JUATIKA
JURNAL AGRONOMI TANAMAN TROPIKA
VOL. 7 NO. 3 September 2025

DOI :https://doi.org/10.36378/juatika.v5i2.4702
eissn 2656-1727
pissn 2684-785X
pages : 870 – 877

RESEARCH ARTICLE Open Access

Application of Biochar Compost Residue and Liquid Organic Fertilizer from Tofu Waste on Pakcoy Plants' Growth and Yield

Margareta Siba Soge[1,*], Natalia Desy Djata Ndua[1], Deseriana Bria[1]

Abstract

This research was conducted from October to November 2024 in the greenhouse and laboratory of the Faculty of Agriculture, Science, and Health at Timor University. The purpose of this study was to determine the effect of the interaction between biochar compost residue and tofu waste POC on the growth and yield of pak choy plants. The study employed a completely randomized design (CRD) factorial experiment consisting of two factors. The first factor was biochar compost residue, and the second factor was tofu waste POC residue. The biochar compost factor consisted of three levels: 0% biochar compost, 10% biochar compost (0.4 kg biochar compost mixed with 3.6 kg soil), and 30% biochar compost (1.2 kg biochar compost mixed with 2.8 kg soil). The tofu waste POC factor also had three levels: 0 mL/L water, 100 mL/L water, and 200 mL/L water. These factors resulted in nine treatment combinations, each replicated three times, for a total of 27 experimental units. The results showed no significant interaction between biochar compost residue and tofu waste POC. However, the biochar compost residue alone had a substantial effect on plant growth parameters. This research provides valuable information for agriculture by helping to determine the use of biochar compost as a fertilizer and growing medium in pak choy cultivation, enhancing growth and yield.

Keywords: Biochar Compost Residue, Pakcoy, Tofu Waste Liquid Organic Fertilizer Residue

1. Introduction

Organic fertilizer residues can serve as a source of nutrient reserves remaining in the soil, which can subsequently be utilized to support plant growth in the following planting season (Ulumuddin, 2019). The presence of organic fertilizer residues in the soil is highly beneficial for cultivating bok choy, as the nutrients remaining after previous fertilization can still be absorbed by the plants. These residual nutrients can be utilised in subsequent planting cycles without the need for additional fertilisation (Rizki, 2025). Organic fertilizers have the capacity to absorb and retain water; therefore, soils containing high levels of organic fertilizer residues have the potential to enhance crop production (Wahyuni et al., 2016). Organic fertilisers can be either liquid or solid and are derived from natural materials, such as plant residues, animal manure, animal by-products, or other organic waste that has undergone biotechnological or composting processes. Their application improves the physical, chemical, and biological properties of the soil while enriching its nutrient and organic matter content through the addition of minerals and/or beneficial microorganisms (Hartatik et al., 2015). Organic fertilizers suitable for cultivating pak choy include biochar compost and liquid tofu waste–based organic fertilizer.

Biochar compost is an organic fertilizer derived from the faeces of living creatures, green waste, household waste, and agricultural waste. The addition of biochar to the soil serves as a soil conditioner, aiming to enhance soil conditions and support optimal plant growth. Biochar is not applied directly to the soil. However, it is used as a mixing agent (bulking agent) in further processing for the composting process, thereby accelerating humification and producing compost with better final quality (Raharjo & Delang, Research by Neonbeni (2025) states that the influence of biochar compost residue can manipulate the growing environment, increasing plant growth and yield in the second growing season. Biochar compost has the

*Correspondence: margaretasoge8@gmail.com
1) Universitas Timor - Sasi, Kec. Kota Kefamenanu, Kabupaten Timor Tengah Utara, Nusa Tenggara Timur, Indonesia

potential to enhance cation exchange capacity and reduce soil acidity, improve soil structure, and provide essential nutrients for plants. Furthermore, biochar compost can also reduce the need for additional fertilizers and increase the efficiency of nutrient absorption by plants (Lelang & Gusmao, 2019). Furthermore, liquid tofu waste processed into POC contains various organic nutrients, including phosphorus, nitrogen, and sulfur. Therefore, this tofu waste POC has the potential to be utilized as a liquid organic fertilizer for bok choy plants (Nika, 2023).

The results of T. Hawalid's (2019) research indicated that the dosage of liquid organic fertilizer from tofu waste at 400 ml/L in water had the most significant effect on plant growth and production. Research by Marian *et al.* (2019) stated that liquid organic fertilizer derived from liquid tofu waste had a nutrient content of 0.12% N, P_2O_5 as much as 0.17%, K_2O as much as 0.13%, Mg as much as 0.03%, Ca as much as 0.19%, C-organic as much as 0.37%, and has a pH of 7.33. In this study, residue from liquid organic fertilizer from tofu waste was used. In addition, the use of liquid organic fertiliser produced from liquid tofu waste has the potential to be a valuable alternative for supporting environmentally friendly agriculture, reducing the excessive use of inorganic fertilisers (Marian et al., 2019).

