JURNAL AGROEKOTEKNOLOGI TERAPAN
Applied Agroecotechnology Journal

Agroteknologi Universitas Sam Ratulangi **e ISSN:2797-0647**

Response Of Liquid Organic Fertilizer Concentration Levels on The Growth and Yield of Three Varieties of Pakchoy (*Brassica rapa* L.).

Rani Seftiani*, Alfu Laila, Julio Eiffelt Rossaffelt Rumbiak, Endang Sulistyorini.

Department of Agroecotechnology, Faculty of Agriculture, Sultan Ageng Tirtayasa University, Serang, Banten, Indonesia

*Corresponding author:
raniseftiani2@gmail.com

Manuscript received: 20 Dec 2025.
Revision accepted: 22 Jan. 2026.

Abstract. Pakchoy production in Indonesia has declined due to excessive use of inorganic fertilizers and suboptimal cultivation practices, necessitating the adoption of alternative fertilization methods, such as liquid organic fertilizer (LOF), which can improve soil structure, provide readily available nutrients, and enhance plant growth. This study aimed to determine the effects of varying concentrations of Infarm LOF on the growth and yield of three pakchoy (Brassica rapa L.) varieties to identify the most effective combination for cultivation. The Research was conducted from September to November 2025 in the home yard area of Kp. Cibuah, Cibuah Village, Warunggunung District, Lebak Regency, Banten, using a randomized block design with two factors: LOF concentration and pakchoy varieties. LOF concentration levels were P0 (no LOF), P1 (3 mL/L), P2 (6 mL/L), and P3 (9 mL/L), while varieties included (V1 = Nauli F1, V2 = Flamingo, and V3 = Green). The results showed that P1 (3 mL/L) produced the best growth performance, indicated by plant height and fresh shoot weight. The Nauli F1 variety showed the best growth response across most parameters. In addition, a significant interaction between Infarm LOF concentration and pakchoy varieties was observed for leaf number and leaf greenness.

Keywords: Infarm, Pakchoy, Concentration level, Variety

INTRODUCTION

Indonesia is known as an agricultural country because the majority of its population works as farmers, supported by fertile soil conditions and the availability of land that can still be developed for agriculture. Vegetables are one of the commodities that contribute significantly to the agricultural sector, including bok choy, which is increasingly popular due to its high nutritional and economic value (Roidi, 2016). However, pakchoy production in Indonesia has fluctuated in recent years. Data from the Central Statistics Agency (2023) recorded a decline in cabbage/mustard greens production from 760,608 tons in 2022 to 686,876 tons in 2023, as the harvested area shrank from 71,390 hectares to 69,190 hectares. This decline is related to increasing market demand pressures and various cultivation constraints. One of the main causes of production fluctuations is the excessive use of inorganic fertilizers, which, in the long term, can reduce soil fertility and have negative environmental impacts (Ratriyanto *et al.*, 2019). Furthermore, low productivity is also influenced by the limited application of cultivation technologies, such as soil cultivation, selection of superior varieties, pest control, irrigation, and fertilization (Oktafia & Maghfoer, 2018). This situation indicates the need to improve cultivation technologies that are more environmentally friendly and sustainable.

One possible solution is effective fertilization. Farmers have traditionally relied on synthetic chemical fertilizers, but their intensive use can degrade soil quality and disrupt nutrient balance. Conversely, liquid organic fertilizer (POC) offers several advantages, including increased chlorophyll formation, enhanced photosynthetic performance, and enhanced plant resistance to environmental stress (Suryati *et al.*, 2019). POC also provides nutrients that are more easily absorbed by plants and improves soil structure and microbial activity (Agus *et al.*, 2024). Variations in POC concentration have been shown to affect vegetable growth and yield (Putra *et al.*, 2022). One widely used type of POC is POC Infarm, which contains macro

and micro nutrients, growth regulators, and soil microorganisms with a composition of 18% N, 26% P, 26% K, 2% organic C, growth hormones, and a pH of 7.5 at a concentration of 9,000 ppm (Wisanggeni, 2024). This information indicates that Infarm POC has strong potential to support bok choy growth, particularly when applied at the appropriate concentration. Pratama Candra Ardira *et al.* (2024) stated that the concentration of Infarm liquid organic fertilizer significantly affected plant height and leaf number. A concentration of 3 mL/L of Infarm liquid organic fertilizer showed the highest results. Research by Tanjung (2016) showed that the Flamingo variety of bok choy had the best effect on plant height, leaf number, and fresh weight.

