

## The Composition Effect of Bamboo Leaves and Goat Manure Fertilizer on Growth Mustard (*Brassica juncea* L.)

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### Abstract

*The mustard plant is a commercially valuable vegetable popular with the public, so demand for this vegetable continues to increase. One of the factors that influences growth in terms of external factors is the planting medium. Planting media made from organic materials is a solution to using chemicals that cause residues that damage the environment. This research was conducted to determine the best type of planting media and the composition of the planting media for the growth of mustard plants. Treatment using P1 (Control) = soil; P2 = soil: organic fertilizer (goat manure) (1:1); P3 = soil: bamboo leaves (1:1) using Randomized Complete Block Design method with five replications. The research results on planting media treatment with goat manure influenced the growth of mustard greens, including plant height, number of leaves, leaf length, root length, and root wet weight.*

*Keywords: organic fertilizer, plant productivity, planting media, soil fertility, vegetative phase*

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### 1. Introduction

Mustard greens are a fairly good type of commercial vegetable. Apart from being very supportive from a technical, climatological, and socio-economic perspective, this type of vegetable is suitable for cultivation in Indonesia. This vegetable is popular with many people, so the demand for this vegetable is increasing along with increasing public awareness of the importance of balanced nutritional needs, which are beneficial for health [6] [12].

Mustard greens production in Indonesia in 2021 was 727,467 tons/ha, an increase of 8.99% compared to the previous year, namely 667,473 tons [2]. These data show that the public consumption of mustard greens is very high. Factors influencing plant growth include internal and external factors [3]. Internal factors are factors found in the seed or plant itself. External factors exist outside the seed or plant, influencing growth in terms of external factors, namely the planting medium.

Planting media made from organic materials is a solution to the use of chemicals that negatively impact both human life and the surrounding environment. Organic farming is part of natural agriculture, which, in its implementation, tries to avoid using chemicals that cause residues that damage the environment to achieve healthy environmental conditions. It is also to produce sustainable crop production by improving soil fertility through natural sources.

The primary source of organic material for soil comes from plant tissue in the form of plant waste, one of which is bamboo leaf waste, often found in the environment and can be used as organic fertilizer. Another source of organic material is from animals, namely carcasses and feces [10]. Commonly used animal manure, namely goat manure, can improve the soil's physical, chemical and biological fertility [14] [16]. Based on the above, it is necessary to conduct a study regarding the use of organic fertilizer derived from plant tissue and goat manure to increase the productivity and growth of mustard plants optimally.

## 2. Material and Methods

The research was conducted on the Villa Mas Garden Residential Land, Perwira Village, North Bekasi District, Bekasi City, West Java Province, from November 2022 to January 2023. This research uses *Randomized Complete Block Design*. The single factor is the comparison of the composition of the planting media. The treatments given were different compositions of planting media with the following ratio: P1 (Control) = Soil; P2 = Soil: Organic fertilizer (goat manure) (1:1); P3 = Soil: Bamboo Leaves (1:1). The bamboo leaves used in this study were dried bamboo leaves that had been cut into pieces or crushed. There were five repetitions, with a total of 15 experimental units. The observed parameters are the number of leaves, plant height, leaf length, root length, and root wet weight. The observational data is tested for variance at the 5% level. If there is a real influence, it will be tested further with the Duncan Multiple Range Test (DMRT) at the 5% level.

## 3. Results and Discussion

Applying organic fertilizer can increase soil fertility physically, chemically, and biologically [5] [16]. Soil fertility affects plant growth and productivity. In addition, organic fertilizer provides nutrient availability for plants so that the vegetative and generative phases are optimal [24]. The influenced vegetative stage includes the number of leaves, plant height, leaf length, root length, and root wet weight.

### Number of Leaves

Data from the research showed that several planting media compositions significantly affected the number of mustard green leaves from 12 days after planting up to 30 days after planting. In contrast, in previous observations (3-9 days after planting), each treatment did not provide influence (Table 1). The highest number of leaves in each statement was in treatment P2, namely giving soil and goat dung in a ratio of (1:1). This is because the content in P2 is very good for the growth of mustard plants so that mustard plants can grow optimally compared to other treatments. As [23] argued, providing manure, especially for goats, complements the natural supply of nutrients to meet plant needs. Adequate plant nutrient needs, both macro, and microelements, will help plant metabolism run smoothly, which will then help stimulate plant growth, both vegetative and generative [17] [19].

Table 1. Effect of planting media on the number of mustard leaves

Treatment	Number of Mustard Plant Leaves									
	Days after planting									
	3	6	9	12	15	18	21	24	27	30
P1	0	1a	1.6a	2ab	2.4a	2.8ab	3.8a	4.4a	5.8a	6.8a
P2	0	1.2a	1.8a	2.4a	2.6a	3.2a	4.2a	5a	6.4a	7.6a
P3	0	1.2a	1.4a	1.6b	1.8b	2b	2.8b	4a	4.4b	4.8b

The numbers followed by the same letter in the same column are not significantly different in Duncan's 5% test.