Pakcoy (*Brassica rapa* L. subsp. *chinensis*) is a leafy vegetable that possesses distinctive characteristics and broad appeal among consumers, both in Indonesia and internationally. Its popularity stems from its pleasant flavour, crisp texture, and savoury taste, which contribute to its growing commercial value (Diantari & Nurjanah, 2023). In light of this, it is essential to investigate the effects of biochar compost residue and liquid organic fertilizer residue derived from tofu waste on the growth and yield of Pakcoy. The application of biochar compost residue at a rate of 10 tons per hectare has been reported as the most effective treatment for enhancing plant growth and yield (Nahak, 2021). Similarly, the use of liquid organic fertilizer produced from fermented tofu waste has shown significant positive effects on Pakcoy growth (Istiqomah, 2022). Furthermore, the combined treatment of tofu waste–derived liquid organic fertilizer residue at a concentration of 200 mL/L and biochar compost at 30% has proven to be the most effective combination for promoting the growth of Pakcoy plants.

2. Material and Methods

The research took place from October to November 2024, located in the greenhouse and laboratory of the Faculty of Agriculture, Science, and Health, Timor University. The research employed various tools, including buckets, analytical scales, sieves, sacks, cameras, jerry cans, measuring cups, spray bottles, rulers, writing instruments, ovens, and watering cans. Meanwhile, the materials used included soil, biochar compost residue, liquid organic fertilizer from tofu waste, Nauili F1 variety bok choy seeds, polybags, plastic clips, tissues, plastic bags, brown envelopes, Paranet, label paper, and water.

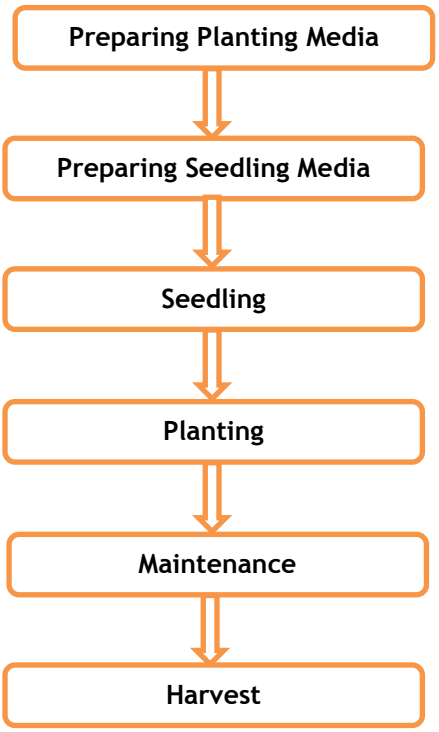

Figure 1. Research flow diagram

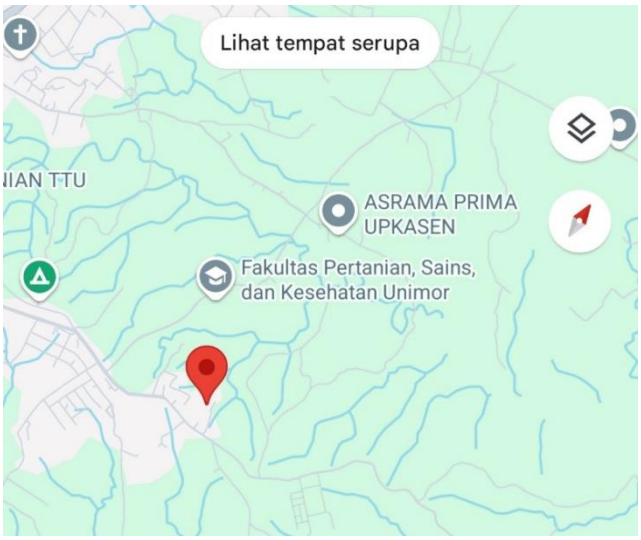

Figure 2. Coordinate Points of Research Locations (Lat-9.510832 ˚ Long 124.510493˚**)**

This research design employed a completely randomized design (CRD) with two factors. The first factor was biochar compost residue (K) with three treatment levels: (without biochar compost/0%), (10% biochar compost with a ratio of 1 kg compost: 3 kg soil), and (30% biochar compost with a ratio of 3 kg compost: 1 kg soil). The second factor was tofu waste POC residue (T), also

consisting of three dosage levels: 0 mL/L water, 100 mL/L water, and 200 mL/L water. There were nine treatment combinations (K0T0 to K2T2), each repeated three times, resulting in a total of 27 experimental units.

In this study, the parameters observed included growth parameters, such as plant height and number of leaves, as well as yield parameters, including root length, root volume, fresh shoot weight, dry shoot weight, fresh root weight, dry root weight, and harvest index. From the research results, the data were analyzed using ANOVA analysis of variance to determine the real differences between the treatments tested using the DMRT Duncan Multiple Range Test (at a significance level of 5%). Data analysis was conducted using SAS software version 9.1, following the guidelines established by Gomez and Gomez (2010).

3. Results and Discussion

3.1. Plant Height.

ANOVA analysis data are presented in Table 1. Shows that there is no interaction between residues from biochar compost and liquid organic fertilizer of tofu waste on plant height parameters at 35 DAP observation age. The results also show that a single treatment of biochar compost residue has a significant effect on plant height parameters, where the application of 1.2 kg of biochar compost residue is significantly different from other treatments. Meanwhile, the single treatment of liquid organic fertilizer residue of tofu waste does not have a significant effect.

