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RESEARCH ARTICLE Open Access

The Effect of Organic PGR Application from Mung Bean Sprouts Extract on the Growth of Stem Cuttings of Honey Water Apple Plants (*Syzygium aqueum*) in Danau Balai Village

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Abstract

Honey water guava (*Syzygium aqueum*) is one of the newest high-quality commodities and is increasingly being cultivated by farmers in various regions. This study aimed to evaluate the effects of applying organic plant growth regulators (PGRs) derived from sprout extracts at different doses on the growth of water apple (*Syzygium aqueum*) plants. A completely randomized design (CRD) with a single treatment factor was employed. The results demonstrated that the 60 mL treatment of ZPT Organic Benefits Extract was the most effective in promoting plant growth, achieving an average height of 10.8 cm and five shoots at 4 weeks after planting (WAP), compared to the control treatment, which reached only 8 cm in height and two shoots. These findings indicate that the 60 mL dose of organic PGR extract from sprouts significantly enhanced growth and stimulated shoot development relative to the other treatments.

Keywords: Honey Water Apple Plant, Mung Bean Sprouts Extract, Organic Growth Regulators, Stem Cutting Growth

1. Introduction

Indonesia is a country with a tropical climate and very fertile soil, making land clearing relatively easy due to the suitable soil texture and supportive climate. Several types of plants thrive here, including the honey water apple (*Syzygium aqueum*), which grows widely throughout the country (Lase et al., 2023). The water apple was first discovered in the Karang Anyer area. This fruit is characterized by its sweet taste, with a Brix level ranging from 12 to 15, and its relatively large size, making the honey water apple a standout among tropical fruits. The fruit consists of approximately 93% water and contains vitamins A and C, which are beneficial for health(Asnawi, 2023). According to Emilda (2020), the nutritional content of 100 g of water guava includes 80 kJ of calories, 90% water, 0.3 g of fat, 8 mg of vitamin C, 1.9 g of fibre, 0.7 g of protein, 4.5 g of carbohydrates, and 253 IU of vitamin A.

The honey guava (*Syzygium aqueum*) is a new and superior commodity that is now widely cultivated by farmers in areas such as Danau Balai Village, Rantau Selatan District, Labuhanbatu Regency, North Sumatra Province. This honey guava has a distinctive bell-shaped form with reddish-tinged skin and a delightful taste. Each honey guava tree can produce 200–300 fruits annually, yielding a total weight of 30–40 kg per tree per year (Syariani, 2018).

High-quality guava fruit is typically produced from new branches that develop through pruning. Routine pruning is performed annually to encourage the tree to produce a new crown, which subsequently forms an ideal canopy and significantly influences the tree's yield (Oktavianto & Setiyono, 2022). The waste generated from pruning is often discarded; however, some use it as animal feed. Therefore, it is essential to optimize its utilization as a primary material for vegetative plant propagation. Efforts to develop fruit seedlings must be fully supported to produce high-quality, healthy, and superior seedlings that enhance crop production (Darmaji et al., 2023).

Water apple propagation can be done in two ways: generative and vegetative. Generative propagation is a method of plant propagation that uses seeds, whereas vegetative propagation utilizes parts of the plant itself, such

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as roots, shoots, leaves, stems, branches, or twigs (Siagian et al., 2020). Each has its advantages and disadvantages. For example, generative propagation has the advantage of having a strong root system, a longer productive period, more resistance to pests and diseases, easier propagation, and lower costs. At the same time, vegetative propagation has the advantage of using cuttings, which can produce plants that are exact replicas of the parent and flower and fruit more quickly. Typically, plants used for cuttings are sourced from healthy trees with clear origins, possess strong roots, and come from trees that have already borne fruit (Wayan Agus Wijana, 2021).

