# Propagation of Sparkleberry (*Vaccinium arboreum*) Improved via Cutting Type©

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## INTRODUCTION

Partly due to difficulty propagating, *Vaccinium arboreum* is seldom marketed as a landscape plant. However, *V. arboreum*, also known as sparkleberry or farkleberry, can grow to be an aesthetically pleasing semi-evergreen small tree, with attractive fall color, exfoliating bark, and edible fruit. *Vaccinium arboreum* is very drought tolerant and can grow in a range of soil types; therefore, it is a good selection as an attractive woodland shrub/small tree for xeriscaping and native plant landscaping. Though seed germination is more difficult compared to other commercial blueberry species (Lyrene and Brooks, 1995), *V. arboreum* plants are commercially propagated from seeds. Asexual propagation techniques will be necessary for clonal propagation of selected cultivars of *V. arboreum*.

To date, there has not been much research on the propagation of *V. arboreum*. Stockton (1976) tried to propagate *V. arboreum* using softwood stem cuttings and K-IBA quick-dips (0, 10,000, 15,000, and 20,000 ppm). After 60 days, cuttings were checked for rooting and minimal to no success was observed in all of the treatments (Stockton, 1976). Reese (1992) used semi-hardwood stem cuttings, various levels of IBA+NAA, willow water, and Hormodin® 3 to determine rooting percentage of *V. arboreum*. Similar to the previous study, little rooting was observed, with only a 0-12.5% rooting percentage recorded among the treatments. The control treatment had 0% rooting and all of the treatments were statistically similar, suggesting that none of the treatments influenced rooting success (Reese, 1992). Hence, previous research suggests *V. arboreum* is a very hard-to-root species, with no indication of viable treatments to enhance rooting of stem cuttings.

The objectives of this study were to determine whether cutting type (softwood, semi-hardwood, or hardwood), cutting position (terminal or subterminal), IBA concentration, or the interaction of these treatments influence rooting of *V. arboreum* stem cuttings. Previous experiments did not specify if the cuttings were taken from juvenile or mature wood. Only juvenile wood was used in this study, as juvenile wood is typically easier to root than mature wood for most species (Hartmann et al., 2011).

## MATERIALS AND METHODS

This study was conducted at the Paterson Greenhouse Complex, Auburn University, Auburn, Alabama. Cutting propagation material of *V. arboreum* was collected from two locations. Water sprouts from native, mature plants were collected from the Robert Trent Jones Golf Trail at Grand National (RTJ) in Opelika, Alabama (lat. 32°69'N, long. 85°44'W, USDA hardiness Zone 8a). Juvenile cuttings arising from latent buds on mature plants that had been cut back to approximately 1 m in height in February 2010 were collected from Stone County, Mississippi (SCMS) (lat. 30°80'N, long. 89°17'W, USDA hardiness Zone 8b). Softwood, semi-hardwood, and hardwood cuttings were collected, as well as sub-terminal and terminal cuttings. Cuttings were trimmed to 10-12 cm long.

Caliper of all cuttings ranged from RTJ and SCMS averaged 2.96 and 3.81 mm, respectively. Caliper of the semi-hardwood cuttings from RTJ and SCMS averaged 2.99 and 3.25 mm, respectively. Caliper of the hardwood cuttings from RTJ and SCMS averaged 2.82 and 3.07 mm, respectively.

Auxin solutions were prepared using Hortus IBA Water Soluble Salts® (Hortus USA Corp.) and deionized water. The basal end of each cutting was cut at a 45° angle and received a 10-s basal quick-dip to a depth of 3 cm in either water (control) or a solution of 1000, 2500, 5000, or 7500 ppm IBA. Cuttings were then inserted to a depth of 3 cm into a cell in a 48-cell tray. A peat and perlite substrate (1:1, v/v) was used. After they were inserted, the cuttings were placed on a greenhouse bench in a 1.2-m-wide by 2.4-m-long by 0.9-m-tall polyethylene covered enclosure to ensure the relative humidity stayed at an appropriate level. Overhead mist was provided within the enclosure for 2 sec every 10 min.

