



Organic Media Composition and Liquid Organic Fertilizer Concentration on Growth, Chlorophyll Content, and Anthocyanin of Red Ginger (*Zingiber officinale* var. *rubrum*)

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ABSTRACT

The demand for red ginger in both domestic and export markets continues to rise; however, local productivity remains insufficient due to conventional cultivation systems, the high cost of environmentally harmful inorganic fertilizers, and suboptimal growing media. At the same time, increasing public awareness of healthy products requires environmentally friendly cultivation innovations. Therefore, this study aims to provide a practical and sustainable cultivation solution to improve red ginger yield, safety, and applicability for farmers. This study examined the effect of combining organic growing media (cocopeat, rice husk charcoal, and bokashi) with different concentrations of liquid organic fertilizer (LOF) on the growth and yield of red ginger. These combinations are expected to enhance media quality, improve nutrient uptake efficiency, and promote optimal vegetative growth and rhizome formation. The experiment was conducted at the Sei Semayang experimental field from July to October 2025 using a factorial Randomized Complete Block Design (RCBD) with two factors. The first factor was growing media composition with three levels: 40%:30%:30%, 50%:25%:25%, and 60%:20%:20% (cocopeat, rice husk charcoal, and bokashi). The second factor was LOF application at four levels: control, 3 cc L⁻¹, 6 cc L⁻¹, and 9 cc L⁻¹. The results indicated that the best media composition was 60%:20%:20%. LOF application significantly affected chlorophyll and anthocyanin content, with the optimal dose at 3 cc L⁻¹. Higher doses reduced growth and yield.

Keywords: growing media; liquid organic fertilizer; red ginger

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INTRODUCTION

Red ginger is an agricultural commodity needed by the community as a spice and traditional medicine which has quite good marketing prospects for development. Red ginger has superior properties as an antioxidant, anti-inflammatory, anti-bacterial, and carminative, so this plant is developed in Indonesia (Nurdyansyah and Widyastuti, 2022). Red ginger rhizome has high economic value because it is used in various medicines, kitchen spices and commodity trade. The prospects for developing ginger in Indonesia are quite clear, especially to meet the export needs of industry, traditional medicine, food and beverage industry, cooking spices, sources of essential oils and oleoresins (Rialita et al., 2015).

Red ginger has now become a national export commodity, both in the form of fresh ginger and processed products. This makes the demand for red ginger commodities continue to increase in line with the development of the ginger-based food and beverage industry. The prospects for developing red ginger in Indonesia are currently still quite bright. Demand for

ginger in Indonesia during the 2018-2020 period increased by an average of 2.91% per year to 1,246,029 kg (Putri, 2023; Lidar et al., 2022; BPS & Dirjen Hortikultura, 2021).

The high annual market demand for red ginger rhizomes has so far been unable to be met by ginger producers in Indonesia. This is due to limited land resources, conventional red ginger cultivation methods, low soil organic matter content, and the use of expensive inorganic fertilizers, which often increase ginger production costs and are unsafe for the environment and health. In addition, the desire to live healthily and return to nature in today's society has apparently raised awareness to consume healthy and pesticide-free agricultural products, including organic ginger products. In this regard, it is necessary to prepare an innovative organic ginger cultivation technology to support the production of competitive and high-quality organic ginger. One of the technological innovations that has been prepared is cultivation through innovative planting media by utilizing organic waste, so that it is hoped that

it can accelerate the process of cell or tissue division and have an impact on the process of plant growth and development for the better (Soeparjono, 2011).

Organic growing media is a media whose components mostly come from living organisms. The use of organic materials as a planting medium is far superior to inorganic materials because organic materials are able to provide nutrients for plants. Bokashi compost is produced from the fermentation process or brewing of organic materials using EM4 technology. Coconut fiber is an alternative organic material that can be used as a planting medium with the advantage of its characteristics being able to bind and retain water strongly, according to the area, and contains essential nutrients, such as Ca, Mg, K, N, and P. Rice husk charcoal is the result of incomplete combustion of black rice husks. The black color of charcoal husks is due to their high heat absorption capacity, which increases the temperature and accelerates germination. Furthermore, husks also have a high carbon (C) content, making them an excellent growing medium. Therefore, one of the efforts that can be made to produce healthy, pesticide-free ginger while meeting the needs of the community and exports is to conduct research related to cultivation techniques for improving ginger plants, namely the use of organic waste as a planting medium (Soeparjono, 2016).

