The application of liquid organic fertilizer from vegetable and fruit waste has a significant effect on the variables of plant height, number of leaves and harvest weight observed. The optimum dose of liquid organic fertilizer from vegetable and fruit waste for lettuce plants is 60ml/L/polybag.

Keywords: liquid organic fertilizer, vegetable waste, fruit waste, lettuce

Introduction

Sustainable agriculture is an agricultural system that has the principle of LEISA (*Low External Input Sustainable Agriculture*), namely by preserving the environment, and maintaining ecosystem space (Yuriansyah *et al*, 2020). One of the efforts that can be made in maintaining environmental sustainability is to pay attention to the use of fertilizers. Fertilization can be done with inorganic fertilizers or organic fertilizers (Saragih et al., 2023). The long-term use of inorganic fertilizers in the land has a negative impact on plants

and soil fertility, therefore, organic fertilizers are a better choice (Fadhilah et al., 2021). Inorganic fertilizers have short-term benefits, but they have severe long-term side effects such as soil poisoning and decreased soil fertility. Excessive use of inorganic fertilizers in crops will have an impact on soil fertility such as a decrease in soil productivity. Soil damage caused by the use of inorganic fertilizers can be repaired by the application of organic fertilizers (Raden et al., 2017).

The use of organic fertilizers has the advantages of being inexpensive, improving soil structure, texture and aeration, improving the ability to hold groundwater and stimulating the development of healthy roots (Assefa & Tadesse, 2019). Organic fertilizers are able to bind the ability of soil to absorb water, increase resistance to erosion, increase biodiversity, and increase soil fertility, but will not increase residues on plants so that they are safe for the environment and health (Lesik et al., 2019). Organic matter is a material derived from the remains of living things, such as plant residues, animal manure, and microorganisms, which can be placed in or on the ground to increase the content of organic compounds and nutrients in plants (Hasibuan, 2015).

The use of fruit and vegetable waste used as liquid organic fertilizer has been carried out by several previous researchers, that waste made into compost based on fruit and vegetables produces N, P, K content that is good for plant growth (Hastuti et al., 2024). The formula of liquid organic fertilizer is made from a mixture of vegetable waste, fruit waste and fish waste to enrich the content of macronutrients and micronutrients, so that it becomes a complete fertilizer for plants (Ranasinghe et al., 2019). The results show that the content of compost fertilizer is considered good for lettuce cultivation activities. (Siahaan et al., 2024)

The opportunity to use liquid organic fertilizer in increasing production needs to be accompanied by efforts to provide cheap liquid organic fertilizer (Panataria et al., 2023). The community can make liquid organic fertilizer by utilizing organic waste which has been a problem so far. The benefits of the research are reducing the amount of urban organic waste as a solution to the problems of health problems and environmental pollution, as well as providing organic fertilizers for plant cultivation in urban agriculture (Nisa et al., 2024). This study aims to test the application of liquid organic fertilizer from urban organic waste to the growth and production of lettuce plants. (Kusnadi et al., 2024)

Literature Review

Lettuce Plant (*Lactuca sativa L.*) It has the advantages of a short harvest life, extensive post-harvest adaptation and is not affected by temperature changes (Pracaya and Kartika, 2016). One of the businesses that can improve the quality or production of lettuce is by diversifying cultivation patterns to maintain land fertility and also for sustainable agriculture (Munthe *et al*, 2018).

Research Method

Research for waste collection and making fruit and vegetable compost was carried out in Gading Rejo, Pringsewu, Lampung Province. This research was conducted in August – November 2023. The ingredients used are: Belini lettuce seeds (Cap Pertiwi), leftover vegetables (*family Cruciferae*), leftover fruits (tomatoes, bananas, papayas, oranges), EM-4, water, and molasses. Then, the tools used are: buckets, tarpaulins, shredders, padlocks, stirrers, *polybags*, digital scales, measuring instruments, stationery, scissors, and labels.

This research begins with making compost, thereis composting that requires the collection of leftover vegetable and fruit waste in the market. After collecting, star fruit waste is weighed as much as 50 kg each. After weighing, waste is shredded using a shredding machine. After that, the waste is processed, organic matter is stockpiled and given 50 ml of EM-4 liquid, 3 liters of molasses, and 5 liters of water. Organic matter is fermented for 30 days. Stir well once every two days so that the hot temperature can be reduced. The success of compost fermentation is characterized by a brownish-black color, humus soil odor.

