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The Effect of Anaerobic Composting Method of Coffee Waste on The Growth of Robusta Coffee Seedlings (*Coffea canephora* L.)

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ABSTRACT

Coffee is one of the plantation commodities that has significant economic value. A factor that needs to be considered in coffee plant cultivation is good planting media composition. This study aims to determine the effect of planting media composition on the growth of robusta coffee seedlings. This study used a Completely Randomized Design with treatments M0= Soil: 100%, M1= Soil: 50% + Coffee Husk Compost: 25% + Rice Husk: 25%, M2= Soil: 25% + Coffee Husk Compost: 50% + Rice Husk: 25%, M3= Soil: 25% + Coffee Husk Compost: 25% + Rice Husk: 50%. The analyses conducted were compost analysis and initial and post-incubation soil analysis. Observation data were analyzed using the F test followed by DNMRT at the 5% level. The research results show that the provision of coffee husk compost and rice husks affects the chemical properties of the soil and the growth of coffee seedlings. The planting media composition of Soil: 25% + Coffee Husk Compost: 50% + Rice Husk: 25% proved to increase the pH of the planting media from 5.5 to 6.6, increase in total N-value from 0.2% to 0.5%, available P from 18.6 ppm to 38.5 ppm and the soil CEC from 7.6 me/100g to 36.6 me/100g. This planting media composition also makes it possible to enhance the growth of robusta coffee seedlings in plant height, stem diameter, number of leaves, leaf width, and root volume. Thus, this planting media composition is a suitable medium for the growth of robusta coffee seedlings.

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INTRODUCTION

Coffee is one of the leading plantation commodities with important economic value in Indonesia. West Sumatra Province is one of the regions that contributes to national coffee production. Based on data from the West Sumatra Province Central Statistics Agency (2022), in 2021 West Sumatra will have a coffee area of 23,902.16 Ha with a total production of 6,139.08 tons, consisting of 5,888.25 Ha for Arabica coffee with a production of 3,413.15 tons and 18,013.91 Ha with production of 2,725.93 tons for robusta coffee. One of the largest coffee producing areas for the West Sumatra region is South Solok Regency.

Several factors that need to be considered in cultivating coffee plants to increase production are the use of quality coffee seeds and the use of fertile planting media. A good planting medium must provide the nutrients that plants need. Generally, the planting medium used in the seeding process is topsoil and a mixture of several organic materials with soil. Continuous use of topsoil will cause erosion of topsoil, so the soil will become degraded and an obstacle in future coffee breeding. According to Irawan and Kafiar (2015), topsoil is still the main choice as a planting medium, this is because the topsoil contains organic material which is good for seeding and cultivation. However, if top soil is used continuously in large quantities, this can damage the environment.

Seeing the potential problems with the current planting media in nurseries, such as soil degradation and nutrient depletion, that will occur in the future, it is necessary to seek an alternative. One effort that can be made is to reduce the use of top soil and add organic material from residual biomass from harvested crops. Organic materials are able to help seedlings develop better because they are able to absorb water and can also retain water for quite a long time.

Organic materials used as planting media include rice husks, soil and coffee husk compost. Planting media containing rice husks have the potential to retain water, however the use of rice husks cannot provide sufficient nutrients for the growth of coffee seedlings. Hakim (2013), states that using raw rice husks as a planting medium has several benefits. It efficiently retains water, does not decompose quickly, and is a good source of potassium (K) for plants. Additionally, it does not clump or compact, allowing plant roots to grow well. However, raw rice husks tend to be lacking in nutrients.

Therefore, to meet the nutrient needs of coffee plants, it is necessary to add organic materials. These materials serve as a planting medium and a source of nutrients that can support plant growth. Compost made from coffee fruit skins is a valuable resource that serves as a growing medium and nutrient contributor. This compost is an alternative that can be useful as a source of organic material that contributes nutrients to plants. However, the waste from coffee fruit skins has been a significant issue, often left to rot or burned, leading to detrimental effects on the environment such as soil degradation and air pollution. To address this problem, the waste can be transformed into a natural fertilizer through a composting process. Currently, the composting process for coffee fruit skins is done using aerobic composters, which take longer to decompose the coffee skins. Therefore, anaerobic composting methods are necessary to accelerate the composting process, potentially producing a large amount of coffee fruit skin compost in a shorter period. Suharno *et al*. (2021) stated that aerobic organic waste composting takes 1-2 months, while anaerobic composting only takes 12 days.

