

Effect of Various Concentrations of Organic Avocado Peel Stimulant on Latex Yield of Rubber Plant (*Hevea brasiliensis* Muell. Arg.) Clone PB 260

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ABSTRACT

Rubber plants are a very important plantation commodity in Indonesia, rubber plants provide a significant contribution as a supplier of rubber raw materials and play an important role in environmental conservation and biological resources. Rubber plants produce latex, to improve the quality of latex, improvements that can be made are by using grafted seeds. Therefore, in cultivating rubber plants, good planting materials are needed to support the productivity of rubber plants. To increase latex production in rubber plants, stimulant treatment is needed. This study aims to determine the effect of providing organic stimulants from avocado (*Persea americana* Mill) fruit peels on the latex yield of clone PB 260 and to obtain the best concentration results from providing organic stimulants from avocado (*Persea americana* Mill) fruit peels. The method used is a randomized block design (RAK) consisting of one treatment factor, namely the concentration of ethrel and the concentration of avocado peel extract consisting of 6 treatment levels. A0 = Without Stimulant, A1 = Ethrel 10pa Concentration 2.5%, A2 = Avocado Peel Extract Concentration 50 gr/300ml, A3 = Avocado Peel Extract Concentration 100 gr/300ml, A4 = Avocado Peel Extract Concentration 150 gr/300ml, A5 = Avocado Peel Extract Concentration 200 gr/300ml. Each treatment had 4 repetitions, so there were 24 experimental plants.

Keywords: Rubber Plant, Clone PB 260, Organic Stimulant, Avocado Peel, Latex

INTRODUCTION

Rubber (*Hevea brasiliensis*) is a highly important plantation commodity in Indonesia, contributing significantly as a source of raw material for natural rubber and playing a vital role in environmental conservation and biodiversity preservation (Pulungan, 2014). In Indonesia, rubber cultivation is widespread across various regions, particularly throughout Sumatra Island and several other islands. Its management is carried out by private estates, government-owned plantations, and individual farmers, with major production areas concentrated in North Sumatra,

West Sumatra, Riau, Jambi, and South Sumatra (Anwar, C., 2006). Rubber plants (*Hevea brasiliensis*) consist of various clones, which are vegetatively propagated from parent trees and inherit identical traits from the original source (Tumpal and Suhendry, 2013).

The use of superior clones plays a crucial role in enhancing latex quality, particularly through budded planting materials (Pusat Penelitian Karet, 2016). Therefore, the selection of high-quality planting stock is a key factor in the success of rubber cultivation. In South Sumatra, clone PB 260 is recommended as a leading variety. This clone is

recognized for its high latex yield, resistance to foliar diseases such as *Oidium* and *Corynespora cassiicola*, and vigorous growth performance. Under optimal conditions, PB 260 can produce between 1.5 to 2.5 tons of latex per hectare annually (Galingging et al., 2017).

In addition to the selection of superior clones, tapping practices are also a critical component in the initial phase of rubber production, as they involve the incision of the tree bark to extract latex (Rouf, 2012 as cited in Triyani, 2021). To achieve optimal and sustainable yields, it is essential to implement standardized tapping techniques while considering the physiological condition of the tree to prevent excessive stress. Beyond the tapping method itself, attention must also be given to the plant's turgor pressure. This pressure increases along the cell walls as cell volume expands and serves as an early indicator that the rubber tree is physiologically ready for optimal tapping (Yosephine & Guntoro, 2019).

Proper tapping practices that consider turgor pressure can be further enhanced by the application of stimulants to the tapping panel to increase latex yield. According to a study by Purnama Arisa D (2020), the application of ethephon at an 8% concentration influenced the duration of latex flow. Meanwhile, the highest volume, weight, and dry rubber yield were observed at a 6% concentration, whereas the highest dry rubber content was achieved with a 2% ethephon concentration. In this context, the use of clone PB 260 is highly suitable, as it exhibits a rapid response to stimulant application and water, showing minimal coagulation (non-procoagulating latex). This clone is also characterized by a fast latex dripping rate. In contrast, clone GT 01, classified as a "Slow Starter" type, demonstrates higher latex viscosity compared to PB 260, ranging

between 25% and 28% (Suherman et al., 2020).