The study used the Group Random Design (RAK) method with one factor , namely the application to lettuce plants. The treatment was given in 5 levels and repeated 3 times. Compost is given to each polybag one week before transplanting from seeding. The level of liquid organic fertilizer given is: P0: 0 ml /L, P1: 20 ml /L, P2: 40 ml/L, P3: 60 ml /L, P4: 80 ml /L. The data that has been obtained is tested using ANOVA, if an interaction with a real effect is found, then BNT is further tested at a level of α 5%.

The variables observed include : (1) analysis of the content of liquid organic fertilizers pH, N, P, K, Mo, and Fe; (2) The height of the lettuce plant (cm) is measured with a meter starting at 1 MST. This observation is carried out 1 time a week until harvest (4 weeks); (3) the number of leaves, carried out on perfectly grown leaves that are 1 MST. This observation is carried out 1 time a week until harvest (4 weeks); (4) The harvest weight (grams) of the harvested elada is then weighed with a digital scale.

The application of liquid organic fertilizer to salada plants is 1 time/week. The preparation of planting media is carried out by mixing soil, chicken manure, with a ratio of 1:1. Lettuce seeds are sown in a *tray* that already contains the planting medium. Planting is carried out by *transplanting* from *a tray* to *a polybag* measuring 30 x 30, if the lettuce seedlings already have 4 leaves.

Result

The use of liquid organic fertilizer in this study has an effect, with the available nutrient content, plant growth and development become better. The results of the analysis of liquid organic fertilizer showed that the content of pH, N, P, K, and microelements had results in accordance with SNI Kepmentan 261 of 2019. With the results of this analysis, the application

of liquid organic fertilizer for vegetables and fruits strengthens that the results are significant in the observed variables due to the presence of nutrients that are fulfilled for plants.

Table 1. Results of POC analysis

Parameters	Unit	Results of Analysis	SNI
pH		5,3	4-9
N	%	3,13	2-6
P	%	2,87	2-6
K	%	4,89	2-6
Mo	Ppm	2,3	2-10
Fe	Ppm	188,53	90-900

Remarks: Results of POC analysis with SNI in accordance with Ministry of Agriculture 261 of 2019

Table 2. Effect of liquid organic fertilizer on plant height (cm).

Fertilizer Dosage	Plant Life			
	1 WAP	2 WAP	3 WAP	4 WAP
P0	5,23	9,43	13,33	16,62 b
P1	6,86	10,25	14,66	17,59 b
P2	8,38	13,27	17,25	20,17 ab
P4	8,47	15,11	22,72	25,19 a
P3	8,82	15,36	21,89	26,42 a

Description : WAP: Week After Planting, P0: 0ml/L, P1: 20ml/L, P2: 40ml/L, P3: 60ml/L, P4: 80ml/L. Numbers accompanied by the same letters are not real in BNT 5%, numbers accompanied by letters that are not the same are different in BNT 5%.

In high yields of plants, it was obtained that there was an increase in growth and development in each treatment in each week of observation. At observation four weeks after planting, P3 treatment with a dose of 60ml/L had a higher number compared to other treatments, namely 26.42 cm, and P0 as a control had a lower number compared to other treatments, namely 16.62 cm but did not differ significantly from P1 of 17.59 cm. In the observation, the P2 treatment, although only 20.17 cm, was not significantly different from the P4 treatment of 25.19 cm, and P3 of 26.42 cm. According to Nurdin (2017), macronutrients are needed in relatively large quantities at each stage of plant growth, especially at the vegetative growth stage. Plants that lack nutrients will not be enough to meet their life needs to grow and develop, plants that lack nutrients will inhibit their growth and there will be stunted growth and even wither and die.

Fertilizerapplication can improve soil chemistry, pH, and C-organic soil. With better soil chemistry, the nutrients contained in the soil will also increase, so that it will be easier for plants to use as a food source for plant growth and development. With sufficient nutrients, the height of the plant will be better and more branches and leaves will be formed.

