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The Effect of Concentration and Soaking Time on The Shallots Exract Against The Growth of Stem Cuttings Dersono Guava (*Syzigium Malaccense*)

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ABSTRACT
The purpose of the research to determine the effect of shallot extract concentration and soaking duration on the growth of stem cuttings of water apple (Syzygium malaccense), observed through shoot number, leaf number, and shoot emergence time over four weeks. A 4 × 3 factorial randomized block design with five replications was applied. The results showed that the combination of shallot extract treatments had a highly significant effect on all variables. The best outcome was obtained from the 80% concentration with 4-hour soaking (K2L2), which produced the highest average number of shoots (11.8), leaves (16.6), and the fastest shoot emergence (0.4–0.6 weeks). In contrast, excessively high concentrations (100%) tended to inhibit growth, likely due to phytotoxic effects. Natural auxins and cytokinins in shallot extract played an important role in stimulating cell division and vegetative growth. These findings indicate that shallot extract can be used as an effective natural alternative to synthetic growth regulators for vegetative plant propagation.

Keywords: *Stem cuttings, shallot extract, Syzygium malaccense.*

INTRODUCTION
The demand for dersono guava (*Syzygium malaccense*) is increasing in the domestic market, especially in urban areas, because this fruit is rich in nutrients such as fiber, potassium, phosphorus, as well as vitamin A, B1, C, and other bioactive compounds (Firdaus et al., 2022). As an annual fruit plant that comes from tropical areas such as Indonesia, guava dersono has a high potential to be developed. However, plant propagation through seeds takes a long time to bear fruit, which is about 3 to 5 years, and produces plants that do not necessarily have superior properties from their parents.

To overcome these obstacles, vegetative propagation methods such as stem cuttings become an effective solution because they are able to produce plants with identical properties and a faster harvest period. However, the success of cuttings is highly dependent on supportive treatment, one of which is the use of growth regulators (ZPT). Auxin is one of the important ZPT in stimulating the growth of roots and buds in cuttings.

Shallots are known to contain natural ZPT in the form of auxin and cytokinin, especially in the young shoots, such as Indole Acetic Acid (IAA) compounds that play a role in cell division and elongation (Tania et al., 2023; Pamungkas & Puspitasari, 2018). Therefore, the use of shallot extract as a natural ZPT becomes an environmentally friendly alternative to stimulate the vegetative growth of dersono guava stem cuttings. The purpose of the research to evaluate the effect of the concentration and duration of soaking shallot extract on the growth of dersono guava plant cuttings.

METHOD
This research was carried out in an experimental garden located in Rejosari Hamlet, Tinggar Village, Bandarkedungmulyo District, Jombang Regency, East Java, from February to March 2025. The materials used in this study include 70 stems of dersono guava stem cuttings measuring ±20 cm, shallot extract, and planting media in the form of soil. The tools used include sterile knives, polybags, measuring cups, stationery, rulers, labels, and mobile phone cameras.

In this study, the design used is the Group Random Design (RAK) of the 4 × 3 factorial pattern with five repetitions. The first factor is the concentration of shallot extract which consists of four levels: 0% (K1), 80% (K2), 90% (K3), and 100% (K4). The second factor is the soaking time of the cuttings, which is 3 hours (L1), 4 hours (L2), and 5 hours (L3). Thus, there are 12 combinations of treatments that are repeated five times each, resulting in a total of 60 experimental units, and each unit consists of one cutting.

The research procedure begins with the selection of healthy and medium-aged cuttings, then cut to a length of ±20 cm and the bottom is cut at an angle. The leaves on the stem are removed to reduce evaporation. Shallot extract is made by pureing fresh shallots using a blender, then filtering to obtain the extract without pulp. Soaking is done at the base of the cuttings (3–5 cm) into the extract solution according to the treatment for 3, 4, or 5 hours, while the control is soaked in plain water.

After soaking, the cuttings are planted in a planting medium (a mixture of soil, sand, and compost with a ratio of 1:1:1) that has been put into a polybag. The cuttings are then treated with regular watering and placed in a shady location. Observations are carried out every week on three main parameters: the number of shoots, the number of leaves, and the time of sprouting. The number of buds is calculated based on the buds that grow from the leaf axils or the tip of the stem, the number of leaves is calculated on the leaves that have opened completely, and the time of sprouting is calculated in weeks after planting (WAP).

