



E-ISSN 3032-601X & P-ISSN 3032-7105

Vol. 2, No. 4, 2025

MISTER

**Journal of Multidisciplinary Inquiry in Science,
Technology and Educational Research**

**Jurnal Penelitian Multidisiplin dalam Ilmu
Pengetahuan, Teknologi dan Pendidikan**

**UNIVERSITAS SERAMBI MEKKAH
KOTA BANDA ACEH**

mister@serambimekkah.ac.id

Journal of Multidisciplinary Inquiry in Science Technology
and Educational Research

Journal of MISTER

Vol. 2, No. 4, 2025

Pages: 4335-4341

Increased Productivity of *Agathis labillardierei* Species Growth with ZPT-Cytosine Injection and Coffee Waste Fertilizer

Markani, Savira Dyah Istiqlawati, Sevina Ayu Andini,
Ananta Ria Safitri

PT Pertamina Patra Niaga Aviation Fuel Terminal Sultan Mahmud Badaruddin
II, Sumatera Selatan, Indonesia

Article in Journal of MISTER

Available at : <https://jurnal.serambimekkah.ac.id/index.php/mister/index>

DOI : <https://doi.org/10.32672/mister.v2i4.3700>

How to Cite this Article

APA : Markani, M., Savira Dyah Istiqlawati, Sevina Ayu Andini, & Safitri, A. R. (2025). Increased Productivity of *Agathis labillardierei* Species Growth with ZPT-Cytosine Injection and Coffee Waste Fertilizer . Journal of Multidisciplinary Inquiry in Science, Technology and Educational Research, 2(4), 4335 - 4341. <https://doi.org/10.32672/mister.v2i4.3700>

Others Visit : <https://jurnal.serambimekkah.ac.id/index.php/mister/index>

MISTER: *Journal of Multidisciplinary Inquiry in Science, Technology and Educational Research* is a scholarly journal dedicated to the exploration and dissemination of innovative ideas, trends and research on the various topics include, but not limited to functional areas of Science, Technology, Education, Humanities, Economy, Art, Health and Medicine, Environment and Sustainability or Law and Ethics.

MISTER: *Journal of Multidisciplinary Inquiry in Science, Technology and Educational Research* is an open-access journal, and users are permitted to read, download, copy, search, or link to the full text of articles or use them for other lawful purposes. Articles on Journal of MISTER have been previewed and authenticated by the Authors before sending for publication. The Journal, Chief Editor, and the editorial board are not entitled or liable to either justify or responsible for inaccurate and misleading data if any. It is the sole responsibility of the Author concerned.



ISSN 3032-7105

ISSN 3032-601X



9

773032

710001

9

773032

601002

Increased Productivity of *Agathis labillardierei* Species Growth with ZPT-Cytosine Injection and Coffee Waste Fertilizer

Markani¹, Savira Dyah Istiqlawati², Sevina Ayu Andini³, Ananta Ria Safitri^{4*}
PT Pertamina Patra Niaga Aviation Fuel Terminal Sultan Mahmud Badaruddin II,
Sumatera Selatan, Indonesia^{1,2,3,4}

Corresponding Author's Email: anantasafitri@gmail.com

Received: 08 10, 2025

| Accepted: 08, 23, 2025

| Published: 08 25, 2025

ABSTRACT

*Various industrial sectors widely use Damar Putih trees, particularly as a source of resin raw materials. However, the high demand for resin from this species is not matched by its declining growth rate and productivity. Based on previous research, it has been found that fermented coffee waste used as liquid fertilizer can significantly improve the quality and productivity of tomato fruits. Therefore, this study aims to conserve the White Damar species using ZPT-Cytosine injection and coffee waste fertilizer. This study employs an experimental method designed to enhance the growth productivity of the *Agathis labillardierei* species through the application of cytosine growth regulator injections and the use of organic fertilizer made from coffee waste (coffee waste fertilizer). The results indicate that this approach successfully increased the average stem growth rate from 8 cm/month to 10 cm/month, with plant height reaching 80 cm within six months. The use of coffee waste as organic fertilizer not only contributes to the availability of essential nutrients but also serves as an environmentally friendly waste management solution.*

Keywords: Coffee Waste Fertilizer; Damar Putih; ZPT-Cytosine Injection.

