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Basal Scarification: A Technique for Improved Grapevine Rooting and Propagation

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ABSTRACT

Background: Grapes are a potentially valuable crop for the Philippine economy, providing income to farmers and contributing to the country's agricultural sector. Grape propagation is a crucial practice in grape production as it improves yield, disease resistance and high-quality grapevines. This practice is critical for commercial grape production for developing new grapevine varieties, desirable traits and helping preserve genetic diversity, ensuring the long-term sustainability of grape production.

Methods: Thus, this study was conducted to explore the enhanced propagation of grape cuttings through basal scarification techniques. Research evaluated seven (7) basal scarification techniques of grape "catawba" cuttings (T1- control/ without basal scarification, T2- 1 slit basal scarification, T3- 2 slit basal scarification, T4- 3 slit basal scarification, T5- 4 slit basal scarification, T6- 5 slit basal scarification and T7- 6 slit basal scarification) with 10 samples per treatment laid out in a randomized complete block design (RCBD) replicated four (4) times.

Result: Results revealed that slit basal scarification enhances growth and rooting response of grapes cuttings. Six slit basal scarification techniques on grape cuttings obtained the highest in terms of the number of leaves (5.87), percentage of survival (76.67%), rooting percentage (60.1%) and the longest length of shoots (9.07 cm). No significant differences were observed among other data parameters evaluated. By applying basal scarification to grape cuttings, growers can improve the chances of successful propagation and establish healthy, productive grapevines.

Key words: Cuttings, Grapes, Growth and rooting response, Slit basal scarification.

INTRODUCTION

European colonists considered grapes an important part of the diet of many Native Americans and considered as one of the important ingredients in the production of wine (Hartmann *et al.*, 1983). Nowadays, the bulk production of grapes commonly comes from temperate countries, particularly in France, Italy and China (FAO, 2022). In these countries, grapes are commonly propagated, but promising production was also observed in other provinces of the Philippines, such as Cebu, Iloilo, Cotabato, Masbate and La Union (Yap, 2018). In the current data of FAO (2022), the country has a total grape area of 369 hectares with a total of 212 tons. It seems like growing grapes in a tropical country is unlikely, but indeed, evidence has found that it can be cultivated in the Philippines (Wen *et al.*, 2013). Grape propagation plays a vital role in ensuring the sustainability and productivity of grape production and its importance cannot be overstated. Propagation enables mass production of high-quality grapevines, ensuring a consistent supply of healthy plants for commercial production, which is also an important consideration in winemaking and commercial viticulture. As compared to the conventional sexual propagation technique, propagation through asexual propagation using cuttings is preferred as a type of planting material because of its faster and easier method of propagation and results in a large plant in a short period (North Carolina State Extension, 2018). Benefits of grape propagation can lead to increase productivity, better fruit quality, improved grapevine performance, disease resistance and tolerance to environmental stresses. This crop is a prolific grower, whose source of cuttings is easily available. Three types of cuttings can be used for grape propagation, namely softwood cuttings, semi-hardwood cuttings and hardwood cuttings. During its growing season, softwood cuttings are more available when plants are actively putting out new shoots, while semi-hardwood and hardwood cuttings are mostly available after harvest or off season when the plants are at the dormant stage (Warmund *et al.*, 1986), but the common method of propagation used in grape planting is through hardwood cuttings (Waite *et al.*, 2014). Other important studies that affect the propagation of grapes are

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on the large proportion of disease, disease control and climate change adaptation (Martelli, 1999; Rego *et al.*, 2009; Stamp, 2001; Delrot *et al.*, 2020; Tomasi *et al.*, 2011; Trbic *et al.*, 2021).