Given these problems and potential, Research is needed to determine how liquid organic fertilizer concentration levels affect the growth and yield of three bok choy varieties (*Brassica rapa* L.). This Research is important to determine the most effective combination of liquid organic fertilizer concentration and bok choy varieties to support increased productivity and the development of sustainable pakchoy cultivation.

RESEARCH METHODOLOGY

This study employed an experimental design and was conducted from September 2025 to November 2025 at the Yard of the House, Cibuah Village, Cibuah Hamlet, Warunggunung District, Lebak Regency, Banten. The tools used included a shovel, a seedling tray 54 x 28 cm, a sprayer, a polybag size 20 x 20 cm, a measuring tape, a ruler, stationery, a 9 MP camera, a digital scale, a 1000 ml measuring cup, a bucket (7 L volume), labels, a SPAD meter, and a dipper. The materials used in this study included pakchoy seeds of the Nauli F1, Flamingo, and Green varieties; Infarm liquid organic fertilizer; goat manure fertilizer; rice husk charcoal; soil; botanical pesticides; and water. This study uses a randomized group design (RAK) with two factors: the concentration of Infarm liquid organic fertilizer (P) consisting of four levels: control (P0), 3 mL/L (P1), 6 mL/L (P2), 9 mL/L (P3), and pakcoy plant varieties (three levels): Pakcoy Nauli F1 variety (V1), Pakcoy Flamingo variety (V2), Pakchoy Green variety (V3). The total number of treatment combinations obtained is 3 x 4 = 12. Each treatment combination is replicated 3 times, yielding 36 experimental units, each containing 3 plants.

Research Implementation

The Research was conducted in several stages: preparation of growing media, seed germination, transplanting, application of treatments, plant maintenance, observation, and harvesting. The growing medium consisted of soil, rice husk charcoal, and goat manure, mixed at a 1:1:1 (v/v) ratio, and filled into 36 polybags (20 × 20 cm). These were labeled and arranged according to the experimental design. Pakcoy seeds were soaked in warm water for 30 minutes and sown in seed trays containing soil and rice husk charcoal (1:1), with one seed per cell. The trays were maintained under shaded conditions with daily watering until seedlings reached 3-4 leaves at 14 days after sowing. Healthy, uniform seedlings were transplanted into polybags in the afternoon to minimize transplant shock. Infarm liquid organic fertilizer (LOF) was applied by drenching the growing medium at four concentrations (0, 3, 6, and 9 mL/L) at 1, 2, 3, and 4 weeks after transplanting (WAT). Plant maintenance included watering twice daily, replanting dead or abnormal plants, manual weeding, and pest and disease control with garlic extract (3 mL/L) as needed. Growth parameters were measured at 1-4 WAT, and yield components were assessed at the end of the experiment. Harvesting was performed simultaneously at 4 WAT, in accordance with standard harvest criteria.

Data Analysis

After data collection, the data were processed using analysis of variance. If the analysis of variance showed a significant to highly significant effect, further testing was conducted using Duncan's Multiple Range Test (DMRT) at the 5% level.

RESULTS AND DISCUSSION

Plant height

Based on the plant height graph in Figure 1, the effect of liquid organic fertilizer concentration on pakcoy plant height varies across observation ages. At the age of 1 WAT, the results did not significantly affect the provision of POC infarm. 2 and 4 WAT gave a significant effect on the provision of POC infarm, while at the age of 3 WAT, the effect was very significant on the provision of POC infarm treatment of 3 mL/L with an average of 19.33 cm. Syafruddin (2016) explained that nutrient provision must be appropriately managed, adjusted to plant needs and soil nutrient conditions, to increase productivity and efficiency while maintaining environmental sustainability.

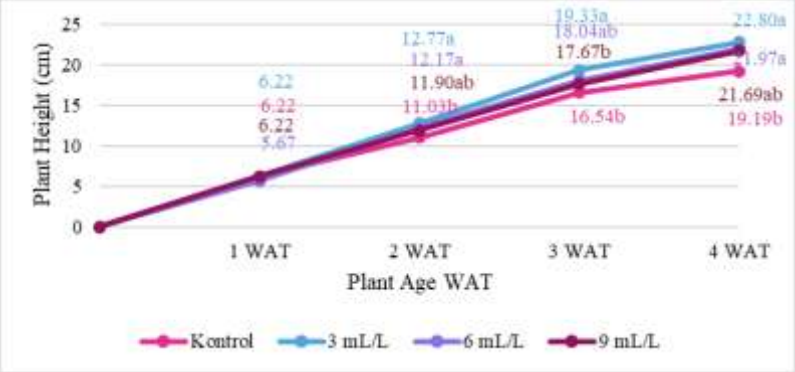

Figure 1. Graph of the Effect of Infarm POC Concentration on Pakcoy Plant Height. Numbers followed by the same letter in the same column or row indicate results that have no significant effect in the 5% DMRT follow-up test