INTRODUCTION

Agathis labillardierei, better known as Damar Putih, is a tree species with significant economic and ecological value (Apriyadi et al., 2023). This plant is widely used in various industrial sectors, particularly as a source of resin raw material (Usri et al., 2020). However, the high demand for resin from this species is not balanced by its decreasing growth rate and productivity. This decline is evident in the decreasing population in its natural habitat. Several factors contribute to this decline, including land degradation, climate change, and soil nutrient deficiencies. Therefore, Agathis labillardierei has been designated as a protected plant species under Ministerial Regulation No. P106 of 2018 on Protected Plant and Animal Species. As a result, special efforts are needed to enhance the conservation and resilience of this species.

The amount of coffee waste produced by the Pemuda Pemudi (Kemudi) NGO continues to increase and has not been utilized to its full potential. In fact, this waste contains various important nutrients such as nitrogen, phosphorus, potassium, and other organic compounds that have the potential to improve soil quality. Therefore, a strategy is needed to utilize coffee waste and reduce the accumulation of organic waste. According to research published in the Journal of Applied Horticulture, fermented coffee grounds used as liquid fertilizer can significantly improve the quality and productivity of tomato fruits. This is due to the nutrient content in coffee grounds, which helps improve soil structure and stimulate vegetative and generative plant growth (Norhayati, Ng, & Adzemi, 2019). Furthermore, research conducted by Sartono Joko Santosa & Teguh Yuwono (2018) also shows that coffee waste can be used to fertilize plants and as an organic pesticide. Thus, coffee waste as organic fertilizer can be a sustainable alternative in addressing waste while increasing plant fertility.

METHODS OF RESEARCH

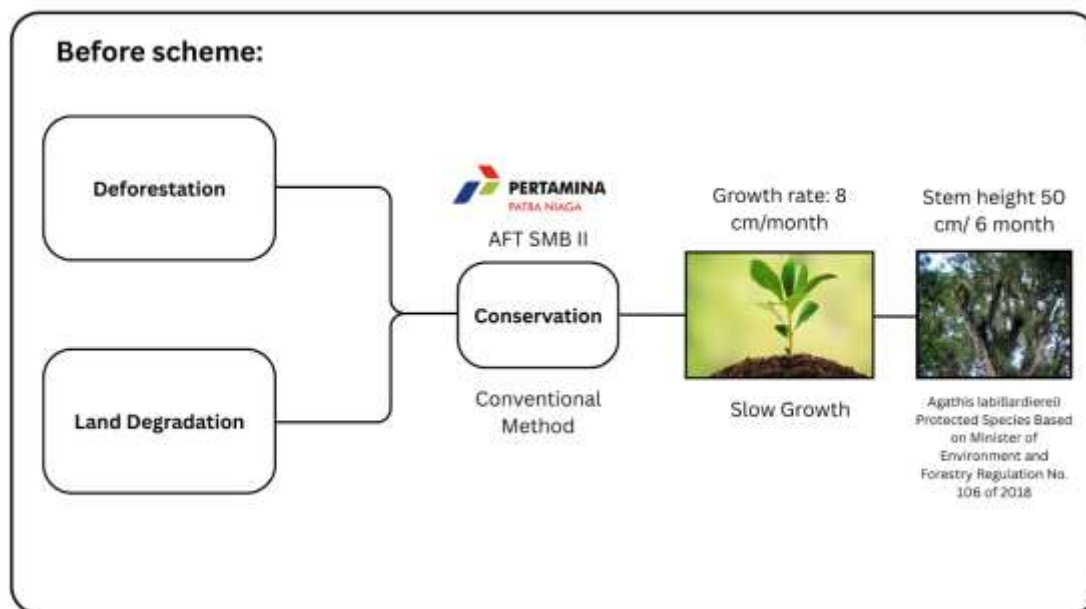
This study used an experimental method designed to increase the growth productivity of the Agathis labillardierei species through the application of cytosine growth regulator injections and the application of organic fertilizer made from coffee waste (coffee waste fertilizer). The experimental method is a research approach that involves manipulating one or more variables (such as fertilizer type or light intensity) to observe and measure their effects on plant growth and development under controlled conditions (Hoshmand, 2018). The research design used was a Completely Randomized Design (CRD) with several treatments, namely a control without treatment, application of coffee waste fertilizer, injection of Cytosine GRP, and a combination of coffee waste fertilizer and Cytosine GRP. Each treatment was conducted in multiple replicates to ensure the validity of the results. The parameters observed included plant height, stem diameter, number and area of leaves, dry biomass weight, and relative growth index. With this method, the study is expected to demonstrate the significant effects of coffee waste fertilizer application and cytokinin ZPT injection, both individually and in combination, on the sustainable enhancement of Agathis labillardierei growth productivity.

