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The Effect of Seed Type in Fruit and Coconut Water Soaking on Germination and Growth Red Snake Fruit (Salacca Sumatrana Becc

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A B S T R A C T

This study aims to analyze the effect of seed type and coconut water soaking time on germination and early growth of Red Salak Sidimpuan (Salacca sumatrana Becc.). The study used a factorial Completely Randomized Design with two factors, namely seed type (single, two, and three) and soaking time (24 hours water, 12, 18, and 24 hours coconut water). The parameters observed included germination power and speed, plant height, leaf emergence age, and leaf width. The results showed no significant interaction between the two factors. Seed type affected plant height at 38 and 45 days after planting, while 24-hour soaking affected at 59 days after planting. In general, seed viability was high, with 24-hour coconut water soaking being recommended to support early growth.

INTRODUCTION

Red Sidimpuan Snake Fruit (Salacca sumatrana Becc.) is a leading horticultural commodity originating from South Tapanuli, North Sumatra, and boasts high economic value and growing market potential. This fruit is known for its sweet taste, dense flesh, and distinctive red or reddish-red flesh. However, productivity data shows fluctuations and a downward trend in production in recent years, partly due to traditional cultivation techniques and a lack of innovation in plant maintenance. Meanwhile, demand for snake fruit continues to increase in line with population growth and increasing public awareness of fruit consumption as a source of nutrition, necessitating efforts to increase production through the provision of quality seeds**.**

Snake fruit can be propagated vegetatively or generatively, but seed propagation is considered more economical, easier, and produces relatively robust plants. However, the success of generative propagation is greatly influenced by seed quality, including viability, size, and nutrient reserves. In Red Snake Fruit, the number of seeds per fruit can vary between one, two, and three, which is thought to be related to differences in size and nutrient content. Single seeds are generally larger and contain more nutrient reserves than two or three seeds, thus potentially resulting in better germination and initial growth. However, scientific studies on the effect of seed number as a seed source on the germination quality of Red Snake Fruit are still limited.

Another problem in the generative propagation of snake fruit is physical dormancy due to the hard and thick seed coat, which inhibits the absorption of water and oxygen necessary for the embryo's metabolic processes. Without special treatment, snake fruit seeds can experience a relatively long germination time. One method widely used to break dormancy is soaking the seeds in natural ingredients containing growth regulators, such as young coconut water. Coconut water is known to contain natural hormones such as auxin, cytokinin, and gibberellin, which play a role in stimulating cell division and elongation and accelerating the germination process. However, research on the effect of coconut water soaking time on Red Sidimpuan Snake Fruit seeds, especially those with red or reddish hues, is still limited.

Based on these problems, this study aims to examine the effect of seed type (single seed, two seeds, and three seeds) and the duration of coconut water soaking on the germination and early growth of Red Salak Sidimpuan, which includes germination speed, plant height, age of leaf emergence, and leaf width. In addition, this study also analyzes the possibility of interaction between these two factors in determining the quality of early plant growth. The results of this study are expected to provide scientific contributions in the development of seed multiplication technology based on easily obtained natural materials, as well as being a practical reference for farmers in increasing the production efficiency and productivity of Red Salak Sidimpuan in a sustainable manner.

METHODS

This research was conducted at the Screen House of the Faculty of Science and Technology, Muhammadiyah University of South Tapanuli from May to July 2025. The research used an experimental method with a quantitative approach to examine the effect of seed type and duration of coconut water soaking on germination and initial growth of Red Sidimpuan Salak. The experimental design used was a factorial Completely Randomized Design (CRD) with two treatment factors. The first factor was the type of seed consisting of single seeds, two seeds, and three seeds, while the second factor was the duration of seed soaking which included soaking using water for 24 hours as a control treatment, and soaking using young coconut water for 12 hours, 18 hours, and 24 hours.

Each treatment combination was repeated three times, and in each replication there were four plant units, so that the total experimental units used in this study were 144 plants. The research material in the form of Red Sidimpuan Salak seeds was obtained from farmers' gardens in West Angkola District, South Tapanuli Regency, by selecting red or reddish colored fruit as a seed source. The selected fruit was then peeled, the fruit flesh was separated, and the seeds were washed thoroughly, then drained until dry. The clean seeds were grouped based on the number of seeds in the fruit, namely single seeds, two seeds, and three seeds, before being given a soaking treatment.

