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# Germination of Salak (*Salacca Zalacca)* Seeds with Chemical Scarification Treatment

Perkembangan Biji Salak (Salacca Zalacca) dengan Perlakuan Skarifikasi Kimia

**Elda Sari Siregar*, Amir Mahmud, Rafiqah Amanda Lubis, Muhammad Agung Permadi, Ramadhan Syaputra Dly**

Department of Agrotechnology, Faculty of Agriculture, Universitas Muhammadiyah Tapanuli Selatan

*Corresponding author: eldasarisiregar@gmail.com

***ABSTRACT***

*To get salak seeds that can produce, it is done generatively (zalacca seeds) and vegetatively (saplings). Several treatments can be given to the seeds, so that the level of dormancy can be lowered and the percentage of germination remains high. Dormancy in salak seeds can be overcome by chemical scarification treatment.This study aims to determine the effect of $KNO_3$, $H_2SO_4$, and $GA_3$ in breaking dormancy and germination of salak (Salacca zalacca) plants. In this study using a non-factorial randomized block design with one factor, namely $P_0$ (control), $P_1$ ($KNO_3$ 60%), $P_2$ ($KNO_3$ 70%), $P_3$ ($KNO_3$ 80%), $P_4$ ($H_2SO_4$ 60%), $P_5$ ($H_2SO_4$ 70%), $P_6$ ($H_2SO_4$ 80%), $P_7$ ($GA_3$ 25 ppm), $P_8$ ($GA_3$ 50 ppm), $P_9$ ($GA_3$ 75 ppm), $P_{10}$ ($KNO_3$ 60% and $GA_3$ 25 ppm), $P_{11}$ ($KNO_3$ 70% and $GA_3$ 50 ppm), $P_{12}$ ($KNO_3$ 80% and $GA_3$ 75 ppm), $P_{13}$ ($H_2SO_4$ 60% and $GA_3$ 25 ppm), $P_{14}$ ($H_2SO_4$ 70% and $GA_3$ 50 ppm), $P_{15}$ ($KNO_3$ 60% and $GA_3$ 75). Parameters observed were germination, maximum growth potential, plant height, number of leaves, leaf length, and leaf width. Based on the results of the DMRT test at 5% level, it showed that each treatment had an effect on the chemical scarification treatment showing a significant effect on germination, maximum growth potential, plant height, number of leaves, leaf length, and leaf width. However, it did not have a significant effect on the number of leaves at 12 WAP, leaf width at 11 and 12 WAP.*

***Keywords:*** *Salak Seed, Chemical Scarification*

## INTRODUCTION

Salak (*Salacca zalacca*) is a plant from the palmae family whose fruit is edible. Salak is a tropical fruit that is in great demand by the public, so it is classified as a horticultural commodity that has the potential to be cultivated (Ariviani and Parnanto, 2013). Salak is one of the preferred fruit plants and has good prospects for cultivation. Salak plants naturally develop more generatively or through seeds. The low production of salak plants is caused, among other things, by the use of seeds or seeds that are not superior. One of the efforts so that the implementation of the cultivation of salak plants can achieve a good level of production, it is recommended to choose and use superior seeds (Anarsis, 2006). To get salak seeds that can produce, it is done generatively (salak seeds) and vegetatively (sapling shoots). Propagation of salak by seed is much easier and cheaper, especially for large quantities. In addition, a stronger plant condition will be obtained. The weakness of the generative nursery system is that the fruiting time is longer, it does not always have the same genetic and superior traits as the parent tree and it is not certain whether the seeds will become female plants or become male plants (Sutoyo *et al.*, 2010). The hard skin of the salak seed is one of the causes of the long dormancy period. Things that cause slow germination are thick seed coats, imbalance of stimulant compounds, and inhibitors to stimulate seed germination activity. Another thing that can cause seed germination to be very slow or experience a long period of dormancy is the physical condition of the seed coat (Muhammad *et al.*, 2008).

