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The Effect Of Gamal Leaf Liquid Organic Fertilizer On The Growth Of Arabica Coffee (*Coffea Arabica* L.) Seedlings In Polybags

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ABSTRACT

This research was carried out for 3 months, namely from March 2023 to June 2023, located at the BPDAS-HL Palu-Poso Permanent Nursery, this study used the Complete Randomized Design method consisting of 4 treatments, namely P0 = 0%, P1 = 20%, P2 = 30% and P3 = 30%. The four treatments were repeated seven times, bringing the total sample to 28 experimental units. The parameters observed are the increase in seedling height, stem diameter and number of leaves. The data analysis used is fingerprint analysis (F test) fingerprint analysis shows that the best treatment, it will be continued with further tests, namely the BNJ test level of 5%. The results showed that the concentration treatment of liquid organic fertilizer made from gamal leaves had a real influence on the increase in height, stem diameter and number of leaves in arabica coffee seedlings. The best treatment in this study was 40% concentration treatment (P3) with an average seedling height of 15.27 cm, an average seedling stem diameter of 3.17 mm and an average number of seedling leaves of 12.28 strands and the results of BNJ fingerprint analysis with an average height of 5.59 cm, number of leaves of 1.2 strands and stem diameter of 0.88 mm.

Keywords : Gamal, Organic Fertilizer, Arabica Coffee

1. INTRODUCTION

Arabica coffee plants (Coffea arabica L.) are one of the non-timber forest products (NTFPs) which have quite high economic value seen from the sales price among other plantation crops and play an important role as a source of foreign exchange for the country (Defitri, 2016). The distinctive taste of coffee is influenced by the acid groups contained in it, so it can affect the quality of the coffee. The most dominant acid content found in coffee beans is chlorogenic acid with a percentage of 8% in unprocessed coffee beans or 4.5% in roasted coffee. Chlorogenic acid is a compound that is included in the phenolic component (Dewajanti, 2019).

One thing that needs to be paid attention to when cultivating Arabica coffee is fertilization. Fertilizer is really needed to add nutrients for plant growth, the recommendation to use fertilizer or other materials that are organic in nature is intended to reduce the problems that currently arise due to the use of chemicals that have been proven to damage the soil and the environment, such as the use of chemical fertilizers which will result in damaging the soil. (Tanti, 2019). Gamal is a shrub type plant from legume relatives (Fabaceae or Leguminaceae family). Using gamal leaves as a

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liquid organic fertilizer is an effective method considering that gamal leaves are quite available and contain many organic elements (Masluki, 2015).

One of the plants belonging to the leguminoceae group which has the potential to be used as a liquid organic fertilizer that can stimulate plant growth is gamal. The content of gamal leaves can be obtained at 3.15% N, 0.22% P, 2.65% K, 1.35% Ca, and 0.41% Mg. In 1 ha of land, the biomass of gamal is cultivated using alley cropping with corn can contribute nutrients as much as 150 kg N ha, 52 kg P, 150 kg K, 223 kg Ca, and 33 kg Mg (Asparingga dan Widyawati, 2023). Gamal can also be used as an organic material because it has a high nutrient content in tissue. Apart from increasing nutrients, gamal leaves also provide other benefits, namely as animal feed. One year old gamal plants contain N; 1-3% P; 0.77%K; 15-30% crude fiber; 1.9-3.2% Ca; 0.5-0.8% Mg and gamal leaves also play a role in increasing soil organic matter and soil nitrogen levels, suppressing plant growth, reducing erosion rates and increasing water absorption by the soil (Fortunasari, 2018).

Liquid organic fertilizer is the result of fermentation of various organic materials which contain various amino acids, phytohormones and vitamins which play a role in increasing and stimulating the growth of microbes and the soil rhizosphere. Liquid organic fertilizers also usually contain a lot of microbes which function to propagate N and P&K solvents, quickly increase the levels of macro and micro nutrients naturally which are really needed by plants and increase the COC (Cation Exchange Capacity) so that the ability to bind cations becomes higher, as a result if fertilized with high doses of plant nutrients that are not easily leached (Kurniawati, et al. 2015).