The data obtained is analyzed using Excel software. Next, the data is analyzed using a 4 × 3 factorial ANOVA, and if there is a real difference between the treatments, further tests are carried out with the BNT method at the level of 5%.

RESULT AND DISCUSSION

Result

Observation of the concentration and duration of soaking shallot extract on the growth of dersono guava stem cuttings is observed by counting the number of leaves and the number of buds and the time of emergence of dersono guava plant buds which are treated at 1 WAP, 2 WAP, 3 WAP and the last observation at 4 WAP.

Picture 1 picture of each treatment

Description :
Main treatment : K1= 0% concentration, K2= 80% concentration, K3= 90% concentration, K4= 100% concentration.
Special treatment : L1= soaking time 3 hours, L2= 4 hours of soaking time, L3= soaking time 5 hours.

- Results of Observation of the Number of Buds (1–4 WAP)

Table 1 Average table of the number of buds of darsono guava plant towards the application of concentration and soaking time of shallot extract

Treatment	1 WAP	2 WAP	3 WAP	4 WAP
K1L1	0,4	4,4	4,4	4,4
K1L2	1,6	4,8	4,4	4,8
K1L3	2	3,8	3,8	3,8
K2L1	7,2	7,8	7,8	7,8
K2L2	6,8	7	7,4	7,4
K2L3	5,6	5,8	6,6	6,6
K3L1	5,8	6,8	7,2	7,2
K3L2	5,2	5,4	5,2	5,2
K3L3	4,4	4,2	4	4
K4L1	3,4	3,2	2,2	2,2
K4L2	3,8	3,2	2,8	2,8
K4L3	1,4	2,6	2	2
Information	**	**	**	**

Treatment description: K= Concentration of shallot extract, L= Soaking Time of shallot extract
Information : nt = Not real, *= Real difference, **= very real difference

Numbers followed by different letters in the same column show a real difference based on the BNT test at the 5% level.

The growth in the number of buds began to be seen from the first week on the treatment using shallot extract, especially K2L1 (80%, 3 hours), with an average of 4.0 buds. Control treatment (K1) shows the lowest results. In the second week, K2L1 again recorded the highest number of buds (7,2 buds), followed by K3L1 and K2L2. ANOVA and BNT tests show that the effect of the treatment is very real (**). The improvement continued in the third week, where K2L2 (80%, 4 hours) produced an average of 10.6 buds, the highest of all treatments. Until the fourth week, K2L2 still showed the best results with an average of 11.8 buds, followed by K2L1 (11,6) and K3L1 (11,4). This result shows that the combination of 80% concentration and 3-4 hours of soaking consistently provides the growth of the highest and most significant number of buds.

- Observation Results of the Number of Leaves (1–4 WAP)

Table 2 Average table of the number of leaves of darsono guava plant against the application of concentration and soaking time of shallot extract

Treatment	1 WAP	2 WAP	3 WAP	4 WAP
K1L1	0	7,2	11,2	11,2
K1L2	0	6,2	8,6	10
K1L3	0	3,6	5,6	8,2
K2L1	0	10,8	14	15,2
K2L2	0	9,8	14,2	16,6
K2L3	0	7,8	12,8	14
K3L1	0	9,2	10,8	12,6
K3L2	0	6,2	7,2	8,8
K3L3	0	3	5,6	8
K4L1	0	3,4	3,4	4,4
K4L2	0	3,8	3,8	5,6
K4L3	0	3,4	3,4	4
Information	NT	**	**	NT

Treatment description: K= Concentration of shallot extract, L= Soaking Time of shallot extract
Information : nt = Not real, *= Real difference, **= very real difference

Numbers followed by different letters in the same column show a real difference based on the BNT

test at the 5% level.

