

Growth Response of Lime (*Citrus Aurantifolia*) Cuttings at Origin Different Parts of Cuttings and Providing Natural ZPT on Shallots

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ABSTRACT

This research was carried out in Binjai Serbangan, Air Joman District, Asahan Regency. The research was carried out from February to May 2022. The aim of the research was to determine the response of the growth of citrus cuttings to the origin of different cuttings and the natural ZPT of shallots.

This research used a factorial randomized block design (RAK) with two factors, namely: (1) Origin of cuttings (A) consisting of 3 levels, namely: A1 = shoot part, A2 = middle part, A3 = base part (2) Onion Extract Red (B), namely: B0 = 0%, B1 = 25%, B2 = 50%, B3 = 75%. The observation parameters carried out were the percentage of growth, age at emergence of shoots, number of shoots, height of shoots.

The results showed that the origin of the cuttings had a significant effect on the number of shoots and shoot height at 6 mst. But on the percentage of growth, the age at which shoots appeared had no significant effect. The best treatment is in A2 = middle part. The concentration of shallot extract had a significant effect on the height of shoots aged 6 WAP. However, the percentage of growth, the age at which shoots appeared and the number of shoots had no significant effect. The best treatment is B3 = 75%. The interaction between the origin of the cuttings and the concentration of shallot extract had no significant effect on all parameters.

Keywords: Lime, Cuttings, Shallots, Origin of the Cuttings

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INTRODUCTION

Oranges (*Citrus Sp*) are one of the local fruits originating from Indonesia. This plant is often found in the territory of our country, Indonesia. There are various kinds or types found in Indonesia, such as sweet oranges, chili oranges, limes, grapefruits, and others. This fruit can grow in the lowlands and even the highlands.

Lime (*Citrus aurantifolia* Swingle) is an annual plant originating from Southeast Asia, since hundreds of years ago, this plant has been found in Indonesia as a wild plant and as a garden plant. Lime (*Citrus aurantifolia* Swingle) is a type of citrus that has a wider variety of uses compared to other citrus, so this citrus is often used by consumers. The need for

fruit, such as oranges, continues to increase in line with increasing population, people's income levels, and increasing public awareness about the importance of nutritious food. The need for citrus fruit also tends to increase with advances in technology and knowledge that make it possible to process a wider variety of fruits. This means opening up good opportunities for farmers (Arifin, 2020) .

Lime can be propagated generatively or vegetatively. Generative propagation of this plant can be done through seeds, while vegetative propagation is done by grafting, grafting and cuttings. Cuttings is a method of plant propagation by using vegetative parts of plants which are separated from the mother plant which, when planted in favorable conditions, will develop into plants that are able to grow well. The advantage of vegetative propagation by cuttings is that a large number of new plants are obtained in a relatively short time, besides that you can obtain the same characteristics as the parent. The success of propagation by cuttings is influenced by environmental factors including light, humidity and temperature. In addition, the next determining factor is a growth regulator (Anto Jeruk-Converted, nd)

The success of using ZPT for cuttings propagation is influenced by the concentration and length of time the cuttings are immersed in the solution. The soaking time must be adjusted to the concentration of the solution used. At high concentrations, soaking is done in a short time, but at lower concentrations it takes a longer time. Soaking must be done in a shady and humid place so that ZPT absorption runs smoothly (Kusdianto 2012, 2012).

Shallots contain the hormone auxin which can stimulate root growth in plant cuttings. In addition, the crushed shallots will form allithiamin compounds. This compound can function to facilitate metabolism in plant tissues and can act as a fungicide and bactericide (Wibowo, 1988) in (Ramadhani et al., 2016).