The use of stimulants has a positive impact on increasing latex production; however, excessive application may lead to reduced yields and can induce tapping panel dryness (TPD). A decline in latex volume during tapping may result from over-intensive extraction practices. When the rate of latex harvesting exceeds the tree's biosynthetic capacity and the refilling process in the latex flow area, latex production will progressively decline with each tapping cycle (Gultom et al., 2017).

Avocado peel is a natural source of organic ethylene. The use of stimulants derived from avocado peel has been proven to enhance latex yield in rubber trees. Findings from previous research indicate that avocado peel extract contains ethylene concentrations ranging from 28.9 to 74.2, making it a promising eco-friendly alternative to synthetic stimulants such as ethrel (Sudjatha & Nil Wayan, 2017).

The objective of this study is to evaluate the effect of organic stimulant derived from avocado peel (*Persea americana* Mill) on the latex yield of rubber clone PB 260, and to determine the optimal concentration of avocado peel-based stimulant for enhancing latex production.

MATERIAL AND METHOD

Time and Location

This research was conducted at PT. Melania Indonesia, located in Mainan Village, Km 25, Sembawa Subdistrict, Banyuasin District, South Sumatra Province. The study commenced in June and concluded in November 2025. The experimental work was carried out in Division 4, Task B g9, using 14-year-old rubber trees as sample plants.



Tools and Materials.

The tools used in this study included: tapping knife, latex cup, cup ring, latex bucket, spout, blender, gauze cloth, digital scale, measuring cylinder, coagulum grinding machine, oven, avocado peel extract container, camera, and writing instruments. The materials used in this study were: rubber trees of clone PB 260, avocado peel, ethrel 10PA, NH₃ (ammonia), and distilled water.

Research Methodology

The experimental design used in this study was a Randomized Complete Block Design (RCBD), consisting of a single treatment factor: the concentration of ethrel and avocado peel extract. The study included six treatment levels as follows:

- A0 = No Stimulant (Control)
- A1 = Ethrel 10PA at 2.5% concentration
- A2 = Avocado Peel Extract at 50 g/300 ml
- A3 = Avocado Peel Extract at 100 g/300 ml
- A4 = Avocado Peel Extract at 150 g/300 ml
- A5 = Avocado Peel Extract at 200 g/300 ml

Each treatment was replicated four times, resulting in a total of 24 experimental rubber trees.

RESULT AND DISCUSSION

Observation Results: Latex Volume

Based on the analysis of variance (ANOVA), the application of avocado peel extract as a stimulant had a significant effect on the latex volume of rubber trees of clone PB 260.

Table 1. Latex Volume Results

Treatment	Volume Lateks (ml)
A0 : No Stimulant	67,25

(Control)	
A1 : Ethrel 10PA at 2.5% concentration	106,25
A2 : Avocado Peel Extract at 50 g/300 ml	135
A3 : Avocado Peel Extract at 100 g/300 ml	137,5
A4 : Avocado Peel Extract at 150 g/300 ml	272,5
A5 : Avocado Peel Extract at 200 g/300 ml	156

Based on the table above, the application of avocado peel extract at various concentrations effectively increased latex volume in rubber trees of clone PB 260. Treatments with avocado peel extract showed a significant difference compared to both the control (no stimulant) and Ethrel 10PA at 2.5% concentration. The highest average latex volume was recorded in the treatment with avocado peel extract at 150 g/300 ml, reaching 272.5 ml, which surpassed all other avocado peel extract treatments. Conversely, the lowest latex volume was observed in the control treatment, with a value of 67.25 ml.

Observation Results: Lump Weight

Based on observational data and research findings, the application of avocado peel extract produced a significant effect on the lump weight of latex in rubber trees of clone PB 260. The average results are presented in the table below:

Table 2. Lump Weight Results

Treatment	Lump Weight (gr)
A0: No Stimulant (Control)	93,75
A1 : Ethrel 10PA at 2.5% concentration	81,25
A2 : Avocado Peel Extract	79,5



at 50 g/300 ml	
A3 : Avocado Peel Extract at 100 g/300 ml	75,5
A4 : Avocado Peel Extract at 150 g/300 ml	134,75
A5 : Avocado Peel Extract at 200 g/300 ml	82,25

Based on the table above, the application of avocado peel extract as a stimulant resulted in a significant difference compared to the control treatment and Ethrel 10PA at 2% concentration. The most effective treatment was avocado peel extract at a concentration of 150 g/300 ml, which produced the highest average lump weight of 134.75 g. In contrast, the lowest average lump weight was recorded in the treatment with avocado peel extract at 100 g/300 ml, yielding 75.5 g.