In implementing organic farming, the supporter of successful agricultural products that are classified as healthy agricultural products is by using liquid organic fertilizer. LOF is an extract from the results of the decomposition of organic materials which is useful for providing nutrients for plants, improving soil structure, suppressing harmful bacteria in the soil, continuous use will improve the physical, chemical and biological properties of the soil, and is safe for the environment (Sitanggang et al., 2022). The results of research by Nugrahini and Tutik (2013) stated that providing liquid organic fertilizer with a concentration of 3 mL L⁻¹ can produce longer shoots, more leaves, larger shoot diameters, more internodes and longer roots compared to treatment without liquid organic fertilizer.

This study addresses the increasing demand for red ginger, which has not been matched by sufficient production due to limited land, conventional cultivation practices, low soil organic matter, and reliance on costly inorganic fertilizers that harm the environment and human health. In addition, growing consumer awareness of healthy, pesticide-free products highlights the need for sustainable cultivation methods. The use of organic growing media such as cocopeat, rice husk charcoal, and bokashi, combined with liquid organic fertilizer (LOF), offers a promising solution. Therefore, this study aims to evaluate the optimal combination to improve growth, physiological characteristics, and yield of red ginger in an environmentally friendly manner.

MATERIALS AND METHODS

This research was conducted at the Sei Semayang experimental field in Deli Sedang Regency, North Sumatra, at an altitude of approximately 30 meters above sea level. The study began in July 2025 and ended in October 2025.

This research method uses a Factorial Randomized Complete Block Design (RCBD) consisting of 2 factors and 3 replications. The first factor is the composition of the planting media with 3 levels [cocopeat + rice husk charcoal + bokashi (40% : 30% : 30%)], [cocopeat + rice husk charcoal + bokashi (50% : 25% : 25%)], [cocopeat + rice husk charcoal + bokashi (60% : 20% : 20%)]. The second factor is the application of LOF with 4 levels (control, 3 cc L⁻¹, 6 cc L⁻¹, and 9 cc L⁻¹).

The research began with land preparation, red ginger seeds, and planting media. The red ginger rhizome used were uniform, weighing between 10 and 30 grams and having 1 or 2 buds. The rhizome used are certified seeds with the Jahira 2 variety. The planting media used is first weighed so that the total planting media in one polybag is 2 kg. Plant by inserting 1 seed into a polybag to a depth of 5 cm. Next, the application of LOF with the NASA trademark is carried out 2 weeks after planting (2 MST) with a 1 week watering interval until harvest. LOF application is sprayed on the leaves (foliar).

The parameters observed were root length, root volume, dry weight of tubers, chlorophyll (a, b, and total), and anthocyanin which were observed at the end of the study, namely (16 WAP). The length of the root is observed by measuring from the base of the stem (root neck) to the tip of the longest root using a meter. Root volume is determined by calculating the increase in water volume in the measuring cup before and after the rhizome is placed in the measuring cup. The dry weight of the tubers was weighed using an analytical balance which had previously been dried in an oven at 70°C for 48 hours or until constant. Chlorophyll a, b, and total were observed using the Wintermans and De Mots (1965) method. 1 gram of red ginger leaves was taken, ground with 15 mL of 96% ethanol and then filtered. After that, it was read using a UV/VIS spectrophotometer with a wavelength of 649 nm and 665 nm. Total chlorophyll, chlorophyll a, chlorophyll b in units of g/mg are calculated using the formula:

$$\begin{aligned}\text{Chlorophyll a} &: (13.7 \times A_{665}) - (5.76 \times A_{649}) \\ \text{Chlorophyll b} &: (25.8 \times A_{649}) - (7.60 \times A_{665}) \\ \text{Total chlorophyll} &: (6.10 \times A_{665}) + (20.0 \times A_{649})\end{aligned}$$

The total anthocyanin content in mg/100g units is calculated using the formula (Zahroh and Agustini, 2021):

$$\text{Content} = \frac{A \times MW \times DF \times V \times 100}{\varepsilon \times l \times WI}$$

RESULT AND DISCUSSION

Root Length and Root Volume

The ANOVA results showed that growing media composition (M) had a significant effect on root length and root volume, whereas liquid organic fertilizer (LOF) application (P) and the interaction between both factors (M × P) had no significant effect on these parameters in red ginger. The growing media composition consisting of cocopeat (60%) + rice husk charcoal (20%) + bokashi (20%) produced the highest root length and root volume, reaching 47.01 cm and 35.42 mL, respectively, compared to the other media compositions (M1 and M2) (Table 1).

