Rooting Response of Piedmont Azalea (*Rhododendron canescens*) to Auxin Basal Quick Dip on Single Node Cuttings

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Summary
Piedmont azalea (*Rhododendron canescens*) is a deciduous azalea native to the southeastern United States as well as areas in Maryland and Pennsylvania. Cutting propagation is used to help reduce the variability observed when propagating from seed. As a whole, deciduous azaleas are known to be difficult to root via cuttings, however, Piedmont azalea has been reported to be moderate to easy to propagate as softwood cuttings. Piedmont azalea has been observed to successfully root as softwood cuttings treated with a range of indole-3-butyric acid (IBA) from 5,000 to 10,000 ppm. The objective of this research was to determine rooting response of new growth, single node cuttings to an auxin basal quick dip in order to provide growers with relevant cutting propagation recommendations. Naturally occurring auxins are said to be produced in newly forming tissues. Therefore, it is possible adding a low dose of endogenous auxin could encourage young plants to potentially root faster and more efficiently than an older cutting. Auxin source was Hortus IBA Water Soluble Salts® (Hortus IBA) at 0, 50, 250, or 400 ppm IBA applied via five second quick dip. Data collected after 120 days included rooting percentage, total root number, and root quality (1-5, with 1=no roots and 5=healthy, vigorous root system). Results indicate that single node Piedmont azalea cuttings will root with or without the use of an auxin basal quick dip.

Introduction

Deciduous azaleas (*Rhododendron spp.*) are described by Dirr (2017) as being "among the most common woody flowering shrubs in the United States, with a myriad of shapes, sizes, and flower colors." Although native to many areas of the world, 15 species are native to the eastern United States (Dirr and Heuser, 2018; Hyatt, 2006). Piedmont azalea, (*Rhododendron canescens* [Michaux.] Sweet) is the most common native azalea in the southeastern United States. It is reported to be found in Arkansas, Louisiana, Mississippi, Alabama, Georgia, Florida, Tennessee, South Carolina, North Carolina, as well as areas of Texas and

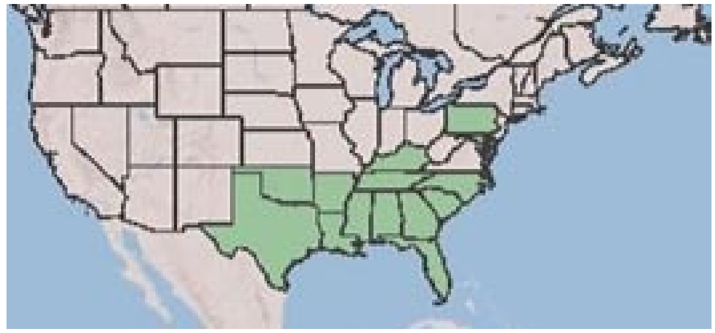

Fig. 1. Native distribution of Piedmont azalea, *Rhododendron canescens* (USDA).

Oklahoma (Figure 1 above) (Thompson, 2018; USDA, NRCS, 2020). Flowers are mildly fragrant and range from white to pink in color appearing in early spring (Figure 2 on page 43) (Dirr, 2017; Hyatt, 2006).

Propagation of native deciduous azaleas can be done by seed, cutting, and layering. Deciduous azaleas are considered to be a difficult to root plant species. Due to trait variability observed in seed-grown azaleas, cutting propagation is preferred; however, cutting propagation recommendations can vary (Hyatt, 2006; Sommerville, 1998). According to Dirr and Heuser (2018), slightly firm, 15.2 cm (6 in) cuttings should be taken from the beginning to the end of April. Dirr and Heuser (2018) also recommend using a fungicide with 4,000 ppm IBA dip; however, recommended auxin concentrations can vary with different cultivars. Hyatt (2006) recommends taking 5 to 8 cm (2 to 3 in) softwood cuttings in late May to early June while the plants are actively growing. Bir (1992) achieved successful rooting with softwood cuttings taken after the new growth had ceased and treated with 1,000-2,500 ppm IBA. Ryals et al. (2019) achieved low percentages of rooting when cuttings of new plant tissue were taken after flower senescence and treated with 2,500 ppm IBA.