Based on the graph in Figure 2, variety significantly affected plant height at 1 week after transplanting (WAT) in the Nauli F1 treatment, with an average of 6.50 cm, indicating better early growth. Meanwhile, at ages 2, 3, and 4 WAT, the three varieties did not significantly affect one another, so their growth was similar. These results indicate that the Nauli F1 variety exhibits a specific growth advantage at 1 WAT, although this advantage is not consistent across all observation times. The significant effect at 1 WAT is thought to arise because each variety has distinct genetic traits and environmental adaptability. Each genotype can respond differently to growing conditions, even when subjected to the same treatment. This is consistent with the explanation of Triana *et al.* (2020), who stated that genetic differences between varieties can lead to differences in plant growth even when planted under the same conditions.

Number of leaves

Based on the graph visualized in Figure 5, the POC concentration treatments showed different responses at each observation age. At 1 WAT, 2 WAT, and 3 WATS, all POC concentrations had no significant effect on leaf number. This indicates that increasing the dose does not always increase growth and may even reduce nutrient absorption efficiency. These results indicate that a concentration of 3 mL/L is the optimal dose for increasing the number of pakchoy leaves across all observation phases, whereas higher doses do not yield a significant increase in growth. In line with Prizal (2017), plants can grow and produce optimally when their nutrient requirements are met.

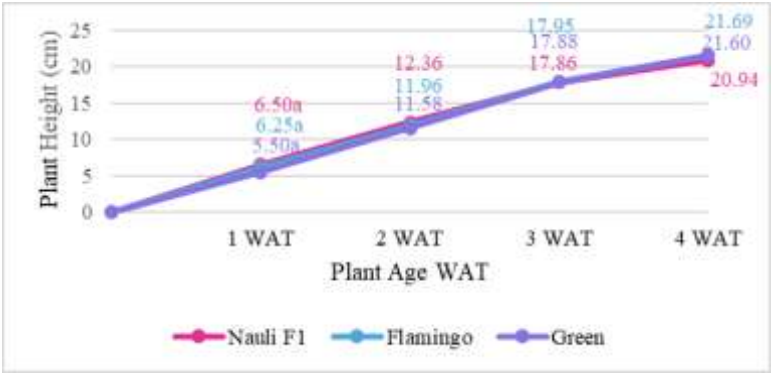

Figure 2. Graph of the Effect of Variety on Pakcoy Plant Height. Numbers followed by the same letter in the same column or row indicate results that have no significant effect in the 5% DMRT follow-up test.

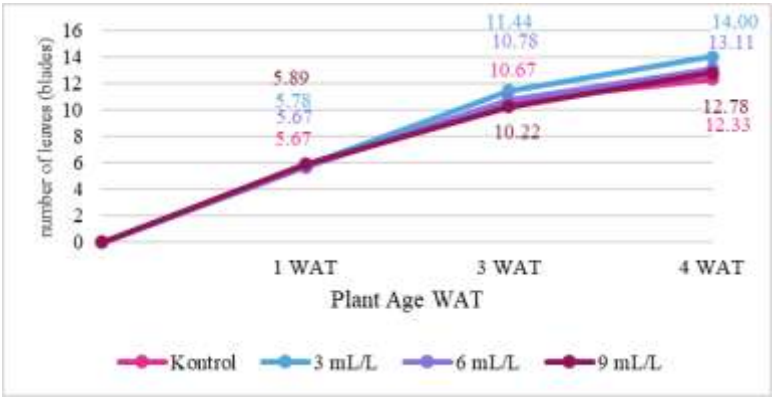

Figure 3. Graph of the Effect of Infarm POC Concentration on the Number of Pakcoy Leaves. Numbers followed by the same letter in the same column or row indicate results that have no significant effect in the 5% DMRT follow-up test.