A completely randomized design was used with 30 cuttings (replications) per treatment. Rooting response (rooted or unrooted) was recorded for all cuttings, with a cutting considered rooted when any sign of adventitious roots were seen emerging from the stem. Additional data collected include number of primary roots emerging from the stem of each rooted cutting, total length of primary roots on each rooted cutting, number of rooted cuttings with new shoots, total shoot length on each rooted cutting, number of cuttings that formed callus, and callus caliper of cuttings with callus.

The treatment design was a 2×2×3×5 complete factorial design with four factors:

1) source (water sprouts from mature plants or sprouts arising from latent buds on cut back plants).
2) cutting position on the stock plant (terminal and subterminal).
3) cutting maturity (softwood, semi-hardwood and hardwood).
4) IBA rate (0, 1000, 2500, 5000, and 7500 ppm), for a total of 60 treatment combinations.

The experimental design was a completely randomized design. Data were analyzed using generalized linear models with the GLIMMIX procedure of SAS (version 9.2; SAS Institute Inc., Cary, North Carolina).

## RESULTS

In the original model, only softwood and hardwood cuttings were used. This was due to the fact that semi-hardwood, terminal cuttings were unavailable at one of the sources. The only three-way interaction term that was significant was source × type × position; therefore, the way that source and type affect a cutting could vary depending on the position. For this reason, separate analyses were run for subterminal and terminal cuttings.

### Subterminal Cuttings

There were no significant effects of IBA rate on rooting percentage (Table 1) or any of the parameters (root number, root length, shoot number, shoot length, callus presence, and callus caliper) measured on sub-terminal cuttings. The source and type of cutting did influence the rooting percentage. The highest rooting percentage occurred when using softwood cuttings from RTJ with a rooting percentage of 38.6% (Table 2). Similar rooting was observed in SCMS softwood and semi-hardwood with rooting percentages of 34.6% and 28.5% respectively. None of the treatments significantly influenced the number of primary roots per rooted cutting. Type of cutting influenced the length of primary roots. The longest roots were found on SCMS semi-hardwood cuttings with an average total root length of 23.3 cm. Stone County, Mississippi softwood and hardwood and RTJ semi-hardwood cuttings had statistically similar root lengths, with average total root lengths of 18.3, 17.0, and 17.1 cm, respectively (Table 2).

Table 1. Influence of IBA rate on rooting percentage of subterminal and terminal *Vaccinium arboreum* stem cuttings.

| Subterminal rooting (%) | SCMS[z] | | | RTJ[y] | | |
|---|---|---|---|---|---|---|
| IBA rate (ppm) | Softwood | Semihard | Hardwood | Softwood | Semihard | Hardwood |
| 0 | 26.6[x] | 36.6 | 0.0 | 33.0 | 3.3 | 11.6 |
| 1000 | 30.0 | 16.6 | 0.0 | 36.6 | 6.6 | 8.3 |
| 2500 | 36.6 | 43.3 | 3.3 | 35.0 | 10.0 | 11.6 |
| 5000 | 36.6 | 23.3 | 0.0 | 36.6 | 16.6 | 13.3 |
| 7500 | 43.3 | 23.3 | 0.0 | 51.6 | 10.0 | 8.3 |
| Significance[w] | NS | NS | NS | NS | NS | NS |
| Terminal rooting (%) | SCMS | | | RTJ | | |
| IBA rate (ppm) | Softwood | Semihard | Hardwood | Softwood | Semihard | Hardwood |
| 0 | 36.7 | . | 0.0 | 36.7 | . | 3.3 |
| 1000 | 20.0 | . | 3.3 | 60.0 | . | 0.0 |
| 2500 | 26.7 | . | 6.6 | 36.7 | . | 3.3 |
| 5000 | 23.3 | . | 0.0 | 40.0 | . | 3.3 |
| 7500 | 40.0 | . | 0.0 | 43.3 | . | 0.0 |
| Significance | NS | . | NS | NS | . | NS |

[w]nonsignificant (NS).
[x]*n*=30.
[y]Robert Trent Jones Golf Course in Opelika, Alabama, cuttings taken from water sprouts of mature plants.
[z]Stone County, Mississippi, cuttings taken from plants cut back in Feb, 2010.