The planting medium used was a mixture of soil, sand, and compost in a 1:1:1 ratio, which was placed in 10 × 15 cm polybags as planting containers. The coconut water used in this study was young coconut water with a concentration of 100% without any mixture, with a soaking solution volume of 250 ml for each treatment. The seeds were soaked according to the specified treatment duration, then planted in the prepared planting medium. Planting was carried out with the seeds positioned to facilitate the emergence of sprouts, and placed under black plastic shelter to maintain environmental conditions during the initial growth phase.

Plant maintenance was carried out intensively through regular watering in the morning and evening according to weather conditions, weeding, and fertilization to support plant growth. Observations were carried out periodically from planting until the end of the study. The parameters observed included germination power expressed as a percentage, germination speed in days, plant height measured periodically every seven days, leaf emergence age expressed in days after planting, and leaf width measured at the end of the observation period. All observation data were analyzed using analysis of variance (ANOVA) with the help of SPSS version 25 software. If the analysis results showed a significant effect, further tests were carried out using the Duncan Multiple Range Test (DMRT) at 5% and 1% confidence levels to determine the differences between treatments in more detail.

RESULTS

The results showed that the treatment of seed type, duration of coconut water soaking, and the interaction of the two did not have a significant effect on the germination of Red Salak Sidimpuan seeds. Analysis of variance showed that all treatments had a significance value above 0.05, which indicated no statistically significant difference. The overall average germination rate reached 97.22%, indicating that most of the seeds used had high viability. The 24-hour coconut water soaking treatment showed the highest germination rate, namely 100%, although it was not statistically significantly different from the other treatments. This indicates that the physiological quality of the seeds used was relatively good so that they were able to germinate optimally in various treatment variations.

Regarding the germination rate parameter, the analysis also showed that seed type, soaking time, and the interaction between the two factors had no significant effect on the time of emergence. The average germination rate for all treatments was 7.44 days after planting. The 24-hour coconut water soaking treatment tended to produce a faster germination rate than the other treatments, although the difference was not significant. This condition indicates that the imbibition process and seed metabolic activation occurred relatively uniformly across all treatments, so that treatment variations were not able to make a significant difference in the germination rate.

Observations on plant height showed that the effects of treatments varied at each observation time. At 31 days after planting (DAP), seed type and soaking time did not show a significant effect on plant height. However, at 38 and 45 DAP, seed type significantly affected plant height growth, with single seeds tending to produce taller plants than two and three seeds. At 59 DAP, the duration of coconut water soaking treatment had a significant effect, with soaking for 18 to 24 hours showing better growth. Meanwhile, at 66 DAP, all treatments again showed no significant effect on plant height.

Observations on the age of leaf emergence showed that all treatments responded relatively uniformly. Statistical analysis showed no significant differences between seed types or soaking times on the time to first leaf emergence. The average age of leaf emergence was around 52 days after planting, indicating that the leaf formation process was more influenced by internal plant factors than by the initial seed treatment. Similarly, for leaf width, analysis of variance showed that seed type, soaking time, and the interaction between the two treatments did not significantly affect leaf size.

In general, the research results indicate that the Red Salak Sidimpuan seeds used have high physiological quality, allowing them to grow and develop well under various treatments. Although some treatments showed a trend toward increased growth descriptively, particularly soaking in coconut water for 18–24 hours and using single seeds, these effects were not strong enough to produce statistically significant differences in most of the observed parameters.

DISCUSSION

The results showed that seed type, coconut water soaking time, and the interaction between the two did not significantly affect most germination and early growth parameters of Red Salak Sidimpuan. The high germination rate obtained in all treatments indicated that the seeds used had good viability and vigor. This condition indicates that internal seed factors, such as embryo integrity and food reserve availability, are more dominant in determining germination success than external treatments. Seeds with high physiological quality tend to be able to carry out imbibition and metabolic activation optimally, so that differences in soaking treatments did not have a significant impact on the germination percentage.