Dormancy is a latent state of growth and metabolism, which can be caused by unfavorable environmental conditions or factors from the plant itself. Dormancy is also a working principle of plant seeds to defend themselves against very low temperatures in winter, even at warmer temperatures (Sasmitamihardja and Siregar, 1997). Several treatments can be given to the seeds, so that the level of dormancy can be lowered and the percentage of germination remains high. The treatment can be aimed at the seed coat. This is intended to eliminate germination inhibiting factors and reactivate dormant cells. Seed dormancy can be divided into several types and sometimes one type of seed has more than one type of dormancy.

The way to overcome this dormancy is to encourage seed germination so that sprouts are produced in large quantities and are quickly available (Mustika, 2010). According to Sutopo (2004) there are several ways to break seed dormancy, namely mechanical treatment, chemical treatment, soaking with water, giving a certain temperature and light. Dormancy in salak seeds can be overcome by chemical scarification treatment. Chemical scarification is a treatment to accelerate the dormancy period in hard-skinned seeds by using chemicals. Chemical scarification can be done by soaking the seeds in a sulfuric acid solution for a few minutes and washing the seeds with running water (Ramadhani et al, 2014). According to Fahmi (2012) explained that the purpose of the chemical scarification treatment is to make the seed coat easier for water to enter in the imbibition process. Soaking hard seeds can use a solution of $KNO_3$, $H_2SO_4$, and HCL with a concentrated concentration so as to soften the seed coat and facilitate the imbibition process. Purnomosidhi *et al.*, (2013) also explained that breaking dormancy in thick and hard skinned seeds could use chemical solutions such as sulfuric acid ($H_2SO_4$), hydrochloric acid (HCL), and hydrogen peroxide ($H_2O_2$).

Based on the description above, it is necessary to conduct research on breaking dormancy in salak plant seeds with the title "Seed Germination (*Salacca zalacca*) Chemical Scarification Treatment".

## MATERIALS AND METHODS

This research will be conducted in Bange Village, Kec. Malintang Hill, Kab. Christmas Mandailing. The materials used are salak Padangsidimpuan seeds, a solution of potassium nitrate ($KNO_3$), sulfuric acid ($H_2SO_4$) and the hormone gibberellin ($GA_3$), aquades, soil, rice husks, polybags, wood or bamboo, nails, raffia rope, paranet, sample plant signage. The tools used are hoe, machete, meter, measuring cup, TDS meter, ruler, stationery and other tools that support this research.

This research was conducted using a non-factorial randomized block design (RAK), with the following treatments: P0: no treatment (control), $P_1$: the seeds were soaked in water for 15 minutes then immersed in $KNO_3$ 60%, P2: the seeds are soaked in water for 15 minutes then soaked in 70% $KNO_3$ for 25 minutes. P3: seeds are soaked in water for 15 minutes then soaked in $KNO_3$ 80% for 35 minutes, $P_4$minutes then dipped in$_5$H2SO4$_{15}$ 60%, $P_{15}$: seeds are soakedminutes then soaked in $H_2SO_4$ 70% for 25 minutes, $P_6$ : seeds soaked in water for 15 minutes then soaked in $H_2SO_4$ 80% for 35 minutes, $P_7$ : seeds soaked in water for 15 minutes then dipped in $GA_3$ 25 ppm, $P_8$ : seeds soaked in water for 15 minutes then soaked in $GA_3$50 ppm for 11 hours, $P_9$ : seeds soaked in water for 15 minutes then soaked in $GA_3$ 75 ppm for 16 hours, P10 : $KNO_3$ 60% for 15 minutes then dipped into a solution of $GA_3$ 25 ppm, P11 : seeds soaked in $KNO_3$ 70% for 15 minutes then immersed $GA_3$ for 11 hours. P12: seeds soaked in $KNO_3$ 80% for 15 minutes then soaked in a solution of $GA_3$ 75 ppm for 16 hours, P13: seeds soaked$_2SO_4$ 60% for 15 minutes then immersed in $GA_3$ 25 ppm. P14: soaked seeds $H_2SO_4$ 70% for 15 minutes then soaked in a solution of $GA_3$ 50 ppm for 11 hours, P15: seeds soaked in $H_2SO_4$ 80% for 15 minutes then immersed in 75 ppm $GA_3$ for 16 hours. Observation parameters Number of leaves (strands) Germination (%), Maximum Growth Potential (%), Seedling Height (cm), Research data were analyzed using variance (ANOVA) followed by Duncan's Mean Difference Test (DMRT).