Observation Results: Dry Rubber Content (DRC)

Based on observational data and research findings, the application of avocado peel extract produced a significant effect on the Dry Rubber Content (DRC) of latex in rubber trees of clone PB 260. The results are presented in the following table:

Table 3. Dry Rubber Content Results

Treatment	KKK (%)
A0 : No Stimulant (Control)	31,4
A1 : Avocado Peel Extract at 50 g/300 ml	34,26
A2 : Ethrel 10PA at 2.5% concentration	28,97
A3 : Avocado Peel Extract at 100 g/300 ml	34,34
A4 : Avocado Peel Extract at 150 g/300 ml	39,28
A5 : Avocado Peel Extract at 200 g/300 ml	37,15

Based on the table above, the application of avocado peel extract as a stimulant produced a significant difference compared to both the control treatment and Ethrel 10PA at 2% concentration. The highest average Dry Rubber Content (DRC) was obtained from the treatment using avocado peel extract at a concentration of 150 g/300 ml, reaching 39.28%.

Discussion

Latex production is largely determined by the turgor pressure of laticifer cells, osmotic balance, and the duration of flow before plugging occurs. According to the Physiology of Rubber Tree Latex, latex volume is more influenced by flow duration than by the amount of rubber particle reserves themselves. Effective stimulation will extend flow duration by delaying the coagulation of rubber particles at the ends of the vessels.

The control treatment (A0) showed the lowest volume (67.25 ml), indicating that without stimulants, the plugging process occurs relatively quickly. Application of 2.5% Ethrel (A1) increased the volume to 106.25 ml. Ethrel works by releasing ethylene, which increases osmotic pressure and metabolic activity in laticifer cells. This mechanism has been explained by Plant Physiology and Development, where ethylene can increase membrane permeability and activate certain metabolic responses associated with controlled physiological stress (Taiz, L., Zeiger, E., et.al, 2015).

However, all avocado peel extract treatments showed higher volumes than Ethrel. This indicates that the natural extract works not through a single hormonal mechanism, but likely through a combination of antioxidant activity, phenolic compounds, and natural phytohormones.

A concentration of 150 g/300 ml (A4) produced the highest volume (272.5 ml). This significant increase indicates an optimum dose. This response follows a dose-response curve in plant physiology, where moderate concentrations produce maximum stimulation, while excessive concentrations can cause a decreased response. At a concentration of 200 g/300 ml (A5), the volume decreased to 156 ml, indicating possible osmotic stress or disruption of the physiological balance of the tapping panel tissue.

Comparatively, this result is higher than some reports of volume increases resulting from the use of synthetic ethylene in conventional tapping systems, which generally increase production by 30–100% depending on the clone and the exploitation system. The very high response at a concentration of 150 g/300 ml indicates that the PB 260 clone has a high sensitivity to natural stimulants. According to the Sembawa Rubber Research Center, the PB 260 clone is known to be responsive to intensive exploitation systems and stimulants, so genetic factors likely strengthen the effects of the treatment (Balai Penelitian Karet Sembawa, 2014).

In the control treatment (A0), the lump weight reached 93.75 g. Meanwhile, the application of Ethrel 10 PA at a concentration of 2.5% (A1) resulted in a lower lump weight (81.25 g). This phenomenon indicates that the increase in latex flow due to ethylene is not always accompanied by an increase in dry matter content. According to the Physiology of Rubber Tree Latex, ethylene works primarily by extending latex flow time by increasing turgor pressure and delaying plugging, but its effect on rubber particle synthesis is not always proportional. Under certain conditions, ethylene stimulation can increase the serum fraction, resulting in a

relative decrease in dry rubber concentration (D'Auzac, J., Jacob, J. L., & Chrestin, H. 1989).

