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The Effect of Liquid Organic Fertilizer Made from Gamal Leaves (*Gliricidia sepium*) on the Growth of Stone Begonia (*Begonia sp.*) Cuttings

Rahmi[1*], Ramal Yusuf[1], Nadine[1], Rahmat[1], Moh. Ilwan[2]

[1] Agrotechnology study program, Department of Agricultural Cultivation, Faculty of Agriculture, Tadulako University, Palu, Indonesia.
[2] Student of Agrotechnology study program, Department of Agricultural Cultivation, Faculty of Agriculture, Tadulako University, Palu, Indonesia.

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Corresponding Author:
Rahmi
rahmilatifrozali0206@gmail.com

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Abstract: Fertilisation is a key factor in improving the productivity and quality of stone mistletoe (Begonia sp.) plants; one method is the application of liquid organic fertiliser made from gamal leaves. This study aimed to determine the effect of the concentration of liquid organic fertiliser made from gamal leaves on the growth of stone mistletoe cuttings. This study employed a Randomised Block Design (RBD) with a single factor comprising six treatment levels and three replicates. The concentrations used were as follows: K0: Control, K1: 40 ml/l water, K2: 80 ml/l water, K3: 120 ml/l water, K4: 160 ml/l water and K5: 200 ml/l water. The observational data were analysed using analysis of variance (ANOVA), and where a significant effect was found, this was followed by a BNJ test at the 5% significance level. The results of the study showed that treatment K3 (120 ml/litre of water) had the most favourable effect on all observed variables, namely shoot length, number of leaves, leaf length, leaf width and root length.

Keywords: Begonia; Gamal leaves; Liquid organic fertilizer

Introduction

The rock mistletoe (*Begonia* sp.) is a plant traditionally used by local communities to treat various ailments. Rock mistletoe is a plant that grows and takes root on rocky outcrops in the mountains of Wawopada Village, Lembo Subdistrict, Morowali Regency, Central Sulawesi (Ardi et al., 2014, 2019). This plant is effective in treating cancer/tumors, dry cough, lung infections, lower back pain, kidney issues, stomach ulcers, and other conditions (Anam et al., 2013; Kalpanadevi et al., 2012).

In Central Sulawesi, particularly in Morowali, the rock mistletoe is still very rarely cultivated and is considered rare. Efforts to cultivate the rock mistletoe include meeting its nutrient requirements. Nutrient needs can be maximally met; one way to enhance nutrient availability in the soil is through fertilization (Irawati et al., 2017; Nurmayulis et al., 2018).

Fertilization is the process of applying organic and inorganic nutrients to plants to meet their nutrient requirements and increase yields. Currently, farmers prefer to use inorganic fertilizers. However, the continuous and excessive use of inorganic fertilizers has a detrimental impact on soil conditions and the surrounding environment. Liquid organic fertilizers are solutions derived from the decomposition of plant residues, animal manure, and human waste. They contain multiple nutrients that quickly address nutrient deficiencies (Alex, 2015).

Fertilization aims to replace lost nutrients and replenish those needed by plants to increase crop production and quality. According to Dewanto et al. (2013), there are two types of fertilizers: inorganic and organic. Inorganic fertilizers are produced through

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chemical, physical, and biological engineering processes and are typically manufactured in industrial facilities or fertilizer plants. Meanwhile, organic fertilizers consist mostly or entirely of organic materials derived from plants or animals that have undergone processing; they can be in solid or liquid form and are used to supply organic matter and improve the physical, chemical, and biological properties of the soil.

The use of chemical (inorganic) fertilizers has been the primary driver behind the rapid increase in agricultural land productivity. Inorganic fertilizers help the soil provide essential elements such as N (Nitrogen), K (Potassium), P (Phosphorus), Mn (Manganese), S (Sulfur), and other minerals required by plants but often lacking in the soil. However, excessive use of chemical fertilizers can have negative environmental impacts (Bhardwaj et al., 2014; Rosadi, 2015). Therefore, to reduce the use of inorganic fertilizers, one approach is to increase the use of organic fertilizers. Organic fertilizers play a role in enhancing the biological, chemical, and physical properties of the soil, thereby making the soil fertile and conducive to plant growth.

Organic fertilizers include manure, green manure, compost, and liquid fertilizers. Organic fertilizer is a solution derived from the decomposition of organic materials originating from plants, food scraps, and animal and human waste, containing nutrients from more than one element. According to Hadisuwito (2012), the advantages of liquid organic fertilizer include its varied nutrient content—containing both macro and micro nutrients—faster nutrient absorption since the nutrients are already dissolved, and the ability to provide nutrients tailored to the plant's specific needs.