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## RESULTS AND DISCUSSION

### Germination

Based on Table 1, it can be seen that germination gave significant treatment at plant ages 4, 5 and 6 WAP. At the age of 4 WAP the salak seeds in treatment $P_{15}$ (seeds soaked in $H_2SO_4$ 80% for 15 minutes then soaked in a solution of $GA_3$ 75 ppm for 16 hours) had germinated 100% but in the other treatments still germinated 33.33% and in some treatments have not germinated. Soaking salak seeds using a solution of $H_2SO_4$ and $GA_3$ can thin the skin of the seeds of salak so as to facilitate the entry of water (imbibition) and oxygen in the seeds of salak. This is in accordance with the research of Purwani (2006) which explains that the immersion treatment with 40% $H_2SO_4$ for 20 minutes has the best effect on germination with a percentage of 90% germination.

Table 1. Germination of Salak Seeds at the age of 4 WAP - 6 WAP

| Treatment | Germination (%) | | |
|---|---|---|---|
| | 4 WAP | 5 WAP | 6 WAP |
| P0 | 33,33b | 100d | 100b |
| P1 | 0a | 0a | 100b |
| P2 | 33,33b | 100d | 100b |
| P3 | 0a | 66,67c | 100b |
| P4 | 0a | 100d | 100b |
| P5 | 0a | 100d | 100b |
| P6 | 0a | 33,33b | 100b |
| P7 | 0a | 100d | 100b |
| P8 | 0a | 100d | 100b |
| P9 | 0a | 66,67c | 100b |
| P10 | 0a | 0a | 66,67a |
| P11 | 33,33b | 33,33b | 100b |
| P12 | 0a | 100d | 100b |
| P13 | 0a | 66,67c | 100b |
| P14 | 33,33b | 66,67c | 100b |
| P15 | 100c | 100d | 100b |

Description: Numbers followed by the same letters in the same column not significantly different according to the DMRT test with a level of 5%.

Likewise with $GA_3$ (gibberellin solution), the entry of gibberellins with a certain concentration causes a chemical process in the seeds which is characterized by germination. After the imbibition process, the release of gibberellins from the embryo will signal the seed to end its dormancy and germinate (Campbell, et al: 2003). This is consistent with research by Falastin (2006) which showed that the treatment of soaking salak seeds in gibberellins at various concentrations had a significant effect on seed germination time, and had no effect on viability and speed of seed germination. Gibberellins solution with a concentration of 40 ppm can increase the speed of germination of salak seeds.

### Germination Power

Based on Table 2, it can be seen that there was a significant difference in the maximum growth potential of salak seeds at 4, 5 and 6 WAP.WAP, the salak seeds had grown 100% in the P15 treatment (the seeds were soaked in$_{H2SO4}75_4$ minutes then soaked in a solution of $GA3_{15}$ ppm for 16 hours) and in the other treatments it was still growing 33.33% and at some treatments have not grown. After 5 WAP, in general, the salak seeds had grown except in treatment $P_1$ (seeds were soaked in water for 15 minutes then dipped in 60% $KNO_3$ ), and $P_{10}$ (seeds were soaked in 60% $KNO_3$ 60%) for 15 minutes then dipped in GA solution.$_3$ 25 ppm). Furthermore, the salak seeds at the age