MATERIALS AND METHODS

Carried out this research in Nagari Lubuk Gadang Selatan, Sangir District, South Solok Regency from January - August 2023. The experimental design used in this research was a Completely Randomized Design which consisted of 4 treatments and repeated five times. The treatment level tested was a combination of planting media composition between top soil (T), coffee husk compost (K) and rice husks (S). The planting media compositions were designed based on the effectiveness of using topsoil as a planting medium, the role of rice husk in retaining water, and the potential of coffee husk compost to provide nutrients for the growth of coffee seedlings.

The treatment compositions were as follows: M0 = Soil: 100%, M1 = Soil: 50% + Coffee husk compost: 25% + Rice husks: 25%, M2 = Soil: 25% + Coffee husk compost: 50% + Rice husks: 25% and M3 = Soil: 25% + Coffee husk compost: 25% + Rice husks: 50%. An analysis of variance (F test) was carried out at the 5% level to test the hypothesis of the effect of various treatments on the experimental observation data. It was continued with Duncan's New Multiple Range Test (DNMRT) if significant differences. The research stages carried out were:

1. Making coffee skin compost using an anaerobic composter

With anaerobic composting, safety and simplicity are key. All you need is a 20 kg bucket, a 30 cm long hose, and a tight-fitting lid. The process is straightforward and can be easily managed. The bucket is then fitted with a 30 cm long hose and the bucket is closed tightly with a lid. A hole is made in the bucket cover and a hose is provided to drain the oxygen in the composter media by attaching a hose to the bucket cover and applying plastic glue to make it strong so that air does not enter through the sides around the hole. At the end of the outer hose, make a container by inserting the end of the hose into a bottle filled with water.

By combining 4 kg of coffee fruit skins with 2 kg of cow manure and adding an activator in the form of 40 ml of EM4 solution and 20 g of brown sugar dissolved in 1 liter of water, you're not just creating compost. You're contributing to a healthier, more sustainable environment. The coffee fruit skins that have gone through the process of separating the beans from the coffee skins are weighed as 4 kg + 2 kg of cow manure. Add activator in the form of 40 ml of EM4 solution and 20 g of brown sugar dissolved in 1 liter of water. After that, cover the bucket for 4 weeks until compost forms. Budiwanti (2021), states that compost that is ready to be used is characterized by a dark black color, loose, not hot and odorless.

2. Preparation of planting media and planting of Robusta coffee seedlings

The soil used as the planting medium is topsoil in its natural condition, and soil samples were taken up to a depth of 20 cm. After that, the soil is air-dried for approximately 2 weeks and sieved with a 2 mm sieve. The next step is to prepare the planting media according to the planned treatment level with a total weight of the planting media being 5 kg per polybag. This is followed by a crucial 2-week soil incubation period, a meticulous process that ensures the mixing of the planting media is as effective as possible.

The coffee seedlings used in this study are of the Hibiro 1 variety, which has reached the age of 4 months. The seedlings were cared for by fertilizing, watering, weeding, and controlling pests and diseases. A crucial part of this care was the fertilization, carried out two weeks after planting using NPK fertilizer (15:15:15) with a dose of 2.5 g per polybag, as Laviendi *et al*. (2017) recommended.

3. Observation Variables

3.1. Soil Analysis

a. Initial Soil Analysis

The initial soil sample, a critical stage in the growth of coffee seedlings, undergoes a meticulous process before being mixed with coffee husk compost and rice husk. A precise amount of 500 g of soil is carefully selected, then air-dried for three days and sieved with a 2 mm sieve. This is followed by a comprehensive soil chemistry analysis in the laboratory, testing parameters such as soil pH, organic-C, total-N, available-P, CEC (Cation Exchange Capacity), and base saturation (K, Ca, Mg, Na).

b. Soil Sample Analysis After Incubation

The soil sample at this stage is the soil that has been mixed with coffee husk compost and rice husk and then incubated for two weeks. Soil is taken from each treatment amounting to 500 g, then air-dried for three days and sieved with a 2 mm sieve. Then, a soil chemistry analysis is carried out in the laboratory. The tested parameters are soil pH, organic-C, total-N, available-P, CEC, and base saturation (K, Ca, Mg, Na).