Table 1. Plant height (cm)

Age	Treatment	POC (0 ml)	POC (100 ml)	POC (200 ml)	Average (cm)
	compost (0 kg)	20.03 ± 0.24	19.2 ± 0.43	19.57 ± 0.39	19.60c
	compost (0.4 kg)	20.4 ± 0.20	20.73 ± 0.06	20.97 ± 0.06	20.70b
35 DAP	compost (1.2 kg)	21.87 ± 0.18	21.5 ± 0.17	21.7 ± 0.16	21.69a
	Average (cm)	20.77	20.48	20.74	(-)

Description: Numbers followed by the same letter indicate that there is no significant difference at a 5% confidence level according to the DMRT test, while the (-) symbol means that no interaction between. K: Biochar compost, T: Tofu waste POC.

The results of the study (Kefi, 2024) indicate that treatment with fertiliser from biochar compost can have a significant impact on aspects of plant growth, including plant height. This finding suggests that the remaining organic material from biochar compost in the second planting season remains effective in supplying nutrients that support increased plant height. This statement aligns with the findings of Ndua et al. (2025), which demonstrate that the application of biochar compost has the potential to enhance soil characteristics, including soil chemistry, as indicated by increased levels of organic carbon, total N, and phosphorus availability. Research by Raharjo and Delang (2020), suggests that the remaining organic material from biochar compost in the second planting season is still effective in supplying nutrients that support increased plant height.

The single use of tofu waste POC has been shown to have no significant effect on the growth aspect of plant height. Research results Qurrotu'aini *et al.* (2022) show that the effectiveness fertilizer organic liquid fertilizer in supporting plant growth can decrease if a change in the chemistry during the fermentation process, such as a decrease in pH due to decomposition of organic C, occurs, resulting in a sour organic nature sour so that it gives no significant influence on plant growth.

3.2. Amount Leaf

The data in Table 2 shows that there was no interaction between biochar compost residue and liquid organic fertilizer from tofu waste on the number of plant leaves. However, the single treatment of biochar compost residue showed a significant effect, with the 1.2 kg treatment differing significantly from the 0.4 and 0 kg treatments. Meanwhile, the single treatment of liquid organic fertilizer from tofu waste did not show a significant effect on the number of plant leaves.This lack of interaction is likely due to the complex relationship between various factors that influence plant growth and development, such as nutrient availability and balance, plant genetics, and environmental conditions during the research. This result aligns with Panataria's (2022) assertion that plant growth is not solely determined by internal factors, such as hormones or nutrients, but also by various other factors, including environmental conditions like water availability in plant tissues, sunlight intensity, and temperature conditions at the planting location.

Table 2. Number of leaves (strands)

Age	Treatment	POC (0 ml)	POC (100 ml)	POC (200 ml)	Average (strands)
	compost (0 kg)	14.67 ± 1.00	16.33 ± 0.26	16.33 ± 0.59	15.78b
35 DAP	compost (0.4 kg)	17.33 ± 0.44	17.33 ± 0.01	17 ± 0.57	17.22b
	compost (1.2 kg)	21 ± 0.56	17.67 ± 0.09	21 ± 0.48	19.89a
	Average (strands)	17.67	17.11	18.11	(-)

Description: Numbers followed by the same letter indicate that there is no significant difference at a 5% confidence level according to the DMRT test, while the (-) symbol indicates that no interaction between. K: Biochar compost, T: Tofu waste POC.

According to Lelang & Gusmao (2019), soil treated with additional biochar compost tends to have a looser and lighter texture, making it easier for plant roots to penetrate the soil and absorb water and nutrients. This improvement in soil structure also enhances air circulation and drainage, which supports the activity of soil microorganisms in the decomposition process and the release of nutrients. Application: The use of organic materials, such as biochar compost, is effective in increasing the number and activity of soil microorganisms, which in turn help enrich the nutrient content in the soil, allowing it to support plant growth and increase the number of plant leaves.

3.3. Root Length

ANOVA analysis of variance data, as shown in Table 3, indicates that the interaction between biochar compost residue and tofu waste POC did not occur. A single treatment using biochar compost residue yielded significant results, where the treatment of 1.2 kg of biochar compost residue was not significantly different from the treatment of 0 kg, but was significantly different from the treatment of 0.4 kg. The treatment of tofu waste liquid organic fertilizer residue did not substantially affect the root length parameter of bok choy.

Table 3. Root length (cm)

Treatment	POC (0 ml)	POC (100 ml)	POC (200 ml)	Average (cm)
Biochar compost (0 kg)	16.83 ± 0.25	16.73 ± 0.11	15.43 ± 0.03	16.33ab
compost (0.4 kg)	16.1 ± 0.59	15.8 ± 0.46	14.6 ± 0.23	15.50b
compost (1.2 kg)	19.9 ± 0.38	18.7 ± 0.27	15.97 ± 0.11	18.19a
Average (cm)	17.61	17.08	15.33	(-)

Description: Numbers followed by the same letter indicate that there is no significant difference at a 5% confidence level according to the DMRT test, while the (-) symbol indicates that no interaction between. K: Biochar compost, T: Tofu waste POC.

