The Use of Bioorganic Fertilizers to Improve the Quality of Pakcoy Plants (Brassica rapa var. chinensis) and Support Sustainable Agriculture

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Abstract
Research on the use of Bioorganic fertilizer was conducted in Buttu Atas land, Panei District, Simalungun Regency, North Sumatra from November 2025 to December 2025. This study aims to determine what content is contained in the use of Bioorganic on the growth and production of pak choy plants. This bioorganic fertilizer contains agricultural waste such as cocoa waste, coffee grounds, bran, palm bunch ash, and a mixture of beneficial microorganisms.
The provision of bioorganic fertilizer containing many elements needed by plants in addition to containing microorganisms is one factor in increasing the availability of nutrients for plants so that it can increase plant height growth and increase production. Palm bunch ash contains high K elements that play a role in increasing nutrient absorption and play a role in respiration, transpiration, enzyme activity and carbohydrate translocation that can help in the growth of stem diameter. Coffee grounds contain 2.28% Nitrogen, 0.06% Phosphorus and 0.6 Potassium. The pH of coffee grounds is slightly acidic, which is around 6.2 on the pH scale. Coffee grounds contain magnesium, sulfur, and calcium, which are beneficial for plant growth. Other waste products, such as bran and palm ash, also contain NPK, which is beneficial for plants.

Keywords: Bioorganic, Effective Microorganism, Coffee Grounds, Bran Rice, Palm Bunch Ash

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Introduction

Pakchoy (Brassica rapa) is a popular leafy vegetable in Indonesia. Growing pakchoy organically can reduce costs and increase farmers' income. To grow well, pakchoy requires essential nutrients such as nitrogen (N), phosphorus (P), and potassium (K). These nutrients are not always met through chemical fertilizers but can also be obtained through the application of organic fertilizers (Simarmata et al., n.d.).

Plant growth and development can be enhanced by providing nutrients through fertilizer in the growing medium. Fertilizer application requires attention to the appropriate dosage according to the plant's needs to avoid disrupting its growth and development. Excessive and continuous use of synthetic fertilizers can lead to decreased soil fertility (Choirunnisa et al., 2024).

The excessive use of inorganic chemicals has adverse effects on land and crops. Public concern has arisen over the high levels of pesticide residues in agricultural products. It is necessary to develop alternative agricultural systems capable of sustainably producing healthy products in both quantity and quality. One agricultural system that supports this concept is organic farming. The basic principles of organic farming are: (1) Maintaining a healthy ecosystem, (2) Applying the principle of efficiency to cultivation systems, (3) Carrying out production activities with a sustainable agricultural concept, (4) Producing pesticide-free products, and (6) Maintaining environmental sustainability (Yuriansyah et al., 2020).

In this research, I will cultivate Pakchoy using organic biofertilizer containing organic matter from plant residues, such as a combination of cocoa, coffee, bran, palm ash, zeolite (volcanic ash), and agricultural waste. This will be useful for observing its effect on Pakchoy yield.

Research Method

This research was conducted using polybags with soil as the growing medium, and a mixture of the two in various ratios (1:1, 1:2, and 2:1). The treatments used were manufactured bioorganic fertilizer at various dosages (untreated, 20 grams, 30 grams, and 40 grams). In this proceeding, I used parameters to assess the effect of bioorganic fertilizer application on bok choy plant height. Data can be observed based on the average value for each plan

Results

Table 1. Results of the average pakcoy height with bio-organic fertilizer treatment

Treatment	REPLICATION 1 (cm)				REPLICATION 2 (cm)				REPLICATION 3 (cm)			
	M1	M2	M3	M4	M1	M2	M3	M4	M1	M2	M3	M4
D0M0	3,9	5	12,9	14,5	4	5,1	9,7	11,5	4,1	5,3	11,8	13,6
D0M1	6,3	7,4	14,8	16,7	6,6	7	11,8	13,7	6,4	7,2	12,9	14,7
D0M2	4,9	6,1	11,9	13,3	4,9	6,5	10,6	12,3	4,8	6,8	9,7	11,5
D0M3	4,45	5,4	10,1	12,5	4,8	5,2	10,1	12,5	4,875	5,8	11,2	13,3
D1M0	3,9	6,8	13,7	16,5	4	7,2	12,3	15,7	4	7,4	12,1	14,7
D1M1	5,9	8,7	15,6	18,1	6,1	9,2	14,6	17,5	6,1	9,7	15,7	18,7
D1M2	5,2	7,5	13,1	15,6	4,9	7	13,7	16,7	5	8	14	17
D1M3	4,5	8,2	13,9	16,4	4,6	7,6	14	16,4	4,9	8,6	15	17,3
D2M0	3,8	7,8	13,8	17,6	3,8	6,9	13,9	18,1	4	7,9	14,7	17,9
D2M1	6	10,3	16,7	19,6	6,2	9,8	17,1	20,5	6,3	10,1	17,4	19,3
D2M2	4,3	8,4	14,7	17,7	5,2	9,3	15	18,3	4,8	8,2	14,7	17,9
D2M3	3,9	8,8	15,7	18,6	4,9	9,8	15	18,5	4,9	8,8	16,3	19,6
D3M0	4,1	8,8	14,7	18,7	3,9	9,2	15,3	19,7	3,9	9	15,7	20,3
D3M1	6,3	11,8	18,9	25,7	6,5	11,2	18,7	24,3	6,1	11,2	18	26

D3M2	4,9	8,8	16,7	20,8	5,2	9,9	15,5	21	5,1	9,9	14,9	23,3
D3M3	4,2	9,9	17,9	23,7	4,8	10,5	16,5	23,1	4,8	10,7	15,8	24,7

From the results of the average value of plant height growth, bio organic fertilizer treatment can increase the height growth of pak choy plants compared to no treatment. Bio organic fertilizer treatment at a dose of D3 (40 grams) and planting media (M1) of soil: husk (1:1) showed a maximum plant height of 25.7 cm (Replication 1), 24.3 cm (Replication 2), and 26 cm (Replication 3). administration of bio organic fertilizer treatment in week 2 after transplanting.

According to research (Yuriansyah et al., 2020), the use of bio-organic fertilizers can not only increase plant growth but can also reduce the use of chemical fertilizers to maintain soil fertility and environmental sustainability.

Conclusion

The use of manufactured bioorganic fertilizer at a dose of 40 grams appears to be better at increasing plant height. The use of bioorganic fertilizer is an environmentally friendly agricultural solution for producing healthy plants for human consumption. Using a 1:1 mixture of soil and rice husks is a good growing medium for bok choy plants in polybags.

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