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(RESEARCH ARTICLE)

The effect of growing medium composition and AB mix nutrient type on the growth rate of *Alocasia Black Velvet* in a greenhouse

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Abstract

This study aimed to determine the effect of planting medium composition and AB Mix nutrient type on the growth acceleration of *Alocasia Black Velvet* cultivated in a greenhouse. This study was conducted at the Sukamantri IPB Experimental Garden Greenhouse, Bogor, West Java, Indonesia, from July to November 2025. A two-factor randomized block design was used. The first factor was the composition of the planting medium mixture (raw rice husks and chopped andam) and the second factor was the type of AB Mix nutrients (Regular AB Mix and Kryptonium AB Mix). The variables observed included plant height increase, stem diameter increase, leaf thickness, trichome density, and trichome length. The research results showed that the composition of the planting media mixture of raw rice husk and andam shreds (4:1) produced the highest values in plant height increase (3.15 cm), stem diameter increase (3.75 mm), leaf thickness (0.70 mm), trichome density (35.71 mm^2), and trichome length (22.53 µm) compared to other treatments. The application of AB Mix Kryptonium produced the highest value compared to regular AB Mix. Analysis results showed that the interaction between growing medium composition and AB Mix nutrient type did not have a significant effect on all variables. This study concludes that selecting the appropriate growing medium composition and optimal AB Mix nutrient type can accelerate the growth of *Alocasia Black Velvet*.

Keywords: Alocasia; Rice Husk; Andam Chips; AB-Mix Nutrients; Greenhouse

1. Introduction

Alocasia Black Velvet is a type of Alocasia originating from Sabah, Malaysia. This plant is popular for its unique leaves, which are dark green with a velvety texture and striking silver veins [1]. The availability of Alocasia, especially *Alocasia Black Velvet*, is decreasing due to limited seedling stocks caused by slow seedling growth. The slow growth of seedlings is caused by several physiological and environmental factors. The root system of *Alocasia Black Velvet* is very sensitive, making it vulnerable to environmental changes, poor planting media, and poor aeration.

New seedlings that have been transferred from the propagation phase also require a long adaptation period to the external environment. An important aspect in cultivating *Alocasia Black Velvet* is the selection of the right medium and nutrients. The nutrients that can affect the growth of Alocasia plants are macro and micro nutrients. Macronutrients are C, H, O, N, P, K, Ca, Mg, and S, while micronutrients are Mn, Cu, n, Mo, B, Cl, and Fe [2]. The growth of *Alocasia Black Velvet* is highly dependent on the type and composition of the growing medium used, as not all growing media are able to provide optimal environmental conditions for Alocasia plants. Bamboo leaf humus chips, commonly known as andam chips, are an organic growing medium derived from chopped bamboo leaves that have undergone decomposition (humus) [3]. Raw rice husks can be combined with andam chips as a growing medium. Raw rice husks come from rice waste and have good drainage and aeration properties, making them suitable for use as organic fertilizer or growing medium [4].

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Controlled environments such as greenhouses require good and optimal nutrients to support plant growth, because even though the physical environment is controlled (temperature, humidity, and lighting), the availability of nutrients in the growing medium remains a major factor for optimal growth. The growth of *Alocasia Black Velvet* can be stimulated by administering AB Mix nutrients during the cultivation period at the Sukamantri IPB Experimental Garden Greenhouse. The AB Mix commonly used and available on the market are AB Mix Biasa and AB Mik Kryptonium. AB Mix is a nutrient solution containing macro and micro nutrients, generally comprising 12 nutrients, namely 6 macro nutrients (N, P, K, S, Mg, and Ca) and 6 types of micro nutrients (Fe, Zn, Mn, Cu, Mo, and B) [5]. AB Mix Kryptonium contains 17 nutrients. The nutrients contained in AB Mix Kryptonium include 6 types of macro nutrients (N, P, K, Ca, Mg, and S) and 11 types of micro nutrients (Fe, Cu, Zn, B, Mo, Cl, Mn, Ni, Na, Co, and I) [6].

The acceleration of *Alocasia Black Velvet* growth in a greenhouse was the basis for this study, which aimed to examine the most effective type of AB Mix nutrient that could be combined with the most suitable growing medium to accelerate the growth of *Alocasia Black Velvet* in a greenhouse at the Suka Mantri Experimental Garden, Bogor Agricultural University.