Biochar compost residue has been proven to support plant root growth due to its nutrient content, such as nitrogen (N), which stimulates young root growth, phosphorus (P), which is essential for cell division and root formation, and potassium (K), calcium (Ca), and magnesium (Mg), which play a role in strengthening root tissue and increasing air absorption. This finding is supported by the statement that Ridwan et al. (2022) explained that nutrients such as potassium (K), phosphorus (P), and magnesium (Mg) play a crucial role in the process of root length formation. Biochar plays a role in increasing soil porosity, improving looseness, and enhancing the soil's capacity to absorb air, while compost, as a mixture of planting media, functions to provide essential nutrients, maintain soil function and quality, and increase productivity by stimulating microorganism activity (Ceunfin et al., 2025).

3.4. Root Volume

The results of the ANOVA analysis of variance, as shown in Table 4, indicate that there was no interaction between the combination of biochar compost residue and liquid organic fertilizer from tofu waste. The single treatment of biochar compost residue had a significant effect on root volume, where the treatment with 1.2 kg of biochar compost residue was not significantly different from 0.4 kg but was significantly different from 0 kg. The single treatment of liquid organic fertilizer residue of tofu waste showed an insignificant effect on root volume parameters.

Table 4. Root volume (ml)

Treatment	POC (0 ml)	POC (100 ml)	POC (200 ml)	Average (ml)
compost (0 kg)	2.47 ± 0.25	1.17 ± 0.41	2.27 ± 0.08	1.97b
compost (0.4 kg)	2.6 ± 0.29	3.33 ± 0.22	2.17 ± 0.14	2.70ab
compost (1.2 kg)	4.57 ± 0.23	2.4 ± 0.03	3.07 ± 0.09	3.34a
Average (ml)	3.21	2.3	2.5	(-)

Description: Numbers followed by the same letter indicate that there is no significant difference at a 5% confidence level according to the DMRT test, while the (-) symbol indicates that no interaction between. K: Biochar compost, T: Tofu waste POC.

Kriswantoro *et al* (2019) stated that the role of organic fertilizer plays a role in improving the physical properties of the soil, which is shown through the formation of stable soil structures and aggregates, which then increases the soil's ability to absorb water, facilitates infiltration, reduces the risk of erosion, improves cation exchange capacity, and maintains stable soil temperature, thus providing a positive impact on plant growth. Overall, the use of compost and biochar does not have a detrimental effect on plant yields or quality, but can support plant growth, including an increase in the volume of healthy plant roots.

Residues from liquid organic fertilizer made from tofu waste did not significantly impact root volume. According to Panataria *et al.* (2020), the efficiency of nutrient absorption by a plant is influenced not only by the nutrient content in liquid organic fertilizer but also by the method of application. As is known, fertilizer applied through the soil is not fully absorbed by plants, as some can be fixed by soil particles, thus limiting its availability to plants.

3.5. Fresh weight of the crown

Table 5 shows no interaction between the combination

of biochar compost residue and tofu waste liquid organic fertilizer. The single treatment using biochar compost residue had a significant effect on the fresh weight of the shoots, with the 1.2 kg treatment being notably different from the other treatments. On the other hand, the residue from tofu waste liquid organic fertilizer (POC) did not significantly affect the fresh weight parameter of the shoots.

Table 5. Fresh weight of crown (g)

Treatment	POC (0 ml)	POC (100 ml)	POC (200 ml)	Average (g)
compost (0 kg)	31.95 ± 31	27.53 ± 5.40	32.36 ± 5.23	30.61b
compost (0.4 kg)	39.1 ± 4.92	45.45 ± 1.23	42.33 ± 1.91	42.29b
compost (1.2 kg)	90.55 ± 12.22	58.2 ± 2.68	69.49 ± 7.14	72.75a
Average (g)	53.87	43.73	48.06	(-)

Description: Numbers followed by the same letter indicate that there is no significant difference at a 5% confidence level according to the DMRT test, while the (-) symbol means that no interaction between. K: Biochar compost, T: Tofu waste POC.

The results of research by Ndua *et al*. (2025) indicate that the application of a combination of liquid organic ffertiliserfrom tofu waste and biochar compost did not have a significant effect on bok choy plants during their growth period. The results of research by Putri and Herlambang (2025) indicated that the combination of biochar fertiliser and tofu waste POC had no significant effect on bok choy plants during their growth period. According to Panataria *et al*. (2020), the absence of interaction between the two factors is attributed to each factor exerting a dominant influence independently on plant physiological activity. If one factor has a more substantial influence, the impact of the other factor may be obscured or not clearly visible.