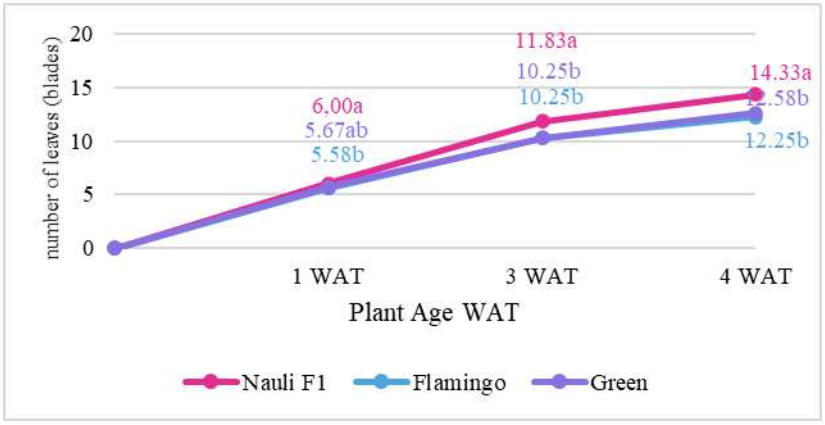

Figure 4. Graph of the Effect of Variety on the Number of Pakcoy Leaves. Numbers followed by the same letter in the same column or row indicate results that have no significant effect in the DMRT follow-up test at the 5% level.

Based on observations of leaf counts at various growth stages, each variety showed distinct responses during plant development, as shown in Figure 4. At the age of 1 WAT, it had a significant effect. Meanwhile, the ages of 3 and 4 WAT had a very significant effect on the Nauli F1 variety. The best-performing variety in the number-of-leaves parameter was Nauli F1, which exhibits rapid leaf growth. The analysis of variance showed a highly significant interaction between the Infarm POC concentration treatment and pakchoy plant varieties in the 2nd week of WAT observations, indicating

that each variety responded differently to the Infarm POC concentration level during the early vegetative growth phase. The Green variety showed a very significant effect at a concentration of 3 mL/L, with the highest value of 11.00. This interaction resulted from differences in each variety's genetic ability to absorb and utilize available nutrients, so the effect of liquid organic fertilizer was not uniform across all varieties. This is consistent with Rahmawati *et al.* (2020), who reported that the interaction between varieties and liquid organic fertilizer concentration can significantly affect plant growth in the early phase, owing to differences in physiological responses and nutrient absorption efficiency among varieties.

Leaf greenness

Leaf greenness was measured 4 weeks after transplanting, coinciding with harvest time. Measurements were made using a Soil Plant Analysis Development (SPAD) meter, which quantifies leaf greenness as an indicator of chlorophyll content

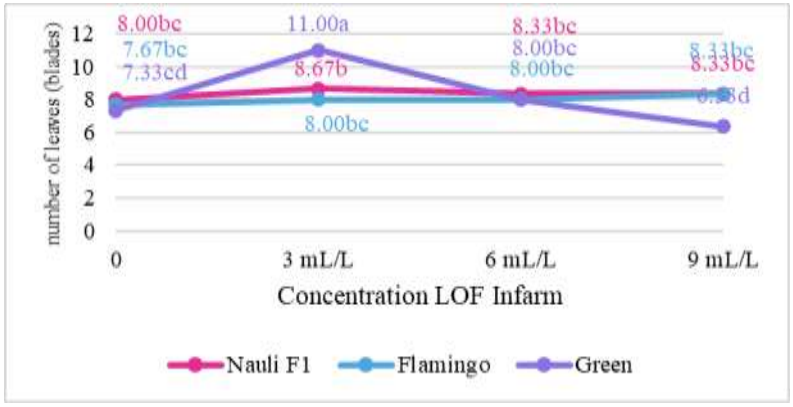

Figure 5. Interaction Graph as a Function of the Number of Pakcoy Leaves 2 MSPT. Numbers followed by the same letter in the same column or row indicate results that have no significant effect in the DMRT follow-up test at the 5% level.