The indicator of the success of grafting is the growth of roots. If the roots grow quickly, it really supports the cuttings in getting a source of nutrition for growth. During the planting process, we can speed up root growth by providing a spur substance, namely growth hormone or Growth Regulatory Oxygen (ZPT). ZPT acts as a biocatalyst that accelerates the synthesis of compounds in cells and uses available reserves in the formation of new plant organs. Giving growth hormones when cutting leaves or making Sansevieria cuttings aims to grow lots of roots in a fairly short or fast time. Red onion bulbs (*Allium ascalonicum*) contain growth hormone, namely the hormone auxin, which can stimulate root growth in plant cuttings. Generally, the auxin hormone is found in the shoots, tops of plants, young leaves, fruit, and leaf axils of a plant (Thahir et al., 2021)

The aim of this research was to determine the growth response of different stem parts to the application of shallot ZPT. Research Hypothesis, There is an influence of the origin of the cuttings on the growth of lime cuttings (*Citrus aurantifolia*), There is an effect of giving natural ZPT of shallots on the growth of lime (*Citrus aurantifolia*) cuttings. There is an interaction of the origin of the cuttings with the application of natural PGR to lime cuttings (*Citrus aurantifolia*).

METHODS

This research was carried out in Binjai Serbangan, Air Joman District, Asahan Regency, with flat topography and a height of ± 17 m above sea level. This research was carried out from February 2022 to April 2022. The materials used are lime stems, natural ZPT (shallots), and planting media (top soil and rice husk charcoal), with a ratio of 75: 25%, poly bag measuring 10 cm x 15 cm. The tools used are: soil processing tools (hoes, saws, using plastic knives, hammers, machetes, buckets), measuring and calculating tools (meters, rulers, calipers, etc.), sample plant signs, treatment signs, research signs and hood shade .

The design used in this research was a factorial randomized block design (RAK) with two factors, namely:

1. Origin of Cuttings (A) consists of 3 levels, namely:

A₁ = Top Section

A₂ = Middle Section

A₃ = Base Section

2. Natural ZPT (Shallots) consists of 3 levels, namely:

B₀ = Control

B₁ = 25% (250 ml of onion extract red + 750 ml water)

B₂ = 50% (500 ml onion extract red + 500 ml water)

B₃ = 75% (750 ml onion extract red + 250 ml water)

Total replications 3, plants per plot 4 plants, sample plants per plot 2 plants, total research plots 36 plots, total sample plants 77 plants, total plants 144 plants.

The research data were analyzed using *Analysis of Variance (ANNOVA)* and continued with the *Duncan's Multiple Range Test (DMRT)* mean difference test.

The linear model for the Factorial Randomized Block Design is as follows:

$$Y_{ijk} = \mu + \alpha_i + A_j + B_k + (AB)_{jk} + \Sigma_{ijk}$$

RESEARCH RESULT

1. Growing Percentage

The results of the analysis of variance showed that the origin of the cuttings had no significant influence on the observed growth percentage. The onion extract treatment had no significant effect on the growth percentage. Likewise, the interaction between the origin of the cuttings and the shallot extract had no significant influence on the growth percentage of lime cuttings.

The results of the average difference test on the origin of the cuttings with shallot extract on the percentage of growth of lime cuttings can be seen in Table 1 below.

Table 1. Average Growth Percentage (%) of Lime Cuttings against the Origin of Cuttings and Red Onion Extract

A/B	B ₀	B ₁	B ₂	B ₃	Average
A ₁	83.33	83.33	83.33	83.33	83.33
A ₂	100.00	83.33	100.00	83.33	91.67
A ₃	66.67	100.00	100.00	100.00	91.67
Average	83.33	88.89	94.44	88.89	

Table 1 shows that the percentage of growing lime cuttings to the origin of the cuttings had no significant effect. Visually, the highest growing percentage was in treatment A₂ = middle and A₃ = base, namely 91.67%. In the shallot extract treatment, it showed no significant effect on the growing percentage of lime cuttings. Visually, the highest growth percentage was found in B₂ = 50%, namely 94.44%.

2. Age of Shoots Appear

The results of the analysis of variance showed that the origin of the cuttings had no significant effect on the observed age of shoot emergence. The shallot extract treatment had no significant effect on the age of shoot emergence. Likewise, the interaction between the origin of the cuttings and shallot extract had no significant effect on the age at which lime cuttings emerged.

The results of the mean difference test on the origin of the cuttings with shallot extract on the age of emergence of lime cuttings shoots can be seen in Table 2 below.