The increased fresh weight of the canopy also indicates more optimal biomass accumulation. This result is suspected to be due to the nutrients contained in biochar compost, which have the potential to provide essential nutrients that support optimal root system growth. Furthermore, composted biochar has the potential to enhance the physical, chemical, and biological properties of the soil, ultimately leading to improved soil conditions for root development and nutrient uptake. Overall, the use of compost and biochar did not have an adverse effect on crop yields or quality. In fact, the combination of the two proved most optimal in increasing chlorophyll content and plant fresh weight (Surjaningsih, 2023). This result indicates that biochar, when mixed into compost, plays a crucial role as an absorbent and storage material for water and nutrients, thereby reducing nutrient loss due to evaporation, especially in areas with high temperatures. These conditions also support a more stable and optimal environment for the life and development of microorganism populations that play a role in the decomposition of organic matter during composting (Mali, 2024).

3.6. Dry weight of crown

The results of the ANOVA analysis of variance in Table 6 indicate that there was no interaction between the combination of biochar compost residue and tofu waste liquid organic fertilizer residue on the dry weight parameter of the shoots. The biochar compost residue had a significant effect, as the treatment with 1.2 kg of biochar compost residue was significantly different from the other treatments. The treatment of tofu waste POC residue had no significant effect on the dry weight of the shoots. The growth of a plant is inseparable from the nutrients needed by the plant, one of which is the nutrients present in the planting medium.

Table 6. Dry weight of the crown

Treatment	POC (0 ml)	POC (100 ml)	POC (200 ml)	Average (g)
Biochar compost (0 kg)	2.22 ± 0.22	1.64 ± 0.19	1.83 ± 0.24	1.90b
compost (0.4 kg)	2.12 ± 0.32	2.36 ± 0.11	2.61 ± 0.06	2.36b
compost (1.2 kg)	4.28 ± 0.23	3.23 ± 0.91	3.24 ± 0.11	3.58a
Average (g)	2.87	2.41	2.56	(-)

Description: Numbers followed by the same letter indicate that there is no significant difference at a 5% confidence level according to the DMRT test, while the (-) symbol means that no interaction between. K: Biochar compost, T: Tofu waste POC.

Biochar compost residue has a significant impact on the dry weight of bok choy plants due to its high nutrient content. Research by Neonbasu (2025) indicates that the addition of compost and biochar at specific doses has been shown to significantly enhance plant growth, as evidenced by increased plant weight. Application: The use of organic materials, such as biochar compost, is effective in increasing the number and activity of soil microorganisms, which in turn enriches the soil's nutrient content. (Khasanah et al. 2020).

3.7. Fresh weight of roots

The results of the ANOVA analysis are presented in Table 7. Show that there was no interaction between the two factors, namely residue from biochar compost and

liquid organic fertilizer from tofu waste. The results of the single treatment of biochar compost residue showed a significant effect, where the K2 treatment was significantly different from the K1 and K0 treatments. The single treatment of liquid organic fertilizer residue from tofu waste had no significant effect on the fresh root weight parameter.

Table 7. Fresh weight of roots (g)

Treatment	POC (0 ml)	POC (100 ml)	POC (200 ml)	Average (g)
compost (0 kg)	2.12 ± 0.43	1.4 ± 0.48	2.25 ± 0.32	1.92c
compost (0.4 kg)	2.86 ± 0.33	3.63 ± 0.10	3.25 ± 0.10	3.24b
compost (1.2 kg)	5.24 ± 0.31	3.53 ± 0.11	4.17 ± 0.16	4.31a
Average (g)	3.41	2.85	3.22	(-)

Information: The numbers that follow with the same letter indicate that there is no difference at a fundamental level of 5% confidence according to the DMRT test, while the (-) symbol indicates that there is no interaction. K: Biochar compost, T: Tofu waste POC.

A significant increase in fresh root weight was also observed, reflecting the fulfilment of nutrient requirements that support the vegetative development of plants, as mentioned by Apriyanto et al. (2023). This result occurs because the composition of the compost and biochar contained in the planting medium supports the growth of bok choy plant roots. The results of research by Neonbeni (2025) indicate that the use of biochar compost residue has been proven to contribute to increased fresh weight of plant roots, which is thought to be related to the availability of nutrients and improvements in soil physical properties, thereby supporting optimal plant growth.

3.8. Dry weight of roots

Table 8 shows that there was no interaction between the biochar compost residue and tofu waste liquid organic fertilizer treatments on the dry weight of the shoots. Similarly, neither therapy alone had a significant effect on dry root weight.

Table 8. Root dry weight (g)

Treatment	POC (0 ml)	POC (100 ml)	POC (200 ml)	Average (g)
compost (0 kg)	0.28 ± 0.02	0.21± 0.02	0.27 ± 0.01	0.26
compost (0.4 kg)	0.31 ± 0.02	0.38 ± 0.03	0.33 ± 0.00	0.34
compost (1.2 kg)	0.47 ± 0.02	0.23 ± 0.01	0.32 ± 0.00	0.34
Average (g)	0.35	0.27	0.31	(-)

Description: Numbers followed by the same letter indicate that there is no significant difference at a 5% confidence level according to the DMRT test, while the (-) symbol indicates that no interaction between. K: Biochar compost, T: Tofu waste POC.

