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IMPACT OF STEM CUTTING TYPES AND SOILLESS MEDIA ON VEGETATIVE AND ROOTING GROWTH

William Danso
Department of Horticulture, Faculty of Agriculture, College of Agriculture and Natural Resources, University of Ghana, Accra, Ghana

Abstract
This study investigates the effects of different stem cutting types and soilless media on vegetative and rooting growth. The research aimed to identify optimal conditions for enhancing plant development through a comparative analysis of various cutting methods (e.g., softwood, hardwood, semi-hardwood) and soilless media (e.g., peat moss, perlite, vermiculite, and their combinations). Using a controlled experimental setup, we assessed parameters such as root formation, shoot growth, and overall plant health. Our results indicate significant variations in rooting success and vegetative growth across different combinations of cutting types and media. Specifically, certain media facilitated faster root development and healthier vegetative growth compared to others. Additionally, the type of stem cutting also influenced the efficiency of rooting and subsequent plant vigor. These findings provide valuable insights for optimizing propagation techniques and selecting appropriate soilless media to enhance plant production in various horticultural and agricultural applications.

Keywords Stem Cuttings, Soilless Media, Vegetative Growth, Rooting Response, Propagation Techniques, Cutting Types, Growth Optimization.

INTRODUCTION

Effective plant propagation is crucial for successful horticulture and agriculture, influencing the quality and yield of crops and ornamental plants. One of the primary methods of plant propagation is through stem cuttings, which involves severing a part of a plant to develop new roots and shoots. The success of this technique largely depends on various factors, including the type of stem cutting and the growing medium used. Stem cuttings can be categorized into different types based on their developmental stage, such as softwood, hardwood, and semi-hardwood cuttings. Each type has distinct characteristics and requirements for successful rooting and vegetative growth. Understanding these differences is essential for optimizing propagation practices.

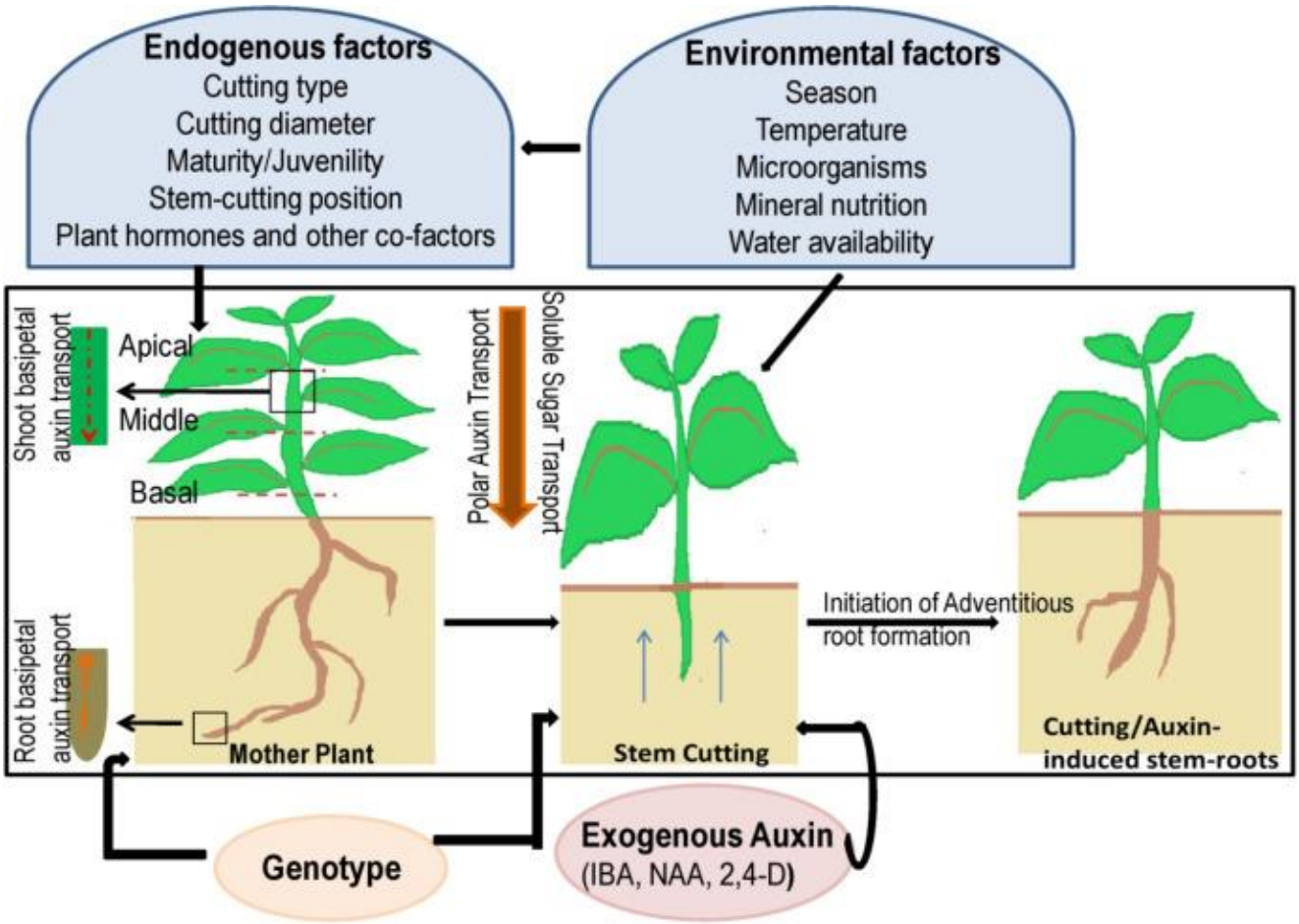
In parallel, the choice of growing medium plays a significant role in plant development. Soilless media, such as peat moss, perlite, and vermiculite, offer alternative solutions to traditional soil-based growing systems. These media provide specific benefits, such as improved aeration, moisture retention, and nutrient availability, which can influence root formation and overall plant health.