Table 2. Average Age of Shoots Emergence (days) of Lime Cuttings on the Origin of Cuttings and Shallot Extract

A/B	B ₀	B ₁	B ₂	B ₃	Average
A ₁	14.33	15.33	15.00	14.67	14.83
A ₂	15.00	15.00	14.67	14.67	14.83
A ₃	14.00	15.00	14.33	14.67	14.50
Average	14.44	15.11	14.67	14.67	

Table 2 shows that the age at which shoots emerge from lime cuttings on the origin of the cuttings has no real influence. Visually, the age at which shoots emerge the fastest is in treatment A₃ = base part, namely 14.5 days. The red onion extract treatment showed no significant effect on the age at which lime cuttings emerged. Visually, the fastest shoot emergence age was B₀ = 0%, namely 14.44 days. The interaction between the origin of the cuttings and the shallot extract had no significant influence on the age at which shoots emerged, the visual age at which shoots emerged the fastest was A₃ B₀ = 14 days.

3. Number of Shoots

The results of the analysis of variance showed that the origin of the cuttings had a real influence on the observation of the number of shoots aged 6 WAP. The onion extract treatment had no significant effect on the number of shoots. The interaction between the origin of the cuttings and the red onion extract had no significant effect on the number of shoots from lime cuttings.

The results of the mean difference test on the origin of the cuttings with shallot extract on the number of shoots of lime cuttings aged 6 WAP can be seen in Table 3 below.

Table 3. Average Number of Shoots (shoots) of Lime Cuttings aged 6 mst against the Origin of Cutting Parts and Red Onion Extract

A/B	B ₀	B ₁	B ₂	B ₃	Average
A ₁	3.43	3.22	3.50	3.18	3.33 b
A ₂	3.68	3.65	3.75	3.52	3.65 a
A ₃	3.60	3.38	3.67	3.88	3.63 ab
Average	3.57	3.42	3.64	3.53	

Note: Numbers followed by different letters in the same column are significantly different according to DMRT at the 5% level

From Table 3, it shows that the origin of the cuttings has a significant influence on the number of shoots from lime cuttings aged 6 WAP, where the highest number of shoots was found in treatment A₂ = middle part (3.65 shoots) which was not significantly different from A₃ = base part (3.63 cm). and A₁ = shoot part (3.33 shoots). The onion extract treatment showed no significant effect on the number of shoots, visually the highest number of shoots was found in treatment B₂ = 50% (3.64 shoots).

The relationship between the origin of the cuttings and the number of shoots of lime cuttings aged 6 days after planting is presented in Figure 1 below.

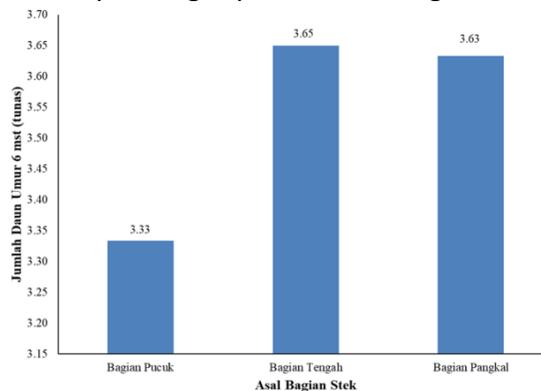


Figure 1. Diagram of the relationship between the origin of the cuttings and the number of shoots

Figure 1 shows that the largest number of shoots is found at the origin of the middle cuttings with a number of cuttings of 3.65 shoots, followed by the origin of the base cuttings with a number of cuttings at 3.63 shoots and the lowest number of cuttings is found

at the origin of the shoot cuttings.

4. Shoot Height

The results of the analysis of variance showed that the origin of the cuttings and the onion extract had a real influence on the observation of shoot height at 6 days after planting. The interaction between cuttings and shallot extract had no significant effect on the height of lime cuttings.

The results of the average difference test on the origin of the cuttings with shallot extract on the shoot height of lime cuttings aged 6 days can be seen in Table 4 below.

