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The Effectiveness of Cow Manure and Banana Peel Liquid Organic Fertilizer on the Growth of Patchouli Plant Cuttings (Pogostemon cablin Benth)

M. Ridho Rambe[1], Najla Lubis[2*], Maimunah Siregar[3]
Universitas Pembangunan Panca Budi, Medan, North Sumatera, Indonesia
Email : najlalubis@dosen.pancabudi.ac.id

Patchouli (Pogostemon cablin Benth) is a tropical shrub that produces the most essential oil in Indonesia. Patchouli can produce 200-300 kg of dried leaves per hectare, which can be distilled into 15-20 liters of oil. The purpose of this study was to determineThe effectiveness of cow manure and liquid organic fertilizer of banana peel on the growth of patchouli cuttings and to determine the best dose of POC for patchouli plants. This study used a factorial Randomized Block Design (RAK) with 2 factors including cow manure and banana peel POC with doses of cow manure, namely: S0 (Control/No treatment), S1 (100 gr/polybag), S2 (200 gr/polybag), S3 (300 gr/polybag). Doses of banana peel POC include: P0 (Control/No Treatment), P1 (15 ml/liter of water), P2 (30 ml/liter of water), P3 (45 ml/liter of water). The parameters observed were plant height (cm), number of leaves (blades), leaf length, number of shoots, age of shoot emergence and percentage of plant survival. The results of the study with the administration of cow manure and banana peel POC gave an effect on plant height, number of leaves, leaf length, number of shoots and age of shoot emergence. However, it did not affect the percentage of survival. The best dose of cow manure is found at S1=100 g/polybag, while for banana peel POC it is found at P3= 45 ml/L water/plot
Keywords: Patchouli; POC; Dosage; Organic; and Parameters

Corresponding Author:
Najla Lubis
Master of Agricultural Science, Panca Budi Development University, Medan Gatot Subroto Street, Km 4, Tanjung Medan, Sunggal, Medan 20122, Indonesia
najlalubis@dosen.pancabudi.ac.id

1. Introduction

Patchouli plant (Pogostemon)*cablin*Benth) isTropical shrubs are the largest producers of essential oils in Indonesia. Essential oils are aromatic, volatile, and alcohol-soluble secondary metabolic products produced by plants, typically composed of terpene or sesquiterpene compounds. Because of this, essential oils are also called volatile oils or ester oils. In global trade, they are also referred to as "essential oils." Patchouli oil contributes more than 40% of foreign exchange from essential oil exports (Dirat Perbenihan, 2022).

Figure 1. Patchouli plant

According to Amelia and Hdipoetyanti E (2018) Indonesiaprovides nearly 90% of the world's patchouli oil needs. In Indonesia, the most widely cultivated essential oil-producing plant is Aceh, which is the largest

producer, followed by Bengkulu, West Sumatra, and Lampung. Patchouli can produce 200-300 kg of dried leaves per hectare, which are distilled to produce 15-20 liters of oil (PSI Plantation, 2025). Manure is processed livestock waste applied to agricultural land to improve soil fertility and structure. The nutrients contained in manure depend on the source of the raw material. Large livestock manure is rich in nitrogen and metal minerals, such as magnesium and potassium. Good planting media will greatly encourage successful growth. Planting media such as cow dung, sludge, botong,

rice husk charcoal,Empty oil palm bunches (TKKS) can increase the growth and production of planted plants (Siregar et al., 2018) POC is a solution resulting from the decomposition of organic materials originating from waste.Living organisms, namely plant residues, animal and human waste, that contain more than one nutrient. Among the advantages of organic fertilizers are that they can quickly address nutrient deficiencies, are free from nutrient leaching problems, and provide nutrients quickly. Compared with liquid inorganic fertilizers, liquid organic fertilizers are generally less damaging to soil and plants, even when used frequently (Lubis et al., 2022). Liquid organic fertilizer is used to repair soil structure damaged by the continuous use of inorganic or chemical fertilizers. The macro and micro nutrients contained in banana peel liquid fertilizer are essential for plant growth and development, thereby increasing productivity.Plants. Solid raw materials that are soaked are the source of liquid organic fertilizer. Liquid organic fertilizer that has been soaked for several weeks and has undergone various treatments is ready (DA Luta, 2020).