The application of biochar compost residue as a single treatment had no significant effect on root dry weight. This is suspected to be due to low nutrient availability, as the decomposition of organic matter in the biochar has not yet occurred optimally. This result aligns with the statement by Damayani *et al*. (2014), who found that residue from the planting media mixture did not provide adequate support for plant growth, indicating that the decomposition process was not optimal. Research by Gumelar & Seo (2021) showed that the use of biochar and compost had no significant impact on the dry weight of plant roots. Research by Madjen (2018) stated that the application of compost and biochar did not produce significant differences in plant growth.

Treatment with liquid organic fertiliser residue from tofu waste had no significant effect on the dry weight of plant roots. This result is suspected to be due to the fertilizer applied during the previous planting having undergone evaporation and infiltration. As is known, fertilizer applied through the soil is not fully absorbed by plants, because some of it can be fixed by soil particles, thus limiting its availability to plants. Treatment using POC made from tofu waste did not have a significant impact on the vegetative growth of mustard greens, either in terms of plant height or the number of leaves (Pariyanto et al., 2023). Research results by Sanda & Hasnelly (2023) show that the application of POC is ineffective against wide-leaf plants, allegedly due to fertiliser. This result is seldom made into a primary source of nutrients. POC tends to be easily washed away by erosion, which causes the nutrients contained in it to decrease and ultimately have no impact on the increase of wide-leaf plants. This result is reinforced by Ediwirman's (2022) statement, which states that applying organic fertiliser to the land tends to have low effectiveness and efficiency. Because only part of the nutrients absorbed by the roots of the plant is temporary, and the rest can be lost due to movement to a deeper layer of land or evaporated into the atmosphere, this method is less than optimal for providing nutrients in a sustainable manner for the plant.

3.9. Harvest Index

From the results analysis of the fingerprint variety Anova in Table 9, it can be seen that there is no occurrence

of interaction between the residue from biochar and the residue from compost from organic liquid Fertiliser and Tofu waste on the index parameters of the harvest plant Pakcoy. The single treatment of biochar compost residue and the single treatment of liquid organic fertilizer residue also did not significantly affect the harvest index parameter of Pakcoy plants.

Table 9. Harvest index

Treatment	POC (0 ml)	POC (100 ml)	POC (200 ml)	Average (%)
compost (0 kg)	93.79 ± 0.05	95.48 ± 0.44	93.52 ± 0.02	94.26a
compost (0.4 kg)	93.56 ± 0.14	92.63 ± 0.36	93.03 ± 0.19	93.08b
compost (1.2 kg)	94.47 ± 0.09	94.34 ± 0.03	94.19 ± 0.10	94.33a
Average (%)	93.94	94.16	93.58	(-)

Information: The numbers that follow with the same letter indicate that there is no difference at a 95% confidence level according to the DMRT test, while the (-) symbol indicates that there is no interaction. K: Biochar compost, T: POC Tofu waste.

The single treatment of biochar compost residue significantly affected the harvest index parameter, with the best treatment being 1.2 kg of biochar compost residue. The results of research (2025) stated that the application of biochar compost was proven to significantly affect plant growth, while increasing the population of soil microorganisms, as the organic material content became an energy source for bacteria. The combination of biochar and compost produced a more substantial synergistic effect in improving soil properties and increasing crop yields compared to only biochar or compost alone. The results of research by Herman and Resigia (2018) indicated that the use of biochar and rice straw compost had a positive impact on plant growth and production.

4. Conclusion

The application of biochar compost residue as a single treatment had a significant effect on several growth parameters, including plant height and number of leaves at 35 days after planting, root length and volume, fresh and dry shoot weight, root fresh weight, and harvest index. The best results were obtained with the treatment dose of 1.2 kg of biochar compost residue.

References

Apriyanto, F. I., & Afrizal, R. (2023). Pemberian dosis POC Jakaba terhadap pertumbuhan dan produksi tanaman pakcoy (*Brassica rapa* L.). *Jurnal Pertanian*, 11(3), 343–351.

Ceunfin, S., et al. (2025). Pertumbuhan pakcoy di lahan kering melalui optimalisasi media dan baris tanam dalam vertikultur fertigasi. *Agroteknika*, 8(2), 442–451. https://doi.org/10.55043/agroteknika.v8i2.521

Damayani, N., Nurlaeny, N., & Kamil, K. (2014). Efek residu dari kombinasi media tanam abu vulkanik Merapi, pupuk kandang sapi, dan tanah mineral terhadap C-organik, kapasitas pegang air, kadar air, dan bobot kering pupus tanaman jagung (*Zea mays* L.). *Bionatura: Jurnal Ilmu-Ilmu Hayati dan Fisik*, 15(3), 196–202. https://www.neliti.com/id/publications/217778

Diantari, R., & Nurjanah, E. S. U. (2023). Respon pertumbuhan dan hasil pakcoy pada beberapa komposisi media tanam. *Seminar Nasional Pertanian Pesisir*, 2(1), 508–521.