3.2. Analysis of Coffee Compost Using Anaerobic Method

Robusta coffee fruit skin compost with an anaerobic composter is analyzed for pH value, water content, carbon (C), nitrogen (N), C/N ratio, and phosphorus (P) compared to the quality standard of compost fertilizer from solid organic waste according to the Soil and Fertilizer Instrument Standard Testing Agency in 2023.

3.3. Plant Growth Observations

The observations of plant growth due to the response to the application of anaerobic coffee husk composter are plant height, stem diameter,

number of leaves, leaf length, leaf width (Plant observations begin when the plant is two weeks old after planting and are carried out at 2-week intervals for eight observations in total), and root volume (Observations are carried out after the seedlings are four months old after planting).

RESULTS AND DISCUSSION

A. Quality Analysis of Compost

Our research sample, tested in the laboratory, has shown that the anaerobic composter method is highly effective in producing high-quality coffee husk compost. The quality of the compost meets the standards set by the Soil and Fertilizer Instrument Testing Center in 2023, as detailed in Table 1.

Table 1. Analysis results of chemical properties of coffee husk compost with anaerobic composter

Parameter	Compost	Quality Standard *
pH	8,4^{s}	4 - 9
Organic-C (%)	18^{s}	9,8 – 32
Macro nutrients ($N+P_2O_5+K_2O$) (%)	2,5^{s}	Min.2
C/N	20^{s}	<25
Water content (%)	19^{s}	Maks. 20
Particle size 2-4,75 mm (%)	87^{s}	Min 75

Note: (s) Indicates compliance,
*Source: Soil and Fertilizer Standard Testing Agency 2023

Table 1 indicates that coffee husk compost boasts a pH of 8.4, falling into the basic category. This high pH holds the potential to elevate the pH level in acidic soil, thereby enhancing nutrient availability. The Organic-C content, at a substantial 18%, is a significant boost for soil or planting media. The macronutrient content, at a generous 2.5%, surpasses the minimum standard for solid organic fertilizer, making this coffee husk compost a valuable source of nutrients for plant growth. Moreover, with 87% of the compostable to pass through a 2 mm sieve, the high yield from an anaerobic composter is a testament to its efficiency.

B. Analysis of Initial Soil and Soil after Incubation

The soil in Kenagarian Lubuk Gadang Selatan, Sangir District, South Solok Regency is classified under the inceptisol soil order, which has a low nutrient content. Based on soil analysis in the laboratory, it was found that there was a significant change in the nutrient content, specifically [details of the change], between the initial soil and the planting medium consisting of a mixture of soil, compost, and rice husks. Generally, the addition of coffee husk compost and rice husks to the planting medium can improve soil fertility quality. The results of the analysis of the initial soil and the mixture of planting media after being incubated for 2 weeks can be seen in Table 2.

Table 2. Results of soil nutrient analysis on initial soil and soil after incubation

Parameter*	Land of Beginnings	Soil after incubation		
		T: 50% + K: 25% + S: 25%	T: 25% + K: 50% + S: 25%	T: 25% + K: 25% + S: 50%
pH (H_2O)	5,1^{m}	5,6^{am}	6,6^{n}	6,4^{am}
Organik-C (%)	1,6^{r}	2,2^{s}	3,1^{t}	2,7^{s}
CEC (me/ 100 g)	7,6^{r}	21,3^{s}	36,6^{t}	22,5^{s}
Total-N (%)	0,2^{r}	0,4^{s}	0,5^{s}	0,3^{s}
Available-P (ppm)	18,6^{s}	22,8^{s}	38,5^{s}	21^{s}
K (me/ 100 g)	0,2^{r}	0,2^{r}	0,3^{r}	0,2^{r}
Ca (me/ 100 g)	2,9^{r}	4,1^{r}	4,7^{r}	4,4^{r}
Mg (me/ 100 g)	2,1^{t}	2,6^{t}	4,4^{t}	2,6^{t}
Na (me/ 100 g)	0,11^{r}	0,22^{r}	0,32^{r}	0,24^{r}

Note : r = low, s= currently, t= high, m =acid, n=netral, am = slightly acidic
T= soil, K = compost, S = rice husks
*Source: Soil and Fertilizer Standard Testing Agency 2023

