Winter Propagation of Confederate Rose (*Hibiscus mutabilis*) with Hardwood Cuttings©

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Confederate rose (*Hibiscus mutabilis*), a native of southeastern China, is an old-fashioned, ornamental plant often found in older gardens in the southern USA. Hardy in U.S.D.A. Zones 7-9, plants grow as large shrubs or small trees in warmer areas, but generally die back to a woody base or short trunk in colder areas of their range. Stems from the past growing season that remain on plants during the winter in the warmer regions may be used to prepare hardwood stem cuttings. The current study examined hardwood cutting propagation of confederate rose in response to a 1-sec basal quick-dip in auxin (1000 ppm IBA, 3000 ppm IBA, 1000 ppm IBA + 500 ppm NAA, and 3000 ppm IBA + 1500 ppm NAA) and a basal wound (along with 1000 ppm IBA only). Cuttings were rooted in a warm, high-humidity environment within a greenhouse. Auxin treatments improved overall rooting percentage and total root length, with 1000 ppm IBA (without and with a basal wound) providing the highest rooting percentages (about 70%) and non-treated cuttings the lowest (44%). A significant increase in total root length on rooted cuttings resulted with the use of 3000 ppm IBA and use of a basal wound plus 1000 ppm IBA compared with non-treated cuttings. Auxin and wounding treatments did not have any significant inhibitory effects on bud break and growth of new shoots on rooted cuttings.

INTRODUCTION

Confederate rose, also known as cottonmallow or Dixie rosemallow, is an old-fashioned plant that was once commonly grown throughout the southern USA, although the species is native to southeastern China (Flora of China Editorial Committee, 2006; Scheper, 2003; Welch, 2009). Often considered a "pass-along" plant due to its distribution through friends and neighbors, confederate rose is popular for its large, soft, gray-green foliage during the summer, and large, showy flowers produced late in the season when few other plants are in bloom (Russ, 2007).

Confederate rose is hardy in U.S.D.A. Zones 7 to 9 (Scheper, 2003). Plants grow as large shrubs or small trees in warmer areas, dropping their leaves in winter and leafing out on old stems in the spring (Russ, 2007). Plants behave more like herbaceous perennials in the colder parts of its hardiness range, producing new flowering branches from a woody base or short trunk each year (Editors of Sunset Books and Sunset Magazine, 1997). Plants will grow to 15 ft high and 10 ft wide in frost-free areas and 6-8 ft in areas with hard freezes (Knox and Schoellhorn, 2011).

Plants of confederate rose flower from late summer to early fall, with flowers clustered near the ends of the branches (Liberty Hyde Bailey Hortorium, 1976; Scheper, 2003). The 6- to 10-in.-wide flowers open white or pink and darken as they age over about 3 days, resulting in multiple flower colors on the same plant. Commonly grown cultivars are 'Flora Plena', with double white flowers, and 'Rubra', of shorter stature and with deep pink to carmine flowers (Knox and Schoellhorn, 2011).

Propagation of confederate rose from hardwood cuttings collected from stock plants during the winter in areas where stems from the previous season's growth are not killed by cold winter temperatures would permit maximum use of propagation materials for the rapid multiplication of new cultivars by supplementing, or being used in place of, leafy stem cuttings taken during the growing season. Therefore, the objective of the present study was to examine the need for an auxin treatment and basal wounding treatment to optimize rooting of hardwood cuttings of confederate rose. Auxin treatments are commonly used in commercial plant propagation to increase overall rooting percentages, hasten root initiation, increase the number and quality of roots, and encourage uniformity of rooting (Hartmann et al., 2002; Macdonald, 1987). Hardwood cuttings of some ornamental species root readily without any auxin treatment, eliminating one step in commercial propagation (Blythe and Sibley, 2009). Application of auxin is sometimes carried out in conjunction with a wounding treatment in order to expose more of the cambium tissue to the auxin (Blythe et al., 2007).

MATERIALS AND METHODS

Collection, preparation, treatment, and placement of cuttings took place on 4 Feb. 2008. Cutting propagation material was collected from mature plants of 18 different, unnamed clones of confederate rose growing in field rows in Poplarville, Mississippi (U.S.D.A. Hardiness Zone 8a). Subterminal cuttings were prepared 4¾ to 5½ in. in length with four vegetative buds, trimming ½ in. above and below a vegetative bud. Caliper of the cuttings ranged from 0.35 to 0.40 in.

Auxin solutions were prepared by diluting Dip'N Grow® (10,000 ppm IBA + 5000 ppm NAA; Dip'N Grow Inc., Clackamas, Oregon) and Dip'N Grow Lite (an experimental product with 10,000 ppm IBA; Dip'N Grow Inc.) with isopropyl alcohol and deionized water to produce a final solution containing 50% alcohol. Cuttings in one treatment remained untreated, whereas cuttings in all other treatments received a 1-sec basal quick-dip to a depth of 0.6 in. in their respective auxin treatments (1000 ppm IBA; 3000 ppm IBA; 1000 ppm IBA + 500 ppm NAA; 3000 ppm IBA + 1500 ppm NAA). In an additional treatment, cuttings were wounded by making a vertical incision to remove a wedge of bark ½ in. in length (penetrating slightly into the wood at the base of the cutting) on two opposing sides of the cutting base, followed by a basal quick-dip in 1000 ppm IBA solution. Treatments were randomly assigned to cuttings within each clone. Cuttings were inserted to a depth of 1 in. into individual cells of 6-packs (TJ606 jumbo inserts; 11.5 in.^{3} per cell; Dillen Plastics, Middlefield, Ohio) containing a commercial blend of peat, perlite, vermiculite, and pine bark (Fafard 3B; Conrad Fafard Inc., Agawam, Massachusetts) as the rooting substrate.