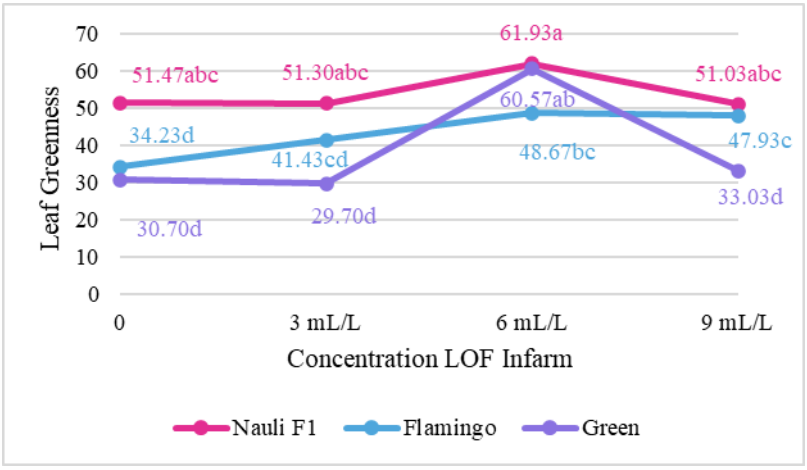

Figure 6. Interaction Graph on Leaf Greenness Level of Pakchoy Plants. Numbers followed by the same letter in the same column or row indicate results that have no significant effect in the 5% DMRT follow-up test.

In Figure 6, the interaction between the infarm POC treatment and three pakcoy varieties significantly affects the leaf greenness parameter. In the combination of the Nauli F1 variety and a concentration of 6 mL/L, with a value of 61.93. This occurs because each variety has a different ability to respond to the activity contained in the infarm POC. According to Fauzi and Puspitawati (2017), nitrogen is an essential nutrient for the synthesis of chlorophyll, the green pigment of leaves that is essential for

photosynthesis. Chlorophyll absorbs sunlight, a source of photosynthetic energy. Overall, these findings confirm that genetic factors of varieties play a significant role in determining the ability of plants to form chlorophyll, so that the Nauli F1 variety is the most responsive variety and shows the best performance on the leaf greenness parameter, especially when combined with liquid organic fertilizer treatments such as Infarm POC, which functions to support plant health and vegetative growth.

Crop wet weight

Based on Figure 7, the results significantly Influence the application of POC infarm to the fresh weight parameter of the canopy. The best treatment was achieved with a concentration of 3 mL/L, yielding an average of 37.67 grams. Increasing the concentration of POC in the soil reduced yields because nutrient availability did not match plant requirements. Consistent with Sari *et al.* (2021), applying liquid fertilizer at excessive concentrations can reduce plant growth and fresh weight due to nutrient imbalances that disrupt physiological processes.

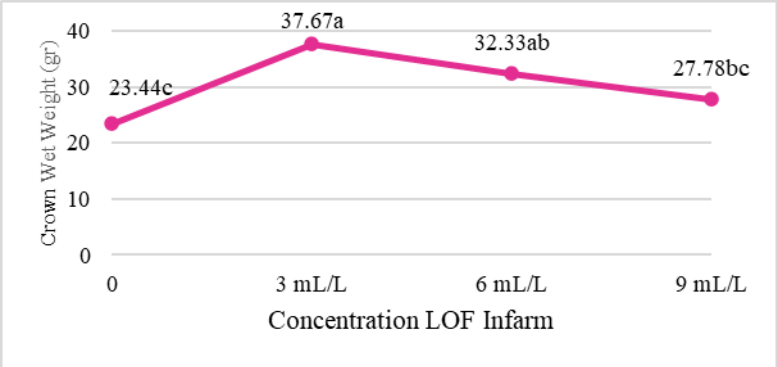

Figure 7. Graph of the Effect of Infarm POC Concentration on the Fresh Weight of Pakcoy Plant Shoots. Numbers followed by the same letter in the same column or row indicate results that have no significant effect in the 5% DMRT follow-up test.

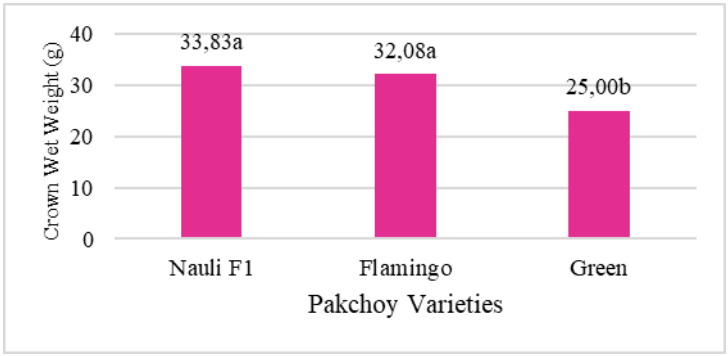

Figure 8. Graph of the Effect of Variety on Fresh Weight of Pakcoy Plant Shoots. Numbers followed by the same letter in the same column or row indicate results that have no significant effect in the DMRT follow-up test at the 5% level.