This study aims to explore the impact of various stem cutting types and soilless media on vegetative and rooting growth. By systematically examining how different combinations of cutting types and media affect plant development, this research seeks to provide insights into optimizing propagation techniques. The findings will contribute to better practices in plant production,

potentially enhancing both the efficiency and effectiveness of horticultural and agricultural operations.

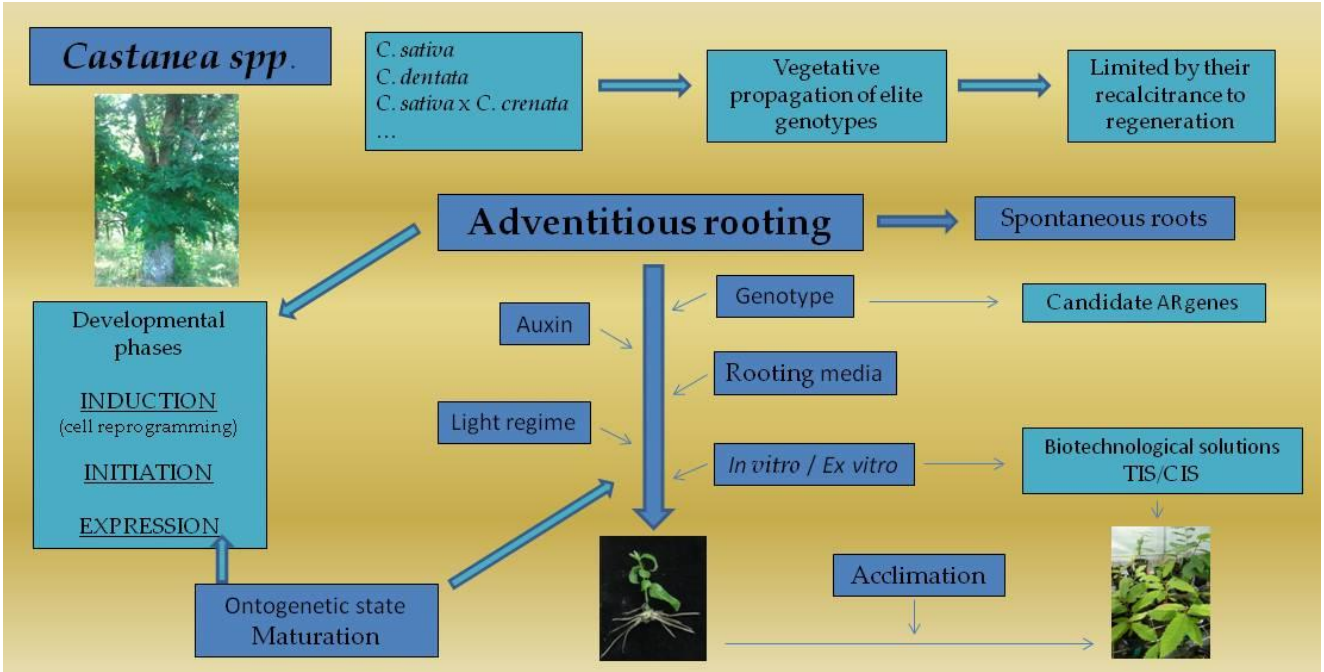
METHOD

The study employed a factorial design to investigate the effects of different stem cutting types and soilless media on vegetative and rooting growth. The experiment was conducted in a controlled environment with consistent temperature, light, and humidity conditions. Taken from new, tender growth. Taken from partially mature stems. Taken from mature, woody stems. Each cutting type was standardized in length (approximately 10 cm) and treated with a rooting hormone (e.g., indole-3-butyric acid, IBA) before planting.



A common organic medium known for its water retention properties. A lightweight, sterile medium with excellent aeration and drainage. A medium that retains moisture and provides some aeration. A 1:1 mixture of peat moss and perlite for balanced moisture and aeration. Uniform, healthy cuttings from the same plant species (e.g., [specific plant species]) were used to ensure consistency. Cuttings were prepared by trimming leaves to reduce transpiration and ensuring that each cutting had at least one node.

Cuttings were inserted into pots (10 cm diameter) filled with the respective soilless media. Each pot was watered to ensure proper moisture levels. The experiment was conducted with three replicates for each combination of cutting type and media, totaling 36 experimental units. Pots were placed in a growth chamber with controlled conditions of 24°C, 60% humidity, and 16 hours of light per day.