### Plant Height

Table 2 shows that providing several planting media compositions, namely soil, soil, and goat dung (1:1); soil and bamboo leaves (1:1) significantly affected the height growth of mustard greens starting three days after planting. The increase in plant height in treatment P2 was due to the provision of goat manure in this treatment, which provided sufficient nutrients for mustard plants, as argued [13], who stated that the provision of compost could improve the physical and chemical properties (soil pH, soil organic C, soil organic matter, and soil water quality, so that plant roots will easily absorb nutrients in sufficient quantities) enough so that plant growth will increase nicely. Organic fertilizer positively influences the rate of soil organic carbon absorption [7].

Table 2. Effect of planting media on height growth of mustard greens

Treatment	Plant Height (cm)									
	HST									
	3	6	9	12	15	18	21	24	27	30
P1	1.64b	3.9a	5.16a	6.54a	7.18a	7.92a	9.34a	12ab	14.98a	17.46a
P2	2a	4.14a	5.54a	6.86a	7.42a	7.96a	11.1a	13.28a	16.36a	18.3a
P3	1.94ab	3.82a	4.76a	6.1a	6.44a	6.98a	8.46a	9.26b	10.76b	11.7b

The numbers followed by the same letter in the same column are not significantly different in Duncan's 5% test.

Figure 1: The highest mustard plant height was found in treatment P2, namely the provision of soil and goat manure (1:1). The content in P2 is very good for the growth of mustard plants so that mustard plants can grow optimally compared to other treatments. The results of show that the best growth and yield of green mustard greens from the effects of their study was obtained in the treatment of husk charcoal planting media with a dose of 1:1 goat manure, which was able to increase plant height, number of leaves, area leaves, fresh weight of plants, and dry weight of mustard greens [1].

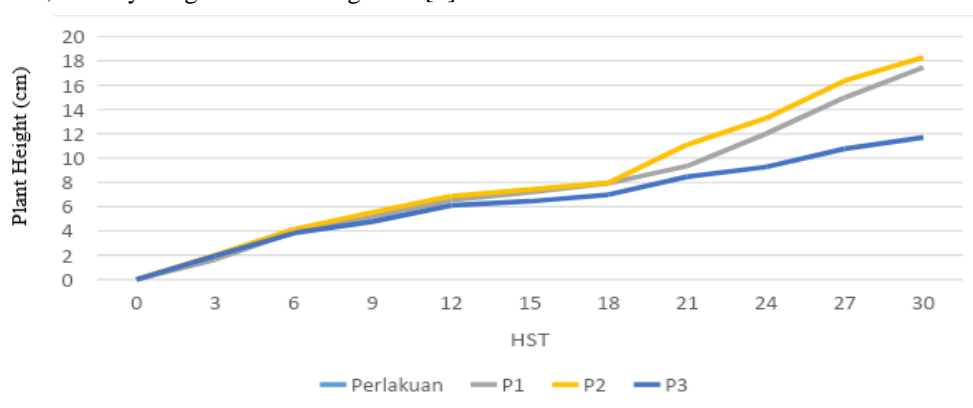


Figure 1. Graph of the effect of planting media on the growth of mustard greens

### Leaf Length

Table 3 shows that the provision of several compositions of planting media, soil, soil and goat dung (1:1), soil, and bamboo leaves (1:1) significantly affected the growth of mustard plant leaf length starting at 15 days after planting. Previous observations (3-12 days after planting) of mustard plant leaf length showed no significant differences in all treatments (Table 3). The increase in leaf length in treatment P2 was due to the provision of goat manure, which provided sufficient nutrients and maintained the balance of soil water and air in the soil. The availability of nutrients largely determines the amount of nutrient uptake by plants and the balance of soil water and air in the soil [8]. Based on research [20], organic fertilizer can reduce plant stress against drought and increase the uptake of N, P, and K nutrients.

Table 3. Effect of planting media on the growth of mustard leaf length

Treatment	Leaf Length (cm)									
	HST									
	3	6	9	12	15	18	21	24	27	30
P1	0	0.26a	1.5a	2.82a	4.16a	5.3ab	7.5ab	9.6a	13.1a	15a
P2	0	0.4a	1.46a	2.68a	4.34a	5.66a	8.9a	10.84a	14.16a	15.32a
P3	0	0.46a	1.42a	2.08a	3.06b	3.88b	5.5b	5.94b	7.52b	7.98b

The numbers followed by the same letter in the same column are not significantly different in Duncan's 5% test.

