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The Effect of Composition of Cocopeat Planting Media and Addition of Goat Manure Fertilizer on Gelinggang Microgreens (*Cassia alata* L.)

Tsalitsa Aghnia Nazhiifah[1]*, Ronny Mulyawan[1], Jumar[1], Irvan Indra Resnawan[1]

[1] Program of Agroecotechnology, Faculty of Agriculture, Lambung Mangkurat University, South Borneo, Indonesia

*Corresponding author. Email: ronny.mulyawan@ulm.ac.id

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Abstract
Microgreens are plants with a short duration of 7–14 days after germination. Microgreens are more commonly used as salads, but can also be used as a source of medicinal ingredients that are rich in antioxidants. Gelinggang plants are shrubs that are useful in traditional medicine because they can be used as antibiotics for several diseases. Determination of good planting media that supports the growth of microgreens and high chemical content is still being studied. The combination of cocopeat and goat manure composition is considered to be an option as a suitable medium for microgreens. This study aims to determine the effect of the composition of cocopeat and goat manure planting media on the growth of Gelinggang microgreens (*Cassia alata* L.). This study used a Completely Randomized Design (CRD) with one factor and five treatments, namely P0 (control, 150 g cocopeat), P1 (20% goat manure + 120 g cocopeat), P2 (25% goat manure + 112.5 g cocopeat), P3 (30% goat manure + 105 g cocopeat), and P4 (35% goat manure + 97.5 g cocopeat), with four replications. The parameters observed included plant height, fresh weight, and chlorophyll a, chlorophyll b, and total chlorophyll content. The results showed that the best treatment that was able to significantly increase plant height, fresh weight, and chlorophyll content was a combination of 20% goat manure and 120 g cocopeat, which was proven to be an alternative planting medium that supports optimal growth of Gelinggang microgreens plants.

Keywords:
Microgreen, gelinggang, cocopeat, goat manure fertilizer, chlorophyll

1. Introduction

The best solution for urban farming systems is microgreens because of the ease of finding planting media and tools used when planting, and the opportunity to develop microgreens is also quite in demand because of the fast harvest period and high vitamin content, especially because agricultural land is shrinking [1] [2]. The antioxidant and phytochemical content in microgreens is influenced by light intensity factors [3]. When microgreens first appeared, they were only known as flavor enhancers and to beautify food because they have a delicious and distinctive texture and taste. Currently, microgreen vegetables are widely used for main dishes and as a source of medicine [4]. Therefore, microgreens began to be developed using superior medicinal plant seeds such as gelinggang plants which can be used as antibiotics.

One of the superior medicinal plant commodities from South Kalimantan is the gelinggang plant, gelinggang has other terms such as ketepeng cina, ketepeng kerbau, ketepeng badak, and akon-akonan [5]. Many people use this gelinggang plant to treat various skin diseases such as eczema, itching and other skin diseases caused by microorganisms [6]. Because many people use the gelinggang plant for treatment, the gelinggang plant is commonly known in traditional medicine because it contains chemicals such as alkaloids, saponins, flavonoids, tannins and anthraquinones. The anthraquinone content has antifungal properties that work fungistatically by inhibiting the growth of fungal hyphae, so that fungal growth stops [7]. In general, this chemical content is closely related to the chlorophyll content of plants which indirectly affects plant growth.

Planting this gelinggang microgreen requires a planting medium as a place for plants to grow, a place for roots or root buds to grow and develop. Planting media that are categorized as organic materials usually come from several living organisms, for example parts of plants such as leaves, stems, flowers, fruit, or bark, using organic materials for planting media is much better than inorganic materials. This is because organic materials are able to provide nutrients for plants. Organic materials also have macro and micro pores that are almost balanced so that the air circulation produced is quite good and has a high water absorption capacity [8]. Microgreens can be planted in various planting media and various hydroponics such as rockwool, cocopeat, hydroton and others. Because they look clean and neat, these materials are also chosen because they have high absorption capacity [9]. Cocopeat is commonly used for planting media and can replace soil. Coconut fiber waste planting media (cocopeat) is one of the organic materials that can be used for growing media. Cocopeat is a planting medium produced from the process of crushing coconut fiber, the process of crushing coconut fiber produces fiber, as well as fine powder or cocopeat [10] [11].