The highest yield was obtained with the avocado peel extract treatment at a concentration of 150 g/300 ml (A4), with a lump weight of 134.75 g. This significant increase indicates that this concentration optimally stimulates rubber biosynthesis. Polyisoprene synthesis in laticifer cells is highly dependent on sucrose availability and enzymatic activity in the mevalonate pathway. According to Plant Physiology and Development, hormonal balance and cell physiological status significantly determine the efficiency of secondary metabolism, including the production of isoprenoid-based compounds such as natural rubber (Nixon Flórez-Velasco et al., 2024).

Avocado peel extract is known to contain phenolic compounds, flavonoids, tannins, and antioxidants. These compounds have the potential to maintain cell membrane stability and reduce oxidative stress in laticifer tissue. Protection against oxidative stress is crucial because tapping can increase the formation of free radicals, which accelerate rubber particle coagulation and metabolic disruption. Therefore, the increase in lump weight at a concentration of 150 g/300 ml is likely due not only to increased latex flow but also to increased synthesis efficiency and rubber particle stability (M. Naser et al., 2025).

Conversely, at a concentration of 100 g/300 ml (A3), the lowest lump weight (75.5 g) was obtained, even lower than the control. This indicates a non-linear dose response. In plant physiology, the response to plant growth regulators or bioactive compounds generally follows an optimum response curve. Suboptimal concentrations can result in ineffective stimulation, while excessive

concentrations have the potential to cause physiological stress. A further decrease to a concentration of 200 g/300 ml (82.25 g) strengthens the indication of a physiological tolerance threshold (NA Sugiarto, 2024).

In the unstimulant treatment (A0), the dry rubber content was 31.4%, which is still within the normal range for fresh latex. Application of Ethrel 10 PA 2.5% (A1) increased the dry rubber content to 34.26%. Ethrel works by releasing ethylene, which can prolong latex flow and increase the turgor pressure of laticifer cells. However, the increase in dry rubber content due to ethylene is generally not always significant because ethylene stimulation predominantly affects flow duration rather than rubber particle synthesis itself. According to the *Physiology of Rubber Tree Latex*, dry rubber content is highly dependent on the balance between rubber particle biosynthesis and the serum fraction released during the tapping process (Taiz, L., Zeiger, E., et al, 2015).

The highest yield was obtained with avocado peel extract at a concentration of 150 g/300 ml (A4), with a dry rubber content of 39.28%. This value represents a significant increase compared to the control and Ethrel. This indicates that avocado peel extract at the optimum concentration can increase the efficiency of polyisoprene biosynthesis in laticifer cells (Tupy, J. 2017).

Physiologically, natural rubber synthesis occurs through the mevalonate pathway, which utilizes sucrose as the primary substrate. This process is strongly influenced by cellular metabolic conditions, energy (ATP) availability, and plant hormone balance. According to *Plant Physiology and Development*, hormonal regulation and cellular redox balance play a crucial role in plant secondary metabolism. The phenolic, flavonoid, and antioxidant compounds in

avocado peel are thought to help maintain laticifer cell membrane stability and reduce oxidative stress caused by tapping, thus enabling more efficient rubber biosynthesis (Venkatachalam, P., & Thulaseedharan, A., 2016).

The increase in the 150 g/300 ml concentration also indicates that this treatment not only increases latex flow volume but also enriches the rubber particle content within it. This is consistent with the increase in lump weight after the same treatment, indicating a consistent effect on production quantity and quality.

Conversely, at a concentration of 50 g/300 ml (A2), the 150 g/300 ml concentration decreased to 28.97%. This indicates that low doses are not yet effective enough to stimulate the metabolic activity of polyisoprene formation. At higher concentrations (200 g/300 ml), the KKK decreased slightly compared to the optimum dose (37.15%), indicating a physiological tolerance limit for the plant to the stimulant concentration. This response follows the optimum curve pattern in plant physiology, where moderate concentrations produce a maximal response, while concentrations that are too low or too high produce a suboptimal response (Yew, F. K., & Gomez, J. B., 2015).

CONCLUSION

Based on the research findings, the application of avocado peel extract had a significant effect on increasing latex volume and Dry Rubber Content (DRC) in rubber trees of clone PB 260. The optimal concentration was found at 150 g/300 ml, yielding the highest latex volume of 272.5 ml and a DRC of 39.28%. These results indicate that organic stimulants derived from avocado peel have the potential to serve as an

environmentally friendly alternative to synthetic ethrel.

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