The insignificant effect of coconut water soaking on germination power and speed can be explained by the sufficient water content and natural hormones already present in the seed tissue. The imbibition process that occurs during water and coconut water soaking meets the initial seed requirements for initiating metabolism. Therefore, the presence of auxin, cytokinin, and gibberellin hormones in coconut water does not provide a significant additional effect once the seed's physiological condition is already at an optimal level. This aligns with the concept that growth regulator treatment is more effective on seeds of moderate or low quality than The significant effect of seed type on plant height at 38 and 45 days after planting indicates that differences in seed number in the fruit are related to the availability of nutrient reserves for the embryo. Single seeds, which are generally larger, have more concentrated endosperm reserves, thus supporting cell division and elongation more efficiently in the early growth phase. Conversely, in two- and three-seeded plants, nutrient reserves must be distributed among several growth points, resulting in relatively slower shoot growth. This explains why single seeds tend to produce taller plants in the early vegetative phase

The significant effect of soaking time at 59 days after planting indicates that coconut water has the potential to positively impact vegetative growth at certain stages. The natural hormones in coconut water are thought to stimulate meristem activity and internodal elongation, thereby increasing plant height. However, this effect was temporary and inconsistent across the observation period. This suggests that the influence of coconut water's growth regulators is more dominant in the early growth phase and diminishes as photosynthesis and nutrient uptake from the growing medium increase.

The uniformity of leaf emergence age and leaf width across all treatments indicates that vegetative organ formation is more controlled by genetic factors and endogenous hormonal regulation than by the initial seed treatment. Apical meristem activity and leaf tissue differentiation occurred relatively uniformly due to the stable environmental conditions of the study and the seed source being from the same parent tree. Therefore, treatment variation was unable to significantly modify leaf development patterns.

Overall, the results of this discussion indicate that the success of germination and initial growth of Red Salak Sidimpuan is more determined by the physiological quality of the seeds and internal plant factors than by the coconut water soaking treatment. Nevertheless, the trend of the results indicates that the use of single seeds and coconut water soaking for 18–24 hours has the potential to support early vegetative growth. Therefore, this treatment can be considered as an alternative in seed propagation practices, especially when the seed quality used is at a moderate or low level.

ADVANCED RESEARCH

Based on the results of this study, further, in-depth studies are needed to optimize the generative propagation techniques of Red Salak Sidimpuan through a more comprehensive physiological and agronomic approach. Further research is recommended to examine variations in the concentration of young coconut water, either in dilution form or in combination with other natural growth regulators, to determine the optimum dose that is most effective in increasing seed vigor. Furthermore, evaluation of other pre-planting treatments, such as mechanical or chemical scarification, temperature treatment, and a combination of soaking with other dormancy-breaking methods, is needed to overcome the characteristics of the hard and impermeable seed coat of snake fruit.

Further research should also consider a wider range of seed source factors, such as differences in fruit age, physiological maturity, location of the parent plant, and environmental conditions of seed origin, to determine their impact on germination quality and early growth. The use of seeds from several local populations or varieties of Red Sidimpuan Salak is also important to assess the stability of responses to soaking treatments across different genetic backgrounds. Furthermore, long-term observations up to the generative phase, including flowering age, fruiting time, and plant productivity, are necessary to determine the impact of early seed treatment on plant performance during the production stage.

Seed physiological and biochemical aspects also need to be the focus of further research, particularly regarding germination enzyme activity, endogenous hormone dynamics, and changes in food reserves during imbibition and germination. This approach is expected to provide a more in-depth explanation of the seed response mechanisms to coconut water treatment. Furthermore, the integration of modern cultivation technologies, such as the use of biochar-based growing media, mycorrhizae, or biofertilizers, also has the potential to be studied to improve the efficiency of early plant growth.

With the development of further, targeted, multidisciplinary research, it is hoped that a more effective, adaptive, and sustainable seed propagation technology package for the Red Sidimpuan Snakefruit will be developed. These research findings will not only benefit the development of scientific knowledge in the fields of seed physiology and horticulture, but will also support increased productivity and competitiveness of local snakefruit commodities at the regional and national levels.

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