A growing media composition with 60% cocopeat has a high water-holding capacity combined with good

Table 1. Root length and root volume with planting media composition treatment and LOF application at 16 MST

Parameter	Growing Media	Liquid Organic Fertilizer (LOF) (cc/l)				Means
		P0 (0)	P1 (3)	P2 (6)	P3 (9)	
Root Length	M1	38.50	46.83	47.83	40.00	43.29 ab
	M2	39.17	42.67	41.17	39.67	40.67 a
	M3	43.93	50.00	48.17	45.93	47.01 b
	Means	40.53	46.50	45.72	41.87	
Root Volume	M1	25.00	33.33	20.00	16.67	23.75 ab
	M2	16.33	28.33	23.33	20.00	22.00 a
	M3	30.00	41.67	30.00	40.00	35.42 b
	Means	23.78	34.44	24.44	25.56	

Description: M1: cocopeat+rice husk charcoal+bokashi (40%:30%:30%), M2: (50%:25%:25%), M3: (60%:20%:20%). Numbers in columns and rows followed by the same letter indicate no significant difference according to the DMRT test $\alpha = 5\%$.

porosity, resulting in a loose and stable structure. This condition facilitates red ginger roots to penetrate the growing media, expand the root zone, and promote optimal root elongation. As an organic growing medium, cocopeat is widely used due to its high water retention capacity and favorable physical structure that supports root system growth and development. Cocopeat composition is considered effective in enhancing root growth (Lamdo et al, 2023). According to Kalaivani and Jawaharlal (2019), cocopeat is known for its moisture retention and fibrous structure, which promote aeration, root development, and oxygen uptake. Therefore, cocopeat serves as an optimal medium for root development (Krishnapillai et al, 2020).

Based on Table 1, the application of liquid organic fertilizer (LOF) showed no significant effect on root length and root volume. This is presumably because the macro- and micronutrient contents in LOF are predominantly utilized by plants for above-ground growth, such as leaf formation, stem elongation, and increased photosynthetic activity. The foliar application of LOF promotes better growth of stems and leaves; however, root development is not optimal because photosynthates tend to be allocated and utilized in the leaves. This finding is consistent with Adeniyi et al. (2016), who stated that foliar fertilization cannot fully meet plant nutritional and mineral requirements compared to soil fertilization.

Furthermore, root volume is an important parameter in plant growth as it reflects the capacity of the root system to absorb nutrients and support metabolic processes. According to Lakitan (1993), most essential nutrients required by plants are absorbed from the soil solution through the roots. Therefore, the growth and development of the root system are strongly influenced by soil or growing media conditions. Several key factors affecting root distribution patterns and development include soil temperature, aeration level, water availability, and nutrient availability.

Dry Weight of Tubers

The ANOVA results indicated that growing media composition (M) had a significant effect on rhizome dry

weight, whereas liquid organic fertilizer (LOF) application (P) and the interaction between both factors ($M \times P$) had no significant effect on the tuber dry weight of red ginger. The growing media composition consisting of cocopeat (60%) + rice husk charcoal (20%) + bokashi (20%) produced the highest tuber dry weight, reaching 11.51 g, compared to the other media compositions (M1 and M2) (Table 2).

This result suggests that the composition of 60% cocopeat + 20% rice husk charcoal + 20% bokashi provides superior conditions compared to other combinations. The higher proportion of cocopeat (60%) ensures optimal water and nutrient retention without causing excessive compaction, thereby maintaining healthy and active root systems. Rice husk charcoal (20%) enhances aeration and porosity, allowing sufficient space and oxygen availability for optimal root growth, while bokashi (20%) supplies organic nutrients and active microorganisms in appropriate amounts. This balanced combination creates favorable conditions for root development, improves nutrient uptake efficiency, and promotes carbohydrate accumulation in the rhizome, ultimately increasing tuber dry weight.

These findings are consistent with Sutari et al. (2018), who reported that a growing media composition of compost, rice husk charcoal, and cocopeat effectively retains water. Porous growing media contain air spaces between particles that facilitate proper air circulation. A medium with high water retention capacity can supply adequate water for optimal photosynthesis. Moreover, such conditions are supported by optimal media porosity, which enhances rhizome growth and development (Struik, 2007).