Among the varieties shown in Figure 8, Nauli F1 had the greatest effect, with an average yield of 33.83 grams. There was no interaction between the infarm POC treatment and the bok choy plant varieties. The Nauli F1 variety is a bok choy variety with superior genetic potential for producing high fresh weight. This superiority is achieved through a genetic selection process that targets optimal

growth characteristics, particularly the development of large, fleshy leaves. This is consistent with the findings of Permatarasari *et al.* (2023), who reported that the use of superior varieties can increase crop yields by up to 56%.

Root weight/plant

Based on Figure 9, the wet weight of the pakcoy plant roots shows that the POC treatment did not significantly affect the wet weight of the roots, so that the variations that appeared were more fluctuating and did not show a clear increase. The low wet weight was attributable to the absence of inorganic fertilizers in the soil, which prevented the plant's nutrient requirements from being met by POC alone, thereby inhibiting its growth and development. Hartatik and Setyorini (2015) explained that the nutrient composition of organic fertilizers is typically low and highly variable, so their function for plants is not immediate but long-term.

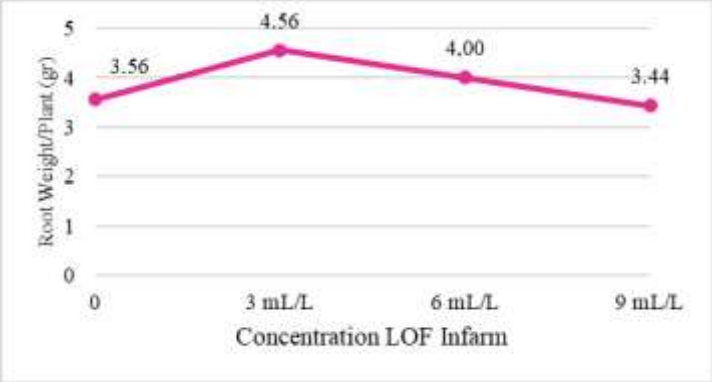

Figure 9. Graph of the Effect of Infarm POC Concentration on the Fresh Weight of Pakcoy Plant Roots. Numbers followed by the same letter in the same column or row indicate results that have no significant effect in the 5% DMRT follow-up test. Data Transformation

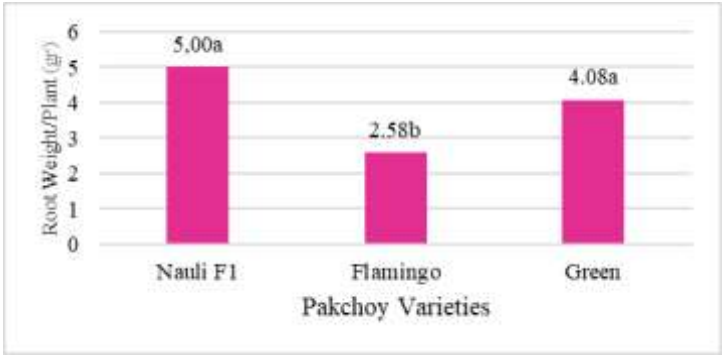

Figure 10. Graph of the Effect of Variety on the Fresh Weight of Pakcoy Roots. Numbers followed by the same letter in the same column or row indicate results that have no significant effect in the DMRT follow-up test at the 5% level. Data Transformation

The difference in root wet weight is more strongly influenced by the variety factor, as shown in Figure 10. This significantly affects the variety with the highest yield, Nauli F1, which averages 5.00 grams. These results indicate that pakchoy root development is more determined by the variety's genetic characteristics than by the application of liquid organic fertilizer. These differences include the ability to absorb water and nutrients, the rate of root growth, and the efficiency with which soil nutrients are utilized. According to Dewi (2019), varieties with stronger and more widely developed root systems tend to have higher

root wet weight because they accumulate more root biomass.

Root volume

Based on the graphical results visualized in Figure 11, which show significant differences between treatments, the concentration of Infarm Liquid Organic Fertilizer (POC) did not significantly affect plant root volume. Hakim *et al.* (2021) reported that administering liquid organic fertilizer at the appropriate dose can increase nutrient availability, thereby directly stimulating root cell division and development.