Table 4. Mean Shoot Height (cm) of Lime Cuttings aged 6 mst to the Origin of Cuttings and Shallot Extract

A/B	B ₀	B ₁	B ₂	B ₃	Average
A ₁	17.93	17.20	17.88	19.40	18.10 b
A ₂	18.25	20.08	19.48	20.20	19.50 a.m
A ₃	18.17	18.88	19.42	20.13	19.15 ab
Average	18.12c	18.72b	18.93b	19.91a	

Note: Numbers followed by different letters in the same column are significantly different according to DMRT at the 5% level

Table 4 shows that the origin of the cuttings has a significant influence on the shoot height of lime cuttings aged 6 WAP, where the highest shoot height was found in treatment A₂ = middle part (19.50 cm) which was not significantly different from A₃ = base part (19.15 cm). and A₁ = shoot part (18.10 cm). The onion extract treatment showed a significant effect on shoot height, where the highest shoot height was found in treatment B₃ = 75% (19.91 cm), significantly different from B₂ = 50% (18.93 cm) B₁ = 25% (18.72 cm) and B₀ = 0% (18.12 cm). The interaction between the origin of the cuttings and the shallot extract had no significant effect on shoot height, the highest visual shoot height was A₃ B₃ = 20.13 cm.

The relationship between the origin of the cuttings and the shoot height of lime cuttings aged 6 WAP is presented in Figure 2 below.

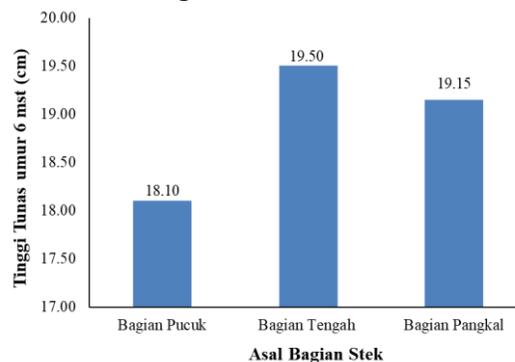


Figure 2 . Relationship diagram of the origin of cuttings and shoot height

Figure 2 shows that the highest shoot height is found at the origin of the middle cuttings with a cutting height of 19.50 cm, followed by the origin of the base cuttings with a cutting height of 19.15 cm and the lowest cutting height is at the origin of the shoot cuttings, namely 18.10 cm.

The relationship between the concentration of shallot extract and the height of lime cuttings aged 6 WAP is presented in Figure 3 below.

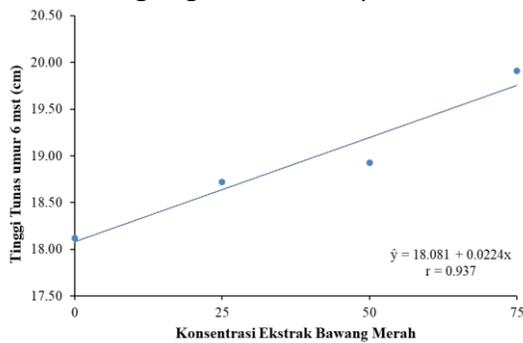


Figure 3 . Graph of Relationship between Shallot Concentration and Shoot Height

Figure 3 shows that the shoot height of lime cuttings will increase as the concentration of shallots given to the concentration solution increases. In the graph, it can be seen that there is a positive linear relationship with the regression equation $\hat{y} = 18.081 + 0.0224x$ and the value of $r = 0.937$.

DISCUSSION

Effect of Origin of Cuttings on the Growth of Lime (*Citrus aurantiifolia*) Cuttings

Based on the results of statistical analysis, it shows that the origin of the cuttings has a real influence on the number of shoots and shoot height at 6 days after planting. But on the percentage of growth, the age at which shoots appeared had no significant effect.

The real influence given by the origin of the part of the cuttings used is thought to be because this section is a good place to store food reserves. In this study, the best part was found at the origin of the middle part of the cutting. According to Khairatih *et al.*, (2019) branch cuttings originating from the center of the stem have a balance between carbohydrates and growth hormones which can push the roots out, so that the nutritional needs in the growth of cuttings are sufficiently available. According to Roja (2009), cuttings from the middle stem are quite good because they contain sufficient food reserves.

According to Agustin (2017) the middle material has more and more balanced food supplies (carbohydrates and nitrogen). High carbohydrate and nitrogen supply is better than cuttings which have low carbohydrate and nitrogen supply because it initiates roots more quickly and the percentage of rooted cuttings is higher and root production will be more.