of 6 WAP had grown 100%, except in the $P_{10}$ (seeds were soaked in $KNO_3$ 60% for 15 minutes then dipped in a solution of $GA_3$ 25 ppm) 66.67%. Hard seed breaking can be done by soaking in hot water and use of an acid solution. One of the acid solutions used is sulfuric acid solution ($H_2SO_4$) where sulfuric acid compounds can soften the waxy coating on hard seeds and are able to break down the cell walls of salak seeds so that they grow well. Suyatmi (2008) in his research showed that $H_2SO_4$ are decompose easier in water and can promote the growth of sprouts properly. Based on the results of the DMRT test, it showed that the chemical scarification treatment had a significant effect on plant height.

Table 2. Maximum Growth Potential of Salak Seeds at Age 4 WAP–6 WAP

| Treatment | Germination Power (%) | | |
|---|---|---|---|
| | 4 WAP | 5 WAP | 6 WAP |
| P0 | 33,33b | 100d | 100b |
| P1 | 0a | 0a | 100b |
| P2 | 33,33b | 100d | 100b |
| P3 | 0a | 66,67c | 100b |
| P4 | 0a | 100d | 100b |
| P5 | 0a | 100d | 100b |
| P6 | 0a | 33,33b | 100b |
| P7 | 0a | 100b | 100b |
| P8 | 0a | 100d | 100b |
| P9 | 0a | 100d | 100b |
| P10 | 0a | 66,67c | 66,67a |
| P11 | 33,33b | 0a | 100b |
| P12 | 0a | 100d | 100b |
| P13 | 0a | 66,67c | 100b |
| P14 | 33,33b | 66,67c | 100b |
| P15 | 100c | 100d | 100b |

Description: Numbers followed by the same letter in the same column were not significantly different according to the DMRT test with a level of 5%.

**Plant Height**

Based on Table 3, it can be seen that at the age of 4 WAP some of the salak seeds had started to grow, the highest was in the $P_{15}$ (seeds were soaked in $H_2SO_4$ 80% for 15 minutes then soaked in $GA_3$ 75 ppm for 16 hours) with a plant height of 2.53 cm. At the age of 6 WAP, each treatment showed a significant difference. The highest salak plant was found in treatment $P_{15}$ (seeds were soaked in $H_2SO_4$ 75 ppm for 16 minutes then soaked in $GA_3$ 15 hours) which was 3.3 cm and lowest in treatment $P_9$ (seeds are soaked in water for 15 minutes then soaked in a solution of $GA_3$ 75 ppm for 16 minutes) which is 0.2 cm. In general, salak plants aged 12 WAP have seen an increase in plant height in each treatment.solution $KNO_3$.contains two nutrients, namely nitrogen (N) 12% and potassium (K) 44%The K element contained in $KNO_3$ is absorbed by plants in the form of $K^+$ then distributed from adult organs to young organs, while nitrogen is absorbed by plants in the form of $NO^3$, this ion functions for plant vegetative growth, especially in shoot growth (Koheri, et al., 2015).

This is in accordance with research by Khalimah (2011), which showed that administration of $KNO_3$ through the leaves of the iles-iles plant increased tuber weight, while administration through soil increased plant vegetative growth, Anggaraini (2018), reported that administration of $KNO_3$ could increase plant height, dry weight, shoot/root ratio, and chlorophyll index.

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Table 3. Plant Height of Salak Seeds in Chemical Scarification Treatment