Supporting plant growth and increasing soil fertility is by adding organic fertilizers such as goat manure to the planting medium. Goat manure is easy to obtain as the main source of nutrients in organic cultivation. Goat manure has a nutrient content of 0.70% N, 0.40% P_2O_5, 0.25% K_2O, 20-25 C/N and 31% organic matter [12]. Goat manure is one of the basic ingredients of organic fertilizer that is abundantly available and easy to apply. The potential for using organic fertilizers with goat manure as the basic ingredient is very large because it contains nutrients needed by plants and does not interfere with the habitat of soil microorganisms [12] [13]. Based on the description, this study was conducted to determine the effect of the composition of cocopeat planting media and goat manure fertilizer on the growth of gelinggang microgreen (*Cassia alata* L.) and to determine the best composition of cocopeat planting media and the addition of goat manure fertilizer for gelinggang microgreen.

2. Material and Methods

2.1 Time and Place

The research was conducted in August 2024 at the Greenhouse, Faculty of Forestry, Lambung Mangkurat University, Banjarbaru, South Kalimantan.

2.2 Material and Tools

The materials used in this study were gelinggang seeds, cocopet passes 5 mesh sieve, goat manure passes through a 5 mesh sieve, 80% acetone, label paper, tissue, sample plastic, filter paper, aluminum foil and water.

The tools used in this study were dropper pipettes, mortar and pestle, plastic spoons, Erlenmeyer flasks, cuvettes, measuring cups, thinwall, tweezers, handsprayer, tissue, analytical scales, rulers, plastic clips, black plastic, stationery, and cameras.

2.3 Experimental Design

The design in this study was arranged in a Completely Randomized Design (CRD) consisting of one factor with 5 treatments and there were 20 experimental units, namely:

P0 = Control (150 g cocopeat) without goat manure fertilizer,
P1 = 20% (30 g goat manure fertilizer + 120 g cocopeat),
P2 = 25% (37.5 g goat manure fertilizer + 112.5 g cocopeat),
P3 = 30% (45 g goat manure fertilizer + 105 g cocopeat),
P4 = 35% (52.5 g goat manure fertilizer + 97.5 g cocopeat)

2.4 Research Procedures

Collecting Goat Manure Fertilizer. Goat manure fertilizer was obtained from one of the fertilizer sellers in Banjarmasin as much as 3 kg. The goat manure fertilizer used was goat manure fertilizer that had been crushed so that it was easy to apply, had a texture like soil, did not have a bad smell, and was blackish brown in color.

Preparation of Planting Media. The planting media used was cocopeat. Before use, cocopeat was soaked in water for 1 day to remove tannins. Cocopeat was dried in the sun until dry and then mixed with goat manure fertilizer according to the treatment doses P0, P1, P2, P3, P4. Then put into a planting container measuring 6 cm high, 19.5 cm long, and 19.5 cm wide or thinwall with a size of 2000 ml, then leveled using a plastic spoon. Labeling was done before giving treatment. Labels were attached to each experimental container to mark the treatment and make it easier to observe.

Seed Planting. Before the seeds are planted, they need to be soaked in warm water for 4 hours so that the seeds open, then aired first, then the gelinggang seeds are placed and arranged in a container, using tweezers to place the seeds, each container contains 100 seeds, after the seeds are placed and arranged, then spray the planting medium that has been placed with water until the humidity (80-90%). Then cover the container with black plastic for 2 days,

Watering. Watering using well water, watering is carried out from the beginning of the planting period until harvest regularly once a day in the morning using a Hand sprayer. Watering is done until the humidity is around 60%.

Harvesting. Microgreens are harvested at a very young age, which is 14 days after planting. The characteristics are that the cotyledon leaves and the first true leaves or what are commonly called the first true leaves have grown, with a height of 5-10 cm. Microgreen harvesting is done by pulling the plants up to the roots.