2. Materials and Methods

2.1. Materials

The tools used in this study were 13 cm diameter plastic pots, sprayers, 2 liter measuring cups, 10 mL measuring cups, buckets, rulers, calipers, leaf color charts, hygrometers, TDS meters, pH meters, tweezers, scissors, microscopes, microscope slides, cover glasses, and razor blades. The materials used in this study were 2-month-old *Alocasia Black Velvet* seedlings, chopped andam and raw rice husk planting media, labels, writing instruments, distilled water, AB Mix Biasa nutrients, AB Mix Kryptonium, curacron, antracol fungicide, and B1 fertilizer.

2.2. Method

This study was conducted at the Sukamantri IPB Experimental Garden Greenhouse located in Bogor, West Java, Indonesia from July to November 2025. This study used a two-factorial randomized block design (RAK). The first factor was the composition of the planting medium mixture, which consisted of four levels, namely: K_1 = chopped andam + raw rice husks = 1:1 (v/v), K_2 = chopped andam + raw rice husks = 2:1 (v/v), K_3 = chopped andam + raw rice husks = 3:1 (v/v), and K_4 = chopped andam + raw rice husks = 4:1 (v/v). The second factor is the type of AB Mix nutrients, consisting of two levels, namely Regular AB Mix and Kryptonium AB Mix, each with a concentration of 1250 ppm. There were 8 treatment combinations with 6 replicates, requiring 48 *Alocasia Black Velvet* plants.

The study began with the selection of uniform *Alocasia Black Velvet* seedlings that were 2 months old, had the same height, and had 2 leaves. The media was prepared by measuring and mixing chopped and raw rice husks until homogeneous according to the ratio of each treatment, namely 1:1, 2:1, 3:1, and 4:1. The measured and mixed media was then placed in 13 cm diameter plastic pots. The plastic pots filled with planting media were then labeled according to the replicates and treatments. After that, the selected *Alocasia Black Velvet* plants were transplanted into 48 plastic pots that had been labeled and filled with planting media. Before applying the AB Mix nutrients, the plants were first watered with B1 fertilizer to stimulate root growth and prevent root stress. Two types of nutrients were applied, namely Regular AB Mix and Kryptonium AB Mix, each with a concentration of 1250 ppm. AB Mix Regular and AB Mix Kryptonium nutrients were prepared by making a stock solution using 25 ml of stock solution A and stock solution B in AB Mix Regular and AB Mix Kryptonium, which were dissolved in each bucket containing 2.5 liters of water. However, before mixing the nutrients into the water, the water was first measured for its standard ppm and pH. The standard ppm measurement of the water will later be subtracted from the ppm of the water containing the AB Mix nutrients. The water mixed with the AB Mix Regular and AB Mix Kryptonium nutrients is stirred until homogeneous, then the ppm and pH of the solution are measured again. The AB Mix Regular and Kryptonium nutrients are applied twice a week, every Wednesday and Saturday, by pouring them onto the plant medium. Plant maintenance, including watering, is done 2-3 times a week depending on the moisture level of the medium. Fungicide and insecticide applications are done once a month.

Observations of plant height and stem diameter were conducted every two weeks, while leaf thickness, trichome density, and trichome length were measured at the end of the study. Leaf samples for trichome observation were taken by selecting two mature *Alocasia Black Velvet* leaves for each treatment, then these leaf samples were analyzed for trichomes at the Horticultural Agronomy Laboratory, Faculty of Agriculture, Udayana University. The selected leaf samples were cut and then made into cross-sections and longitudinal sections as thin as possible using a razor blade. The sections were placed on a glass slide that had been labeled for each treatment and dripped with sufficient distilled

water, then covered with a cover glass. This observation is repeated 4 times for each treatment. The prepared slides are then observed using a microscope with 40x magnification with a field of view of 0.19625/mm^2. The length and number of trichomes are calculated using the ImageJJS application. The number of trichomes calculated using the application is then used to calculate the density using the following formula:

Field of view area = πr^2

$$\text{Trichome density} = \frac{\text{number of trichome}}{\text{field of view}}$$

3. Results and Discussion

The results of the ANOVA test showed that the interaction between the composition of the planting medium mixture and the type of AB Mix nutrients was not significant. The single factor of the composition of the planting medium mixture was not significant for all observation variables. The single factor of the type of AB Mix nutrients also showed insignificant results for all observation variables. The results of the ANOVA test analysis showed that the combination of planting medium composition and AB Mix nutrient type did not significantly affect the growth rate of *Alocasia Black Velvet*.