Based on the initial soil analysis conducted in the laboratory, the inceptisol soil pH criteria were to be acidic, with a value of 5.1. After mixing with compost and rice husk, there was a change in soil pH after incubation for two weeks. The planting medium pH changed from 5.1 to 6.6 in the treatment of Soil: 25% + Coffee husk compost: 50% + Rice husk: 25%. This indicates that adding coffee husk compost and rice husk has been proven to increase soil pH. The high pH of coffee husk compost, which is 8.4, can also increase the soil pH. In addition, the increase in soil pH can occur due to the presence of hydroxide from the decomposition process, which reduces the concentration of H^{+} in the soil solution. Soil acidity is directly related to its fertility because the pH value affects the availability of nutrients needed by plants. This is consistent with the research findings conducted by Manurung et al. (2022) that the level of soil acidity can affect the availability of nutrients that can be absorbed by plant roots where each nutrient in the soil is maximally available at a particular range. According to Mpapa (2016), soil acidity can have a direct impact on plants due to the increase of free hydrogen ions. A pH of around 6.5 is considered the best.

The organic carbon content increased after the soil was mixed with compost and rice husk. Organic carbon increased from 1.6% to 3.1%. This increase occurred because of coffee husk compost's high organic carbon content, which reaches 18% organic carbon. The organic carbon content of the soil is an indicator of the soil's organic matter content. If the organic matter content of mineral soil is categorized as high, it can be indicated that the soil is fertile. Gerson et al. (2008) stated that the content of organic soil matter had been proven to play a vital role in controlling soil quality, whether physically, chemically, or biologically. Therefore, soil amendment materials such as compost and rice husk can be used to increase the soil's organic carbon content.

The nutrient content significantly increases after the soil is enriched with compost and rice husk. This substantial boost in nutrient content, including N, P, K, Ca, Mg, and Na, within the planting medium is a promising sign of improved soil fertility. The total N content of the planting medium has transitioned from a low to a moderate criterion, a clear indication of the positive impact of the treatment. The increase in the amount of nitrogen, possibly from the decomposition of coffee husk compost, is a testament to the effectiveness of the treatment. The amount of nutrients K, Ca, Mg, and Na in the planting medium also increased, further reinforcing the positive impact on soil fertility. According to Sutedjo & Kartasapoetra (2002), the N nutrient element functions to enhance plant growth, maintain leaf greenness (chlorophyll), increase protein content in the plant body, improve the quality of plants that produce leaves and increase the proliferation of microorganisms in the soil which are important for the continuity of the decomposition of organic materials.

Our analysis reveals a significant increase in available P in the soil treated with coffee husk compost and rice husk. It is evident that the application of 50% coffee husk compost and 25% rice husk results in a higher available P value compared to 100% soil. This increase in available P value is primarily attributed to the contribution of the P element present in the coffee husk compost. As the dosage of coffee husk compost increases, so does the contribution of the P element, leading to a higher available P value. As Yasin et al., (2018) suggest, compost plays a crucial role in increasing the availability of P in the soil through the decomposition process that produces CO2 and organic acids. The CO2 gas produced dissolves in water, forming carbonic acid, effectively increasing the availability of P in the soil.

The Cation Exchange Capacity (CEC) value obtained from the soil analysis with the composition of Soil : 100% is 7.6 me/100 g with a low criterion and increased to 36.6 me/100 g with a high criterion at the planting medium composition of 25% soil + 50% Coffee husk compost + 25% Rice husk. Cation Exchange Capacity (CEC) is the positive charge from cations absorbed at a certain pH by soil colloids. The soil's CEC is closely related to soil fertility, where functional groups that undergo ionization produce a number of negative charges on the surface of soil colloids, and the decomposition of organic materials can produce humus to increase CEC. According to Rahmah et al. (2014), on soils with relatively low CEC values, the process of nutrient absorption by soil colloids is low, and as a result, these nutrient elements will easily be leached and lost with infiltration water. According to Rahmah *et al*. (2014), in soils with relatively low Cation Exchange Capacity (CEC), the process of nutrient absorption by soil colloids only occurs optimally. As a result, nutrients can easily be leached and lost along with water movement in the soil (infiltration, percolation). Consequently, the nutrients are not available to the plants. The CEC value of soil varies greatly and depends on its characteristics and properties.

C. Response of planting media composition to the growth of Robusta coffee seedlings

Among the various planting media compositions that were utilized, a variability analysis was conducted. This analysis, which measures the degree of dispersion or spread in a set of data, demonstrated that the composition of the planting media significantly affected observations on plant height, number of leaves, stem diameter, leaf length, leaf width, and root volume of Robusta coffee seedlings. The planting media composition that provided the best growth response in Robusta coffee seedlings was found to be in the planting media with a composition of 25% soil + 50% coffee husk compost + 25% rice husk. The growth response of the plants can be seen in Figure 1.