2.5 Observed Variables

The observed variables consisted of plant height carried out on the 14^{th} day during harvesting. Measurements were made from the base of the stem to the tip of the highest leaf using a ruler expressed in centimeters (cm), the wet weight of the microgreen was weighed as a whole microgreen after harvest except for the roots using a digital scale, total chlorophyll content, the chlorophyll content tested was chlorophyll a, chlorophyll b and total chlorophyll. The first step in the leaf chlorophyll test was to take a sample of leaves that had been cleaned using tissue, then weighed with a weight of 1 gram. After that, the next leaf sample was ground using a mortar until smooth and 20 mL of 80% acetone solution was added. After that, the solution was filtered with filter paper and put into an Erlenmeyer flask. Then the solution was put into a 1000 mL measuring cup and distilled water was added to the boundary line and then stored in a glass cup that had been coated with aluminum foil. Then the filtrate was put into the cuvette until the boundary line and its absorbance was measured using a spectrophotometer at a wavelength of 645 nm and 663 nm. The amount of chlorophyll a, chlorophyll b and total chlorophyll was calculated using the following formula:

$$Chlorophyll\ a = 12,7\ \times A_{663} - 2,69 \times A_{645} \times \frac{20\ ml}{1000 \times 1\ g'} \quad (1)$$

$$Chlorophyll\ b = 22,9\ \times A_{645} - 4,68 \times A_{663} \times \frac{20\ ml}{1000 \times 1\ g'} \quad (2)$$

$$Total\ chlorophyll = 20,2\ \times A_{645} + 8,02 \times A_{663} \times \frac{20\ ml}{1000 \times 1\ g} \quad (3)$$

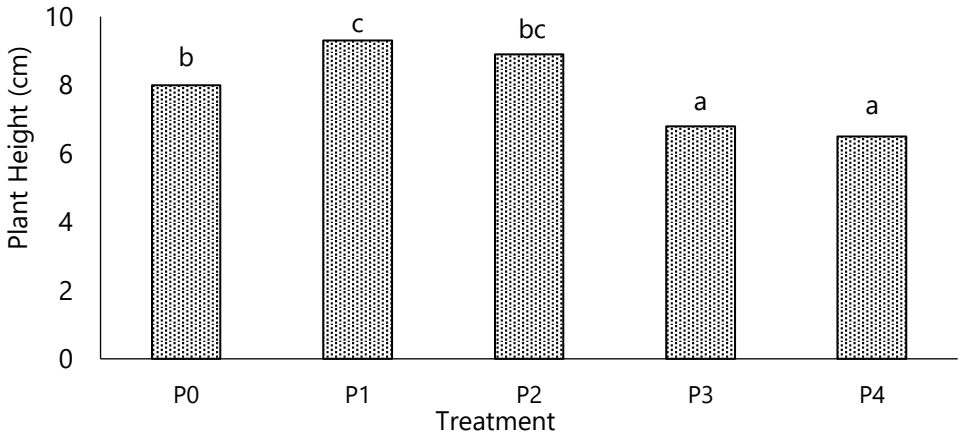
2.6 Data Analysis

The observation data is analyzed first with the Homogeneity Test or Barlett's Variance Test. If the data is homogeneous, it is continued with the ANOVA (Analysis of Variance) analysis. If the data is not homogeneous, data transformation is carried out. If the analysis of variance shows a significant effect, the test is continued with the DMRT (Duncan Multiple Range Test) with a 5% error test level.

3. Results and Discussion

3.1 Gelinggang Microgreen Height

The results of the analysis of variance showed that the provision of goat manure fertilizer with different doses on the height of microgreen showed a significant effect. The average results of the height of gelinggang microgreen can be seen in Figure 1.



Description: P0 = Control; P1 (30 g goat manure + 120 g cocopeat); P2 (37.5 g goat manure + 112.5 g cocopeat); P3 (45 g goat manure + 105 g cocopeat); P4 (52.5 g goat manure + 97.5 g cocopeat).