Besides being difficult to root, deciduous azaleas can also be problematic to come out of dormancy and put on new growth (Brown, 2017). According to Hyatt (2006), the stronger the rooting hormone used, the more difficult it is for cuttings to break dormancy and start actively growing. Piedmont azalea has been reported to be anywhere from moderate-to-easy to propagate as softwood cuttings, according to Galle (1987). Treatment of Piedmont azalea softwood cuttings with 10,000 ppm K-IBA resulted in successful rooting performance (Knight et al., 2005). Also, rooting with lower rates of K-IBA (7,500 ppm) occurred and an increase of rooting percentage was observed. Berry (1998) also observed rooting when new soft growth was treated with 5,000 ppm K-IBA. Auxins can be thought of as "master plant hormones" due to the fact that they influence almost every part of a plant's growth and development (Ross et al., 2002). Translocation of auxins is thought to occur from the shoot tips down to the root tip (Goldsmith, 1977). Based on the location of naturally occurring auxins and the translocation path, it could be possible to take new, young plant tissue cuttings and utilize the naturally occurring auxin. Addition of a low dose, synthetic auxin treatment to young plant tissue cuttings could encourage the plant to possibly root faster and more efficiently than with a hardwood cutting. Thus, the objective of this study was to determine if rooting response was improved when young plant tissue, single node Piedmont azalea cuttings were treated with a basal quick dip in a range of IBA concentrations.

Materials and Methods

Piedmont azalea cuttings were taken on 3 April 2020 and 21 April 2022 from native populations at The Crosby Arboretum located in Picayune, MS (lat. 30°30'11" N, long. 89°39'53" W, elevation 17 meters USDA hardiness zone 8b). Cuttings were taken around 7:00 am after a recent rain both years to ensure they were turgid to aid in reduction of transpiration stress on the cuttings (Bir, 1996). Using the method that was described by Jenkins (2007), cuttings were taken from tissue soft enough to be removed via pinching with fingers (Figure 3 on page 44). The cuttings were single node with an average length around 1 inch long. Immediately after pinching, cuttings were placed and stored in a cooler of city water until being stuck in the respective treatments (Jenkins, 2007). At sticking, cuttings were turgid and showed no signs of wilting or stress.

Hortus (Hortus IBA Water Soluble Salts®, Phytotronics, Inc. ®, Earth City, MO) was mixed with city water and applied as a five second quick dip to the cuttings at four different auxin levels (0,

Fig. 2. Piedmont azalea flowers with showy soft pink color.

50, 250 or 400 ppm). The four auxin treatments were arranged in a randomized complete block experimental design with four blocks and eight cuttings per treatment per block (4 x 8 = 32 total cuttings per treatment; 32 x 4 = 128 total cuttings in study). After treatment application, cuttings were stuck in a growing mix (Jolly Gardener® Pro Line C/B Growing Mix, Old Castle Lawn & Garden, Atlanta, GA) in 2.25 in, 38 cell propagation tray inserts. The growing mix contained Canadian sphagnum peat, processed pine bark, coarse perlite, and medium vermiculite. Cuttings were then placed under intermittent mist for 6 seconds every 6 minutes during daylight hours. Sixty days after sticking, mist intervals were reduced to 2 seconds every 6 minutes. The study was terminated 120 days after sticking. In order to count and view the roots, substrate was washed off by gently spraying the roots with water. Data collected after 120 days included rooting percentage, total root number, and root quality (1-5, with 1=no roots and 5=healthy, vigorous root system). Data were analyzed using PROC GLIMMIX and Tukey's HSD at $P \leq 0.05$ in SAS version 9.4 (SAS Institute INC., Cary, NC).

Results and Discussion

Results indicated that total root number, root quality rating, and rooting percentage were all observed to be similar among treatments within each year and across all years (Tables 1-3 on page 45).

There were no significant differences in treatment effect on root number with the average number of roots ranging from 4.3 to 3.5 across all years (P=0.4580), 5.8 to 4.1 in 2020 (P=0.3184), and 3.8 to 2.9 in 2022 (P=0.4063) (Table 1 on page 45). No significant treatment differences were observed in root quality ratings with the average root quality rating ranging from 3.2 to 3.8 in 2020 (P=0.3716), 2.7 to 3.0 in 2022 (P=0.6988)

Fig.3. The circled area depicts the single node, new growth that was removed via pinching with fingers.