Technological modification is required to improve the physical properties of soil by altering the growing media, such as combining compost, coconut fiber (cocopeat), and rice husk charcoal. Compost is utilized due to its complete nutrient content, including both macro- and micronutrients, which, even when applied in small amounts, can enhance plant growth and yield. Compost, rice husk charcoal, and cocopeat are important organic materials that contribute to improving the properties of growing media.

Table 2. Dry weight of tubers with treatment of planting media composition and LOF application at 16 MST

Parameter	Growing Media	Liquid Organic Fertilizer (LOF) (cc/l)				Means
		P0 (0)	P1 (3)	P2 (6)	P3 (9)	
Root Length	M1	1.83	4.36	4.27	2.53	3.25a
	M2	4.11	10.18	4.48	6.53	6.33b
	M3	10.39	13.54	11.45	10.67	11.51c
	Means	5.44	9.36	6.74	6.58	

Notes: M1: cocopeat+rice husk charcoal+bokashi (40%:30%:30%), M2: (50%:25%:25%), M3: (60%:20%:20%). Numbers in columns and rows followed by the same letter indicate no significant difference according to the DMRT test $\alpha = 5\%$.

The addition of organic materials can increase microbial populations, enhance enzyme activity, improve water-holding capacity, strengthen pH buffering capacity, and ultimately increase crop yield (Khanam et al, 2001; Edwards, 2002).

The results of the study showed that the dry weight of the tubers differed significantly in each planting media treatment. Treatment M3 produced the highest dry weight of tubers (11.51 g), about twice as large as M2 (6.33 g) and about 3.5 times as large as M1 (3.25 g). The magnitude of this difference not only reflects better plant growth conditions, but also indicates a physiological mechanism link between optimal root system development and the plant's ability to produce, translocate, and accumulate photoassimilates to storage organs, so that tuber formation and filling take place more effectively.

The M3 planting medium, which contains higher organic matter, is thought to be able to create a better soil pore structure, thereby supporting the growth of a longer, wider, and optimally developed root system. This condition is in line with the research results of Cavalieri-Polizeli et al. (2022), which showed that improving soil structure quality through the addition of organic matter was positively correlated with increases in total root length, root volume, and root dry weight. A more developed root system will expand the root exploration area in absorbing water and nutrients, because the wider the contact surface between the roots and the soil, the more effective the nutrient absorption process through ion diffusion can be (Nasielski et al., 2019). As a result, plants grown on M3 media have a higher capacity to absorb growth resources, thus supporting a more optimal rate of photosynthesis and increasing the supply of photoassimilates to storage organs. The continuous availability of assimilates ultimately encourages more optimal tuber formation and filling.

Based on Table 2, the application of liquid organic fertilizer (LOF) showed no significant effect on tuber dry weight. Although the results of this study indicated a significant effect on chlorophyll content, no corresponding effect was observed on tuber dry weight. Liquid organic fertilizer significantly influences chlorophyll content because it contains nitrogen and other essential nutrients that play a direct role in chlorophyll synthesis, thereby increasing leaf greenness and photosynthetic capacity. However, an increase in chlorophyll content does not automatically lead to an increase in tuber dry weight, as biomass accumulation in the tuber is influenced by assimilate distribution (source-sink relationship), growth stage, and environmental

factors. This finding is consistent with previous studies by Tuhuteru et al. (2020) and Setiyowati et al. (2010), which reported that the application of liquid organic fertilizer did not significantly affect the tuber dry weight of shallots.

Chlorophyll Content

The ANOVA results showed that growing media composition (M), liquid organic fertilizer (LOF) application (P), and the interaction between both factors (M $\times$ P) had significant effects on chlorophyll a, chlorophyll b, and total chlorophyll content. The best interaction between growing media and LOF was observed in treatment M3P1 for chlorophyll a, b, and total chlorophyll, with values of 57.87, 30.75, and 88.62 mg g⁻¹, respectively (Table 3). This indicates that the growing media composition of cocopeat + rice husk charcoal + bokashi at a ratio of 60%:20%:20%, combined with LOF application at a concentration of 3 cc L⁻¹, is the most effective treatment in enhancing leaf chlorophyll content, reflecting optimal nutrient uptake and photosynthetic efficiency.