Another advantage of liquid organic fertilizer is that it can be applied more evenly, and its concentration can be adjusted according to plant needs; nutrient absorption occurs more rapidly and can be immediately utilized by plants because the nutrients within it are already dissolved, so its effects can be seen directly in plant growth (Lingga, 2011).

According to Novriani (2016), gamal is an alternative source of raw materials that can be used as a liquid organic fertilizer. Gamal is a plant from the Leguminosae family that contains high levels of various essential nutrients sufficient to meet the general nutrient requirements of plants. Gamal leaf tissue contains 3.15% N, 0.22% P, 2.65% K, 1.35% Ca, and 0.41% Mg.

According to Oviyanti et al. (2016), Peni et al. (2021), Maman et al. (2022), gamal also has advantages over other Leguminosae plants, namely that it is easy to cultivate, grows rapidly, and produces high biomass. Gamal also has a relatively high nitrogen content and a low C/N ratio, which makes the plant's biomass decompose easily.

Several studies using gamal leaves as a liquid organic fertiliser have shown significant effects on plant growth. The results of Qoniah (2019) study show that 1 litre of gamal leaf liquid fertiliser contains 8.02% K, 0.34% Ca, 0.01% Mg, 0.03% P and 0.11% N, and is acidic with a pH of 5.05%.

Furthermore, Sado (2016), in a study titled "The Effect of Gamal Leaf Liquid Fertiliser (Gliricidia sepium) on the Growth of Caisim Mustard (Brassica juncea L.)", stated that differences in the concentration of gamal leaf liquid fertiliser affected the growth of caisim mustard plants, namely an increase in the number of leaves, fresh weight, dry weight and leaf area. Furthermore, gamal leaf liquid fertiliser at a concentration of 30% was found to be most effective for the growth of caisim mustard plants.

According to Rahmanto (2019), the application of liquid organic gamal leaf fertiliser to cucumber plants has a very significant effect on the growth and yield of cucumber plants, in terms of plant height, number of leaves, fruit length, fruit circumference and fresh fruit weight.

Based on the above, research is required into: the effect of liquid organic gamal leaf fertiliser on the growth and yield of stone mistletoe, and the optimal concentration of liquid organic gamal leaf fertiliser.

Method

This study was conducted in Matansala Village, Bungku Tengah Subdistrict, Morowali Regency. The research location was determined using a purposive method (Sugiyono, 2018; Mukhlis et al., 2019; Mukhlis et al., 2024; Asgaf et al., 2025). The study took place from October to December 2025.

The tools used in this study were a measuring stick, a hoe, a cutter, scissors, a jerry can, raffia rope, writing utensils, a camera, and 12.5 x 25 cm poly bags. The materials used in the study were stone mistletoe (*Begonia* sp.) stems 10–15 cm long, a mixture of soil and manure, gamal leaves, sugar, and rice washing water.

This study employed a randomized block design (RBD) with 6 treatments and 3 replicates. The treatments were as follows:

K_0: control/without gamal leaf POC
K_1: application of gamal leaf POC at 40 ml/l of water
K_2: application of gamal leaf POC at 80 ml/l of water
K_3: application of gamal leaf POC at 120 ml/L of water
K_4: application of gamal leaf POC at 160 ml/L of water
K_5: application of gamal leaf POC at 200 ml/L water

Research Preparation
Making Gamal Leaf POC

Prepare one plastic bucket measuring 22 cm x 30 cm (length x diameter). Finely chop the gamal leaves. Then

prepare 5 liters of rice washing water and 5 tablespoons of brown sugar. Mix all ingredients thoroughly. Place the mixed ingredients into a jerrycan and seal tightly to prevent contamination. Let it sit for 25 days. The physical characteristics of the gamal leaf liquid organic fertilizer used are a brownish-yellow color, the constituent materials have decomposed, and the scent of the gamal leaf liquid organic fertilizer resembles the smell of fermented tape.

Preparation of the Research Site

a) The research plot is first cleared; this area serves as the site for placing the polybags.
b) The growing medium used consists of soil and manure in a 1:1 ratio.
c) The polybags used measure 12.5 x 25 cm.

Preparation of Plant Seedlings

a) Select healthy, straight, and pest-free stems. The stems used should not be too young or too old.
b) Cut the stems to 10–25 cm using a sharp knife or clean scissors.
c) Remove most of the leaves, leaving 2–4 leaves at the top to reduce transpiration and maintain photosynthesis.