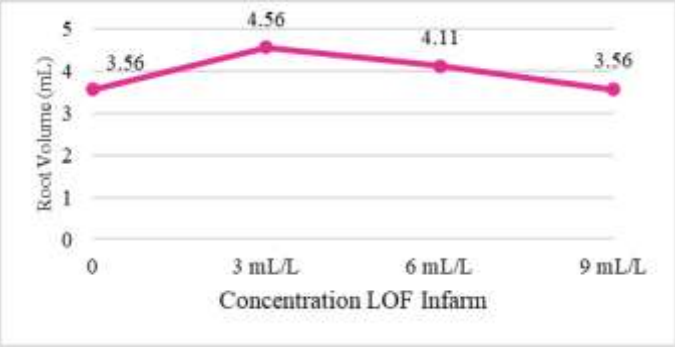

Figure 11. Graph of the Effect of Infarm POC Concentration on Pakcoy Plant Root Volume. Numbers followed by the same letter in the same column or row indicate results.

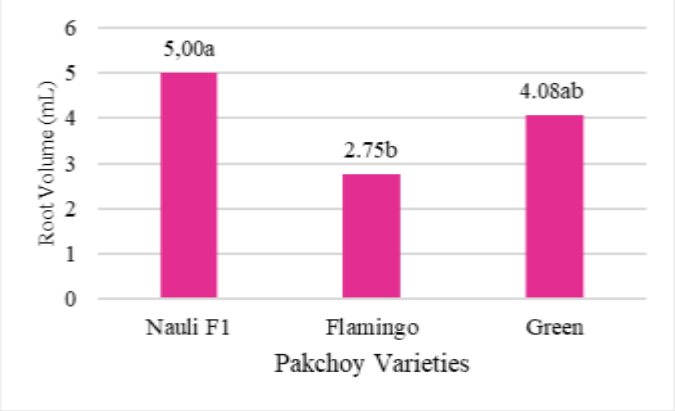

Table 4. Figure 12. Graph of the Effect of Variety on Pakcoy Root Volume. Numbers followed by the same letter in the same column or row indicate results that have no significant effect in the 5% DMRT follow-up test. Data Transformation.

The difference in root volume is more strongly influenced by the variety factor shown in Figure 12. This significantly affects the variety, with Nauli F1 achieving the best result, averaging 5.00 grams. Suhartini *et al.* (2020) reported that the pakcoy Nauli F1 variety exhibited a superior root system, including a larger root volume, compared with other varieties, attributable to genetic advantages in root formation and development.

CONCLUSION AND RECOMMENDATIONS

Based on the conducted Research, it can be concluded that the application of Infarm liquid organic fertilizer at a concentration of 3 mL/L produced the best growth performance of pakchoy, as reflected by plant height at 2 WAT (12.77 cm), 3 WAT (19.33 cm), and 4 WAT (22.80 cm), as well as the highest fresh canopy weight (37.67 g). Among the tested varieties, Nauli F1 showed the most favorable response, indicated by superior

plant height at 1 WAT (6.50 cm), higher leaf number at 1, 3, and 4 WAT (6.00, 11.83, and 14.33 leaves, respectively), greater fresh canopy weight (33.83 g), fresh root weight (5.00 g), and root volume (5.00 mL). In addition, an interaction effect was observed between the application of 3 mL/L Infarm liquid organic fertilizer and the Green variety on leaf number at 2 WAT, as well as between the 6 mL/L Infarm treatment and the Nauli F1 variety on leaf greenness, indicating that varietal differences Influence plant responses to fertilizer concentration. It is recommended to apply Infarm liquid organic fertilizer at a concentration of 3 mL/L and to use the Nauli F1 variety to obtain optimal pakchoy growth and yield. Further Research is suggested to evaluate different fertilizer concentrations and pakchoy varieties under varying conditions.

REFERENECES

Agus, S. S., Choirul, A., Dian, E. K. (2024). Respons Pertumbuhan dan Poduktivitas Tanaman Sawi Pakcoy (*Brassica rapa* L.) Melalui Pengaplikasian Jenis Pupuk Organik Cair. Jurnal Agroradix. 8 (1). 90-96

Badan Pusat Statistik. (2023). Produksi Tanaman Sayuran 2021-2023. Badan Pusat Statistik. [Diakses pada 4 Juni 2025]. https://www.bps.go.id/id/statistics-table/2/NjEjMg==/produksi-tanaman sayuran.html

Dewi, K.T. (2019). Respon Pertumbuhan dan Hasil Tanaman Pakcoy (*Brassica rapa* L.) Varietas Nauli F1 dengan Pemberian Pupuk Organik Cair. Jurnal Agrorektan. Vol. 6 (2): 77–92.