and from 3.0 to 3.3 across all years (P=0.6797) (Table 2 on page 45). Rooting percentages across all years ranged from 73 to 84%, depending on treatment, with the average overall rooting percentages of 80% across all treatments (P=0.3962) (Table 3 on page 45). In 2020, rooting percentages ranged from 72 to 91%, depending on treatment, with average overall rooting percentages of 83% across all treatments (P=0.2045) (Table 3). In 2022, rooting percentages ranged from 75 to 78% with average overall rooting percentages of 77% across all treatments (P=0.9812) (Table 3). In other studies, Piedmont azalea rooting percentages have ranged from 75 to 100% (Knight et al., 2005; Thompson, 2018). Even though rooting percentages are very similar, previous studies used older cuttings compared to this study and required high concentrations of IBA (7,500 to 10,000 ppm) to achieve these percentages.

Propagation methods that will provide the grower with a quality liner at maximum efficiency are critical to the success of Piedmont azalea in the market. Based on the results found in this study, it would appear that new growth, single node cuttings of Piedmont azalea can be successfully rooted without an additional exogenous auxin application. Gaining the ability to grow hard to root species without the use of exogenous auxins can benefit propagation nurseries financially and in management practices. Plant production without the use of auxin can provide a savings in input costs spent on auxins, labor costs, and reduction in plant production time. Knowing that Piedmont azalea can be propagated without the use of auxin will reduce the time it takes to stick cuttings by eliminating the hormone dipping process. Growers can also reduce the spread of disease by being able to stick cuttings directly into growing media without the possibility of contaminating them in the hormone dipping process. Also, knowing how to propagate Piedmont azalea from different cutting types gives growers the flexibility to propagate it at the most efficient time during their crop rotations.

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Table 1. Influence of auxin basal five second quick dip on number of roots of Piedmont azalea.

Treatment	2020	2022	All Years
Control	5.8 a[z]	2.9 a	4.3 a
50 ppm[x] IBA[w]	4.7 a	3.8 a	4.2 a
250 ppm IBA	4.8 a	2.9 a	3.9 a
400 ppm IBA	4.1 a	2.9 a	3.5 a
Standard Error	0.6570	0.5015	0.9351
Significance (p-value)[y]	0.3184	0.4063	0.4580

[z]Means followed by the same letter within a column are similar and not significantly different ($\alpha = 0.05$).
[y]P values for differences between means were obtained using Tukey's honest significant difference (HSD) at $P \leq 0.05$.
[x]1 ppm = 1mg/L
[w]IBA = indole-3-butyric acid

Table 2. Influence of auxin basal five second quick dip on root quality[x] of Piedmont azalea.

Treatment	2020	2022	All Years
Control	3.8 a[z]	2.7 a	3.2 a
50 ppm[w] IBA[v]	3.6 a	3.0 a	3.3 a
250 ppm IBA	3.5 a	2.7 a	3.1 a
400 ppm IBA	3.2 a	2.9 a	3.0 a
Standard Error	0.2537	0.2721	0.3729
Significance (p-value)[y]	0.3716	0.6988	0.6797

[z]Means followed by the same letter within a column are similar and not significantly different ($\alpha = 0.05$).
[y]P values for differences between means were obtained using Tukey's honest significant difference (HSD) at $P \leq 0.05$.
[x]Root quality (visual rating of 0-5, with 0=dead, no callus and 5=healthy, vigorous root system).
[w]1 ppm = 1mg/L
[v]IBA = indole-3-butyric acid

Table 3. Influence of auxin basal five second quick dip on root percentage[x] of Piedmont azalea.

Treatment	2020	2022	All Years
Control	91 a[z]	78 a	84 a
50 ppm[w] IBA[v]	88 a	78 a	83 a
250 ppm IBA	81 a	75 a	78 a
400 ppm IBA	72 a	75 a	73 a
Standard Error	0.0672	0.0814	0.0594
Significance (p-value)[y]	0.2045	0.9812	0.3962

[z]Means followed by the same letter within a column are similar and not significantly different ($\alpha = 0.05$).
[y]P values for differences between means were obtained using Tukey's honest significant difference (HSD) at $P \leq 0.05$.
[x]Percent rooted (visual rating of whether roots were present or not).
[w]1 ppm = 1mg/L
[v]IBA = indole-3-butyric acid

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Additional index words. Hortus IBA Water Soluble Salts®, IBA, Propagation, Single Node.