RESULT AND DISCUSSION

Data

The *Agathis labillardierei* Species Growth Productivity Improvement Program with Cytosine Growth Regulator Injection and Coffee Waste Fertilizer is designed to accelerate the growth of these plants in a sustainable manner through the use of coffee grounds as organic fertilizer and the application of Cytosine Growth Regulator injection. The innovative aspects of this program have never been implemented by other companies in Indonesia, particularly in the oil and gas distribution sector, according to the Best Practices for 2020-2023 published by the Indonesian Ministry of Environment and Forestry.

Prior to the program, conservation efforts for *Agathis labillardierei* were conducted using conventional methods, such as planting seedlings in open areas exposed to direct sunlight and regular watering. This method allowed the plants to grow, but their growth rate was suboptimal, with an average growth of only around 8 cm per month. Additionally, biomass productivity was low, nutrient absorption was limited, and the plants were susceptible to pest attacks. Over a six-month period, the average stem height reached only 50 cm. The low nutrient content in the growing medium used also contributed to the slow development of the plants.

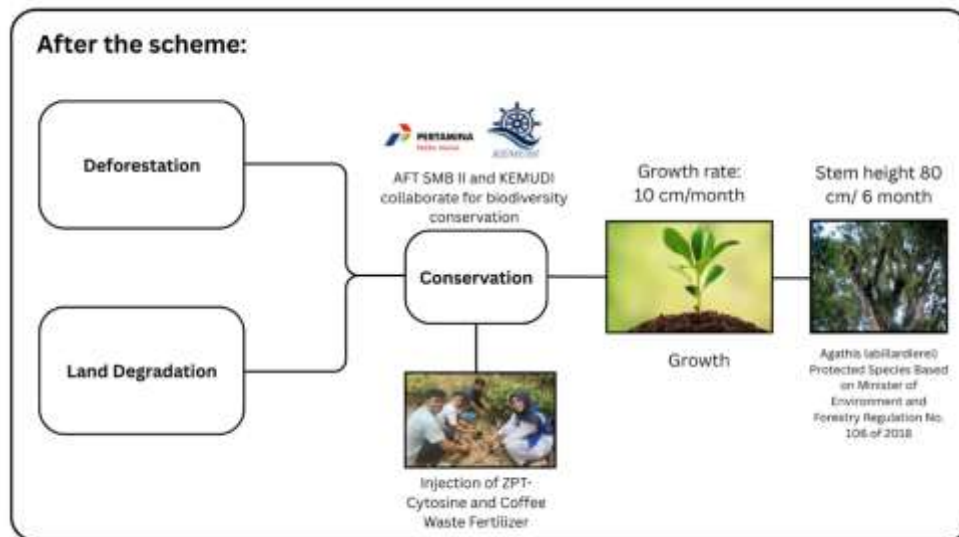


Picture 1. Before Scheme

Source: Biodiversity Aspect Program Innovation Report

After the program, the company implemented the conservation of *Agathis labillardierei* through the application of ZPT-Sitokinin injection technology and the provision of nutrients from organic fertilizer based on coffee grounds with the use of 150 kg of coffee grounds. The process began with the collection of coffee grounds from local partners, the Youth Environmental Conservation Organization (Kemudi), which were then mixed with organic materials such as dry leaves and fermented in sealed containers. The