Table 1 Two-way table of treatment of planting media composition (K) with AB Mix nutrient type (N) on plant height increase, stem diameter increase, leaf thickness, trichome density, and trichome length

Treatment	Plant Height Increase (cm)	Stem Diameter Increase (mm)	Leaf Thickness (mm)	Trichome Density (mm^2)	Trichome Length (µm)
Growing Medium (K)					
K1	2.90 (1.82) a	3.53 (1.98) a	0.69 a	35.71 a	22.10 (4.79) a
K2	2.63 (1.73) a	3.36 (1.92) a	0.65 a	35.08 a	21.70 (4.73) a
K3	2.31 (1.66) a	3.40 (1.96) a	0.67 a	29.97 a	20.76 (4.66) a
K4	3.15 (1.88) a	3.75 (2.03) a	0.70 a	35.71 a	22.53 (4.83) a
5% LSD	0.24	0.28	0.06	6.20	0.86
AB Mix (N)					
Nb	2.52 (1.71) a	3.47 (1.87) a	0.68 a	32.21 a	21.56 (4.72) a
Ns	2.98 (1.84) a	3.55 (1.98) a	0.68 a	36.03 a	21.98 (4.78) a
5% LSD	0.17	0,20	0.05	4.38	0.61

Numbers followed by the same letter in the same treatment and column indicate no significant difference according to the least significant difference (LSD) test at the 5% level. Numbers outside the parentheses are the original data, while numbers inside the parentheses are the transformed data due to non-normal distribution.

3.1. The effect of planting medium composition on the growth rate of *Alocasia Black Velvet*

The K_4 growing medium mixture treatment with a 4:1 ratio showed the best results in terms of plant height and stem diameter. Plant height in the K_4 treatment increased by 3.15 cm, while stem diameter increased by 3.75mm. The observation variables of leaf thickness, trichome density, and trichome length obtained the highest values in the K_4 growing medium mixture treatment, namely 0.70 mm; 35.71 mm^2; 22.53 µm. This proves that a higher proportion of chopped rice husks compared to raw rice husks has a positive effect on the growth of *Alocasia Black Velvet* plants, although this effect has not yet shown a statistically significant difference.

Raw rice husks play a role in the aeration and drainage systems and are also a source of potassium (K). Raw rice husks also tend to be incorporated into growing media that are poor in nutrients [7]. Therefore, raw rice husks must be combined with chopped andam to provide the nutrients necessary for plant growth. Shredded bark contains anthraquinone, which stimulates new cell growth, and potassium (K), which is one of the main nutrients needed by plants in cells, plant tissues, and xylem and phloem. K promotes the growth of meristem tissue, regulates stomatal movement, and strengthens stems [8]. K and anthraquinone promote high plant growth rates and stem diameter. Previous studies

have shown that wood chips are a type of growing medium that has very high moisture content and is preferred by foliage or ornamental plants.

Shredded bark also contains Ca, Mg, and N nutrients that can accelerate root development and vegetative growth [9]. The Mg element plays a role in the process of photosynthesis, which produces sugar as food needed by plants for cell division and enlargement [10]. This also causes the leaf thickness in the K_4 treatment to be higher than in the K1, K2, and K3 treatments. Treatment K_4 produced the best results in terms of trichome density and length compared to other treatments. However, although treatment K4 produced better results, this study cannot yet show that chopped rice husks and raw rice husks have a significant effect on trichome length and density. Previous studies have reported that trichome length in some weed species can reach 209.21 µm [11]. Observations of trichome length in *Alocasia Black Velvet* only reached a maximum of 22.53 µm. This difference is thought to be related to the thick leaf structure of *Alocasia Black Velvet*. Thicker leaves generally have shorter trichomes compared to thinner leaves, which tend to have longer and denser trichomes [12]. The thickness of *Alocasia Black Velvet* leaves is a form of physiological adaptation of the plant to its environment, which allows for greater chloroplast accumulation, so that light capture remains optimal even though *Alocasia Black Velvet* is cultivated under shade or in a greenhouse.