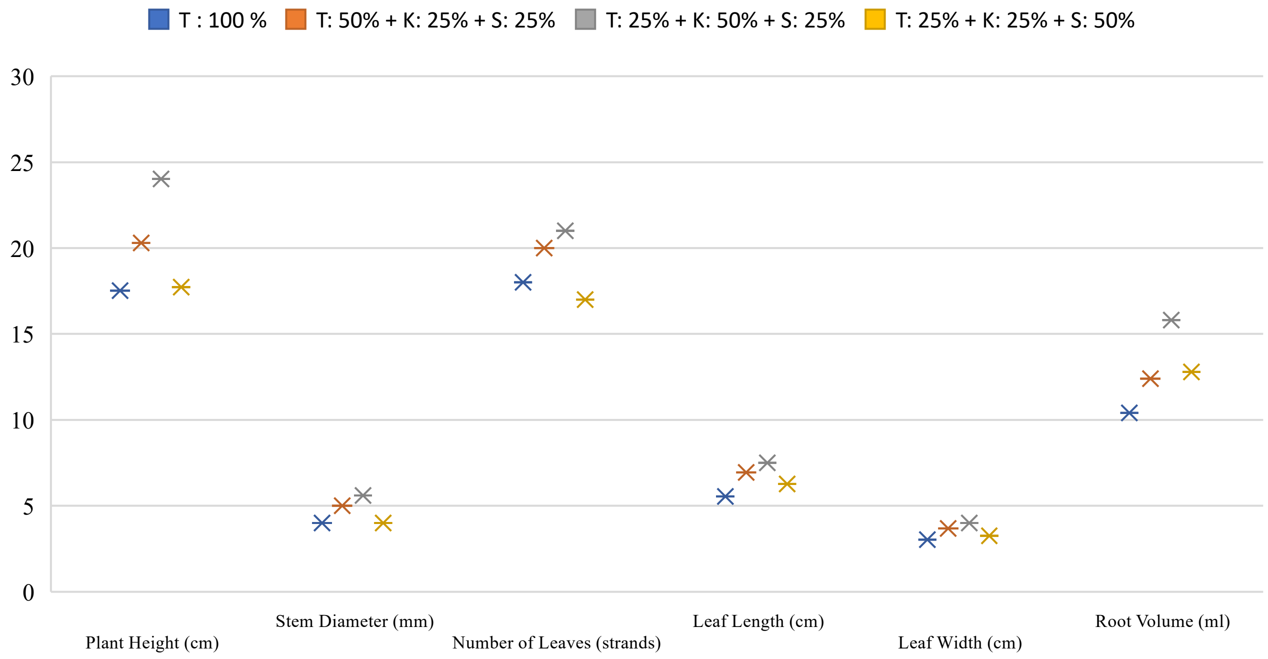

Figure 1. Growth response of plants to several planting media compositions at 16 weeks after planting

Plant Height

Our research has shown that the highest growth in the height of robusta coffee seedlings is found in a planting media composition of Soil: 25% + Coffee husk compost: 50% + Rice husk: 25%. This composition, rich in nutrient elements and with a loose soil structure, supports robusta coffee seedlings' height growth. The addition of rice husk, which improves the soil's aggregate properties, aids in water retention and nutrient absorption by the roots.

Coffee fruit husk compost plays a crucial role in providing nutrient elements, contributing to the robust growth of coffee seedlings. This nutrient-rich compost helps the seedlings reach the high standard of ready-to-distribute seedlings, which is 15 cm. The high potassium (K) content in the coffee husk compost, at 1.3%, significantly influences the seedlings' growth. This is further supported by the research of Riswandi (2021), which emphasizes the role of nutrient elements in the planting media, particularly macronutrient elements, in promoting plant growth.

Stem Diameter

In several growing media compositions that have been used, the variance analysis results indicated that the composition of the growing media used could significantly affect the observation of the stem diameter of Robusta coffee seedlings. These findings have practical implications for coffee cultivation, inspiring new approaches and strategies. The growing media composition of Soil: 25% + Coffee husk compost: 50% + Rice husk: 25% provided the highest stem diameter with an average value of 5.4 mm. Among the various growing media compositions used, this composition is the one with the highest amount of coffee husk compost, thereby providing more nutrients for plant growth compared to other growing media compositions. The growing media composition of Soil: 25% + Coffee husk compost: 25% + Rice husk: 50% had the lowest stem diameter at 4.22 mm and was not significantly different from the growing media composition of Soil: 100% and the growing media composition of Soil: 50% + Coffee husk compost: 25% + Rice husk: 25%.

