

GROWTH RESPONSE OF PAKCOY (*Brassica rapa* L.) TO VARIOUS ADDITIONS OF POC FROM ORGANIC WASTE

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Abstrac

To provide the nutrients needed by plants, liquid organic fertiliser (POC) made from organic waste can be used as an alternative. The purpose of this study was to determine how various concentrations of POC affect pak choi growth. The method used was a split-plot design consisting of two factors: Factor 1 was the frequency of POC application, namely F1 once a week and F2 twice a week. Factor 2 was the type of fertiliser, namely P1 young papaya, P2 young pineapple, P3 banana stems, P4 guinea fowl manure, P5 rabbit urine, and P6 chicken manure, each at 10 millilitres per litre of water. There were 36 experimental units because the treatment was repeated three times. The data were analysed using the F-test, and if there were significant differences, Duncan's test (DMRT) at the 5% level was used. The results obtained showed that various types of POC had a very significant effect on almost all measured parameters, namely plant height, number of leaves, wet weight, and dry weight. Rabbit urine POC had the best effect on pakcoy plant height, and young papaya POC had the best effect on the number of leaves and wet weight.

Keyword: waste, organic, pakcoy, growth, fertilizer

A. Introduction

Pakcoy (*Brassica rapa* L.) is one of the most widely consumed leafy vegetables due to its exceptional nutritional content. This includes vitamins A, C, and K, as well as various essential minerals (Resmiati et al., 2021). To enhance plant growth and production in pakcoy cultivation, the availability of ideal nutrients is crucial. Liquid organic fertiliser (POC) made from various organic wastes can be used as an alternative to provide the nutrients needed by plants and improve soil fertility (Sutedjo, 2020).

The use of POC in pakcoy cultivation not only helps plants grow faster, but also benefits the environment by reducing organic waste that can damage the environment (Gunawan et al., 2019). In addition, POC can increase the organic matter content in the soil and microbial activity that aids in the decomposition of nutrients, making it better than using chemical fertilisers (Haryanto, 2021).

However, further research is needed on the effectiveness of various types of organic waste used in POC and the effect of the waste content on pakcoy growth in order to determine the optimal concentration for optimal growth.

This study was conducted by considering the possibilities and benefits of various organic materials. The aim was to determine the effect of various levels of POC on pakcoy plant growth and to analyse the impact of POC usage frequency on the growth of these plants. The results of this study are expected to provide useful information for farmers and academics in developing environmentally friendly agricultural technology based on liquid organic fertilisers.

B. Literature Review and Hypothesis Development

The liquid organic fertiliser used is made from several types of organic waste. POC material from young papaya has potential because it contains papain enzymes, growth hormones, and nutrients such as nitrogen, phosphorus, and potassium that are good for plants (Handayani, & Santoso, 2020). Young pineapple can also be used as POC material because it contains bromelain enzymes, vitamins, and minerals that accelerate the decomposition of organic matter and increase the availability of nutrients for plants (Setiawan et al., 2021). In addition, the organic acids in young pineapple help increase the activity of microorganisms in the soil, which supports plant growth (Rahmawati & Suryanto, 2020).

Banana stems can be used as raw material for organic fertiliser or decomposers. Banana stems contain microbes such as *Bacillus* sp., *Aeromonas* sp., and *Aspergillus niger*, which can help break down organic matter. In addition, banana stems also have high phenolic acid content, which helps bind Al, Fe, and Ca ions, which play a role in increasing phosphorus availability in the soil, which is important for flowering and fruit formation (Suhastyo, 2011). Chicken manure, quail manure, and rabbit urine have macro and micro nutrients that are useful for plant growth. Chicken manure is rich in nitrogen (N), phosphorus (P), and potassium (K), which are important for the development of plant leaves and fruits (Suharjo et al., 2020). Quail manure has higher N and P levels than chicken manure, thereby increasing soil fertility (Rahman & Yulianti, 2021). Rabbit urine contains high levels of nitrogen and microelements such as Zn and Fe, which support plant leaf and root growth (Setiawan et al., 2019).

Several organic materials such as papaya scraps, pineapple scraps, chicken manure, quail manure, rabbit urine, and banana stems contain various useful substances. These substances can affect the growth of pak choi plants.

C. Research Method

The research design used was a Split Plot Design involving two factors. The first factor or Main Plot is Liquid Organic Fertiliser (LOF), which consists of 6 types, namely P1: young papaya, P2: young pineapple, P3: banana stems, P4: quail manure, P5: rabbit urine, and P6: chicken manure. Each type of fertiliser was applied at a rate of 200 ml per polybag. The second factor, or Subplot, was the frequency of POC application, which consisted of two levels, namely F1 (once a week) and F2 (twice a week). Thus, there were 12 treatment combinations. Each treatment was repeated 5 times, resulting in a total of 60 experimental units. The data were analysed using the F test. If there were significant differences, the Duncan test (DMRT) was used at a 5% level. The variables observed in this study included plant height, number of leaves, wet weight, and dry weight.