2. Literature Review Andproblem Statement

According to Irawan (2020), the taxonomic morphology of patchouli (Pogostmon cablin Benth) has 200 genera belonging to the labiate family. Patchouli plants can be classified as follows:

Kingdom : Plantae
Division : Spermatophyta
Subdivision : Angiospermae
Class : Dicotyledonae
Order : Labiatales
Family : Labiate
Genus : Pogostemon
Species : Pogostemon cablin, Benth

Patchouli oil (Pogostemon cablin Benth) is internationally known as patchouli oil and has high economic value. Patchouli oil is an essential commodity that has fixative properties (binds other essential oils), making it...widely used in making perfume, detergent and hair conditioner (Swamy and Sinniah, 2016)

According to Pakpahan (2020),Based on the analysis results, banana peel liquid fertilizer contains 0.11% organic C; 0.05% total N; 0.06% P2O5; 0.46% K2O; C/N 2.20% and pH 3.90. The application of banana peel liquid organic fertilizer can significantly increase the growth of patchouli plants. Application of liquid organic fertilizer with a dose of 20 ml/liter of water actually provides the best plant height growth compared to doses of 10 and 15 ml/1 liter of water because the concentration of nutrients needed by patchouli plants is available and balanced so that it can trigger better plant growth (Sumerta et al., 2017).

3. Method

Research activities were carried out onThe study was conducted from November to February 2026, located in Hamlet 3, Sampe Cita Village, Kutalimbaru District, Deli Serdang Regency, North Sumatra. The research location is approximately 500 meters above sea level. This study used various materials, namely cow manure, liquid organic fertilizer from banana peels, EM 4, Aceh patchouli cuttings (Pogostemon cablin

Benth) which are relatively sensitive to certain diseases, planting media, water, and polybags. Meanwhile, the equipment used was a hoe, knife, watering can, stationery, and other supporting tools. This study used a Randomized Block Design (RBD) with 2 factors, 16 treatments and 3 replications.The first is cow manure (S) which consists of 4 levels, namely SO = control/without treatment S1=100g/polybag. S2=200g/polybag, S3=300 g/polybag. The second factor is banana peel POC (P) which consists of 4 levels, namely P0=control/no treatment, P1=15 ml/liter of water, P2=30 ml/liter of water. P3=45 ml/liter of water. The series of activities include land preparation and clearing, plot creation and filling of polybags, filling of planting media, application of cow manure, selection of patchouli cuttings, application of banana peel POC, planting, application of treatment, maintenance and data collection. The parameters observed were plant height, number of leaves, leaf length, number of shoots, age of shoot emergence and percentage of survival.

4. Results and Discussion

Plant height(cm)

The results of the analysis of varianceStatistics show that the application of cow manure and banana peel POC significantly affected the height of plants aged 3, 5, 7, and 9 weeks after planting. The average results of observations of plant height aged 3, 5, 7, and 9 months after being tested with DMRT are shown in Table 1.

Table 1. Average plant height at 3, 5, 7, and 9 weeks after planting due to the application of cow dung and banana peel POC fertilizer.

Treatment	3 MST	5 MST	7 MST	9 MST
Cow Manure Fertilizer (S) S0 (0 g/polybag)	22.12cA	26.12cA	29.75cB	37.08aA
S1 (100 g/polybag)	23.72bA	27.35bA	31.25aA	38.02aA
S2 (200 g/polybag)	22.82aA	25.97aA	31.32aA	37.92aA
S3 (300 g/polybag	24.27aA	26.72aA	31.10bA	39.12aA
Banana Peel POC (P) P0 (0 ml/L.water/plot)	20.62aA	23.82bA	26.87aA	34.07aA
P1 (15 ml/L.water/plot)	23.17aA	26.10aA	29.62aA	36.40bA
P2 (30 ml/L.water/plot)	24.10aA	28.57aA	34.42aB	42.92aB
P3 (45 ml/L.water/plot)	25.15aA	27.77cA	32.50bB	39.47bB

Note: Numbers in the same column followed by different lowercase letters indicate a significant difference at the 5% level, and different uppercase letters indicate a very significant difference at the 1% level.

In Table 1, the highest average plant height at 9 weeks after planting was in the cow dung fertilizer treatment, namely S3 (39.12 cm) and the lowest wasin S1 (37.08 cm). Meanwhile, in the banana peel POC treatment, the highest was in P2 (42.92 cm) and the lowest was in P0 (34.07 cm). The use of cow manure fertilizer effectively increased plant height because it improved soil fertility and structure. This is consistent with the findings of Linus et al. (2019) who explained that manure can retain water and soil cations.

This is in accordance with research (Pakpahan, 2020) which states that banana peel POC treatment with 30 ml/liter of water/plot was proven to provide the highest results on the parametersPlant height. The nitrogen content in banana peels supports optimal plant growth, resulting in maximum production.

Number of leaves per blade

The results of the analysis of varianceStatistics show that the application of cow manure and banana peel POC has a significant effect on the number of leaves of plants aged 3, 5, 7, and 9 weeks after planting.

The average results of observations of plant height aged 3, 5, 7, and 9 after being tested with DMRT are shown in Table 2.

Table 2. Average number of plant leaves at the ages of 3, 5, 7, and 9 MST due to the application of cow dung fertilizer and banana peel POC.