The use of topsoil with the addition of rice husk can improve the physical properties of the soil, thus facilitating the plant's root system. However, the soil composition and rice husk can only improve the physical properties of the soil. Hence, the addition of coffee husk compost is necessary to provide nutrients in the used growing media. According to Dewantara et al. (2017), the growing media composition of soil and rice husk (2:1) can significantly affect Robusta coffee seedlings' stem diameter and total leaf area.

Regarding the nutrients present in the coffee husk compost and also rice husk, the high content of potassium (K) will aid in the development of the stem diameter and plant height. This is a crucial insight for our audience, as it deepens their understanding of the factors influencing plant growth. Besides potassium (K), nitrogen (N) will also affect the development of stem diameter. The application of compost with a higher percentage can increase the total nitrogen (N) value more than the application of rice husk. This is explained by Novita (2018), that the diameter of the stem can increase weekly, because the need for nutrients in the plants has been fulfilled, such as the essential element nitrogen (N).

Leaf count

In several planting media compositions that have been used, variational fingerprint results, which are a set of unique characteristics or traits that can be used to identify a specific planting medium composition, state that the composition of the planting media used can have a significant effect on the observation of the number of leaves of Robusta coffee seedlings. The leaves counted are those that have fully opened, usually a fully opened leaf contains one pair of leaves. The highest number of leaves was found in the planting medium with the composition Soil: 25% + Coffee husk compost: 50% + Rice husk: 25%. The planting medium composition of Soil: 100% did not significantly differ from the planting medium composition of Soil: 50% + Coffee husk compost: 25% + Rice husk: 25%, and the planting medium composition of Soil: 25% + Coffee husk compost: 50% + Rice husk: 25%. Meanwhile, the planting medium composition of Soil: 50% + Coffee husk compost: 25% + Rice husk: 25% and the planting medium composition of Soil: 25% + Coffee husk compost: 50% + Rice husk: 25% significantly differed from the treatment of Soil: 25% + Coffee husk compost: 25% + Rice husk: 50%.

The substantial influence of the proper planting medium composition in the seeding process can affect the number of leaves. With a good planting medium composition, the root system will also be good, enabling the roots of the plant to absorb nutrients effectively and distribute them to the leaves. This process, facilitated by the root system, allows the leaves to process nutrients well through photosynthesis and then distribute them throughout the plant parts. The role of coffee husk compost is to provide nutrients that can be absorbed by roots to support the growth of Robusta coffee seedlings. Leaves are an important part of the plant and influence the process of photosynthesis. Good vegetative growth in leaves will support generative growth. The substantial influence of coffee husk compost in providing nutrients in the soil will support the growth of Robusta coffee seedlings, especially in the number of leaves. Nitrogen is an element that can affect the number of leaves. The N content in the planting medium composition used can support the addition of the number of leaves. This is in accordance with the statement by Novita (2018), that the increase in the number of leaves each week can be influenced by the N content absorbed by the plant.

Leaf Length

In several planting media compositions that have been used, it was found that the variance test had a significant effect on the observation of the leaf length of Robusta coffee seedlings. Figure 1 shows that the most extended average leaf length was found in the treatment with the composition of Soil: 25% + Coffee husk compost: 50% + Rice husk: 25%. The shortest average leaf length was found in the planting media composition of the soil, which was 100%. It was not significantly different from the planting media composition of Soil: 25% + Coffee husk compost: 25% + Rice husk: 50%. The planting media composition of Soil: 100% was significantly different from that of Soil: 50% + Coffee husk compost: 25% + Rice husk: 25%.

The nutrient content found in the planting media composition influences leaf length; the application of coffee fruit husk compost containing NPK elements by 2.5% added to the amount of nutrients in the planting media. Nasution et al. (2017) stated that the total leaf area with the application of coffee fruit husk compost yielded the best results; this is due to the nitrogen (N) and magnesium (Mg) content contained in the coffee fruit husk compost can improve the rate of photosynthesis and cause the photosynthesis process in plants to proceed well.