Cocopeat contains essential nutrients such as nitrogen (N), phosphorus (P), and potassium (K), which are crucial for the synthesis of chlorophyll a, b, and total chlorophyll in plants. In addition, cocopeat has a porous structure that improves root aeration and enhances water and nutrient absorption, ultimately supporting chlorophyll formation. The study by Sipqi et al. (2025) reported that the use of cocopeat in high proportions (90%) significantly increased chlorophyll content. This is likely associated with the high porosity and water-holding capacity of cocopeat, which create an optimal root environment and improve nutrient uptake efficiency.

This finding is consistent with Sisriana et al. (2021), who stated that cocopeat has a near-neutral pH, supporting the availability of essential nutrients such as nitrogen (N) and magnesium (Mg), both of which play important roles in chlorophyll biosynthesis. Moreover, the use of cocopeat positively affects leaf health, which is generally correlated with increased chlorophyll content. Rahhutami et al. (2021) also emphasized that chlorophyll is a green pigment essential for photosynthesis, the process of synthesizing organic compounds using solar energy. Magnesium (Mg) plays a key role in chlorophyll formation and can be supplied through cocopeat-based media.

Furthermore, the application of LOF provides macro- and micronutrients that directly support chlorophyll synthesis in leaves, including N, Mg, and Fe, which are essential components of chlorophyll molecules and photosynthetic enzymes. This is supported by Harbi

Table 3. Chlorophyll a, b, and total with treatment of planting media composition and LOF application

Parameter	Growing Media	Liquid Organic Fertilizer (LOF) (cc/l)				Means
		P0 (0)	P1 (3)	P2 (6)	P3 (9)	
Chlorophyll A	M1	16.57 a	36.93 f	31.07 d	26.15 b	27.68 a
	M2	25.23 b	53.95 h	46.92 g	29.09 c	38.79 b
	M3	30.73 d	57.87 i	53.69 h	33.77 e	44.01 c
	Means	24.18 a	49.58 d	43.89 c	29.67 b	
Chlorophyll B	M1	12.42 a	30.39 hi	26.56 de	22.12 c	22.87 a
	M2	18.55 b	30.68 i	29.33 ghi	26.60 def	26.29 b
	M3	25.62 d	30.75 i	28.05 fg	29.07 gh	28.37 c
	Means	18.86 a	30.60 d	27.98 c	25.93 b	
Total Chlorophyll	M1	28.99 a	67.32 f	57.63 d	48.27 c	50.55 a
	M2	43.78 b	84.63 i	76.25 g	55.69 d	65.09 b
	M3	56.35 d	88.62 j	81.74 h	62.85 e	72.39 c
	Means	43.04 a	80.19 d	71.87 c	55.60 b	

Description: M1: cocopeat+rice husk charcoal+bokashi (40%:30%:30%), M2: (50%:25%:25%), M3: (60%:20%:20%). Numbers in columns and rows followed by the same letter indicate no significant difference according to the DMRT test $\alpha = 5\%$.

et al. (2021) and Boussadia et al. (2010), who reported that LOF contains nitrogen (N), a primary component in chlorophyll formation. Adequate nitrogen availability enhances photosynthetic activity, as reflected in increased assimilation efficiency in plants.

The LOF dose of 3 cc L⁻¹ (P1) is thought to be the most suitable concentration to support chlorophyll formation, whereas increasing the dose to 6 cc/L (P2) and 9 cc L⁻¹ (P3) actually causes a decrease in leaf chlorophyll content. This condition shows that providing excessive amounts of LOF can have a negative impact on the physiological processes of plants.

One mechanism suspected to play a role is the occurrence of ammonium (NH₄⁺) toxicity due to excess nitrogen originating from liquid organic fertilizer. At the right dosage, nitrogen functions as an essential element in chlorophyll formation. However, if the amount of NH₄⁺ absorbed is too high, it can disrupt plant metabolism. At the right dosage, nitrogen functions as an essential element in chlorophyll formation. However, if the amount of NH₄⁺ absorbed is too high, it can disrupt plant metabolism. According to Yang et al. (2020), excessive accumulation of NH₄⁺ in plant tissues can increase the formation of reactive oxygen species (ROS) which causes oxidative stress. This condition inhibits the activity of the Rubisco enzyme and reduces the rate of photosynthesis. In addition, Ding et al. (2018) reported that high concentrations of NH₄⁺ can damage Photosystem II (PSII), which is one of the main components in the photosynthesis process. This damage inhibits electron transfer during photosynthesis so that chlorophyll synthesis is disrupted and chlorophyll degradation occurs more quickly. As a result, the chlorophyll content in plants receiving higher doses of LOF tends to decrease compared to lower doses.