| Treatment | Plant Height (cm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 4 WAP | 5 WAP | 6 WAP | 7 WAP | 8 WAP | 9 WAP | 10 WAP | 11 WAP | 12 WAP |
| P0 | 1.33a | 1.57bc | 2.07bc | 2.47bc | 2.73a | 4.63bc | 4.63a | 5.1ab | 5.17a |
| P1 | 0a | 0a | 0.57ab | 1.03ab | 1.33a | 5.1bc | 5.57ab | 6.03abc | 6.20abc |
| P2 | 0.67a | 0.87ab | 1.47ab | 1.93ab | 2.17a | 5.9c | 6.77b | 7.53c | 7 ,73c |
| P3 | 0.00a | 0a | 1.2ab | 1.5ab | 1.7a | 4.7bc | 5.57ab | 5.67ab | 5.87abc |
| P4 | 0.00a | 0a | 0.53ab | 0.9a | 1.17a | 3.2a | 5.7ab | 6, 47bc | 6.70bc |
| P5 | 0.00a | 0a | 0.67ab | 1.03ab | 1.2a | 5.23bc | 5.97ab | 5.87abc | 6.13abc |
| P6 | 0.00a | 0a | 0.3a | 0.73a | 1.03a | 4.67bc | 5.57ab | 5.93abc | 6.17abc |
| P7 | 0.00a | 0a | 0.37a | 1.07ab | 1.33a | 4.17bc | 4.8ab | 5.3ab | 5.73abc |
| P8 | 0.00a | 0a | 0.67ab | 1ab | 1.37a | 4.03b | 4.73a | 4.97a | 5.37ab |
| P9 | 0.00a | 0a | 0.2a | 0.9a | 1.17a | 3.87b | 4.73a | 5.6ab | 5.80abc |
| P10 | 0.00a | 0a | 0.33a | 0.67a | 0.93a | 4.73bc | 5.1 ab | 5.33ab | 5.80abc |
| P11 | 0.20a | 0.33ab | 0.9ab | 1.27ab | 1.5a | 4.1bc | 4.9ab | 5.07ab | 5.33ab |
| P12 | 0.00a | 0a | 0.8ab | 1.13ab | 1.4a | 4.53bc | 5.33ab | 5.57ab | 6.00abc |
| P13 | 0.00a | 0a | 0 ,6ab | 0.93ab | 1.2a | 4.2bc | 5.3ab | 5.77ab | 5.93abc |
| P14 | 0.47a | 0.6ab | 0.87ab | 1, 33ab | 1.6a | 3.67b | 4.7a | 5.33ab | 5.50ab |
| P15 | 2.53b | 2.87c | 3.3c | 4.2c | 4.53b | 5.37bc | 5.57ab | 5.53a b | 5,83abc |

Information: The numbers followed by the same letter in the same column are not significantly different according to the DMRT test with a level of 5%.

**Number of Leaves (strands)**

Based on the results of the DMRT test, it showed that the chemical scarification treatment had a significant effect on the number of leaves at the age of 9, 10, 11 WAP and had no significant effect on the age of 12 WAP for salak seeds.

Based on Table 4, it can be seen that each salak plant in each treatment with a plant age of 9-11 MST already had fully opened leaves. Meanwhile, salak plants with age 12 WAP were treated at $P_0$ (control) and $P_5$ (seeds were soaked in water for 15 minutes then soaked in $H_2SO_4$ 70% for 25) showed the highest number of leaves, namely 1.33 strands compared to other treatments.

Table 4. Number of Leaves Seeds of Salak Plants in Chemical Scarification Treatment

| Treatment | Number of Leaves (strands) | | | |
|---|---|---|---|---|
| | 9 WAP | 10 WAP | 11 WAP | 12 WAP |
| P0 | 0,33ab | 1ab | 1a | 1,33a |
| P1 | 1b | 1ab | 1a | 1a |
| P2 | 1b | 1ab | 1a | 1a |
| P3 | 0,67ab | 1ab | 1a | 1a |
| P4 | 0,33ab | 1ab | 1a | 1a |
| P5 | 0,67ab | 1,33b | 1,33b | 1,33a |
| P6 | 1b | 1ab | 1a | 1a |
| P7 | 0,67ab | 1ab | 1a | 1a |
| P8 | 0a | 0,67a | 1a | 1a |
| P9 | 0,33ab | 1ab | 1a | 1a |
| P10 | 0,67ab | 1ab | 1a | 1a |
| P11 | 0,67ab | 1ab | 1a | 1a |
| P12 | 0,67ab | 0,67ab | 1a | 1a |
| P13 | 0,67ab | 1ab | 1a | 1a |

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| | | | | |
|---|---|---|---|---|
| P14 | 0,67ab | 1ab | 1a | 1a |
| P15 | 0,33ab | 1ab | 1a | 1a |

Information: The numbers followed by the same letter in the same column are not significantly different according to the DMRT test with a level of 5%.