One of the characteristics of good soil is that it has a thick layer of topsoil. In general, soil conditions in the highlands have quite a lot of organic content and are not too heavily contaminated by the air population. Coffee plants should be planted in soil that has high nutrient and organic content. Apart from loose and organic-rich soil, Arabica coffee also requires soil that has a higher pH, namely 5-6.5 (Khadijah, et al. 2021). Providing liquid organic fertilizer made from gamak leaves can increase the growth of cocoa (Theobrama cacao L.) seedlings, but giving 20% gives the best results with an increase in seedling height of 11.6 cm, stem diameter of 0.44 mm and number of leaves of 8.97. compared to treatments of 5%, 10% and 15% (Masluki, 2015).

2. RESEARCH METHODS

This research was carried out for 3 months, namely from March to June 2023 at the BPDAS-HL Palu-Poso Permanent Nursery, Tadulako University, Palu, Central Sulawesi. This research used the Completely Randomized Design (CRD) method, which consisted of four

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treatments, namely: P0 = 0% (Control) P1 = 20% P2 = 30% P3 = 40% Each of the four treatments was repeated seven times, for a total of 28 experimental units. The tools used in this research are a ruler to measure the height of the seedlings, a caliper to measure the diameter of the seedlings, a jergen as a container for liquid organic fertilizer, a spade to dig top soil, a sieve to sift the soil, a calculator to process data, a master sprayer as a fertilizer spray tool. organic liquid, stationery for writing research results, camera for taking documentation during research activities, and laptop for processing research data. The materials used in this research were Arabica coffee seedlings originating from the BPDAS-HL Palu-Poso nursery and 3 months old which had almost the same seedling height, number of leaves and stem diameter, liquid organic fertilizer made from gamal leaves, label paper was used. for the sample code, top soil as a growing medium taken from the STQ area, 20cm x 25cm polybags as a place for growing seedlings, and water as a mixture for liquid organic fertilizer and for watering Arabica coffee seedlings.

3. RESULTS AND DISCUSSION

Height Addition

To find out the effect of giving gamal leaf liquid organic fertilizer on the growth of arabica coffee (Coffea arabica L.) seedlings, an analysis of variance was carried out in Table 1.

Table 1. Results of fingerprint analysis of various height increases in 12 week old Arabica coffee seedlings at various concentrations of liquid organic fertilizer from Gamal leaves.

SD	DF	SS	MS	CF	TF
Treatment	3	3778.12	3620.80	621.41*	9.28
Error	24	157.32	5.82		
Total	27	3935.45			
Information *= Significant			DC : 35.54%		

Information : SD (Source Of Diversity), DF (degrees of freedom), SS (squared sum), MS (Middle square), CF (Count Factor), TF (Table Factor), DC= Diversity Coeficient

The results of the analysis of variance showed that the effect of applying liquid organic fertilizer made from gamal leaves to arabica coffee (Coffea arabica L.) seedlings had a real influence on the growth of seedling stem height, so further tests were carried out using the 5% Honestly Significant Difference Test (BNJ) presented in table 2.

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Table 2. Average Height addition (cm) of Arabica Coffee Seedlings Aged 12 Weeks at Various Concentrations of Gamal Leaf Liquid Organic Fertilizer

Treatment	Average	TS
P0	8.25[b]	6.4
P1	10.22[b]	
P2	12.35[b]	
P3	15.27[a]	

Note: Numbers followed by the same letter notation indicate that they are not significantly different at the 5% Tukey test (TS) level

Based on the results of the honest significant difference test (BNJ) in table 2, it shows that the 40% concentration treatment (P3) of liquid organic fertilizer made from gamal leaves provides a good increase in height compared to the P0 treatment (0%). In treatment P3 (40%) it is significantly different from treatments P0 (0%), P1 (20%), and P2 (30%) because seen from the average value it is greater compared to the honest real difference (BNJ) value while P0 (0%), P1 (20%), and P2 (30%) are not significantly different from treatment P3 because the average value is smaller than the honest real difference (BNJ) value. The highest average height increase in the 40% concentration P3 treatment was 15.27 cm, the 30% concentration P2 treatment was 12.35 cm, the 20% concentration P1 treatment was 10.22 cm and the P0 (0%) treatment was 8.25 cm. Treatment P1 provided the lowest increase in height among the other treatments. The average increase in height of Arabica coffee seedlings (Coffea arabica L.) in various treatments is presented in Figure 1.