Delrot *et al.* (2020), highlights that grapevine adaptation strategies, including propagation and rootstock selection under changing climates can really influence quality planting materials. Gramaje *et al.* (2018) strongly emphasizes the role of healthy propagation also contributed to reducing disease incidence in grape plants which can increase yield. According to Ollat *et al.* (2025), the type of propagation, cultivar choice and management practices can address challenges in disease occurrence as climate adaptation strategies in grapes. In the study of Reynolds (2022), he also reviews the importance of modern viticulture, including propagation techniques, environmental stress tolerance and productivity.

Optimized propagation techniques in improving rooting and growth responses of plant cuttings, which is relevant to grape propagation practices; for example, research on *Vitis vinifera* found that applying higher concentrations of the rooting hormone IBA significantly increased rooting percentage and improved root system development in hardwood grape cuttings compared to untreated controls, demonstrating the efficacy of hormonal and physical treatments in enhancing grape cutting propagation (Maninderdeep and Singh, 2022). Additionally, investigations in other horticultural species such as West Indian cherry have shown that treating cuttings with appropriate auxin treatments and selecting optimal cutting types can positively influence rooting success and shoot development, underscoring the broader role of propagation technique optimization (Bharanidharan, 2025). Supporting this, *Punica granatum* (pomegranate) studies reported that the use of plant growth regulators like IBA significantly improved root and shoot growth parameters in cuttings, indicating that tailored propagation practices can enhance survival and morphological outcomes across vegetatively propagated crops (Singh *et al.*, 2024). These findings from ARCC-published research collectively reinforce the rationale for examining basal scarification techniques in grape "catawba" cuttings to improve propagation success and contribute to sustainable grape production.

With its significant studies on the types of cuttings used in grape propagation, the basal scarification technique is also valuable in increasing the rooting success rate, stimulating root growth and development and enhancing water and nutrient uptake. Thus, this paper investigated the rooting response and subsequent growth of hardwood grape cuttings to varying basal scarification slits. This study aims to assess the effects of different basal scarification techniques to obtain lower mortality rates and facilitate grape propagation. The use of an appropriate basal scarification technique on hardwood grape cuttings is relevant to determine which technique will produce more vigorous grape seedlings. Improving the growth and rooting success of grapes with the use of an ideal basal scarification technique can lead to increased productivity and better grape yields, which can help the grape farmers, growers and researchers and in small groups to diagnose problems, to interpret data and to apply their meaning.

MATERIALS AND METHODS

Experimental set-up

Sources and selection of samples

Hardwood grape cuttings were collected from a three (3) year old grapevine mother plant. The following criteria were used in selecting grape cuttings: healthy and disease-free parent material and cuttings (Fig 1) with three (3) nodes ranging from 10-12 inches long (Fig 2).

Site of the experiment

The experiment was conducted at Mut'z Marcos Horticulture Garden, Brgy. Kilagasan, Kabacan, Cotabato in 2024. Philippines. The site was provided and subjected to 200-micron UV plastic sheets for protection against solar radiation and potential damage to sample plants. The experiment was conducted from November to December 2024 with a total of ten (10) grape cuttings per experimental unit (Fig 3).



Fig 1: Hardwood Grape Cuttings subjected to basal scarification techniques.

Preparation of treatments

The research study was carried out in a randomized complete block design (RCBD) having seven treatments replicated three (3) times: Treatments of the study are as follows: (T1- control/ no basal scarification slits, T2- one (1) basal scarification slits, T3- two (2) basal scarification slits, T4- three (3) basal scarification slits, T5- four (4) basal scarification slits, T6- five (5) basal scarification slits and T7- six (6) basal scarifications slits. The size of scarification slits was at least 4 cm long per cutting, located at the base of the stem cuttings. Each cutting was planted in an 8x10' black polyethylene bag with four perforation holes/bag. The mixture of the substrates has a mixture of 75% garden soil and 25% coco peat. The growing media was heat sterilized at 90°C for at least 30 minutes. Cuttings were planted by inserting the basal portion of the stem into the potting media at 5 cm.

Data snalysis

The significant differences were analyzed using the Statistical Tool for Agricultural Research (STAR) software version 2.0. The significance level was set at 5% and significant differences were analyzed using Tukey's post-hoc test.