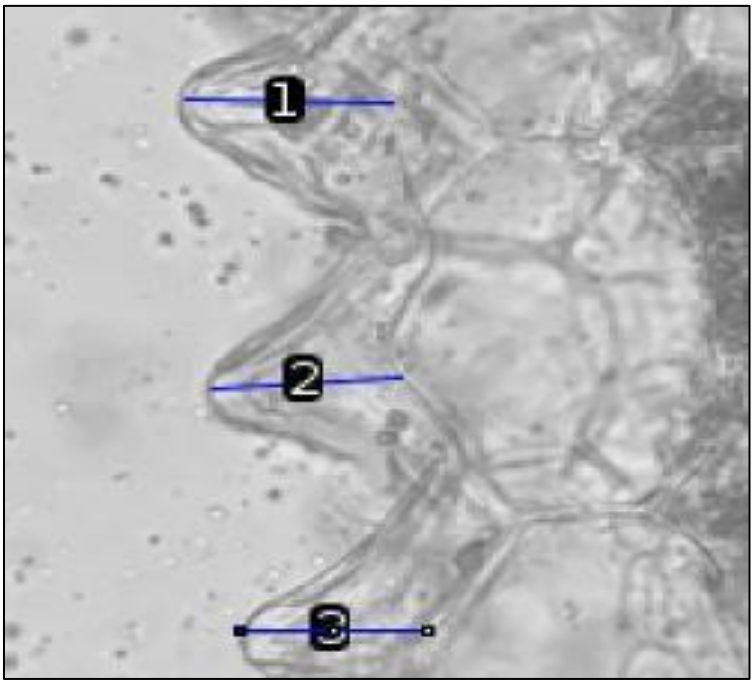

Figure 1 Measurement of trichome length from cross-section trichome observations

3.2. Effect of AB Mix nutrient type on the growth acceleration of *Alocasia Black Velvet*

The best plant height increase was obtained in the AB Mix Kryptonium (Ns) nutrient treatment, which was 2.98 cm. AB Mix Kryptonium also gave the best results in terms of stem diameter increase, which was 3.55 mm.

Previous studies have mentioned that AB Mix Kryptonium can maintain a better balance between nutrients, and the stability of AB Mix Kryptonium nutrients can encourage the rate of assimilation, thereby accelerating plant height growth [6]. Plants that experience an increase in plant height generally also require an increase in stem diameter to support the increased canopy biomass.

The Ns treatment yielded better results in terms of plant height and stem diameter increase compared to AB Mix Regular (Nb), but in terms of leaf thickness, the Ns and Nb treatments yielded the same results, namely 0.68 mm. Both Regular AB Mix and Kryptonium nutrients contain Mg. Magnesium (Mg) plays a role in photosynthesis, particularly as a major structural component and in regulating energy metabolism. Magnesium also plays a role in maintaining leaf tissue thickness by regulating the distribution of photoassimilates. Sufficient Mg availability ensures that the chloroplast structure remains sturdy, where the thylakoid and grana membranes are arranged regularly to support optimal tissue density in the leaves [13]. AB Mix Kryptonium produced the best results in terms of trichome density and length, namely 36.03 mm^2 and 21.98 µm. Trichomes function as a protective layer to reduce the rate of transpiration and protect leaf tissue from excessive sunlight intensity and pest attacks [14]. The best results in the AB Mix Kryptonium treatment

indicate that the composition of macro and micro nutrients is more stable than in the Regular AB Mix [6]. This is especially true for N and Mg, which support cell division and differentiation of epidermal cells into leaf hairs (trichomes). However, referring to previous studies, trichome density is categorized into three types: low density (<300/mm^2) , medium density (300-500/mm^2),and high density (>500/mm^2) [15]. This indicates that although the Ns treatment produced the best results with a density value of 36.03 mm^{2}and a length of 21.98 µm, this value is still classified as low density. Other studies report that plants lacking water or nutrients produce very dense trichomes, giving them a silvery appearance, while plants with sufficient water or nutrients have fewer trichomes to cover the epidermal cells and exhibit a greener color [16]. Sufficient nutrients and AB Mix for *Alocasia Black Velvet* result in fewer trichomes. This condition is also consistent with the characteristics of *Alocasia Black Velvet*, which has greener leaves, even dark green.