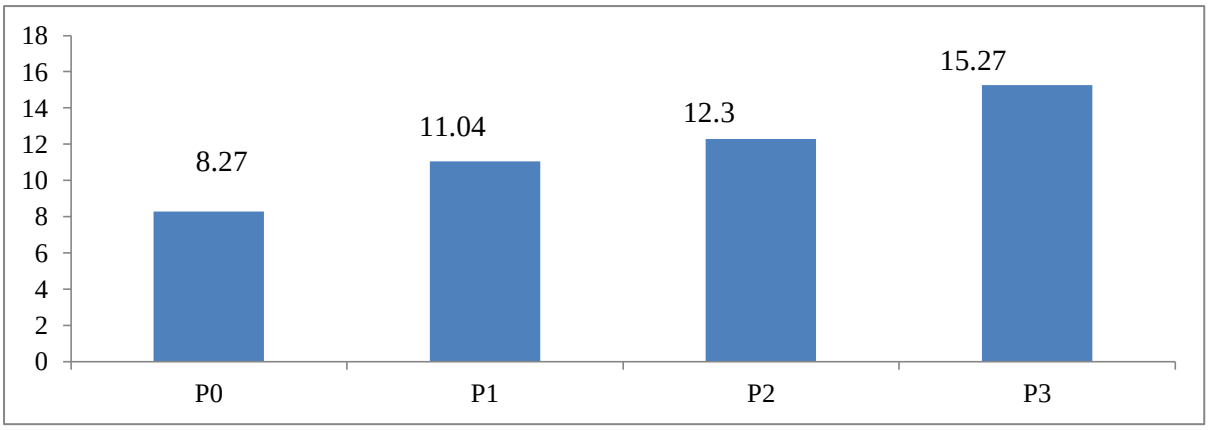

Figure 1. diagram of height addition of Arabica coffee seedlings (Coffea arabica L.)

Based on the results above, it can be seen that there was an increase in plant height in the

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treatment given liquid organic fertilizer from gamal leaves. This is because the fertilizer contains the nutrients N, P, K which plants need for physiological and metabolic processes in plants which will trigger plant growth. According to Siska (2009) "in" Mardianto (2014), the nutrient content, especially nitrogen, is able to encourage and accelerate plant growth.

Number of Leaves Addition

To determine the effect of applying liquid organic fertilizer made from gamal leaves on the growth of Arabica coffee (Coffea arabica L.) seedlings, an analysis of variance was carried out in table 3.

Table 3. Results of various fingerprint analysis of the increase in the number of leaves of 12 week old Arabica coffee seedlings at various concentrations of gamal leaf liquid organic fertilizer

SD	DF	SS	MS	CF	TF
Treatment	3	2122.73	2089.30	1657.54*	9.28
Error	24	33.428	1.23		
Total	27	2156.15			
Information *= Significant			DC : 19.24%		

Information : SD (Source Of Diversity), DF (degrees of freedom), SS (squared sum), MS (Middle square), CF (Count Factor), TF (Table Factor), DC= Diversity Coeficient

The results of the analysis of variance showed that the effect of applying liquid organic fertilizer made from gamal leaves to Arabica coffee (Coffea arabica L.) seedlings had a real influence on the increase in the number of seedling leaves, so a further test was carried out using the 5% Honestly Significant Difference Test (BNJ) presented in table 4.

Table 4. Average Increase in Number of Leaves (strands) of 12 Week Old Arabica Coffee Seedlings at Various Concentrations of Gamal Leaf Liquid Organic Fertilizer

Treatment	Average	TS
P0	4.57^{d}	1.3
P1	6.85^{c}	
P2	9.71^{b}	
P3	12.28^{a}	

Note: Numbers followed by the same letter notation indicate that they are not significantly different at the 5% Tukey test (TS) level

Based on the results of the honest significant difference test (BNJ) in table 4, it shows that

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the 40% concentration treatment (P3) of liquid organic fertilizer made from gamal leaves provides a greater increase in the number of leaves compared to the P0 treatment (0%). In treatments P0 (0%), P1 (20%), P2 (30%) and P3 (40%) they are significantly different because the average value of all treatments is greater than the value of the honest real difference (BNJ). The largest average increase in leaf number in the 40% concentration P3 treatment was 12.28 pieces, the 30% concentration P2 treatment was 9.71 pieces, the 20% concentration P1 treatment was 6.85 pieces and the P0 (0%) treatment was 4.57 pieces. Treatment P1 gave the lowest increase in leaf number among the other treatments. The average increase in the number of leaves of Arabica coffee seedlings (Coffea arabica L.) in various treatments is presented in Figure 2.