Planting

The cut-stone mistletoe stems are planted 5 cm deep in the prepared growing medium.

Maintenance

Pest and Disease Control

Pest and disease control is carried out according to field conditions. Control methods involve physical/mechanical approaches, such as manually removing pests from the plants and then eliminating them. It is essential to monitor plant growth, and if weeds grow in the polybags, they should be removed immediately.

Watering

Watering is done in the morning and evening using a hand sprayer. The best time to water is in the morning, as this gives the plants time to dry before nightfall. However, watering frequency also depends on soil conditions; if the soil is moist, watering is done once a day.

Fertilization

Liquid organic fertilizer is evenly sprayed over the entire plant surface (10 sprays per polybag), and the remaining fertilizer is applied to the growing medium. This is done in the morning between 7:00 AM and 10:00 AM WITA. According to Yulliawati (2015), the optimal application interval for fertilization is 7–10 days, regardless of whether solid or liquid fertilizer is used.

Observation Variables

Shoot Length, Number of Leaves, Leaf Length, Leaf Width, and Root Length.

Data Analysis

The results of the observation of the effect of liquid gamal leaf organic fertilizer were analyzed using analysis of variance (ANOVA). If a significant effect on stone mistletoe was found, the analysis continued with the BNJ test at the 5% level.

Result and Discussion

Shoot Length

Based on the results, shoot length indicates that liquid gamal leaf organic fertilizer has a significant effect on stone mistletoe shoot length. The average data for stone mistletoe shoot length can be seen in Table 1.

Table 1. Average Shoot Length of Stone Mistletoe

Treatment	Average Shoot Length (cm)	Average Shoot Length (cm)
Treatment	14 DAP	21 DAP
K0	0.53a	1.53a
K1	0.56a	1.56a
K2	0.63a	1.63a
K3	1.36 b	2.53b
K4	0.76a	2.26a
K5	0.86a	2.33a
BNJ 5%	0.45	0.66

Table 1 shows that the highest average shoot length of the stone mistletoe was obtained from treatment K (3), namely 1.36 cm at 14 days after sowing and 2.53 cm at 21 days after sowing, while the lowest average was obtained from treatment K (0), namely 0.53 cm at 14 DAP and 1.53 cm at 21 DAP.

Number of Leaves

Based on the observation results, the number of leaves indicates that liquid gamal leaf organic fertilizer has a significant effect on the number of stone mistletoe leaves. The average data on the number of stone mistletoe leaves can be seen in Table 2.

Table 2. Average Number of Stone Mistletoe Leaves

Treatment	Average Number of Leaves	BNJ 5%
K0	14.00a	2.9
K1	14.67a	2.9
K2	15.33a	2.9
K3	20.00b	2.9
K4	16.33a	2.9
K5	16.67a	2.9

Table 2 shows that the highest average number of stone mistletoe leaves was obtained from treatment K (3), namely 20.00, and the lowest average was obtained from K (0), namely 14.00.

Leaf Length

Based on the results of the leaf length observations, it was found that liquid gamal leaf organic fertilizer had a significant effect on the leaf length of the stone mistletoe. The average data for the leaf length of the stone mistletoe can be seen in Table 3.

Table 3. Average Leaf Length of Stone Mistletoe

Treatment	Average Leaf (cm) 35 DAP	Average Leaf (cm) 49 DAP	Average Leaf (cm) 63 DAP
K0	4.83a	6.57a	8.37a
K1	5.27a	7.23a	9.07a
K2	5.37a	7.37a	9.23a
K3	7.97c	10.17c	12.33c
K4	7.20b	9.13b	11.23b
K5	7.17b	9.23b	11.30b
BNJ 5%	0.68	0.85	1.02

Table 3 shows that the highest average leaf length of the stone mistletoe was obtained from treatment K (3), namely 7.97 cm at 35 days after sowing, 10.17 cm at 49 days after sowing, and 12.33 cm at 63 days after sowing.

Leaf Width

Based on the results of leaf width observations, it was found that Gamal leaf liquid organic fertilizer had a significant effect on the leaf width of stone mistletoe. The average data for stone mistletoe leaf width can be seen in Table 4.