Table 2. Effect of cutting source and cutting type on percent rooting, number of roots and root length of subterminal *Vaccinium arboreum* stem cuttings.

| Source | Type | Rooting (%) | Roots (no.) | Root length (cm) |
|---|---|---|---|---|
| RTJ[z] | Softwood | 38.6 a[x] | 2.2 a | 16.0 bc |
| SCMS[y] | Softwood | 34.6 a | 1.9 a | 18.3 ab |
| RTJ | Semihardwood | 9.2 b | 1.6 a | 17.1 abc |
| SCMS | Semihardwood | 28.5 a | 2.4 a | 23.3 a |
| RTJ | Hardwood | 10.6 b | 1.9 a | 10.7 c |
| SCMS | Hardwood | 0.7 c | 1.0 a | 17.0 abc |

[x]Shaffer-Simulated grouping for source*type least squares mean ($\alpha$=0.05).
[y]Stone County, MS, cuttings from plants that had been cut back Feb, 2010 and resprouted.
[z]Robert Trent Jones Golf Trail, Opelika, AL, cuttings from watersprouts.

**Terminal Cuttings**
There were no significant effects of IBA rate on rooting percentage or any of the parameters measured on terminal cuttings (Table 1). The source and type of cutting both significantly influenced rooting percentage. The highest rooting percentage was observed on the RTJ softwood cuttings with 43.3% rooting. Softwood cuttings from SCMS had 29.2% rooting, which was greater than hardwood cuttings from both sources (2.0%) (Table 3). None of the treatments influenced the number of primary roots on rooted cuttings or the total combined length of primary roots.

Table 3. Effect of cutting source and cutting type on percent rooting, number of roots and root length of terminal *Vaccinium arboreum* stem cuttings.

| Source | Type | Rooting (%) | Roots (no.) | Root length (cm) |
|---|---|---|---|---|
| RTJ[z] | Softwood | 43.3 a[x] | 2.2 a | 16.9 a |
| SCMS[y] | Softwood | 29.2 b | 2.0 a | 20.1 a |
| RTJ | Hardwood | 2.0 c | 2.0 a | 19.3 a |
| SCMS | Hardwood | 2.0 c | 2.7 a | 6.4 a |

[x]Shaffer-Simulated grouping for source*type least squares mean (α=0.05).
[y]Stone County, MS, cuttings from plants that had been cut back Feb, 2010 and resprouted.
[z]Robert Trent Jones Golf Trail, Opelika, Alabama, cuttings from watersprouts.

**DISCUSSION**

The IBA rate did not influence the rooting percentage of any of the cuttings. Similar results were observed using various IBA (Stockton, 1976) and IBA+NAA (Reese, 1992) concentrations to root *V. arboreum* cuttings in previous research. Type of cutting greatly affected the rooting success of *V. arboreum*, with softwood cuttings rooting more readily than hardwood cuttings. The source (RTJ or SCMS) of the cutting influenced the rooting percentage of semi-hardwood cuttings. Semi-hardwood cuttings from SCMS had a similar rooting percentage to softwood cuttings, and the cuttings from RTJ had a low rooting percentage, similar to hardwood cuttings. The greater number of sprouts from the plants that had been cut back at the SCMS location allowed us to be more selective, and the cuttings may have been closer to softwood cuttings than the cuttings from RTJ.

Since virtually no rooting success of *V. arboreum* was observed in previous research (Reese, 1992; Stockton, 1976), the fact that we observed 29.2-43.2% rooting in softwood cuttings was encouraging. Although this may not be a commercially feasible way to propagate *V. arboreum*, it demonstrates that it is possible to root and that the methods could potentially be improved. Previous research did not mention whether juvenile or mature cuttings were used in the experiments (Reese, 1992; Stockton, 1976). Only juvenile wood was used in this study, which may explain the greater rooting success. Future research should utilize bottom heat and lower light intensity. Rooting percentages of deciduous azaleas, which are in the same family as *V. arboreum* (*Ericaceae*), were improved in response to bottom heat (Knuttel, 1984; Mylin, 1982; Nienhuys, 1980) and lower light intensity (Read and Economou, 1983).

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