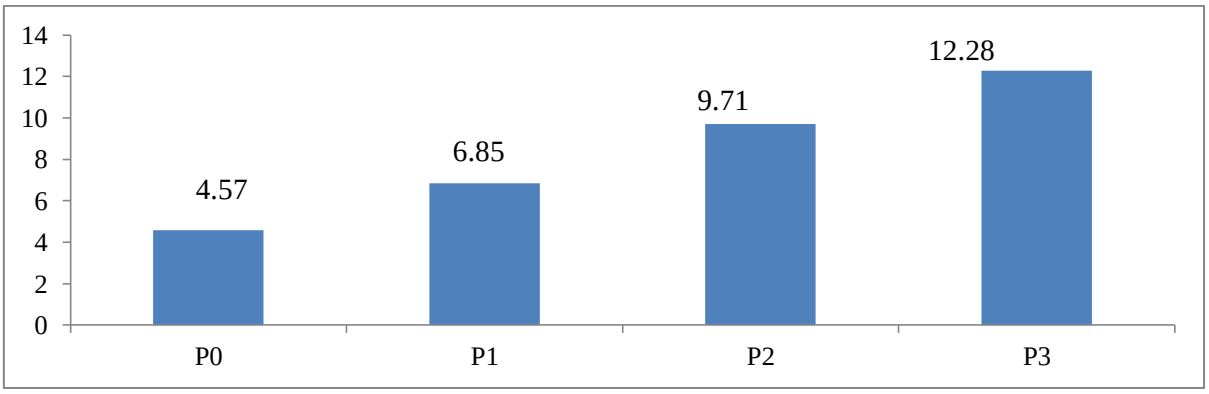

Figure 2. Bar diagram of increase in the number of leaves of Arabica coffee seedlings (Coffea arabica L.)

Based on the results above, it can be seen that there was an increase in the number of plant leaves in the treatment given gamal leaf liquid organic fertilizer. This is because the presence of nitrogen can speed up the photosynthesis process so that the formation of leaf organs becomes faster. According to Nyakpa et al (1988) "in" Dhani, Wardati and Rosmini (2013) the formation of leaves by plants is greatly influenced by the availability of nitrogen and phosphorus nutrients in the medium and those available to the plant. These two elements play a role in the formation of new cells and are the main components of organic compounds in plants such as amino acids, nucleic acids and chlorophyll.

Diameter Of Addition

To determine the effect of applying liquid organic fertilizer made from gamal leaves on the growth of Arabica coffee (Coffea arabica L.) seedlings, an analysis of variance was carried out in table 5.

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Table 5. Results of various fingerprint analysis of increase in diameter of 12 week old Arabica coffee seedlings at various concentrations of liquid organic fertilizer from Gamal leaves.

SD	DF	SS	MS	CF	TF
Treatment	3	141.12	138.07	1224.04*	9.28
Error	24	3.0457	0.11		
Total	27	144.16			
Information *= Significant			DC : 11.66%		

Information : SD (Source Of Diversity), DF (degrees of freedom), SS (squared sum), MS (Middle square), CF (Count Factor), TF (Table Factor), DC= Diversity Coeficient

The results of the analysis of variance showed that various treatments of giving gamal leaf liquid organic fertilizer had a significant effect on the stem diameter of Arabica coffee seedlings (Coffea arabica L.) so further tests were carried out using the 5% Honestly Significant Difference Test (BNJ) which is presented in table 6.