Cuttings are a vegetative propagation technique that involves cutting the vegetative part to be grown into a plant with the same characteristics as the parent (Ayyubi et al., 2019). Cuttings are taken from the middle or tip of the stem, where the stem is already a mix of brown and greenish. The cuttings must have a minimum of three segments or three buds, with a length of material of approximately 20 cm. The cutting must be even and cut the bark of the stem at the base, then apply ZPT to the base and the cut so that the plant can close the wound quickly (recover). Plant the cuttings in a suitable medium and position the stem upright so that the number of roots can grow more effectively (Hariyanti & Furoidah, 2024). Physiological problems that often cause failure in cuttings are inhibited callus and root formation due to low endogenous auxin activity in the stem tissue. Additionally, an imbalance between Auxin and cytokinin can trigger the dominance of shoot formation over root development, thereby reducing the success of cutting rooting.

Plant growth regulators (PGRs) are organic compounds that can stimulate roots at low concentrations. Organic PGRs can be obtained naturally, such as bean sprout extracts. Plant growth regulators are divided into several groups, namely Auxin, cytokinin, gibberellin, and ethylene. The use of PGRs will be effective at specific concentrations. However, if the concentration given is excessive, it can actually damage the cuttings because excessive plant cell division will occur, resulting in inhibited root growth (Lestari, 2011). The administration of bean sprout extract as a natural PGR increases the success of mulberry cuttings rooting compared to the control without PGR (Marlina & Syamsiah, 2024). Based on the above problems, the researcher will conduct a study on the Effect of Organic PGR Application from Mung Bean Sprouts Extract on the Growth of Stem Cuttings of Honey Water Apple Plants (*Syzygium aqueum*) in Danau Balai Village. The purpose of the study is to determine the effect of organic PGR application from sprout extract with various doses on the growth of water apple plants (*Syzygium aqueum*).

2. Material and Methods

2.1. Place and time of research

This research was conducted from January until completion and was located on Jl. Terubuk II, Danau Balai Village, Rantau Selatan District, Labuhanbatu Regency, North Sumatra Province, with coordinates 2°4′30″ N and 99°52′30″ E, with a surface height of 26 meters above sea level.

2.2. Materials and tools

The tools used include a hoe and shovel to prepare the planting medium, a container or bucket to soak the stem cuttings in the sprout extract solution, and labels or tape to mark each treatment. In addition, pruning shears or a knife are used to cut the stems, polybags or pots are used as containers for the planting medium, plastic is used to cover the top of the cut stems to maintain humidity, and a spray is used for regular watering. The materials used include stem cuttings from healthy honey guava plants that have already borne fruit, sprout extract rich in natural growth regulators (PGRs) such as Auxin to stimulate root and shoot growth, water to mix the sprout extract and soak the stem cuttings, and a planting medium in the form of soil or a sand mixture that serves as a place for the stem cuttings to grow. This combination of tools and materials ensures that the cutting process runs optimally, producing healthy and productive plants.

2.3. Research Implementation

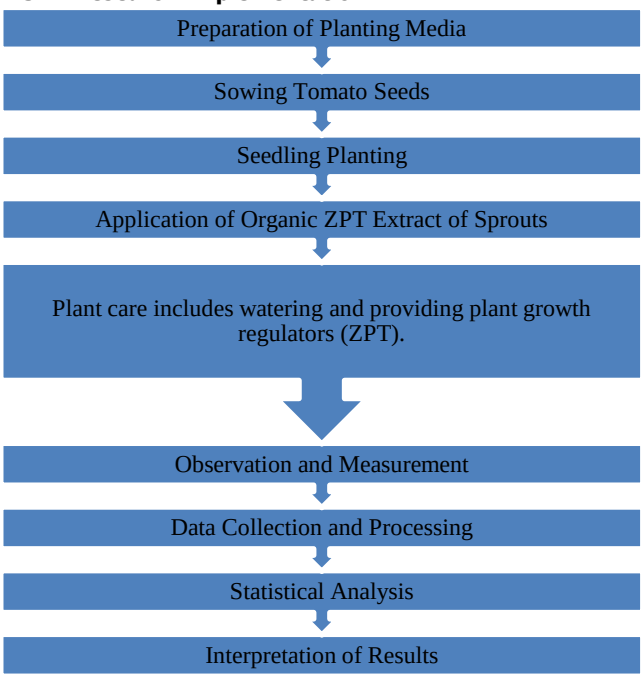

Figure 1. Research flow diagram

2.4. Research methods

This study used an experimental design, namely a completely randomized design (CRD) with one treatment factor, namely the provision of organic PGR from sprout extract, which consisted of several concentration levels: Control, 20 ml (organic PGR from sprout extract), 40 ml

(organic PGR from sprout extract), 60 ml (organic PGR from sprout extract).