Ediwirman. (2022). Pelatihan pembuatan pupuk organik cair dengan bioaktivator di Kenagarian Pancung Taba Kecamatan Bayang Utara Kabupaten Pesisir Selatan. *Jurnal Pengabdian Kepada Masyarakat*, 5, 203–217. http://dx.doi.org/10.31604/jpm.v5i1.203-217

Gumelar, A. I., & Seo, M. (2021). Takaran biochar dan level teh kompos terhadap pertumbuhan dan hasil tanaman kacang tanah (*Arachis hypogaea* L.) di lahan kering Entisol. *Savana Cendana*, 6(2), 29–32. https://doi.org/10.32938/sc.v6i02.958

Hartatik, W., Husnain, H., & Widowati, L. R. (2015). Peranan pupuk organik dalam peningkatan produktivitas tanah dan tanaman. *Jurnal Sumberdaya Lahan*, 9(2), 107–120. https://doi.org/10.2018/jsdl.v9i2.6600

Hawalid, H. (2019). Respon pertumbuhan dan produksi tanaman kacang tanah (*Arachis hypogaea* L.) pada pemberian takaran pupuk organik cair limbah tahu dan jarak tanam yang berbeda. *Klorofil*, 2, 78–82. https://doi.org/10.32502/jk.v14i2.2364

Herman, W., & Resigia, E. (2018). Pemanfaatan biochar dan kompos jerami padi terhadap pertumbuhan dan produksi padi (*Oryza sativa*) pada tanah ordo Ultisol. *Jurnal Ilmiah Pertanian*, 15(1), 42–50. https://doi.org/10.31849/jip.v15i1.1487

Istiqomah, I., Sari, M. M., & Istyadji, M. (2022). Pengaruh pemberian limbah cair tahu dengan konsentrasi yang berbeda terhadap pertumbuhan tanaman pakcoy (*Brassica rapa* L.) secara hidroponik. *JUSTER: Jurnal Sains dan Terapan*, 1(3), 158–170. https://doi.org/10.57218/juster.v1i3.369

Kefi, A., Fatin, F., & Banunaek, Z. A. (2024). Pengaruh waktu penyiangan dan takaran kompos biochar terhadap pertumbuhan dan hasil tanaman bawang putih (*Allium sativum* L.) lokal Eban. *Jurnal Agrorektan*, 11(2), 17–30. https://doi.org/10.35569/q20xhv94

Khasanah, V., Rohmawati, N., & Wawan, W. (2020). Sifat kimia Ultisol dan pertumbuhan gaharu sebagai intercropping di lahan kelapa sawit yang diaplikasikan kompos dan biochar TKKS. *Jurnal Agronomi Tanaman Tropika*, 2(2), 68–85. https://doi.org/10.36378/juatika.v2i2.527

Kriswantoro, H., Safriyani, E., & Bahri, S. (2019). Pemberian pupuk organik dan pupuk NPK pada tanaman jagung manis (*Zea mays saccharata* Sturt). *Jurnal Penelitian Ilmu-Ilmu Pertanian*, 7(1), 274–282. https://doi.org/10.32502/jk.v11i1.209

Lelang, M. A., & Gusmao, V. (2019). Pengaruh takaran kompos biochar pupuk kandang sapi terhadap pertumbuhan beberapa kultivar kacang hijau (*Vigna radiata* L.). *Savana Cendana*, 4(4), 78–82. https://doi.org/10.32938/sc.v4i04.691

Madjen, Y. J. (2018). Aplikasi jenis teh kompos dan takaran biochar terhadap pertumbuhan serta produksi biomassa rumput gajah (*Pennisetum purpureum*). *JAS*, 3(2), 29–31. https://doi.org/10.32938/ja.v3i2.327

Mali, D. D. (2024). Pengaruh perbandingan limbah baglog jamur tiram putih dan kompos biochar sebagai media tanam terhadap pertumbuhan dan hasil pakcoy (*Brassica rapa* L.). *Jurnal Pertanian*, 10, 4–6.

Marian, E., et al. (2019). Pemanfaatan limbah cair tahu sebagai pupuk organik cair pada pertumbuhan dan hasil tanaman sawi putih (*Brassica pekinensis*). *Agritrop*, 17(2), 134–144. http://jurnal.unmuhjember.ac.id/index.php/agritrop/article/view/2663/2238

Nahak, B. (2021). Pertumbuhan dan hasil kacang hijau (*Vigna radiata* L.) dalam tumpangsari dengan jagung (*Zea mays* L.) pada penanaman ketiga di tanah Entisol semi-arid yang mengandung

residu kompos biochar. *Savana Cendana*, 6(4), 72–77. https://doi.org/10.32938/sc.v6i04.139

Ndua, D. N., Bria, D., & Naisali, H. (2025). Aplikasi POC limbah tahu dan kompos biochar serta pengaruhnya terhadap tanah dan pakcoy (*Brassica rapa* L.). *Jurnal Ilmu-Ilmu Pertanian*, 9(1), 33–40. https://doi.org/10.32585/ags.v9i1.6203

Neonbasu, N. B., & Tobing, W. L. (2025). The effect of N fertilizer with media and planting rows in verticulture cultivation of vertigation system on pakcoy plants in dry land. *Agrisaintifika: Jurnal Ilmu-Ilmu Pertanian*, 9(2), 325–331. https://doi.org/10.32585/ags.v9i2.6460