In the first week (1 WAP), all treatments have not shown leaf growth because the plant is still adapting and focusing energy on the formation of roots and early shoots. Leaf growth begins to appear in the second week. K2L1 treatment (80%, 3 hours) recorded the highest number of leaves (10,8 strands), followed by K2L2 (9.8 leaves). The BNT test shows a very real effect between treatments. The third week showed a sharp increase, with K2L2 (80%, 4 hours) producing an average of 14.2 leaves, being the highest, along with an increase in the number of shoots. In the fourth week, K2L2 again became the best treatment with an average of 16.6 leaves. However, this week's BNT test showed no real difference (TN) between treatments, possibly due to uniform environmental factors or natural plant variations.

- Observation Results of the Time of Sprouting (1–4 WAP)

Table 3 Table of the average time of emergence of darsono guava plant buds against the application of concentration and the duration of soaking shallot extract

Treatment	1 WAP	2 WAP	3 WAP	4 WAP
K1L1	0,2	1	1	1
K1L2	0,4	1	1	1
K1L3	0,6	1	1	1
K2L1	1	1	1	1
K2L2	1	1	1	1
K2L3	1	1	1	1
K3L1	1	1	1	1
K3L2	1	1	1	1
K3L3	1	1	1	1
K4L1	1	1	1	1
K4L2	1	1	1	1
K4L3	0,6	1	1	1
Information	**	**	**	

Treatment description: K= Concentration of shallot extract, L= Soaking Time of shallot extract
Information : nt = Not real, *= Real difference, **= very real difference

Numbers followed by different letters in the same column show a real difference based on the BNT test at the 5% level.

In the first week (1 WAP), the difference in the time of emergence of buds between treatments is very visible. The treatment of K2, K3, and K4 shows the time when the buds appear the fastest (average 1.0), meaning the buds have appeared before one week. On the other hand, the control (K1) experienced the slowest emergence of shoots (an average of 0.2–0.6 weeks). ANOVA and BNT test results show a very real influence between treatments (notation "" in Table 4.3**). Starting from the second week to the fourth week, all treatments show a fixed average value of (1.0), which means all the buds have appeared since the first week. K2L1 and K2L2 treatment is the most effective combination in accelerating the emergence of buds.

Discussion

- Number of buds

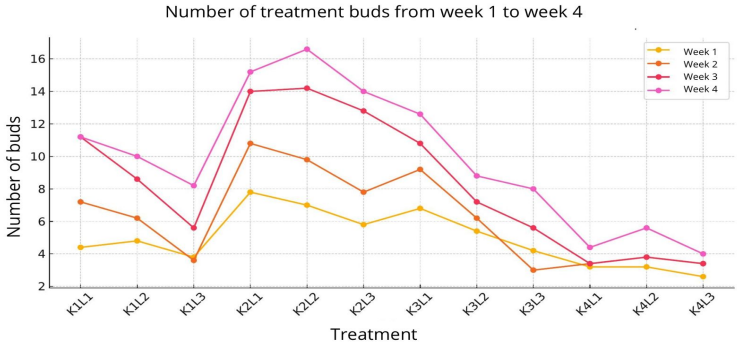

Figure 1. Number of buds

Figure 1 shows a graph of the growth of the number of buds of dersono guava cuttings from the first week to the fourth week. It is seen that K2L2 treatment (80% concentration, 4 hours immersion) produces the highest number of buds, which is an average of 11.8 buds in the fourth week. This result shows that the combination is most effective in stimulating vegetative growth.

This increase in the number of buds is suspected to be due to the natural phytohormone content such as auxin and cytokinin in shallots that accelerate cell division and growth point activation. This result is in line with the research of (Nurkholiza et al., 2020), and (Mayasari et al., 2012), which shows that shallot extract is able to increase the number of buds on various types of plants. Meanwhile, K1 (control) and K4 (100%) treatments showed the lowest results, suspected due to the absence of ZPT (control) or phytotoxic effects at too high concentrations (Susanti et al., 2022).

Thus, the use of shallot extract at a medium concentration (around 80%) with 4 hours of soaking is the most effective treatment in increasing the number of dersono guava cuttings.