Figure 1
Height graph of microgreen gelinggang

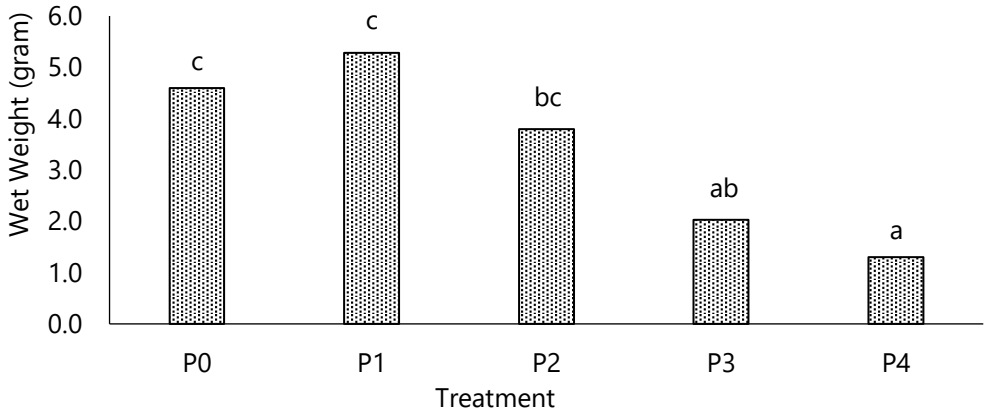
Based on the analysis data in Figure 1, the P1 20% treatment (30 g goat manure + 120 g cocopeat) is with the highest average plant of 9.3 cm, and is not significantly different from P2 20% (37.5 g goat manure + 112.5 g cocopeat), P2 is not different from P0 but different from other treatments. This is because the amount of goat manure is only 30 g less than cocopeat, which is 120 g, so the media becomes looser than other treatments. The dominant cocopeat in the garden media makes growth good, because it makes air and water circulation in the media not blocked and obstructed. Comparison of soil with cocopeat 1:1 can increase the growth of Japanese spinach plants in plant height and number of leaves [14]. The use of planting media has a significant effect on plant height, number of leaves, leaf width and fresh weight of plants, the best results are using cocopeat plant media. Cocopeat has good water absorption capacity with a range of eight times its dry weight and cocopeat contains several main nutrients such as N, P, K, Ca and Mg [15].

In the P1 treatment, only 30 g of goat manure was used, goat manure has a high nitrogen content and is better used for mature plants because microgreens are harvested at a young age, namely 7-14 days and require different nutrients, namely with doses that are not too much. The

goat manure usually has a C/N ratio value of between 20-25, C/N ratio value of less than 20 is what animal manure content must have. Microgreens require specific nutrients, such as nitrogen, phosphorus and potassium (NPK) in a form that is easily absorbed by plants, goat manure that has not been composted may not provide nutrients in a form that is easily absorbed by microgreens. It is better to compost goat manure before application [16] .

3.2 Gelinggang Microgreen Wet Weight

The results of the analysis of variance showed that the provision of goat manure fertilizer with different doses on the wet weight of microgreen showed a significant effect. The average wet weight results of gelinggang microgreen can be seen in Figure 2.



Description: P0 = Control; P1 (30 g goat manure + 120 g cocopeat); P2 (37.5 g goat manure + 112.5 g cocopeat); P3 (45 g goat manure + 105 g cocopeat); P4 (52.5 g goat manure + 97.5 g cocopeat).

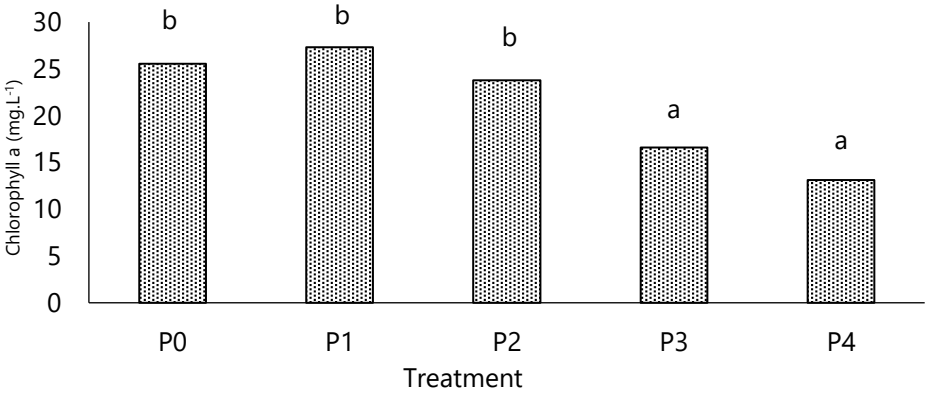
Figure 2
Wet weight graph of gelinggang microgreen