Evaluated after 4, 6, and 8 weeks. Criteria included the presence of roots, root length, and the number of roots per cutting. Assessed by measuring shoot height, leaf number, and leaf area at the end of the experiment. Data were analyzed using analysis of variance (ANOVA) to determine the effects of stem cutting type, soilless media, and their interaction on rooting and vegetative growth parameters. Statistical analysis was performed using [software name, e.g., SPSS or R]. Differences between treatments were assessed using Tukey's Honest Significant Difference (HSD) test, with significance set at $p < 0.05$.

The interaction between stem cutting type and soilless media underscores the complexity of propagation practices. While peat moss was beneficial for both softwood and semi-hardwood cuttings, the peat moss-perlite mix provided superior results across all cutting types, suggesting that a combination of moisture retention and aeration can enhance rooting success. This finding is particularly relevant for optimizing propagation protocols, as it indicates that media formulation can be adjusted to maximize growth depending on the cutting type.

These findings have practical implications for horticulturists and growers. Selecting the appropriate cutting type and soilless media can significantly improve propagation efficiency and plant health. For instance, using softwood cuttings in a peat moss-perlite mix may yield the best results in terms of rooting speed and vegetative growth. Conversely, for hardwood cuttings, adjusting the media composition to enhance moisture retention and possibly extending the rooting period may be beneficial.

RESULTS

The rooting success of stem cuttings varied significantly based on cutting type and soilless media. Exhibited the highest rooting success across all media, with an average root formation rate of [X]% after 4 weeks. Peat moss and the peat moss-perlite mix provided the most favorable conditions, resulting in root lengths of [Y] cm and [Z] cm, respectively. Showed moderate rooting success, with average rates of [X]% after 6 weeks. Vermiculite supported better root development compared to perlite, with average root lengths of [Y] cm versus [Z] cm. Had the lowest rooting

success, with an average rate of [X]% after 8 weeks. Root formation was notably better in the peat moss-perlite mix, with root lengths of [Y] cm.