Treatment	3 MST	5 MST	7 MST	9 MST
Cow Manure Fertilizer (S) S0 (0 g/polybag)	21.75bA	33.24bA	30.07bA	62.12bA
S1 (100 g/polybag)	19.50aA	33.16bA	28.38aA	59.32aA
S2 (200 g/polybag)	16.50bA	29.65aA	27.27aA	58.92bA
S3 (300 g/polybag)	22.50aA	34.73aB	28.52aA	62.38aA
Banana Peel POC (P) P0 (0 ml/L.water/plot)	19.16bA	29.07bA	16.96bA	36.53bA
P1 (15 ml/L.water/plot)	20.12bA	34.40aA	16.91bA	37.16aA
P2 (30 ml/L.water/plot)	20.25bA	35.57aA	19.73aA	40.36bA
P3 (45 ml/L.water/plot)	20.16bA	31.74aB	17.79bA	37.65aA

Note: Numbers in the same column followed by different lowercase letters indicate a significant difference at the 5% level, and different uppercase letters indicate a very significant difference at the 1% level.

In table 2,The results showed that the average number of leaves at 9 weeks post-planting (WAP) was highest in the S3 cow manure fertilizer treatment, with a value of 62.38 leaves. Meanwhile, the S2 treatment produced the lowest number of leaves, at 59.32 leaves. Meanwhile, the banana peel POC treatment had the highest number of leaves in P2, at 40.36 leaves. The lowest number was in P1, at 36.53 leaves.

According to Saragih (2016),Nitrogen accelerates vegetative growth because nitrogen plays a role in converting carbohydrates into protein and then converting them into protoplasm, thus causing leaf growth. With the process of photosynthesis, plants can use it to add new leaves.

Leaf length (cm)

The results of the analysis of varianceStatistics show that the application of cow manure and banana peel POC has a significant effect on the leaf length of plants aged 3, 5, 7, and 9 weeks after planting. The average results of observations of plant height aged 3, 5, 7, and 9 after being tested with DMRT are shown in Table 3.

Table 3. Average leaf length of plants at the ages of 3, 5, 7, and 9 MST due to the application of cow dung fertilizer and banana peel POC.

Treatment	3 MST	5 MST	7 MST	9 MST
Cow Manure Fertilizer (S) S0 (0 g/polybag)	2.58aA	2.97bA	3.93bA	6.46aA
S1 (100 g/polybag)	2.26aA	2.94bA	3.94bA	6.40aA
S2 (200 g/polybag)	2.45aA	3.45aA	4.88aA	6.71aA
S3 (300 g/polybag	3.25bA	3.67aA	4.62aA	6.59aA
Banana Peel POC (P) P0 (0 ml/L.water/plot)	1.34bA	1.86bA	2.50bA	6.31bA
P1 (15 ml/L.water/plot)	1.53bA	2.02aA	2.70bA	6.65bA
P2 (30 ml/L.water/plot)	2.28aA	2.46aA	3.26aA	6.78bA
P3 (45 ml/L.water/plot)	1.42aA	1.80bA	3.39aA	6.41bA

Note: Numbers in the same column followed by different lowercase letters indicate a significant difference at the 5% level, and different uppercase letters indicate a very significant difference at the 1% level.

Table 3 shows that the average leaf length at 9 MST was most frequently found in the cow dung fertilizer treatment.S2 with a value of 6.71 cm. Meanwhile, the S1 treatment produced the lowest number of leaves,

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at 6.40 cm. Meanwhile, the banana peel POC treatment had the highest value in P2, at 6.78 cm. While the lowest was in P0, at 6.31 cm. Banana peel liquid organic fertilizer contains a high amount of nitrogen, which is excellent for stimulating leaf growth and development. Leaves are a crucial part of the plant's organs in the process of photosynthesis.

Number of shoots The results of the analysis of varianceStatistics show that the application of cow manure and banana peel POC has a very significant effect on the number of shoots at the ages of 3, 5, 7, and 9 MST. The average results of observations of the number of shoots of plants aged 3, 5, 7, and 9 after being tested with DMRT are shown in Table 4.

Table 4. Average number of plant shoots at ages 3, 5, 7,and 9 MST due to the provision of cow dung fertilizer and banana peel POC

Treatment	3 MST	5 MST	7 MST	9 MST
Cow Manure Fertilizer (S)				
S0 (0 g/polybag)	7.25^{aA}	7.91^{aA}	9.93^{bA}	16.28^{aA}
S1 (100 g/polybag)	6.59^{bA}	6.95^{aA}	10.94^{aA}	16.20^{aA}
S2 (200 g/polybag)	6.92^{bA}	7.07^{aA}	8.88^{bA}	16.99^{aA}
S3 (300 g/polybag)	7.98^{aA}	8.07^{aA}	11.62^{aA}	16.82^{aA}
Banana Peel POC (P) P0 (0 ml/L.water/plot)	4.03bA	6.95bA	8.50bB	14.99bA
P1 (15 ml/L.water/plot)	4.61bA	8.11aA	13.10cC	15.74aA
P2 (30 ml/L.water/plot)	4.95bA	7.65aA	14.16aA	17.44bA
P3 (45 ml/L.water/plot)	4.36bA	7.28aA	15.39bA	18.11aA

Note: Numbers in the same column followed by different lowercase letters indicate a significant difference at the 5% level, and different uppercase letters indicate a very significant difference at the 1% level.