RESULTS AND DISCUSSION

Table 1 shows highly significant differences among the treatments, specifically on the percentage survival (%) and average number of developed leaves as influenced by different basal scarification slits at forty-five (45) days after planting. Results revealed that grape hardwood cuttings with six (6) basal scarification slits obtained the highest survival rate (76.67%) and the greatest number of developed leaves (5.87) at forty-five (45) days after planting. No significant differences were observed among cuttings subjected to no basal scarification, one (1), two (2), three (3), four (4) and five (5) stem basal scarification slits in terms of the average number and average length of newly developed grape cuttings.

The results indicate that more basal scarification slits are observed to have a higher survival rate and enhanced growth parameters. The study correlates with the findings of Kasim *et al.* (2009) that wounding of the cutting bases is a factor in inducing root calluses and adventitious roots in cuttings. Vera-Batista *et al.* (2002) also revealed that wounding of cuttings allows them to absorb more water, which can enhance the rootability of stem cuttings. In addition, the result of the study was also supported by the study of Puri and Shamet (1988), where they found that



Fig 2: Basal scarification techniques of hardwood grape cuttings.



Fig 3: Actual experimental site of the experiment, Brgy. Kilagasan, Kabacan, Cotabato, Philippines.

more wounding in cuttings gives rise to breakage of anatomical obstacles that act as barriers for the emergence of roots, such as sclerenchyma rings. De Klerk *et al.* (1999) also described that wounding of stem cuttings results in the release of wound-related compounds, which have an important role in the root formation of cuttings. In this regard, Edwards and Thomas (1979) referred to that plant species as also a factor in responding to the basal scarification or wounding treatment. Basal scarification enhances rooting success by modifying both the anatomical and physiological conditions at the cutting base. Wounding increases endogenous auxin sensitivity and accumulation at the injured tissues, which stimulates cell dedifferentiation and the initiation of root primordia (Hartmann *et al.*, 2011). Additionally, the removal or disruption of lignified tissues facilitates reconnection and improves vascular translocation of carbohydrates and rooting cofactors to the basal region, thereby supporting root development (Leakey, 2004). Wound-induced ethylene production and phenolic compounds have also been reported to interact synergistically with auxins, further promoting adventitious root formation (Li *et al.*, 2009). These physiological responses collectively explain the improved survival rate and enhanced growth observed in cuttings subjected to increased basal scarification, particularly in species with anatomical barriers to rooting.

Table 2 shows the data on the rooting percentage, number of roots and length of roots of grape cuttings as influenced by basal scarification slits at forty-five days after planting. Statistical analysis revealed highly significant differences in terms of the rooting percentage were six (6) basal scarifications slits observed to have the highest rooting percentage (60.10%). On the other hand, no significant differences were observed in terms of the number of roots and the length of roots of grape cuttings.

The results indicate that a greater number of basal wounding or scarification in grape cuttings can enhance

Table 1: Percentage survival (%), average number of developed leaves, number of newly developed shoots and average length of newly developed shoots as influenced by different basal scarification slits at forty-five (45) days after planting.

Treatments (Basal scarification)	Percentage ** survival (%)	Average number of ** developed leaves	Average number of ns newly developed shoots	Average length of ** newly developed slits) shoots (cm)
T1- Control (No basal scarification)	23.33^{d}	1.17^{c}	1.72	2.67^{d}
T2- 1 Basal scarification	36.67^{c}	3.43^{bc}	2.27	7.47^{bc}
T3- 2 Basal scarification	23.33^{d}	5.60^{ab}	2.67	6.10^{c}
T4- 3 Basal scarification	36.67^{c}	3.67^{bc}	2.47	6.23^{c}
T5- 4 Basal scarification	30.00^{cd}	3.03^{bc}	1.67	7.43^{bc}
T6- 5 Basal scarification	46.67^{b}	2.23^{c}	2.17	8.90^{b}
T7- 6 Basal scarification	76.67^{a}	5.87^{a}	2.57	9.07^{a}
C.V.(%)	20.19	30.48	12.48	8.73

**- Highly significant.

ns- No significant.