organic fertilizer produced from this combination contains essential nutrients, including nitrogen (1.45–2.3%), phosphorus (0.06–0.3%), potassium (0.6–0.7%), and organic carbon (50–60%), which enhance nutrient availability for plants. On the other hand, the application of ZPT-Cytosine via injection serves to stimulate cell division and accelerate the formation of new shoots. Through this method, a significant increase was recorded, with an average stem height reaching 80 cm in six months and a growth rate of 10 cm/month.



Picture 2. After the Scheme

Source: Biodiversity Aspect Program Innovation Report

This innovation includes changes to the system with genome-based conservation classification, where the addition of organic coffee grounds fertilizer enhances the growth of *Agathis labillardierei*, which is a protected species (Permen LHK No. 106 of 2018), and in collaboration with the NGO Kemudi.



Pictures 3. *Agathis labillardierei* Injection of ZPT-Sitosinin

Source: Biodiversity Aspect Program Innovation Report

The success of this program can be seen from the company's success in conserving 925 *Agathis labillardierei* (Absolut) trees with a budget of Rp50,000,000.00 in 2024.

Absolute calculation

Absolute result = Number of *Agathis Labillardierei* trees cultivated

Table 1. Data on *Agathis Labillardierei* trees cultivated

No	Local Name	Latin Name	2024	Unit	Budget
			Amount		Rp Million
1	Damar Putih	<i>Agathis labillardierei</i>	925	Trees	50

Source: Biodiversity Aspect Program Innovation Report

This processing also eliminates waste that must be disposed of at landfills by up to 100%. Where annual transportation costs decrease from Rp600,000.00 per year to Rp0.00 per year. Thus, there is a cost savings/efficiency of Rp600,000.00.

Contribution of the Program to the Environment and/or Community

Based on the program implemented by the company, it has provided benefits for the environment and society. In terms of value creation, this program has conserved 925 *Agathis labillardierei* (Absolut) trees with a budget of Rp50,000,000 in 2024. In addition to conserving this species, the program has benefits for:

1. For NGOs (Kemudi), it reduces coffee waste by utilizing 150 kg of coffee waste and receiving a budget of Rp50,000,000 for processing coffee waste into organic fertilizer.
2. For the local community, increasing awareness of the conservation of *Agathis labillardierei*, which has high economic value, so that the community can wisely utilize Damar Putih. Additionally, the community's knowledge increases through skill transfer in the production of organic fertilizer from coffee grounds.

Cost Savings

Before the program was implemented, coffee grounds were routinely disposed of at a landfill and required transportation costs of Rp50,000 per month. This meant that the total cost of transporting organic waste to the landfill reached Rp600,000 per year. After the program was implemented, the coffee waste was managed internally and processed into organic fertilizer through a fermentation process. This processing eliminated the need to dispose of waste at the landfill by 100%. As a result, the annual transportation cost decreased to Rp0.00 per year. This resulted in cost savings/efficiency of Rp600,000.00.

Absolute calculation

Cost savings (Rp) = Pre-Program Costs – Cost after program
= Rp600,000.00 - Rp0.00
= Rp600,000.00

$$\begin{aligned}\text{Percentage of Savings (\%)} &= \left(\frac{\text{Cost Savings}}{\text{Pre-Program Costs}} \right) \times 100\% \\ &= \left(\frac{\text{Rp600.000,00} - \text{Rp0,00}}{\text{Rp600.000,00}} \right) \times 100\% \\ &= \left(\frac{\text{Rp600.000,00}}{\text{Rp600.000,00}} \right) \times 100\% \\ &= 100\%\end{aligned}$$

The Program's Contribution to SDG Achievement

The success of this program not only has a positive ecological impact but also directly contributes to the achievement of the Sustainable Development Goals (SDGs). This program reflects the integration of conservation practices, sustainable waste management, and strategic partnerships. The tangible contributions to the achievement of the SDGs are outlined as follows:

1. SDG 12: Responsible Consumption and Production

This program promotes the principles of the circular economy through the utilization of organic waste, particularly coffee grounds, as raw material for organic fertilizer production. As a result, waste that was previously unused becomes a valuable resource, while also reducing the burden of organic waste on the environment.