- Number of Leaves

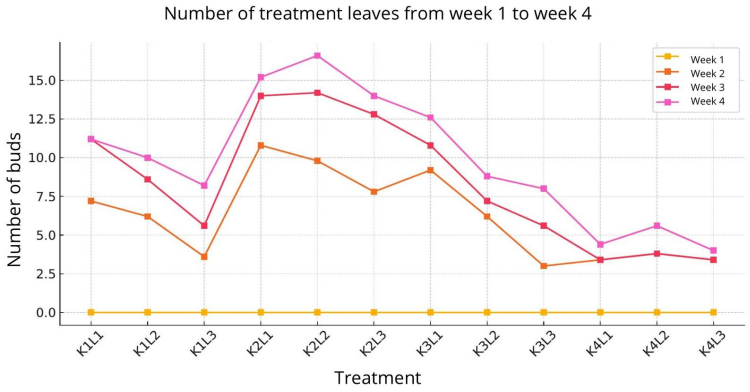

Figure 2. Number of leaves

Figure 2 shows a graph of growth in the number of leaves of dersono guava cuttings from the first week to the fourth week. Observation results show that K2L2 treatment (80% concentration, 4 hours of soaking) gives the highest results, which is an average of 16.6 leaves in the fourth week.

The increase in the number of leaves begins to appear from the second week, along with the active growth of buds. The content of cytokinine and auxin in shallot extract is believed to accelerate cell division, leaf morphological development, and photosynthesis activity.

This research is supported by (Budiasih et al., 2025) who found an increase in leaves in lettuce. Other research by (Irmayanti et al., 2023) and (Mayasari et al., 2012) also showed an increase in the number of leaves with shallot extract. On the other hand, control (K1) and K4 treatment (100%) showed lower results, allegedly due to excess hormones that inhibit growth.

- When Buds Appear

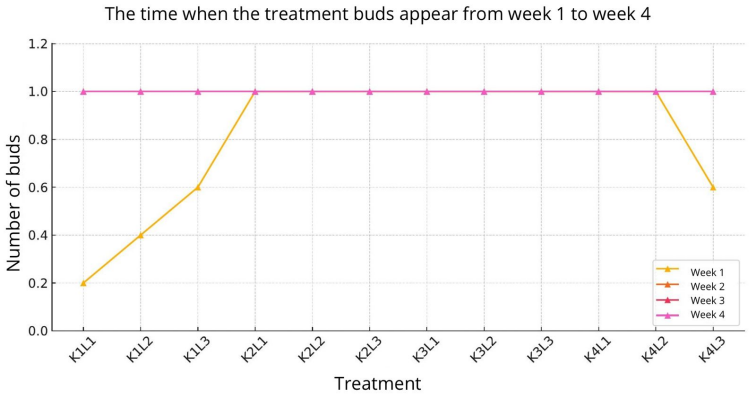

Figure 3. When buds appear

Figure 3 shows a graph of the time when the buds of dersono guava cuttings appear during the observation period. K2L2 and K3L2 treatment (80% concentration and 90% with 4 hours of soaking) shows the time for the earliest shoots to appear, which is about 0.4–0.6 weeks from planting. This shows the effectiveness of the combination in accelerating the activation of growth points.

This acceleration is thought to be due to the content of auxin and cytokinin in shallot extract which stimulates cell division and bud organogenesis. This finding is reinforced by the research of (Nurkholiza et al., 2020), and (Malikatussakdiyah et al., 2024), which shows that shallot extract with moderate concentration is able to accelerate the emergence of buds. On the other hand, control treatment (K1) and K4 (100%) showed buds that appeared more slowly, suspected to be due to hormonal imbalance or physiological stress.

CONCLUSIONS

The study on the effects of concentration and soaking duration of shallot extract on the growth of *Syzygium malaccense* stem cuttings concluded that both factors significantly influenced shoot growth, leaf growth, and the speed of shoot emergence. The best results were obtained with the K2L2 treatment (80% concentration, 4-hour soaking), producing the highest average number of shoots (11.8) and leaves (16.6) by week 4, indicating this combination as the most effective for early vegetative growth. Faster shoot emergence occurred at 80% and 90% concentrations, with shoots appearing as early as week 1, while the control (K1) and the highest concentration (K4) showed slower growth or fewer shoots. Overall, the presence of natural phytohormones in shallot extract played a key role in stimulating shoot and leaf development in S. malaccense cuttings.

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