**Leaf Length (cm)**

Based on the results of the DMRT test at 5% level, it showed that the chemical scarification treatment had a significant effect on leaf length.

Based on Table 5, it can be seen that salak plants at the age of 9, 10, 11 and 12 WAP had significantly different leaf lengths in each treatment. The highest leaf length of salak plants every week was found in treatment $P_1$ (seeds were soaked in water for 15 minutes then dipped in $KNO_3$ 60%) respectively, namely 16.1 cm, 16, 47 cm, 16, 8 cm, and 17, respectively. 07 cm. One of the causes of unproductive leaf growth is physical factors from the plant, such as imperfect height growth. According to Susanto (2014), poor plant physical growth will inhibit plant physiological growth. The role of leaves in plants is very important to be able to continue the process of photosynthesis. Sutopo (2000) stated that the growth rate depends on the food reserves owned by the seeds and then undergoes the decomposition of materials such as carbohydrates, fats, and proteins into soluble forms and is translocated to the growing point for the growth of new components and cells.

Table 5. Leaf Length of Salak Plant Seeds in Chemical Scarification Treatment

| Treatment | Leaf Length (cm) | | | |
|---|---|---|---|---|
| | 9 WAP | 10 WAP | 11 WAP | 12 WAP |
| P0 | 8,07ab | 12,77ab | 13,13ab | 13,37ab |
| P1 | 16,1b | 16,47b | 16,8b | 17,07b |
| P2 | 10,67ab | 15,3ab | 15,67ab | 15,9ab |
| P3 | 6,77ab | 9,7ab | 13,3ab | 14,7ab |
| P4 | 6ab | 12,1ab | 13,17ab | 13,47ab |
| P5 | 10,8ab | 14,77ab | 16,07ab | 16,09ab |
| P6 | 12,3ab | 12,73ab | 13,07ab | 13,9ab |
| P7 | 7ab | 10,4ab | 13,13ab | 13,5ab |
| P8 | 0a | 8,63a | 11,83ab | 12,07ab |
| P9 | 3,2ab | 8,47a | 8,83a | 9,17a |
| P10 | 8,7ab | 12,5ab | 12,8ab | 13,77ab |
| P11 | 9,13ab | 13,63ab | 13,97ab | 14,37ab |
| P12 | 8,73ab | 9ab | 11,23ab | 14,6ab |
| P13 | 10,5ab | 13,87ab | 14,13ab | 14,53ab |
| P14 | 9,1ab | 11,9ab | 12,17ab | 12,5ab |
| P15 | 5,6ab | 13ab | 16,2ab | 16,53ab |

Description: The numbers followed by the same letter in the same column are not significantly different according to the DMRT test with a level of 5%.

## CONCLUSIONS

From the results of the study, it can be concluded as follows: Based on the research, it was shown that chemical scarification treatment with KNO3, H2SO4, and GA3 on dormancy breaking and seed germination showed a significant effect on germination, maximum growth potential, plant height, number of leaves aged 9, 10, and 11 WAP. However, there was no significant effect on the age of 12 WAP, leaf length and leaf width. However, it had no significant effect at the ages of 11 and 12 WAP. In general, the fastest breaking of dormancy and germination of salak plant seeds was in the $P_{15}$ (seeds were soaked in $H_2SO_4$ 80% for 15 minutes then soaked in 75 ppm $GA_3$ for 16

hours) which was 100%.treatment$_2$ (seeds were soaked in water for 15 minutes then soaked in 70% $KNO_3$ for 15 minutes).

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