Table 3. Effect of liquid organic fertilizer on the number of leaves of the plant

Fertilizer Dosage	Plant Life			
	1 WAP	2 WAP	3 WAP	4 WAP
P0	4,33	5,66	6,00	6,66c
P1	4,33	5,66	6,33	8,00bc
P2	4,66	6,66	7,33	9,66b
P4	4,66	6,66	8,00	13,66a
P3	4,66	7,00	8,00	14,00a

Description : WAP: Week After Planting, P0: 0ml/L, P1: 20ml/L, P2: 40ml/L, P3: 60ml/L, P4: 80ml/L. Numbers accompanied by the same letters are not real in BNT 5%, numbers accompanied by letters that are not the same are different in BNT 5%.

In the observation of leaf variables, it was found that the number of leaves always increased in each treatment every week. In the P0 treatment as a control, the number of leaves was less than that of other treatments, which was 6.66 leaves, but there was no significant difference from the P1 treatment of 8.00 leaves. The P3 treatment had a higher number of leaves than the other treatments with a total of 14.00 leaves, but there was no significant difference from the P4 treatment of 13.66 leaves. Nutrient application through liquid organic fertilizer had a significantly different effect on the growth of lettuce leaf count at four weeks after planting.

Leaves are plant organs that function as a place for photosynthesis to take place that will produce photocitrates (Kurniasari et al., 2024). With the help of sunlight, water and carbon dioxide are converted by chlorophyll into organic compounds, carbohydrates and oxygen. The nutrients resulting from photosynthesis are used for plant needs and for food reserves (Shahra et al., 2024). The application of compost fertilizer is able to obtain nutrients to obtain the optimal number of leaves, and the formation of the number of leaves in vegetable plants in the vegetative phase is determined by the size of the cells and the number of cells affected by the provision of nutrients available in the compost fertilizer to be used as food (Makaruku, 2015). When nitrogen is sufficient, the action of auxin will be stimulated so that it will affect the height growth of plants. Nitrogen itself is used as the main constituent of chlorophyll and plant protein, besides that nitrogen also has a role when plants experience a vegetative growth process (Novriani, 2014).

In a study conducted by Sutrisna and Surdianto (2014), it was stated that adequate nutrient (N) provision is important for plant growth to produce good plant growth and better crop yields. And phosphorus (P) nutrients for plants are quite significant in terms of flowering and plant development, hardness and color of fruits, as well as vitamin content. The use of fertilizers containing potassium (K) nutrients is also very important because it can increase the sugar, vitamin, and total acid content in fruits, as well as increase the number of fruits harvested. Therefore, there is a noticeable difference in crop yield when using fertilizers that match the plant's nutritional needs.

Table 4. Effect of liquid organic fertilizer on crop yield weight (gr)

Fertilizer Dosage	Plant Weight (gr)
P0	60,75c
P1	98,56b
P2	112,34b
P4	132,45a
P3	133,21a

Description : P0: 0ml/L, P1: 20ml/L, P2: 40ml/L, P3: 60ml/L, P4: 80ml/L. Numbers accompanied by the same letters are not real in BNT 5%, numbers accompanied by letters that are not the same are different in BNT 5%.

The results of the observation of the variable harvest weight of lettuce plants were obtained that the P0 treatment as a control had a lighter weight than other treatments with a value of 60.75 grams. In the P3 treatment, the heaviest result was obtained compared to other treatments with a value of 133.21 grams but did not differ significantly from the weight in the P4 treatment with a value of 132.45 grams. The weight of the crop harvest is greatly influenced by the growth and development of the plant. Plants with a higher plant height and number of leaves will affect in the photosynthesis process (Krismawati et al., 2024). With a better photosynthesis process in sunlight absorption and nutrient absorption, the metabolism in the plant body will become larger and produce heavier weight. Cinta (2023) stated that applying fertilizer in the right and regular doses will be able to stimulate plant growth. Widiyanto (2022) added that the increase in plant weight is caused by an increase in photosynthetics due to the sufficiency of nutrients absorbed by plants.