Based on the analysis data in Figure 2, the P1 20% treatment (30 g goat manure + 120 g cocopeat) is an average of 5.3 grams. This is because the higher wet weight is caused by good planting media and the media in the container is sufficient for the growth of microgreens, in the planting media there is goat manure and cocopeat with the appropriate dosage. The planting media has a role to support plant growth and as a provider of nutrients and water that will be absorbed by the roots for plants to grow. Planting media in general must be able to maintain the humidity of the area around the roots, and provide enough air and nutrients for plants [17] [18].

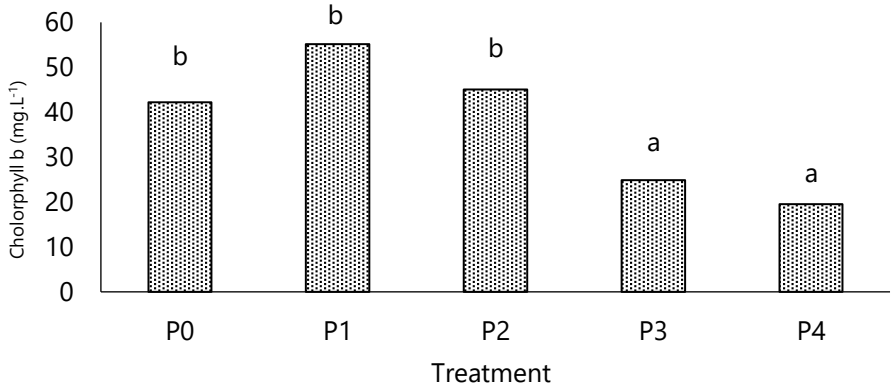
This study used cocopeat planting media. Cocopeat has advantages, namely it comes from organic materials and can make the soil structure good, can loosen the soil, has a pH close to neutral at 5.2-6.8 with that it can neutralize soil acidity, can retain water content, and can support root growth quickly, cocopeat also has pores that help facilitate air exchange so that soil porosity can increase and drainage in containers or land becomes better maintained[13]. Cocopeat can absorb water 8-9 times the weight of cocopeat itself and can be said that cocopeat can store water up to 65-69% [17]. The addition of goat manure fertilizer to the planting medium can provide lower soil density and higher organic C content and can be better development and plant roots will develop easily and will make plant development better and the process of increasing the number of leaves [14].

3.3 Chlorophyll a, b and Total Content in Gelinggang Microgreen

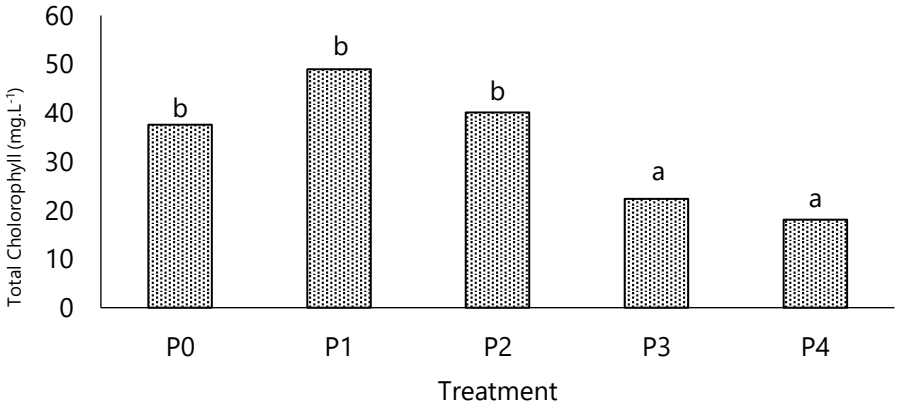
The results of the analysis of variance showed that the provision of goat manure fertilizer with different doses on chlorophyll a, chlorophyll b, and total chlorophyll microgreen showed a significant effect. The average results of chlorophyll a microgreen gelinggang can be seen in Figure 3.