Cuttings were placed inside a polyethylene-covered enclosure (to maintain high humidity) within a climate-controlled greenhouse with an interior, retractable shade curtain. Overhead mist was supplied hourly for 10 sec to maintain a high humidity. Average daily maximum and minimum temperatures were 79 and 63°F, respectively.

A general block design was utilized with clone as the blocking factor and six cuttings (replications) per treatment per clone (for a total of 108 cuttings per treatment). Number of rooted cuttings, total length of primary roots on each rooted cutting, number of new shoots on each rooted cutting and total shoot length on each rooted cutting were determined after a rooting period of 54 days. A cutting was considered to be rooted if it had at least one root >1 in. in length. Root systems were washed to remove substrate and digitally scanned for analysis using WinRhizo software (Regent Instruments Inc., Quebec City, Quebec, Canada) to determine total root length. Data was analyzed using generalized linear mixed models with the GLIMMIX procedure of SAS (SAS Version 9.2; SAS Institute Inc., Cary, North Carolina).

RESULTS AND DISCUSSION

Rooting percentage was improved overall with the use of a basal quick-dip in an auxin solution in comparison with non-treated cuttings (Table 1). Examining specific treatments, 1000 ppm IBA (both without and with a basal wound) enhanced rooting percentage in comparison with non-treated cuttings, whereas higher rates of auxin (IBA alone or IBA+NAA) did not result in as great an improvement. This indicated that use of a basal quick-dip in auxin enhanced rooting percentage, with the lowest rate (1000 ppm IBA, which resulted in 69% rooting) being satisfactory and not improved by additional use of a basal wound.

Table 1. Rooting and initial shoot development responses of subterminal, hardwood stem cuttings of confederate rose treated with and without a basal quick-dip in an auxin solution (IBA or IBA + NAA), plus one treatment using a basal wound, along with a statistical comparison of nontreated cuttings with the overall response of auxin-treated cuttings.[Z]

Auxin rate (ppm)	Rooted cuttings (%)	Total root length[Y] (cm)	New shoots[Y] (no.)	Total length of new shoots[Y] (cm)
Nontreated	44 b[X]	87 b	2.0 a	9.4 ab
1000 IBA	69 a	168 ab	1.9 a	11.3 ab
3000 IBA	59 ab	211 a	1.7 a	13.1 a
1000 IBA + 500 NAA	60 ab	159 ab	1.7 a	10.9 ab
3000 IBA + 1500 NAA	61 ab	145 ab	1.5 a	8.5 b
1000 IBA; basal wound	70 a	193 a	1.8 a	13.0 a
Nontreated vs. auxin-treated[W]	0.0005[V]	0.005	0.1052	0.2684

[Z]Cuttings were prepared 4.75 to 5.50 in. in length and inserted to a depth of 1 in. into a commercial blend of peat, perlite, vermiculite, and pine bark in a warm, high-humidity rooting environment inside a greenhouse for a rooting period of 54 days. There were 6 cuttings per treatment for each of 18 clones (blocking factor), providing a total of 108 cuttings per treatment.

[Y]Rooted cuttings only.

[X]Means followed by the same letter within a column are not significantly different according to the Shaffer-Simulated method (α=0.05).

[W]Auxin-treated' includes four treatments: 1000 ppm IBA, 3000 ppm IBA, 1000 ppm IBA + 500 ppm NAA, and 3000 ppm IBA + 1500 ppm NAA. Cuttings receiving the basal wound were excluded.

[V]Probability value for the test that the difference between the nontreated and auxin-treated cuttings is zero. Small values (generally less than 0.05) indicate a significant difference.

Total root length was greatest overall with the use of an application of auxin in comparison with non-treated cuttings (Table 1). Among the specific treatments, cuttings treated with 3000 ppm IBA, as well as wounded cuttings treated with 1000 ppm IBA, exhibited significantly greater total root length than nontreated cuttings. These responses indicated that the moderate rate of auxin (3000 ppm) promoted development of a larger root system compared with no auxin treatment; however, a response similar to that obtained using 3000 ppm IBA could have been achieved using the 1000 ppm rate of auxin along with a basal wound. Nevertheless, root systems among all cuttings receiving the various auxin treatments were visually noted to be of adequate size for holding together the volume of substrate if removed from the cells, indicating that the lower rate of auxin would be satisfactory for producing root systems of suitable size over the 54-day rooting period used in this study.

The number of shoots that developed from the rooted cuttings and their total length was not significantly affected by auxin application or wounding in comparison with nontreated cuttings (Table 1). With one exception for total shoot length response, treatment means for number of shoots and total shoot length were similar among the individual treatments. These results indicated that auxin treatments used in this study did not have an inhibitory effect on bud break or shoot development on the rooted cuttings, an effect that can occur on stem cuttings of some crops, depending upon the type and concentration of auxin being used (Blythe et al., 2007).

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