Figure 2. The highest leaf length in each observation was in treatment P2, namely the provision of soil and goat manure (1:1). The N nutrient content in the P2 treatment is very good for the growth of mustard plant leaf length. According [9] goat manure contains the nutrient N, which can meet the needs of caisim plants during their growth. This is confirmed of [26] research that with sufficient N, the number of leaves, leaf length, and leaf area of plants increases, thus supporting vegetative growth.

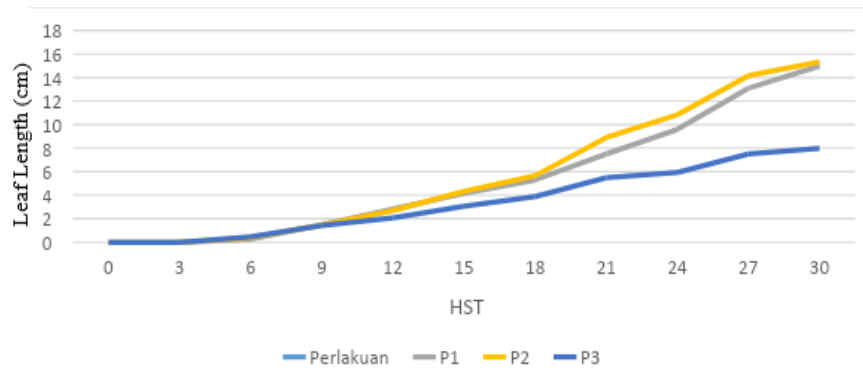


Figure 2. Graph of the effect of planting media on the growth of mustard leaf length

### Root Length

Figure 3. The highest root length of mustard plants was found in treatment P2, using soil and goat dung as a planting medium (1:1) because organic fertilizer from goat dung can provide sufficient nutrients for mustard plants. According to [18], if the elements needed by plants are adequate and available, it will increase the rate of photosynthesis and increase the shoot-to-root ratio so that the metabolic results will form proteins, enzymes, hormones, and carbohydrates, resulting in enlargement, elongation, and cell division will occur more quickly. Organic fertilizer increases N availability, which plays an essential role in plant vegetative growth [27].

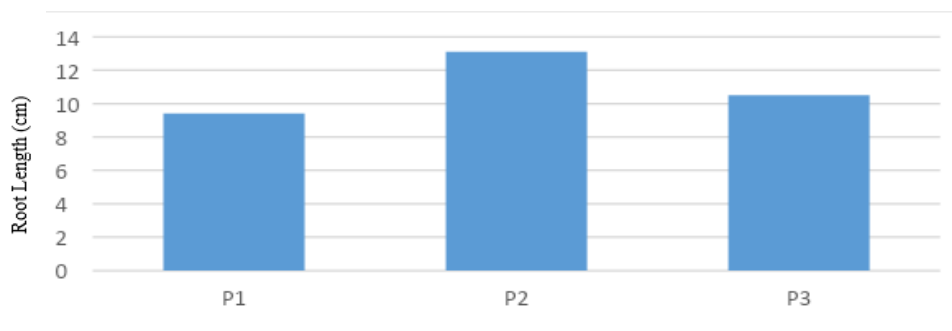


Figure 3. Graph of the effect of planting media on the growth of mustard root length

The research results of [15] stated that adding manure to the soil can improve the physical properties of the soil. Organic fertilizer improves soil aggregates and increases soil nutrient content [11] [22]. If the physical properties of the soil are reasonable, it will make it easier for the roots of the mustard plant to grow in length.

### Root Wet Weight

Table 4 shows that the provision of several planting media compositions, (P1) soil, (P2) soil and goat dung (1:1), (P) soil, and bamboo leaves (1:1) had a significant effect on the wet weight of mustard plant roots. The highest wet root weight was found in treatment P2, namely 12.6 grams.

Table 4. Effect of planting media on the growth of mustard root wet weight

Root Wet Weight	
Treatment	Gram
P1	9.4ab
P2	12.6a
P3	4.8b

The numbers followed by the same letter in the same column are not significantly different in Duncan's 5% test. The analysis showed that the three treatments had significant differences in the wet weight of mustard plant roots. The highest value was obtained in treatment P2, namely soil and goat dung planting media (1:1), which had the highest weight compared to the others. So, it shows that applying organic goat dung fertilizer produces a higher wet weight than without goat dung. According to [21], wet weight is related to the amount of water absorbed, a compound needed in large quantities in each organ. Still, the water content of a plant tissue can change or be unstable according to age. This is reinforced by the opinion of [25] that manure increases water resistance, soil microbiological activity, and cation exchange capacity values and improves soil structure so that plants can absorb a lot of water for survival. With an increase in the C/N ratio of the soil, the activity of soil organisms increases. Improved soil physical properties positively correlate with air and groundwater circulation [4].

#### 4. Conclusion

The composition of organic planting media influences the growth of mustard greens. Vegetative growth of mustard greens showed promising results, including plant height, number of leaves, leaf length, root length, and root fresh weight.

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