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Effects of Mushroom Baglog-Based Liquid Organic Fertilizer on Pakcoy Growth

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ABSTRACT

Liquid organic fertilizer is an important type of organic fertilizer that can improve soil structure and provide additional nutrients. Liquid Organic Fertilizer (LOF) has several advantages over other fertilizers, including ease of production, long-chain nutrient release, facilitation of photosynthesis, increased nutrient content, and improved soil growth. Organic fertilizers are commonly used in agriculture, especially on cultivated lands. Organic waste is a by-product of non-economic production processes. This study was conducted at Muhammadiyah University of Surakarta, specifically in the greenhouse, over a period of 28 days, from November 29, 2023, to December 27, 2023. A Randomized Complete Block Design (RCBD) was used as the basis for the experiment. For liquid organic fertilizer concentration, three treatments were applied to plants in three pots, each containing two Pakcoy plants (*Brassica rapa* L.), with LOF irrigation given every nine days. The first treatment served as a control with no LOF application, while the second treatment involved the application of 1 milliliter of LOF diluted in 500 milliliters of water.
Keywords**:** LOF, fertilizer, soil, organic waste, pakcoy

ABSTRAK

Pupuk organik cair merupakan pupuk organik yang sangat penting dalam produksi pupuk organik yang dapat memperbaiki struktur tanah dan memberikan tambahan unsur hara. Pupuk Organik Cair (POC) memiliki beberapa keunggulan dibandingkan pupuk lain: produksi mudah, pelepasan unsur hara rantai panjang, fotosintesis mudah, peningkatan kandungan unsur hara, dan pertumbuhan tanah lebih baik. Pupuk organik sering digunakan dalam pertanian terutama di lahan. Sampah organik merupakan produk sampingan dari proses produksi non-ekonomi. Studi ini dilakukan di Universitas Muhammadiyah Surakarta, lebih tepatnya di *Green house*. Studi ini dilakukan selama 28 hari, yaitu dari tanggal 29 November 2023 hingga 27 Desember 2023. Rancangan Acak Kelompok (RAK) digunakan sebagai dasar untuk pelaksanaan percobaan ini. Untuk konsentrasi pupuk organik cair, ada tiga perlakuan yang dilakukan pada tanaman dalam tiga pot, masing-masing berisi dua tanaman Pakcoy (*Brassica rapa* L.), dengan penyiraman POC setiap sembilan hari sekali. Perlakuan pertama melibatkan kontrol atau tanpa pemberian POC, dan perlakuan kedua melibatkan pemberian POC 1 mililiter yang dilarutkan ke dalam 500 mililiter air.
Kata Kunci : POC, pupuk, tanah, sampah organik, pakcoy,

1. Introduction

Fertilizers remain the most essential products in the agricultural industry. Currently, inorganic fertilizers are widely used; however, prolonged use can lead to negative environmental impacts, such as decreased soil organic matter, increased susceptibility to erosion, reduced soil permeability, and decreased soil microbial populations (Herdiyantoro, 2015). Considering these negative effects, it is advisable to replace long-term use of inorganic fertilizers with organic fertilizers derived from organic waste.

Organic fertilizers are made from natural materials and contain various nutrients, albeit in relatively small amounts (Lepongbulan, Sitorus, & Rambe, 2017). Organic fertilizers play a crucial role in ensuring the sustainability of agricultural land use. The application of organic fertilizers to crops not only provides essential nutrients but also serves as a method to improve soil structure. Organic fertilizers are classified into two types: solid organic fertilizers (SOF) and liquid organic fertilizers (LOF)

Liquid organic fertilizer (LOF) is produced from the decomposition of organic wastes, including plant residues, agro-industrial by-products, animal manure, and human waste, providing multiple essential nutrients (Kalla, Siregar, & Nasution, 2019). Compared to other fertilizers, LOF is easy to produce, low-cost, and can be applied to soil or leaves to improve nutrient availability, cation exchange capacity, and soil structure while supporting beneficial microorganisms (Sitanggang, Wibowo, & Rahman, 2022; Le et al., 2025; Akhmad & Yassi, 2024; (Lisdayani et al., 2019).

Oyster mushroom substrate, often discarded as waste, contains nutrients such as phosphorus, potassium, nitrogen, and organic carbon, making it suitable as a base material for LOF (Seminar, Prasetyo, & Hidayat, 2021). To enhance its nutrient content, additional materials like banana peels, fruit peels, and vegetables can be added (Aprilio & Suntari, 2015; Thayeb, Maulana, & Fadli, 2021). This study aims to utilize mushroom substrate waste supplemented with other organic materials to produce LOF and evaluate its effectiveness on the growth of Pakcoy (*Brassica rapa* L.).

2. Materials and Methods

This study was conducted at Muhammadiyah University of Surakarta, specifically in the greenhouse, from November 29, 2023, to December 27, 2023, over a period of approximately 28 days. The experiment was arranged using a Randomized Complete Block Design (RCBD**)**. The liquid organic fertilizer (LOF) treatments consisted of three concentrations: Treatment 1 served as the control with no LOF application, Treatment 2 received 1 mL of LOF diluted in 500 mL of water, and Treatment 3 received 1 mL of LOF diluted in 1000 mL of water. Each treatment was applied to three pots, each containing two Pakcoy (*Brassica rapa* L.) plants, with LOF applied every nine days.