Table 6. Average Increase in Diameter (mm) of Arabica Coffee Seedlings Aged 12 Weeks at Various Concentrations of Gamal Leaf Liquid Organic Fertilizer

Treatment	Average	TS
P0	0.97^{b}	0.88
P1	1.3^{a}	
P2	2.84^{b}	
P3	3.17^{a}	

Note: Numbers followed by the same letter notation indicate that they are not significantly different at the 5% Tukey test (TS) level

Based on the results of the honest significant difference test (BNJ) in table 4, it shows that the 40% concentration treatment (P3) of liquid organic fertilizer made from gamal leaves provides a good increase in diameter compared to the P0 treatment (0%). In treatment P3 (40%) it is significantly different from treatments P2 (20%) and P1 (20%) because the average value is greater than the honest real difference (BNJ) value while in treatments P2 (30%) and P0 (0%) is not significantly different because the average value is small compared to the honest real difference (BNJ) value. The largest average diameter increase in the 40% concentration P3 treatment was 3.17 mm, the 30% concentration P2 treatment was 2.84 mm, the 20% concentration P1 treatment was 1.3 mm and the P0 soil treatment without fertilizer (control) was 0.97 mm. The average increase in diameter of Arabica coffee seedlings

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(Coffea arabica L.) in various treatments is presented in Figure 3.

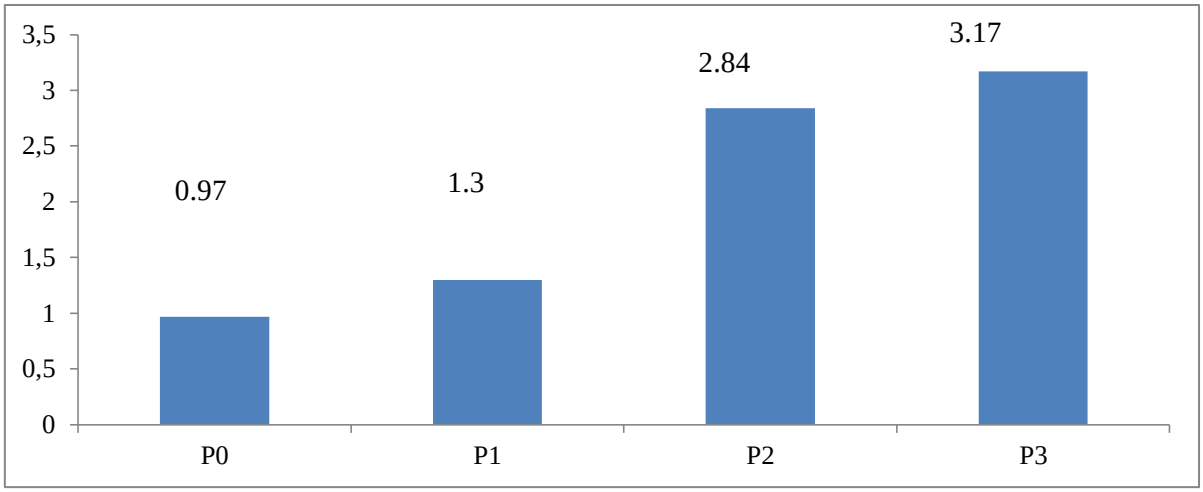

Figure 3. Diagram of Increase in Stem Diameter of Arabica Coffee Seedlings (Coffea arabica L.)

Based on the results above, it can be seen that there was an increase in plant diameter in the treatment given liquid organic fertilizer from gamal leaves. Gamal leaf organic fertilizer is able to supply nitrogen needs in plant tissue, where nitrogen is an important building block for amino acids, amides, nucleotides and nucleoproteins and is essential for cell division. An increase in diameter is essentially the same thing as an increase in height, because both are the result of the activity of nutrients and nutrients that plants absorb from the growing medium.

The addition of liquid organic fertilizer made from gamal leaves can have a good effect when compared to the 0% concentration treatment. The best concentration in this research was a concentration of 40%. According to Musfal (2010), the higher the uptake of nutrients in plants, the better the metabolic and photosynthesis processes, which can increase plant growth. Furthermore, increasing metabolism and photosynthesis in plants can increase plant growth and development, such as plant height, wet weight and dry weight of plants. The results of research (Nurhayati et al, 2022) show that giving POC from gamal leaves has a significant effect on the growth of rubber seedlings under the PB 260 clone on the parameters of plant height, stem diameter and root length.

4. CONCLUSION

Providing various concentrations of liquid organic fertilizer made from gamal leaves with different concentrations had a significant effect on the increase in stem height, stem diameter and number of leaves in Arabica coffee seedlings. The best treatment in this study was a 40% concentration treatment (P3) which gave an average increase in seedling stem height of 16.9 cm, number of seedling leaves of 12.28, and an increase in seedling stem diameter of 3.17 mm.

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