Conclusion

The results of this study show that the content of liquid organic fertilizer for vegetable and fruit waste analyzed is in accordance with SNI Kepmentan 261 of 2019. The effect of applying liquid organic fertilizer from vegetable and fruit waste had a real effect n the variables of plant height, number of leaves, and harvest weight. The optimum dose of liquid organic fertilizer for vegetable and fruit waste on lettuce plants is 60 ml/L/polybag.

References

Assefa, S., & Tadesse, S. (2019). The Principal Role of Organic Fertilizer on Soil Properties and Agricultural Productivity-A Review. Agricultural Research & Technology, 22(2), 46–50. https://doi.org/10.19080/ARTOAJ.2019.22.556192

Cinta, T.S., Widiwurjani, & N. Agustien. 2023. Respon Pupuk N, P, K dan Pupuk Organik Cair pada Pertumbuhan dan Hasil Tanaman Kedelai (Glycine max (L.) Merril). Jurnal Agrium. 20 (1): 42–50.

Fadhilah, N., Sedijani, P., & Mertha, I. G. (2021). The Effect of Fermentation Length and Dosage of Liquid of Organic Fertilizer Banana Peel on the Growth of Red Spinach (Amaranthus Tricolor L.). Jurnal Biologi Tropis, 21(3), 907–916. https://doi.org/10.29303/jbt.v21i3.2759

Hasibuan S. Z., Andi. (2015). Pemanfaatan Bahan Organik dalam Perbaikan Beberapa Sifat Tanah Pasir Pantai Selatan Kulon Progo. Planta Tropika: Journal of Agro Science, 3(1)

Lesik, M. M. N. N., Dadi, O., Wahida, Andira, G., & Laban, S. (2019). Nutrient analysis of liquid organic fertilizer from agricultural waste and rumen liquid. IOP Conference Series: Earth and Environmental Science, 343(1). https://doi.org/10.1088/1755-1315/343/1/012178

Makaruku, M. H. 2015. Respon pertumbuhan dan produksi tanaman selada (Lactuca sativa L.) terhadap permberian pupuk organik.J. Agroforestri. 10(3): 241-246.

Novriani. 2014. Respon Tanaman Selada (Lactuca sativa L.) Terhadap pemberian pupuk organik cair asal sampah organik pasar. J. Klorofil. 9(2):57-61.

Munthe, K., Pane, E., & EL, P. (2018). Budidaya tanaman sawi (Brassica juncea l) pada media tanam yang berbeda secara vertikultur. Agrotekma : Jurnal Agroteknologi dan Ilmu Pertanian 2(2), 138-151.

Nurdin, S. 2017. Mempercepat Panen Sayuran Hidroponik. Agromedia Pustaka.

Pracaya dan J. G. Kartika. 2016. Bertanam 8 Sayuran Organik. Penebar Swadaya. Jakarta.

Raden, I., Fathillah, S. S., Fadli, M., & Suyadi, S. (2017). Nutrient content of Liquid Organic Fertilizer (LOF) by various bioactivator and soaking time. Nusantara Bioscience, 9(2), 209–213. https://doi.org/10.13057/nusbiosci/n090217.

Ranasinghe, A., Jayasekera, R., Kannangara, S., & Rathnayake, R. M. C. . (2019). Effect of nutrient enriched organic liquid fertilizers on growth of Albemonchus esculentus. Journal of Environment Protection and Sustainable Development, 5(3), 96–106.

Sutrisna, N., dan S. Surdianto. (2014). Uji Formula NPK Pada Pertanaman Cabai Rawit Dataran Tinggi Lembang Jawa Barat Formula Test NPK Compound In Pepper Crop In Upland Lemabang, West Java. 16(1), 172–181.

Widiyanto, A., B. Susilo, & L.R. Dwi. 2022. Pertumbuhan dan Produksi Tomat (Lycopersicum esculentum Mill.) akibat Perlakuan Pupuk NPK dan Pupuk Organik Cair Sabut Kelapa. Jurnal Agroplasma. 9(2): 123–136.

Yuriansyah, Y., Dulbari, Y., Sutrisno, H., & Maksum, A. (2020). Pertanian organik sebagai salah satu konsep pertanian berkelanjutan. PengabdianMu: Jurnal Ilmiah Pengabdian Kepada Masyarakat 5(2), 127-132.