D. Discussion

a. Plant Height

Based on the analysis of variance on the plant height variable, the results are shown in the table below

Table 1. DMRT test of the effect of POC application on average plant height

Treatmen	Average	Symbol
P3	5,13	a
P6	7,79	b
P1	11,195	c
P2	11,421	cd
P4	14,558	e
P5	16,624	f

Table 2. DMRT test of the effect of POC application frequency on average plant height

Treatmen	Average	Symbol
F1	52,30666667	a
F2	58,89	b

Based on the results of the analysis of variance (ANOVA), it was found that the types of fertiliser treatments P3, P4, P5 and P6 had a significant effect on plant height, and the frequency of fertiliser application had a very significant effect on the average height of pak choi plants. Treatment P5 produced the best results in terms of plant height. Kata kunci: limbah, organik, pakcoy, pertumbuhan, pupuk,

b. Number of Leaves

Based on the analysis of variance on the variable number of leaves, the results are shown in the table below

Table 3. DMRT test of the effect of POC application on the number of pakcoy leaves

Treatmen	Average	Symbol
P6	21,25	a
P3	22,5	b
P5	31	c
P4	41,75	d
P2	48,5	e
P1	52,5	f

Table 4. DMRT test of the effect of POC application frequency on teh number of leaves

Treatmen	Average	Symbol
F1	49,16	a
F2	53,6	b

Based on the results of the analysis of variance (ANOVA), it was found that all types of fertiliser treatments had a significant effect on the number of pak choi leaves. Treatment P1 produced the best results in terms of leaf count.

c. Wet weight

Based on the analysis of variance on the wet weight variable, the results are shown in the table below

Table 4. DMRT test of the effect of POC application on the wet weight of pak choi plants

Treatment	Average	Symbol
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P6	42,5	a
P3	45	a
P5	62	b
P4	83,5	c
P2	97	d
P1	105	e

Table 5. DMRT test of the effect of POC application frequency on the wet weight of pak choi plants

Treatmen	Average	Symbol
F1	159,5833333	a
F2	202,9166667	b

Based on the results of the analysis of variance (ANOVA), it was found that the types of fertiliser treatments P1, P2, P4 and P5 had a significant effect on wet weight, while the frequency of POC application had a significant effect on the wet weight of pak choi plants. Treatment P1 produced the best results in terms of plant wet weight.

d. Dry weight

Based on the analysis of variance on the dry weight variable, the results are shown in the table below

Table 6. DMRT test of the effect of POC application on the dry weight of pak choi plants

Treatmen	Average	Symbol
P1	7,5	a
P2	8,25	a
P3	11	b
P4	14	c
P5	14	cd
P6	14,5	cd

Table 7. DMRT test of the effect of POC application on the dry weight of pak choi plants

Treatmen	Average	Symbol
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F1	10,58333333	a
F2	12,5	b

Based on the results of the analysis of variance (ANOVA), it was found that the type of P3 fertiliser treatment had a significant effect on dry weight, while the frequency of POC application had a significant effect on the dry weight of pak choi plants.

Various types of liquid organic fertilisers from organic waste tested in this study had a significant impact on almost all measured parameters, such as plant height, number of leaves, wet weight, and dry weight. Rabbit urine POC had the best impact on pak choi plant height. Young papaya POC had the best impact on the number of leaves and wet weight of pak choi plants. Meanwhile, chicken manure POC had the best impact on the dry weight of pak choi plants.

Organic fertilisers made from rabbit urine and chicken manure have a fairly high nitrogen content, thus having a significant impact on vegetative growth parameters such as plant height and dry weight. The growth and development of vegetative parts such as leaves, stems, and roots are greatly influenced by nitrogen, as well as the process of photosynthesis that produces chlorophyll (Farmia, 2021). The nitrogen content in organic fertiliser from rabbit urine is very important for the formation of chlorophyll, which plays a major role in the process of photosynthesis, so that photosynthesis runs optimally and produces abundant photosynthetic results.

Rabbit urine POC contains 2.72% N, 1.1% P, and 0.5% K nutrients. The nutrient content of rabbit urine POC is relatively higher than that of cow and goat urine, as mentioned by Setyanto et al. (2014). The availability of sufficient nitrogen in an easily absorbable form can accelerate the process of cell division and elongation in the stems and leaves of plants. This is clearly seen from the plant height parameter. Pak choi plants that receive an optimal supply of nitrogen will experience faster and more upright stem growth. According to Leksono's (2021) research, the concentration of rabbit urine POC has a significant effect on plant height, number of leaves, largest leaf area, fresh plant weight, dry plant weight, fresh leaf weight, and dry leaf weight. The best results were obtained at a concentration of 40 ml/l of water.

Auxin hormones play an important role in regulating shoot apical dominance and cell elongation. Meanwhile, gibberellin is essential in stimulating stem growth (internodes). The presence of these natural growth regulators works in conjunction with nitrogen, making the plant's height growth process

more effective than if only inorganic nutrients were used. Physiologically, this fertiliser strengthens plant growth by providing complete macro and micro nutrients and improving the quality of the growing medium, resulting in healthier and more optimal plant growth, yielding better dry weight.

In addition to rabbit urine and chicken manure, young papaya used as POC material also has a significant impact on pakcoy plant growth. In a study published by Putra and Ratnawati (2019), POC derived from papaya with a concentration of 50 ml contained 5.47% organic carbon, 1.87% nitrogen, 3.13% phosphorus, and 3.28% potassium. Papaya also contains the enzyme papain, which acts as a powerful biocatalyst. In the context of soil fertility, the application of POC containing papain into the growing medium significantly accelerates the mineralisation process of organic matter. This enzyme is capable of breaking down peptide bonds in complex molecules in the soil into simpler nitrogen compounds, such as peptides, amino acids, and ammonia, which can be directly and more quickly absorbed by plant roots. According to Sulastri (2021), the fermentation process of fruit waste produces a solution containing N, P, K, and plant hormones such as auxin and cytokinin, which play an important role in stimulating the growth of plant roots and stems.

Kata kunci: limbah, organik, pakcoy, pertumbuhan, pupuk,

E. Conclusion

The results obtained indicate that various types of POC have a significant impact on almost all measured parameters, namely plant height, number of leaves, wet weight, and dry weight. Rabbit urine POC has the best effect on pakcoy plant height growth. Young papaya POC has the best effect on the number of leaves and wet weight of pakcoy plants. Meanwhile, chicken manure POC has the best effect on the dry weight of pakcoy plants.

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