The treatment of the position of the branches originating from the tip of the stem

is not optimal for growth, this is due to the difference in the position of the nodes on the stem where the water content will decrease with increasing age of the bamboo. The base has a lower water content than the tip of the stem, but the cells at the tip are still relatively young so that the growth of the cuttings is not optimal.

Branch cuttings originating from the base have old tissue which makes it difficult to take out roots, as well as successful growth of branch cuttings originating from the tip where growth is not optimal because it has young tissue (Putra et al., 2014). According to Sukarman et al. (2002), cuttings originating from the tip have cells that are still young and have relatively lower carbohydrate reserves which affect the level of stem hardness, thereby influencing the percentage of success in growing the cuttings.

The Effect of Shallot Concentration on the Growth of Lime (*Citrus aurantiifolia*) Cuttings

Based on the results of statistical analysis showed that the concentration of shallots had a significant effect on shoot height at 6 WAP. However, the percentage of growth, the age at which shoots appeared and the number of shoots had no significant effect.

The real effect given by the concentration of shallots on shallots is suspected because shallots contain the hormone auxin which can accelerate plant growth. Auxin is a growth regulator that plays a role in the process of cell elongation, stimulates root growth, inhibits the growth of lateral shoots, prevents leaf and fruit abscission (Siskawati *et al.*, 2013). According to Sofwan *et al.*, (2018) shallots contain the hormone auxin which can stimulate root growth in plant cuttings. In addition, in crushed shallots the compound allithiamin will be formed. This compound can function to facilitate metabolism in plant tissues and can act as a fungicide and bactericide.

The use of shallot extract is more profitable because it makes it easy for farmers to obtain practical ZPT from environmentally friendly natural resources. Setyowati (2004), reported that giving red onion with a concentration of 75% gave the best results for the growth of root length, shoot length and number of shoots on honey guava cuttings. Muswita (2011) reported that a concentration of 1.0% shallots was the optimal concentration for the percentage of live cuttings and a concentration of 0.5% for the number of roots of gaharu cuttings. The results of Utami's research (2016) also showed that shallot extract had a significant effect on shoot length, number of leaves, greenness of leaves and dry weight of shoots on plant cuttings.

Interaction of Origin of Cuttings and Shallot Extract Concentration on the Growth of Lime (*Citrus aurantiifolia*) Cuttings

Based on the results of the analysis of variance, it was shown that the interaction between the origin of the cuttings and the concentration of shallot extract had no significant effect on all observed parameters, namely growth percentage, age of shoot emergence, number of shoots and shoot height.

This unreal response is thought to be because each treatment factor at the treatment level does not interact with each other. However, when the two of them meet,

the treatment becomes unbalanced. Two factors are said to interact if the effect of a treatment factor changes when the level of the other treatment factor changes (Gomez and Gomez, 1995), then it is stated that if the effect of the interaction is not significantly different then it is concluded that the treatment factors act independently of one another (Steel and Torrie , 1991).

According to Dwidjoseputro (1994) states that good growth can be achieved if the factors surrounding the plantation affect balanced and mutually beneficial growth. If one of the factors does not give and take, this factor can suppress or inhibit the growth of the plant.

According to what was stated by Sutedjo and Kartosapoetra (1987) that, if one factor has a stronger influence than other factors, then these other factors will be covered, and each factor has properties that are far more influential than the nature of its work, then it will produce an influential relationship. in influencing the growth of a plant.

Although statistically the interaction of the two treatments has not shown a significant effect, visually the effect of the origin of the cuttings and the concentration of shallots gave a good response to the growth of lime cuttings .

CONCLUSIONS

The origin of the cuttings has a real influence on the number of shoots and shoot height at 6 days after planting. However, on the growth percentage, the age at which shoots emerge has no real influence. The best treatment is found in A_2 = middle part.

The concentration of shallot extract had a significant effect on the height of shoots aged 6 WAP. However, the percentage of growth, the age at which shoots appeared and the number of shoots had no real influence. The best treatment is B_3 = 75 %

The interaction of the origin of the cuttings and the concentration of shallot extract had no significant influence on all parameters

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