Leaf Width

In Figure 1, it can be seen that the planting medium composition with the treatment of Soil: 25% + Coffee husk compost: 50% + Rice husk: 25% has the highest average value of leaf width with a value of 4 cm. The planting medium composition of Soil: 100% showed the lowest average leaf width value with a value of 3.04 cm. The planting medium Soil: 25% + Coffee husk compost: 25% + Rice husk: 50% had a not significant effect with the treatment of Soil: 100% and Soil: 50% + Coffee husk compost: 25% + Rice husk: 25%. The planting medium composition of the soil is 25% + coffee husk compost is 50% + rice husk is 25%; it can provide more nutrients than other planting medium compositions. This is due to the more significant amount of compost in the planting medium composition, thus being able to add more nutrients. The pH condition in this composition is also considered neutral, with a pH of 6.6. Macro and micronutrients will be optimally and evenly available if the soil's pH is neutral. Thus, plant roots can absorb nutrients well according to the needs of robusta coffee seedlings. Wijaya (2008) explains that the element N can drive the growth of organs that assist the photosynthesis process in leaves. Each plant with sufficient N will form wider leaf blades with high chlorophyll content to produce enough carbohydrates to support vegetative growth. Sutiyoso (2003) added that the elements that can influence the growth of leaf width include sufficient N and Mg elements. Magnesium (Mg) plays a crucial role in the process of chlorophyll formation. It affects photosynthesis and can also support the work of phosphorus (P) in ATP (Adenine Triphosphate) energy transfer.

In the planting medium composition of soil, 100% has the lowest leaf width value of 3.04 cm; this is due to the dense planting medium composition, which also has a nutrient content that is insufficient for leaf width development. Novita (2018) explains that the growth rate of leaf width can be caused by the nutrient content in the planting medium that does not provide enough N and P, which will inhibit the growth of leaf width and can result in smaller leaves.

Root Volume

In some planting media compositions that have been used, variance analysis results declare that the composition of the planting media used can significantly affect the observation of the root volume of robusta coffee seedlings. The study involved a controlled experiment where robusta coffee seedlings were grown in different planting media compositions. Figure 1 shows that Soil: 25% + Coffee husk compost: 25% + Rice husk: 50% had no significant effect compared to the treatment Soil: 100%, planting media composition Soil: 50% + Coffee husk compost: 25% + Rice husk: 25% and planting media composition Soil: 25% + Coffee husk compost: 50% + Rice husk: 25%. In the planting media composition, the soil was 25% + coffee husk compost, 50% + rice husk, and 25%. There was a significant effect compared to the treatment of planting media composition soil, which was 100%. The highest average root volume value was 15.8 ml for the planting media composition soil: 25% + Coffee husk compost: 50% + Rice husk: 25%. The lowest average root volume value was 10.40 ml for the planting media composition Soil: 100%. This can be caused by the planting media having low nutrient content and a denser soil structure compared to other planting media compositions. This is also influenced by the low CEC value in the Soil: 100% treatment, which is 7.6 me/100 g. The low soil CEC value causes the soil to have a limited ability to provide nutrients.

The extensive root volume value in the planting media composition Soil: 25% + Coffee husk compost: 50% + Rice husk: 25% is caused by the planting media being porous and not compact, allowing the roots to develop well, which can be seen from the high root volume and the number of root hairs on the robusta coffee seedling. Silalahi (2020) states that compost can improve the biological properties of the soil by providing nutrition for microorganisms in the soil. These microorganisms will transform minerals into nutrients that will be composted, thus improving the chemical properties of the soil. Compost and rice husks can make the soil porous and loose, improving the soil's physical properties.

Based on the findings of this research, the use of coffee ground compost with the anaerobic composting method and rice husk with a composition of 25% soil + 50% coffee ground compost + 25% rice husk as a robusta coffee seedling medium (*Coffea canephora* L.) can support the optimal growth of robusta coffee seedlings. This planting medium has the best pH, organic C, total N, available P, CEC, K, Ca, Na, and Mg values compared to other planting media compositions.

CONCLUSIONS

Based on the significant findings of our research on the composition of planting media and its impact on the growth of robusta coffee seedlings, we can confidently conclude that:

1. The composition of the planting media plays a crucial role in the growth of robusta coffee seedlings. It has a direct impact on plant height, stem diameter, leaf number, leaf width, and root volume.
2. The planting media composition of soil: 25% + coffee husk compost: 50% + rice husk: 25% is not just the best composition for supporting robusta coffee seedlings' growth, but also a practical solution for coffee cultivation.

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