Fauzi, A.R., M.D. Puspitawati. (2017). Pemanfaatan kompos kulit durian untuk mengurangi dosis pupuk N anorganik pada produksi tanaman sawi hijau (*Brassica junceae*). Agrotrop: Journal on Agriculture Science. 7(1): 22-30.

Hakim, L., Mulyani, O., dan Sitorus, A. (2021). Pengaruh Konsentrasi Pupuk Organik Cair terhadap Pertumbuhan Vegetatif dan Generatif Tanaman Cabai Rawit (*Capsicum frutescens* L.). *Jurnal Agroekoteknologi*, 9(2), 123–130.

Hartatik, Wiwik, dan Setyorini, D. (2015). Pemanfaatan Pupuk Organik untuk Meningkatkan Kesuburan Tanah dan Kualitas Tanaman . Badan Penelitian dan Pengembangan Pertanian.

Pratama, C. A., Kesumawati, N., Harini, R., Oktavidiati, E., dan Jafrizal. (2024). Respon pemberian berbagai konsentrasi pupuk organik cair komersil dan dosis pupuk kandang kambing terhadap pertumbuhan dan hasil tanaman pakcoy (*Brassica rapa* L.). Skripsi. Fakultas Pertanian dan Peternakan, Universitas Muhammadiyah. Bengkulu.

Prizal, R. M., dan Nurbaiti, N. (2017). Pengaruh Pemberian Pupuk Organik Cair terhadap Pertumbuhan dan Produksi Tanaman Pakcoy (*Brassica Rapa* L.). Jurnal Online Mahasiswa Fakultas Pertanian Universitas Riau. 4 (2), 1-9

Putra, A.A.G., Karnata, I.N., dan Winten, K.T.1. 2022. Pemberian Pupuk UreapadaTanaman Kangkung Darat (*Ipomoea reptans* Poir) Dengan Jarak TanamYangBerbeda. Jurnal Ganec Swara, 16(1), 1297-1305.

Ratriyanto, A. Widyawati, S, D. Suprayogi, Wara, P.S. Prastowo S. Widyas, N. (2019). Pembuatan Pupuk Organik dari Kotoran Ternak untuk Meningkatkan Produksi Pertanian. Jurnal SEMAR. 8(1): 9–13.

Roidi, A. A. (2016). Pengaruh Pemberian Pupuk Hayati Daun Lamtoro (*Leucaena leucocephala*) Terhadap Pertumbuhan Dan Produktivitas Tanaman Sawi Pakcoy. Skripsi. Fakultas Keguruan dan Ilmu Pendidikan Universitas Sanata

Dharma.

Sari, D. P., Nugroho, A., dan Widodo, Y. (2021). Pengaruh konsentrasi pupuk organik cair terhadap pertumbuhan dan hasil tanaman sawi (*Brassica juncea L.*). *Jurnal Hortikultura Indonesia*, 12(2), 85–92.

Suhartini, S., Lestari, A. P., dan Kurniawan, D. (2020). Respon pertumbuhan beberapa varietas pakcoy (*Brassica rapa L.*) terhadap lingkungan tumbuh yang berbeda. *Jurnal Agronomi Indonesia*, 48(2), 167–174.

Suryati, M. W Mellyssa, Fakhrur Razi, dan Raisah Hayati. (2019). Pemanfaatan Limbah Air Kelapa sebagai Pupuk Organik Cair. Prosiding Seminar Nasional Politeknik Negeri Lhokseumawe: 3 (1): 58-61.

Tanjung, Sabdinsyam. (2016). Pembuatan dan Pengujian Tiga Jenis Pupuk Organik Cair terhadap Varietas Tanaman Sawi (*Brassica rapa* L.). Skripsi. Universitas Muhammadiyah Malang. Malang.

Triana, A.N., Faozi, K., dan Beganda. (2020). Pengaruh Kemiringan Pipa terhadap Pertumbuhan dan Hasil Tiga Varietas Pakcoy (*Brassica rapa* L.) pada Sistem Hidroponik NFT (*Nutrient Film Technique*). AGRIVET. Vol. 26 (2): 25- 33

Wisanggeni, B. (2024). POC Infarm. https://bambangwisanggeni. wordpress.com, [diakses 4 Juni 2025]