Each treatment was repeated three times with 12 experimental samples in polybags, using a concentration of organic plant growth regulators (ZPT) from sprout extract.

2.5. Observation Parameters

height: growth in height of honey guava plants after being given PGR treatment.

Number of shoots or branches: observation of the number of shoots or branches that emerge from the stem cutting.

2.6. Data analysis

The data obtained will be analyzed using Analysis of Variance (ANOVA) to determine the differences between the treatments. If a significant difference is found, further testing will be conducted using the Least Significant Difference (LSD) test to determine which treatment yields the best results. The analysis will be carried out using SPSS version 25 software.

3. Results and Discussion

3.1. Plant height

Based on field observations and analysis of plant height data on guava plant growth with organic growth regulator treatment from mung bean sprout extract, the results are presented in Table 1.

Table 1. High Yield of Guava Plants with Organic PGR Treatment from Mung Bean Sprouts Extract

Treatment	Plant Height			
	1 MST	2 MST	3 MST	4 MST
Control	5.2±0.057d	6.1±0.057d	7.1±0.057d	8±0.057d
20 ml (Organic ZPT Sprouts Extract)	5.5±0.057c	6.63±0.088c	7.8±0.057c	9±0.057c
40 ml (Organic ZPT Sprouts Extract)	5.8±0.057b	7.2±0.057b	8.5±0.057b	10.1±0.057b
60 ml (Organic ZPT Sprouts Extract)	6.03 ±0.033a	7.5±0.057a	9±0.057a	10.8±0.088a

Description: Numbers followed by the same letter in the same factor column are not significantly different in the Duncan's distance test at level A=5% with 10 treatments and three replications.

Based on the results of observations of plant height from 1 to 4 weeks after planting, it can be seen that the 60 ml treatment (organic sprout extract PGR) consistently produced the highest growth compared to other treatments, with an average reaching 6.03 cm at 1 week after planting to 10.8 cm at 4 weeks after planting. In contrast, the control treatment showed the lowest growth in each week of observation, starting from 5.2 cm to only reaching 8 cm at 4 weeks after planting. These results indicate that the higher the treatment (for example, 60 ml (organic sprout extract PGR), the greater the effect on increasing plant height. Different letter notations (a, b, c, d) in each week of observation also confirm that the differences between the treatments are statistically significant. Thus, the 60 ml treatment (organic PGR extract from sprouts) proved to be the most effective in increasing plant height compared to other treatments. This study differs from that of Marliana et al. (2022), which showed that the higher the dose of organic PGR (sprout extract), the higher the plant height growth, with the highest dose (60 ml) being the most effective.

3.2. Number of Shoots

Based on field observations and data analysis of the growth of guava plants treated with an organic growth regulator from mung bean sprout extract, the results are presented in Table 2.

Table 2. Results of Data on the Number of Shoots

Treatment	Number of Shoots (Fruit)			
	1 MST	2 MST	3 MST	4 MST
Control	0a	1 ±0.57 d	1.33 ±0.33 d	2 ±0.33 d
20 ml (Organic ZPT Sprouts Extract)	0a	2 ±0.57 c	2 ±0.33 c	3 ±0.33 c
40 ml (Organic ZPT Sprouts Extract)	0a	2.33 ±0.57 b	3 ±0.33 b	4 ±0.33 b
60 ml (Organic ZPT Sprouts Extract)	0a	3 ±0.57 a	4 ±0.33 a	5 ±0.33 a

Description: Numbers followed by the same letter in the same factor column are not significantly different in the Duncan's distance test at level A=5% with four treatments and three replications.