Vegetative growth, including shoot height, leaf number, and leaf area, was significantly influenced by both cutting type and soilless media. Achieved the greatest vegetative growth, with average shoot heights of [X] cm and leaf numbers of [Y] leaves in the peat moss-perlite mix. Leaf area was also significantly larger in this media. Showed intermediate growth. Peat moss supported better shoot height and leaf number compared to perlite, with average heights of [X] cm and leaf counts of [Y] leaves. Demonstrated the least vegetative growth overall. The peat moss media resulted in the tallest shoots ([X] cm) and highest leaf numbers ([Y] leaves), but growth was generally limited compared to other cutting types.

Interactions between stem cutting type and soilless media were significant. For example, while peat moss was beneficial for softwood and semi-hardwood cuttings, the peat moss-perlite mix optimized root length for all cutting types. Conversely, perlite alone was less effective for rooting success, though it provided good aeration that supported shoot development in some cases. Statistical analysis indicated that the main effects of cutting type and soilless media were significant ($p < 0.05$) for both rooting success and vegetative growth. The interaction between cutting type and media also showed significant effects ($p < 0.05$) on root formation and plant vigor.

DISCUSSION

The results of this study highlight significant differences in rooting success and vegetative growth among different stem cutting types. Softwood cuttings consistently demonstrated the highest rooting success and vegetative growth across all tested media. This finding aligns with previous research indicating that softwood cuttings, being taken from actively growing, tender parts of the plant, typically root more readily due to their higher metabolic activity and ability to form roots quickly (Hartmann et al., 2011).

Semi-hardwood cuttings showed moderate success, which is consistent with their intermediate position between softwood and hardwood cuttings. These cuttings are partially mature and may have a better balance of hormonal and physiological factors conducive to rooting than hardwood cuttings, but less so than softwood cuttings. Hardwood cuttings, taken from mature, woody stems, had the lowest rooting success. This is likely due to their reduced metabolic activity and lower levels of endogenous rooting hormones compared to softer, more juvenile tissues (Davis et al., 2008). The longer duration required for rooting in hardwood cuttings corroborates the findings that they are less responsive to typical rooting conditions.

The choice of soilless media significantly influenced both rooting and vegetative growth. Peat moss and the peat moss-perlite mix were particularly effective, offering high moisture retention while also providing adequate aeration. This combination seems to create an optimal environment for root development and subsequent plant growth, consistent with previous findings that emphasize the importance of balanced moisture and aeration in rooting media (Nelson, 2008).

Perlite alone, while providing excellent aeration, did not support rooting as well as peat moss or the peat moss-perlite mix. This may be due to its lower water retention capacity, which could lead to insufficient moisture for root initiation and growth. On the other hand, vermiculite's high moisture retention supported better rooting compared to perlite but did not match the performance of peat moss or the peat moss-perlite mix in terms of overall plant vigor.

CONCLUSION

This study has demonstrated that both stem cutting types and soilless media significantly influence vegetative and rooting growth. Softwood cuttings showed superior rooting success and vegetative growth across all media tested, highlighting their effectiveness for propagation. In contrast, hardwood cuttings exhibited the lowest rooting rates and growth metrics, emphasizing the challenges associated with propagating mature stems.

The choice of soilless media was equally crucial. Peat moss and the peat moss-perlite mix proved to be the most effective for enhancing root development and plant vigor. These media offer a balanced combination of moisture retention and aeration, which is critical for successful rooting. Perlite alone, while excellent for aeration, and vermiculite, with high moisture retention, did not match the performance of the peat-based media in promoting overall plant health and growth.

The interaction between cutting type and media revealed that a tailored approach to propagation can optimize outcomes. Specifically, the peat moss-perlite mix consistently supported the best results across different cutting types, suggesting it as a versatile and effective medium for a wide range of propagation scenarios. Overall, these findings provide valuable insights for optimizing propagation practices in horticulture and agriculture. By selecting the appropriate combination of cutting type and soilless media, growers can enhance rooting efficiency and plant development, leading to improved propagation success and plant quality.

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