Means with different letter superscripts are highly significantly different ($p<0.05$) (Tukey's Test).

Table 2: Rooting percentage (%), number of roots and length of roots (cm) as influenced by different basal scarification slits at forty-five (45) days after planting.

Treatments (Basal scarification)	Rooting** percentage (%)	Number of roots^{ns}	Length of roots (cm)^{ns}
T1- Control (No Basal scarification)	20.36^{d}	8.00	4.33
T2- 1 Basal scarification	26.68^{c}	10.13	7.93
T3- 2 Basal scarification	23.33^{d}	9.14	6.83
T4- 3 Basal scarification	30.57^{c}	13.37	6.33
T5- 4 Basal scarification	28.00^{c}	10.33	7.17
T6- 5 Basal scarification	40.33^{b}	19.67	10.00
T7- 6 Basal scarification	60.10^{a}	15.67	8.83
C.V.(%)	26.71	38.08	28.18

**- Highly significant.

ns- No significant.

Means with different letter superscripts are highly significantly different ($p<0.05$) (Tukey's Test).

root development and a high survival rate. Scarification creates micro-wounds on the cutting's surface, which can stimulate root growth by increasing the number of potential root initiation sites. In addition, it can also improve water uptake, which enhances water absorption, providing cutting with the moisture it needs for root development. In the study of Aiken *et al.* (2020), he supported the results of the study where he found that scarification promotes absorption and improves rates of survival. Furthermore, water and air will more quickly get into the propagule because of its permeability, where cuttings can absorb more water and nutrients. In addition to survival and improving water uptake, scarification or basal wounding facilitates anatomical and physiological changes that favor adventitious root formation in grape cuttings. Wounding disrupts lignified and sclerenchymatous tissues at the basal end, thereby reducing mechanical barriers to root emergence and allowing newly formed root primordia to penetrate surrounding tissues more easily (Puri and Shamet, 1988). Moreover, scarification has been shown to stimulate the accumulation of endogenous auxins and wound-induced compounds at the injury site, which are essential for callus formation and subsequent root initiation (De Klerk *et al.*, 1999; Hartmann *et al.*, 2011). These wound-related responses enhance cell division and differentiation in the cambial region, ultimately leading to improved rooting efficiency and higher survival rates in scarified grape cuttings.

CONCLUSION

Basal scarification is a highly effective technique for enhancing the propagation of grape cuttings. Creating microwounds at the base of the cutting stimulates root development, leading to improved rooting success rates and healthy plants. The study's results showed several benefits, including increased root initiation, enhanced water and nutrient uptake and improved plant establishment. This technique is used to promote the formation of new roots by damaging the outer layer of the cutting, encouraging the plant to produce more initials. In addition, the increase in size or root mass resulting from scarification allows the cuttings to absorb more water and nutrients and support robust growth.

Moreover, with the strong root system of grape cuttings propagated through application of basal scarification, these are more likely to establish successfully in the field, leading to better plant survival. Therefore, in conclusion, 6 basal scarification slits is the best practice for hardwood grape propagation due to its ability to enhance root development, improve plant establishment and increase the overall success rates. By incorporating this technique into propagation protocols, growers can achieve better outcomes and optimize their production efforts.

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Disclaimers

The views and conclusions expressed in this article are solely those of the authors and do not necessarily represent the views of their affiliated institutions. The authors are responsible for the accuracy and completeness of the information provided, but do not accept any liability for any direct or indirect losses resulting from the use of this content.

Informed consent

Not applicable. No humans or animals were used in the study.

Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this article. No funding or sponsorship influenced the design of the study, data collection, analysis, decision to publish, or preparation of the manuscript.

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