Based on the observation of the number of shoots from 1 to 4 weeks after planting, it was noted that at 1 week after planting, all treatments had not shown any shoot growth (0 shoots). However, starting at 2 weeks after planting, significant differences between treatments were observed. The 60 ml treatment (organic sprout extract growth regulator) consistently showed the highest number of shoots from week to week, starting from 3 shoots at 2

weeks after planting and increasing to 5 shoots at 4 weeks after planting. This treatment obtained the letter notation "a," indicating a significant difference from other treatments. In contrast, the control treatment exhibited the lowest shoot growth, with only one shoot at 2 weeks after planting, and this number increased slowly to two shoots at 4 weeks after planting. Different letter notations for each week indicate a significant effect of the treatment on the number of shoots. These results indicate that the 60 ml treatment (organic sprout extract growth regulator) is the most effective in stimulating plant shoot growth.

3.3. Discussion

The observation results showed that the 60 ml (organic sprout extract PGR) treatment had the most significant effect on increasing plant height throughout all observation weeks. The average plant height in the 60 ml (organic sprout extract PGR) treatment continued to increase significantly, starting from 6.03 cm (1 week after planting) to 10.8 cm (4 weeks after planting), and was significantly different from the other treatments. This consistent growth indicates that the nutrients or treatment given in 60 ml (organic sprout extract PGR) were more optimally absorbed by the plants, thus supporting the process of photosynthesis and cell division optimally. In contrast, the treatment (control) consistently showed the lowest growth, ranging from 5.2 cm at 1 week after planting to 8 cm at 4 weeks after planting. This result indicates that without additional treatment, plants experience limitations in obtaining essential nutrients, such as nitrogen, phosphorus, and potassium, which play a crucial role in vegetative growth. The treatment of 20 ml (organic PGR of sprout extract) and 40 ml (organic PGR of sprout extract) showed better growth compared to the control, but remained below 60 ml (organic PGR of sprout extract), indicating a linear relationship between treatment intensity and growth results.

In terms of shoot number, the 60 ml (organic sprout extract) treatment also showed the best results. At 2 weeks post-plantation (WAP), 60 ml (organic sprout extract) had produced an average of 3 shoots, increasing to 5 shoots at 4 weeks post-plantation (WAP). This result indicates that the 60 ml (organic sprout extract) treatment not only promotes plant height growth but also stimulates the formation of new shoots, which are important during the vegetative phase. A significant difference is observed with the letter "a" notation at 60 ml (organic sprout extract), indicating that the treatment effect is statistically significant compared to other treatments. The control treatment again showed the lowest performance in terms of shoot number, reaching only two shoots at 4 weeks post-plantation (WAP). This result may occur due to a lack of essential nutrients that are necessary for plant physiological processes. The low number of shoots may indicate that the plant is experiencing nutritional stress, which inhibits the formation of new organs such as lateral shoots. Without additional input, the plant relies entirely on its soil reserves, which may not be sufficient to meet its needs during the growing period.

Several factors influence the variability in results, including the quality and type of treatment (e.g., fertilizer or hormones), the dosage administered, and the capacity of the planting medium to support nutrient absorption. A treatment of 60 ml of organic ZPT sprout extract may provide a sufficient amount of nitrogen to stimulate leaf and shoot growth, as well as accelerate stem elongation. Additionally, environmental factors such as lighting, temperature, and humidity can affect plant responses to these treatments. These findings suggest that a 60 ml treatment of organic sprout extract is highly recommended to promote optimal plant growth and increase shoot number. This result has important implications for plant cultivation management, particularly during the early growth phase. The study also confirmed that increasing the dosage or quality of treatment directly impacts plant morphological parameters. Therefore, selecting the proper treatment must consider the specific needs of the plant and the characteristics of the growing medium to achieve maximum results. This study aligns with Ramadhanti et al. (2024), which showed that bean sprout extract at a concentration of 20%, especially in combination with the "soil + compost" medium, produced the highest number and weight of pods per plant. This study differs from Zheng et al. (2016), which showed that excessively high concentrations can be toxic or inhibit growth.

Figure 2. Research documentation

4. Conclusion

The 60 ml treatment of organic sprout extract proved to be the most effective in promoting plant growth, resulting in an average height of 10.8 cm and 5 shoots at 4 weeks post-planting, compared to the control group, which reached only 8 cm in height and 2 shoots. These results indicate that the 60 ml treatment significantly accelerated growth and stimulated shoot formation compared to the other treatments.

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