Neonbeni, E. Y., Ceunfin, S., & Meni, V. (2025). Pengaruh residu beberapa jenis kompos biochar pada takaran yang berbeda terhadap pertumbuhan dan hasil kacang hijau (*Vigna radiata* L.) di tanah Entisol semi-arid. *Savana Cendana*, 10(1), 8–20. https://doi.org/10.32938/sc.v10i01.1104

Nika, P. A. (2023). Pengaruh pemberian pupuk organik cair (POC) limbah cair tahu terhadap pertumbuhan dan hasil tanaman sawi (*Brassica juncea* L.). *Jurnal Lahan Pertanian Tropis (JLPT)*, 2(1), 91–97. https://doi.org/10.29303/jima.v2i1.2289

Panataria, L. R., Sihombing, P., & Sianturi, B. (2022). Pengaruh pemberian biochar dan POC terhadap pertumbuhan dan produksi tanaman pakcoy (*Brassica rapa* L.) pada tanah Ultisol. *Jurnal Rhizobia*, 2(1), 1–13. https://doi.org/10.36985/rhizobia.v9i1.217

Panataria, L. R., Sihombing, P., & Sianturi, B. (2020). Pengaruh pemberian biochar dan produksi tanaman pakcoy (*Brassica rapa* L.) pada tanah Ultisol. *Jurnal Ilmiah Rhizobia*, 2(1), 1–14.

Pariyanto, P., Saroni, S. S., & Meilani, A. (2023). Pemanfaatan limbah cair industri tahu sebagai pupuk organik cair (POC) terhadap pertumbuhan tanaman sawi hijau (*Brassica juncea* L.). *Jurnal Riset dan Inovasi Pendidikan Sains (JRIPS)*, 2(2), 145–155. https://doi.org/10.36085/jrips.v2i2.5656

Putri, J. F. A., & Herlambang, S. (2025). Pengaruh pemberian pupuk organik cair limbah udang dan biochar tempurung kelapa terhadap ketersediaan N, P, dan K tanah pada pertumbuhan pakcoy (*Brassica rapa* L.). *Jurnal Tanah dan Sumberdaya Lahan*, 12(1), 33–43. https://doi.org/10.21776/ub.jtsl.2025.012.1.4

Qurrotu'aini, N. R., Mawarni, M., Beay, Y., & Nurrochman, N. (2022). Pengaruh EM4 terhadap pengolahan limbah cair industri tahu menjadi pupuk organik cair. *Jurnal Pengendalian Pencemaran Lingkungan (JPPL)*, 4(1), 7–12. https://doi.org/10.35970/jppl.v4i1.1097

Raharjo, K. T. P., & Delang, V. R. (2020). Pengaruh jenis residu kompos biochar dan umur defoliasi daun jagung (*Zea mays* L.) terhadap pertumbuhan dan hasil kacang merah (*Phaseolus vulgaris* L.) dalam tumpangsari salome. *Savana Cendana*, 5(3), 47–51. https://doi.org/10.32938/sc.v5i03.1054

Ridwan, M., Laili, S., & Tito, S. I. (2022). Respon tanaman alfalfa (*Medicago sativa* L.) terhadap pemberian pupuk organik cair dengan sistem hidroponik rakit apung. *Sciscitatio*, 3(2), 68–81.

Rizki, M. W. L., & Sholihah, A. (2025). Efek residu media sisa tanam periode pertama terhadap serapan hara fosfor tanaman sawi pakcoy (*Brassica rapa* L.) periode tanam kedua. *Jurnal Pertanian Tropika*, 12(2), 178–186.

Sanda, U., & Hasnelly, H. (2023). Respon tanaman selada (*Lactuca sativa* L.) terhadap pupuk kandang sapi dan konsentrasi pupuk organik cair (POC). *Jurnal Sains Agro*, 8(1), 13–25. https://doi.org/10.36355/jsa.v8i1.1000

Seran, A. S., et al. (2025). Respon pakcoy (*Brassica rapa* L.) terhadap pupuk organik cair limbah tahu dan kompos biochar. *Jurnal Ilmu Pertanian*, 8, 139. https://doi.org/10.52166/agroteknologi.v8i2.9178

Surjaningsih, D. (2023). Pengaruh pemberian biochar dan kompos terhadap pertumbuhan tanaman pakcoy (*Brassica rapa* L.) pada tanah Vertisol. *Journal of Applied Plant Technology (JAPT)*. https://doi.org/10.30742/japt.v2i1.76

Ulumuddin, A. S., & Suntari, R. (2019). Pengaruh residu urea dan kompos dengan aplikasi kompos kotoran kambing terhadap sifat kimia tanah dan pertumbuhan tanaman okra pada tanah terdampak letusan Gunung Kelud. *Jurnal Tanah dan Sumberdaya Lahan*, 6(1), 1201–1208. https://doi.org/10.21776/ub.jtsl.2019.006.1.19

Wahyuni, S., Rianto, S., Lasmono, A., & Setyanto, P. (2016). Pengaruh residu pupuk organik terhadap serangan penyakit bulai (*Sclerospora maydis* L.) dan produksi tanaman jagung. *Prosiding Seminar Nasional Agroinovasi Spesifik Lokasi untuk Ketahanan Pangan pada Era Masyarakat Ekonomi ASEAN*, 1, 1604–1610.