(A)



(B)



Description: P0 = Control; P1 (30 g goat manure + 120 g cocopeat); P2 (37.5 g goat manure + 112.5 g cocopeat); P3 (45 g goat manure + 105 g cocopeat); P4 (52.5 g goat manure + 97.5 g cocopeat).

(C)

Figure 3

Chlorophyll a, chlorophyll b, and total chlorophyll graph of microgreen gelinggang

Based on the analysis data in Figure 3 (A), the P1 20% treatment (30 g goat manure + 120 g cocopeat) had an average of 27.33 mg.L^{-1} and was not significantly different from P0 (Control), P0 was not different from P2 but was different from the other treatments. Based on the results data in Figure 3 (B), it shows that the provision of goat manure fertilizer with different doses on chlorophyll b microgreen showed a significant effect. The highest treatment was P1 (30 g goat manure fertilizer + 150 g cocopeat) with the highest result of 55.14 mg.L^{-1}, and was not significantly different from P2 (37.5 g goat manure fertilizer + 112.5 g cocopeat), P2 was not different from P0 but different from other treatments. Based on the results data in Figure 3(C), the provision of goat manure fertilizer with different doses on the total chlorophyll of microgreen showed a significant effect. The highest treatment was P1 20% (30 g goat manure fertilizer + 120 g cocopeat) with the highest result of 49 mg.L^{-1}, and was not significantly different from P2 (37.5 g goat manure fertilizer + 112.5 g cocopeat), P2 was not different from P0 but different from other treatments.

Chlorophyll is a pigment that gives green color to plants which has the function of capturing energy from light so that it can be transferred to proteins in the photosynthesis center [18]. The chlorophyll a content in the analysis data in Figure 3 shows the highest average result of chlorophyll a treatment P1 20% (30 g goat manure + 120 g cocopeat) with an average of 27.3 mg.L^{-1}, the chlorophyll b content in the analysis data in Figure 3 shows the highest average result of treatment P1 20% (30 g goat manure + 120 g cocopeat) with an average of 37.6 mg/L, and the total chlorophyll content in the analysis results in Figure 3 shows the highest average result of total chlorophyll treatment P1 20% (30 g goat manure + 120 g cocopeat) with an average of 37.6 mg.L^{-1}. This is because in this treatment the planting medium fills the planting container so that the microgreen grows optimally, and absorption is maximized, good media makes growth good. Planting media is a material used for nurseries that has a function to store nutrients or nutrients to regulate humidity and air temperature and affects the root formation process, planting media can be categorized into 2 (soil and non-soil planting media), Planting materials have macro and micro pores so that the nutrients are balanced and affect air circulation which results are quite good and has a high water absorption capacity [19], [20], [21].

Lighting affects chlorophyll, good growth will have an impact on better light absorption, with good light absorption in plants will affect better chlorophyll content. Plant growth and development are highly dependent on light, light has a role in primary or secondary metabolic processes, photosynthesis requires light intensity, light spectrum and duration of exposure [22] [23] [24]. The photosynthesis process is influenced by plant chlorophyll. The physical properties of chlorophyll are to receive and reflect light of different wavelengths. Plant chlorophyll absorbs a lot of light with waves between 400 nm – 700 nm and the light spectrum that is mostly absorbed is blue light and red light [18] [25].

4. Conclusion

The conclusion of this study is as follows the provision of cocopeat planting media and the addition of goat manure fertilizer showed a significant effect on all variable parameters. The composition of the addition of cocopeat planting media and goat manure fertilizer that had the most positive effect was P1 20% (30 g goat manure + 120 g cocopeat) on all observation parameters or modifiers such as plant height, wet weight, chlorophyll a, chlorophyll b, and total chlorophyll.

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