2.1 Research Procedures

The research procedures included the following steps:

1. **Soil Preparation:** Soil was poured into pots in sufficient amounts and cleared of weeds or remaining plant debris.
2. **Planting:** Pakcoy seedlings were transferred from polybags to pots, planted at a depth of 2–3 cm, and covered with soil.
3. **Maintenance:** Pakcoy plants were maintained throughout the study, including irrigation, fertilization, and general care.
4. **Harvesting:** Pakcoy plants were harvested approximately 28 days after planting.

2.2 Observed Parameters

1. **Growth Parameters:** Observations were conducted one week after LOF application, including the number of leaves and leaf expansion.
2. **Production Parameters:** Observations were conducted at harvest and included leaf color, root measurement, Pakcoy length and width, and leaf sturdiness.

3. Results and Discussion

The application of liquid organic fertilizer (LOF) significantly influenced the growth and development of Pakcoy (*Brassica rapa* L.) over the 28-day experimental period (Table 1). Leaf number increased steadily across all treatments from Day 7 to Day 28. Treatments with higher LOF concentrations, such as C01 and C23, generally produced more leaves compared to the control, indicating enhanced vegetative growth. Similarly, leaf expansion followed the same trend, with larger leaf areas observed in higher-concentration treatments, suggesting improved nutrient availability and photosynthetic efficiency (Kalla, Siregar, & Nasution, 2019).

Table 1. Mean Values of Leaf Number, Leaf Expansion, Leaf Color, and Root Development of Pakcoy

Treatment	Leaf Number (leaves)	Leaf Expansion (cm)	Leaf Color (Day 28)	Root Development
	Day 7	Day 14	Day 21	Day 28
C01	5	5	7	7
C02	5	3	6	7
C03	5	5	6	7
C11	4	4	5	5
C12	5	4	5	6
C13	5	4	6	6
C21	4	4	5	5
C22	4	4	6	4
C23	5	5	6	6

Notes:

- C01, C02, C03 = Control and different concentrations of LOF (1 mL in 500 mL or 1000 mL water)
- C11, C12, C13; C21, C22, C23 = Other treatment variations
- Measurements were conducted on Days 7, 14, 21, and 28 for leaf number and leaf expansion. Leaf color and root development were observed on Day 28.

The application of liquid organic fertilizer (LOF) significantly affected the growth and development of Pakcoy (*Brassica rapa* L.) throughout the 28-day experimental period. Leaf number gradually increased across all treatments from Day 7 to Day 28, with higher concentrations of LOF, particularly in treatments C01 and C23, producing more leaves compared to the control. Leaf expansion followed a similar pattern, with larger leaf areas observed in higher-concentration treatments, indicating improved nutrient availability and enhanced photosynthetic activity (Kalla, Siregar, & Nasution, 2019). Leaf color also varied according to LOF concentration. Dark green leaves were observed in higher-concentration treatments, while lighter green leaves appeared in lower-concentration and control treatments, reflecting differences in chlorophyll content and nitrogen uptake, which are critical for leaf development and pigmentation.

Root development was positively influenced by LOF application, as treatments with higher concentrations produced longer and denser roots compared to lower-concentration treatments and controls, suggesting improved nutrient absorption and soil structure (Sitanggang, Wibowo, & Rahman, 2022). Plant length and width were also affected by LOF application. Control plants exhibited moderate length and width with sturdy leaves, while plants treated with LOF diluted in 500 mL water showed slightly reduced dimensions and slightly less firm leaves. The highest growth was observed in plants treated with LOF diluted in 1000 mL water, achieving the greatest length and width, although leaf sturdiness remained slightly less firm than in controls. This suggests that higher dilution rates may provide a more gradual release of nutrients, promoting optimal vegetative growth without negatively impacting leaf structural integrity (Rahmawati et al., 2024: Novrimansyah, 2025)

Overall, the data indicate that LOF enhances both above-ground (leaf number, leaf expansion, color, length, and width) and below-ground (root length and density) growth parameters of Pakcoy, supporting its potential as an effective organic fertilizer for sustainable vegetable production.

Fig 1. PakCoy after application liquid Fertilizer Mushroom Baglog

4. Conclusion and Recommendation

The application of liquid organic fertilizer (LOF) significantly improved the growth and development of Pakcoy (*Brassica rapa* L.). Higher concentrations of LOF enhanced leaf number, leaf expansion, plant length and width, and root development, while maintaining sufficient leaf sturdiness. Variations in leaf color reflected differences in chlorophyll content and nutrient uptake, particularly nitrogen. These results demonstrate that LOF is an effective organic fertilizer that supports both above-ground and below-ground growth, providing a sustainable option for vegetable production.

Based on these findings, it is recommended that LOF derived from organic waste, such as mushroom substrate, banana peels, fruit peels, and vegetable residues, be utilized as a nutrient-rich fertilizer for Pakcoy and other leafy vegetables. Further research is suggested to optimize LOF formulation and application rates for different crop species and soil conditions to maximize growth and yield.

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