Anthocyanin Content

The ANOVA results showed that the application of liquid organic fertilizer (LOF) (P) had a significant effect on anthocyanin content, whereas growing media

composition (M) and the interaction between both factors (M × P) had no significant effect on anthocyanin levels. The highest anthocyanin content was observed in treatment P1 (3 cc L⁻¹), with a value of 0.25 mg 100 g⁻¹, compared to the other treatments (Table 4).

In this study, increasing LOF concentration resulted in a decrease in anthocyanin content. High LOF concentrations may lead to excessive nutrient accumulation, which shifts plant resources and anthocyanin (flavonoid pigment) biosynthesis toward vegetative growth, such as organ size development. This finding is consistent with Abubakar et al. (2022), who reported that LOF concentrations exceeding the optimum level can reduce anthocyanin content. This condition occurs because excessive nutrient availability causes plants to prioritize vegetative growth rather than the synthesis of secondary metabolites, including anthocyanins.

Anthocyanin biosynthesis is regulated by key enzymes, particularly phenylalanine ammonia-lyase (PAL), in the phenylpropanoid pathway. The activity of this enzyme is strongly influenced by nutrient balance, especially nitrogen and potassium. Under adequate nutrient conditions, PAL activity can function optimally. In contrast, excessive LOF application leading to nutrient surplus may reduce enzyme activity, thereby decreasing flavonoid and anthocyanin synthesis. Thus, excessive nutrient accumulation in the growing media has the potential to suppress the formation of secondary metabolites, including anthocyanins (Ramadhan et al, 2015).

Furthermore, potassium (K) is a key factor influencing anthocyanin content in sweet potato plants. Previous studies have demonstrated that potassium can promote the conversion of phenolic compounds into flavonoids by enhancing the activity of metabolic enzymes, such as phenylalanine ammonia-lyase (PAL), or by accelerating the production of adenosine triphosphate (ATP), which in turn increases anthocyanin content (Zha and Koffas,

Table 4. Anthocyanin levels with planting media composition treatment and LOF application

Parameter	Growing Media	Liquid Organic Fertilizer (LOF) (cc/l)				Means
		P0 (0)	P1 (3)	P2 (6)	P3 (9)	
Root Length	M1	0.15	0.23	0.12	0.10	0.15
	M2	0.11	0.27	0.13	0.12	0.16
	M3	0.13	0.26	0.17	0.12	0.17
Means		0.13 a	0.25 b	0.14 a	0.11 a	

Description: M1: cocopeat+rice husk charcoal+bokashi (40%:30%:30%), M2: (50%:25%:25%), M3: (60%:20%:20%). Numbers in columns and rows followed by the same letter indicate no significant difference according to the DMRT test $\alpha = 5\%$.

2017). Potassium has also been shown to increase anthocyanin content in potatoes, thereby improving their quality (Michalska et al, 2016).

Table 4 shows that growing media composition did not have a significant effect on anthocyanin content. This may be attributed to the relatively uniform physical and chemical characteristics of the growing media used (cocopeat + rice husk charcoal + bokashi), which remained within a range that generally supports plant growth. As a result, no substantial differences in environmental conditions were created to significantly influence anthocyanin synthesis.

According to Martínez-Ispizua et al., (2023), anthocyanin content varies depending on plant species and is influenced by the chemical characteristics of the growing media, such as pH, acidity level, and the composition of its constituents. Growing media composed of rice husk charcoal and cocopeat, which typically have a near-neutral pH, have been reported to better support increased anthocyanin accumulation compared to media with less suitable chemical properties.

CONCLUSION

The best planting media composition is the composition of cocopeat + rice husk charcoal + bokashi planting media with a ratio of 60% : 20% : 20% for root length, root volume, dry weight of rhizome, and chlorophyll content. Application of liquid organic fertilizer (LOF) with a concentration of 3 cc L⁻¹ significantly affected the chlorophyll and anthocyanin content, while increasing the LOF concentration resulted in a decrease in the chlorophyll and anthocyanin content. The interaction between the composition of the planting media and the application of LOF has a significant effect on the chlorophyll content.

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