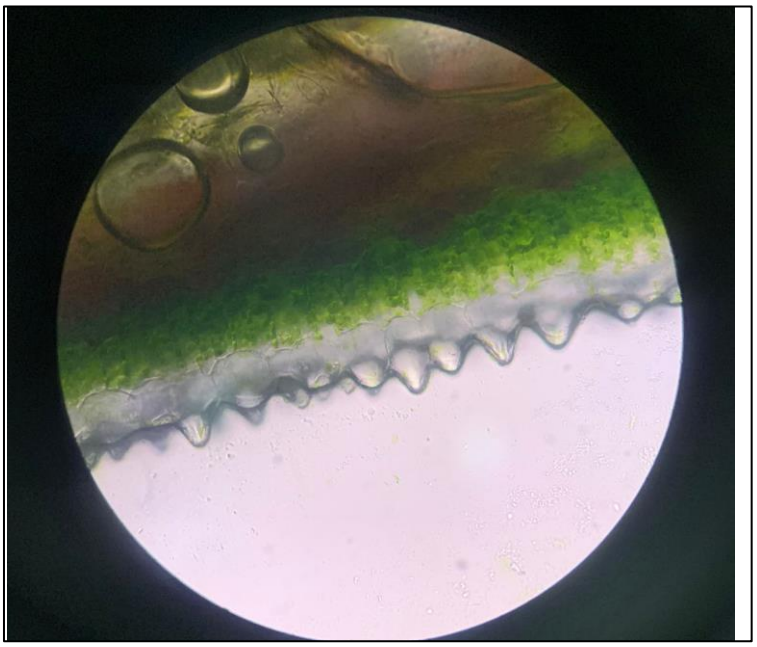

Figure 2 Cross-section of trichomes, 40x magnification

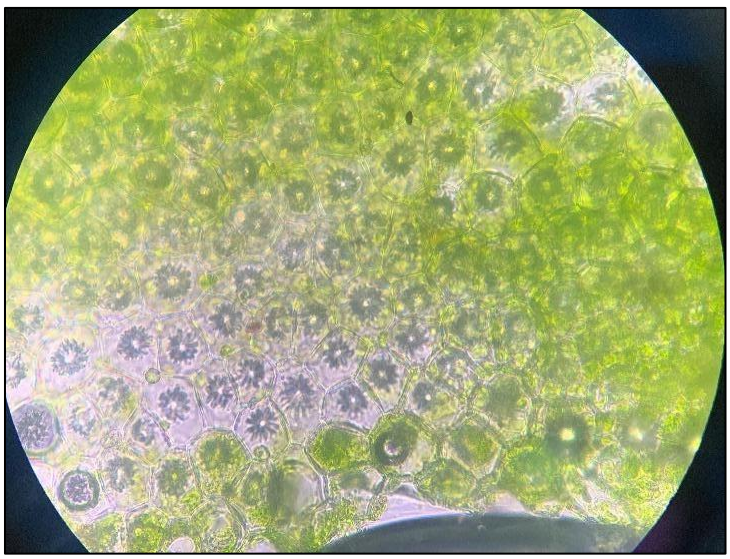

Figure 3 Cross-section of trichomes, 40x magnification

4. Conclusion

The composition of the planting medium mixture that helps stimulate accelerated growth in *Alocasia Black Velvet* was obtained at a ratio of 4:1 (K_4) with an increase in plant height of 3.15 cm and an increase in diameter of 3.75 mm. The variables of leaf thickness, trichome density, and trichome length obtained the highest values in the K_4 growing medium

composition treatment at 0.70 mm; 35.71 mm^2 ; 22.53 µm. The best AB Mix nutrient treatment was AB Mix Kryptonium, which produced, plant height increase of 2.98 cm; stem diameter increase of 3.55 mm; trichome density of 36.03 mm^2 and trichome length of 21.98 µm.

Compliance with ethical standards

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Disclosure of conflict of interest

There are no conflicts of interest to disclose.

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