2. SDG 13: Climate Action

Increased biomass productivity from the *Agathis labillardierei* species contributes to carbon sequestration, supports indirect reduction of greenhouse gas emissions, and strengthens adaptation to climate change through sustainable reforestation.

3. SDG 15: Protecting Terrestrial Ecosystems

This program directly supports biodiversity conservation and local vegetation restoration through increased growth of the endemic species *Agathis labillardierei*. This practice strengthens efforts to protect and restore tropical forest ecosystems.

4. SDG 17: Partnerships for the Goals

The collaboration between the company and the NGO Pemuda Pemudi Cinta Lingkungan (Kemudi) demonstrates the implementation of effective multi-stakeholder partnerships, in line with the principles of SDG 17. This synergy strengthens community empowerment and active participation in environmental management.

CONCLUSION

The program to increase the productivity of *Agathis labillardierei* growth through the application of ZPT-Sitosinin injections and the use of coffee waste fertilizer has proven to be an effective innovation in accelerating the growth rate of plants in a sustainable manner. Compared to conventional methods, this program has successfully increased the average stem growth rate from 8 cm/month to 10 cm/month, with plant height reaching 80 cm within six months. The use of coffee waste as organic fertilizer not only contributes to the availability of essential nutrients but also serves as an environmentally friendly waste management solution. Meanwhile, the

application of ZPT-Sitosinin injections stimulates cell division and the formation of new shoots, thereby accelerating plant biomass productivity.

In addition to its ecological impact, this program also holds innovative value, as it is the first of its kind in the oil and gas distribution sector in Indonesia according to the KLHK Best Practice Guidelines 2020–2023, and strengthens multi-stakeholder collaboration with the Youth Environmental Conservation Organization (Kemudi). Thus, this genome-based conservation innovation not only contributes to the preservation of *Agathis labillardierei*, a protected species (Ministry of Environment and Forestry Regulation No. 106 of 2018), but also reflects the company's responsibility in supporting sustainable and measurable biodiversity management.

REFERENCE

- Apriyadi, A., Syarief, A. N. L., Aprilia, R., & Maharani, S. D. (2023). Efektivitas Damar Putih Dalam Pelestarian Tanaman Endemik Plasma Nutfah Oleh PT Pertamina Patra Niaga DPPU SMB II Di Kota Palembang. *Jurnal Syntax Admiration*, 4(9), 1413-1421.
- Hoshmand, R. (2018). *Design of experiments for agriculture and the natural sciences*. Chapman and Hall/CRC.
- Ministerial Regulation No. P106 of 2018 on Protected Plant and Animal Species
- Norhayati, Y., Ng, W. H., & Adzemi, M. A. (2019). The New Composition of Liquid Organic Fertilizer for Improving Organic Tomato Yield And Quality. *Journal of Applied Horticulture*.
- PT Pertamina Patra Niaga AFT SMB II. (2024). *Biodiversity Aspect Program Innovation Report 2024*. PT Pertamina (Persero).
- Santosa, S. J., & Yuwono, T. (2018). Pemanfaatan limbah ampas kopi untuk tanaman hias dalam pot di Desa sumber Kecamatan Banjarsari Kotamadya Surakarta. *Adi Widya: Jurnal Pengabdian Masyarakat*, 2(2), 167-173.
- Usri, K., Karlina, E., & Takarini, V. (2020). Potensi Damar Indonesia Sebagai Bahan Baku Material Kedokteran Gigi. *Jurnal Material Kedokteran Gigi*, 9(1), 1-5.