In table 4,The results showed that the average number of shoots at 9 weeks after planting (WAP) was highest in the S2 cow manure fertilizer treatment, with a value of 16.99. Meanwhile, the S1 treatment produced the lowest number of leaves, at 16.20. Meanwhile, the banana peel POC treatment had the highest value in P3, at 18.11.

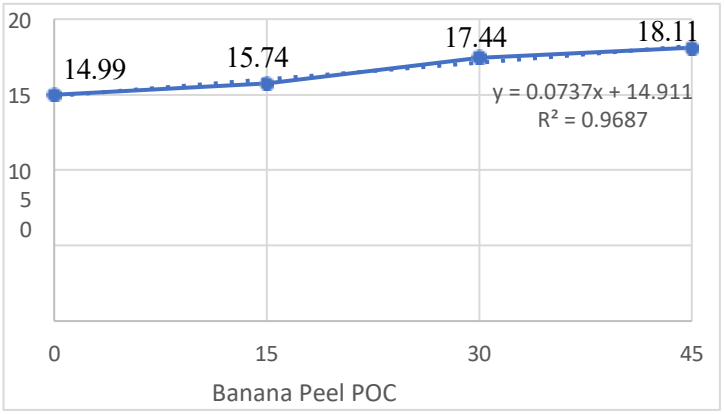

Figure 2. The lowest value was found in P0, at 14.99. For more details, see the following graph.

According to Purbaet al (2017), the increase in the number of shoots in patchouli plants is caused by the ability of a cell called meristematic which functions for division and growth so that more shoots appear. Environmental factors that influence cuttings include rooting media, temperature, light intensity and cutting techniques.

Age of emergence of shoots

The results of the analysis of varianceStatistics show that the provision of cow manure and banana peel POC has a real effect on the age of patchouli shoots.

Table 5. Average age of emergence of plant shoots in patchouli plants due to the application of cow dung fertilizer and banana peel POC.

Treatment	Dose	Age of Emergence of Shoots (days)
Cow Manure Fertilizer (S)		
S0	0 g/polybag	12.52^{aA}
S1	100 g/polybag	12.04^{aA}
S2	200 g/polybag	11.99^{aA}
S3	300 g/polybag	11.93^{aA}
Banana Peel POC (P)		
P0	0 mL/L water/plot	13.57^{bA}
P1	15 mL/L water/plot	12.91^{aA}
P2	30 mL/L water/plot	11.07^{bA}
P3	45 mL/L water/plot	10.93^{aA}

Note: Numbers in the same column followed by different lowercase letters indicate a significant difference at the 5% level, and different uppercase letters indicate a very significant difference at the 1% level.

Based on table 5, the average age of shoot emergence in the cow dung fertilizer treatment was found in S3, namely 11.93 days, while for S0showed the longest age of shoot emergence, namely 12.52 days. For the banana peel POC treatment, The fastest shoot emergence occurred at P3, at 10.93 days, while the slowest occurred at P0, at 13.57 days. Applying PGR to patchouli cuttings also affected the speed of shoot growth (Lumbatoruan, 2018).

Percentage of life

Based on the research conducted, the following survival percentages were obtained:

$$\frac{Jumlah\ populasi\ seluruhnya}{Jumlah\ tanaman\ yang\ hidup} \times 100$$

$$192\ x\ 100\% = 82.3\%$$

FactorEnvironmental factors that influence survival include rooting media, humidity, temperature, light intensity, and cutting technique. Furthermore, the success of cuttings in forming roots and shoots is also influenced by auxin activity from the shoots and leaves (Pandiangan, 2020).

5. Conclusion

This study concludes that the application of liquid organic fertilizer derived from cow manure and banana peels has a positive effect on the growth of patchouli plant cuttings (*Pogostemon cablin* Benth). The combined application of these organic materials has the potential to improve the growth performance of the cuttings, as indicated by their vegetative development. The use of cow manure and banana peel liquid organic fertilizer can therefore serve as an environmentally friendly alternative to support the cultivation of patchouli plants. Further studies are recommended to investigate the optimum fertilizer concentration and application frequency to achieve maximum growth and productivity of patchouli plant cuttings.

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