Table 4. Average Leaf Width of Stone Mistletoe

Treatment	Average Leaf (cm) 35 DAP	Average Leaf (cm) 49 DAP	Average Leaf (cm) 63 DAP
K0	2.27a	3.67a	5.73a
K1	2.47a	4.07a	5.87a
K2	2.53a	4.03a	6.03a
K3	3.47c	5.40c	7.60c
K4	2.73b	4.67b	6.77b
K5	2.87b	4.73b	6.73b
BNJ 5%	0.48	0.57	0.58

Table 4 shows that the highest average leaf width of the stone mistletoe was obtained from treatment K (3), namely 3.47 cm at 35 days after sowing, 5.40 cm at 49 days after sowing, and 7.60 cm at 63 days after sowing.

Root Length

Based on the observation results, root length indicates that liquid gamal leaf organic fertilizer significantly affects root length in stone mistletoe. The average data for stone mistletoe root length can be seen in Table 5.

Table 5. Average Shoot Length of Stone Mistletoe

Treatment	Average Root Length (cm)	BNJ 5%
K0	14.13a	0.49
K1	14.30a	0.49
K2	14.37a	0.49
K3	15.10b	0.49
K4	14.40a	0.49
K5	14.47a	0.49

Table 5 shows that the highest average root length of the stone mistletoe was obtained from treatment K (3), namely 15.10 cm, and the lowest average was obtained from K (0), namely 14.13 cm.

The treatment involving the application of 120 ml/liter of gamal leaf POC (K3) yielded better results than the other treatments; this is likely because the application ensured sufficient nutrient availability to support the growth of the stone mistletoe. In line with Munawar (2011) assertion that sufficient nutrient availability can influence plant growth and development, thereby yielding production in line with potential. Prastowo (2013) also noted that to achieve optimal nutrient application or fertilization efficiency, nutrients must be provided in quantities sufficient to meet plant needs.

Sufficient availability of essential nutrients in the soil can promote good plant growth; conversely, if essential nutrients in the soil are scarce, plant growth will not be optimal because the plant's food supply is insufficient (Daniel et al., 2019).

Additionally, the sufficient and adequate nutrient concentration for the growth of stone mistletoe under the treatment of 120 ml/liter of gamal leaf POC (K3) is likely due to its ability to improve soil fertility, as gamal leaf POC contains high levels of nitrogen (N), which can influence plant growth. The application of high-nitrogen fertilizer can accelerate the growth and development of plant organs, leading to faster increases in leaf number, plant height, and branch growth.

According to Dhani et al. (2014), nitrogen accelerates photosynthesis, leading to faster leaf development. Sufficient nitrogen (N) can stimulate vegetative plant growth. Lakitan (2011) also noted that plants deprived of nitrogen, in accordance with their nutritional needs, will grow stunted with small leaves, whereas plants receiving nitrogen in accordance with their needs will grow tall with broad leaves.

According to Nasution et al. (2017), liquid organic gamal leaf fertilizer is known to contain nutrients in the form of 3.15% N, 0.22% P, 2.65% K, 1.35% Ca, and 0.41% Mg. These nutrients are well-known and have distinct

functions in supporting plant vegetative growth. The nutrient nitrogen (N) plays a role in the formation of plant cells, tissues, and organs. Phosphorus (P) functions in the growth of seeds, roots, flowers, and fruits. Potassium (K) plays a very important role as a regulator of plant physiological processes, including photosynthesis, carbohydrate accumulation, translocation, and transport; the opening and closing of stomata; and distribution within cell tissues. Calcium (Ca) acts as a component that strengthens cell walls and regulates photosynthetic distribution. Magnesium (Mg) plays a vital role in the transport of energy in the form of enzymes into the plant, particularly in the leaves, to control chlorophyll availability.

In addition to enhancing plant growth and yield, Gamal liquid organic leaf fertilizer contains various microorganisms that work within the soil, thereby improving the soil's physical, chemical, and biological properties. As stated by Parnata (2010), the use of liquid organic fertilizer can improve soil physical, chemical, and biological properties, increase crop production quantity and quality, reduce reliance on inorganic fertilizers, and serve as an alternative to manure.

Conclusion

The research results indicate that applying different concentrations of gamal leaf liquid organic fertilizer (POC) significantly influenced the growth of stone mistletoe plants. The application of 120 ml of gamal leaf POC per liter of water yielded the best results for stone mistletoe growth across the observed parameters, including: shoot length in all measurements, number of leaves in all observations, leaf length in all observations, leaf width in all observations, and root length.

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Author Contributions

R.M., M.I: Conceptualization, developing ideas, analyzing data, writing, reviewing, responding to reviewers' comments; R.Y., N.D., R.M.: analyzing data, overseeing data collection, reviewing scripts, and writing.

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Conflicts of Interest

The authors declare no conflict of interest.

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