Vegetative Propagation of Mexican Redbud, Larchleaf Goldenweed, Littleleaf Ash, and Evergreen Sumac by Stem Cuttings

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ABSTRACT

Effect of cutting age (weeks after budbreak) and IBA concentration on percent rooting of Mexican redbud, larchleaf goldenweed, littleleaf ash, and evergreen sumac were investigated. Maximum predicted percent rooting was 88% for cuttings of Mexican redbud taken 4 weeks after budbreak and treated with 21 gliter⁻¹ IBA, 99% for cuttings of larchleaf goldenweed taken 6 weeks after budbreak and treated with 16 gliter⁻¹ IBA, 86% for cuttings of littleleaf ash taken 16 weeks after budbreak and treated with 17 gliter⁻¹ IBA, and 24% for cuttings of evergreen sumac taken 16 weeks after budbreak and treated with 5 gliter⁻¹ IBA.

INTRODUCTION

Mexican redbud (Cercis canadensis var. mexicana (Rose) M. Hopkins), larchleaf goldenweed (Ericameria laricifolia (Gray) Shinners), littleleaf ash (Fraxinus greggii Gray), and evergreen sumac (Rhus virens Gray) are southwestern shrubs with potential as adapted ornamentals for the area (Duffield and Jones, 1981; Miller, 1978; Nokes, 1986). Germ plasm collections of all four species exhibit variability in floral color (Mexican redbud) or growth habit (larchleaf goldenweed, littleleaf ash, evergreen sumac) that could be exploited through vegetative propagation to provide superior plants. Few reports have been published regarding rooting of stem cuttings of these species, but studies on related species indicate timing and 1H-indole-3-butyric acid (IBA) concentration are critical. Despite an early report that untreated stem cuttings of eastern redbud (Cercis canadensis L.) taken in June and July rooted 75% to 90% in 4 weeks (Thomas, 1936), other authors report little success in rooting softwood or semi-hardwood cuttings (Dirr and Heuser, 1987; Hartmann and Kester, 1975; Nokes, 1986). Ashes (Fraxinus spp.) are considered very difficult to propagate from stem cuttings (Dirr and Heuser, 1987). One percent of softwood cuttings of fragrant ash (Fraxinus cuspidata Torrey) treated with an auxin-talc preparation of 0.8 gg⁻¹ IBA rooted (B. J. Simpson, Texas A&M Research Center at Dallas, personal communication). Softwood and semihardwood cuttings of fragrant sumac (Rhus aromatica Ait.), a deciduous species, rooted after treatment with 1 gliter⁻¹ IBA (Tracz, 1983). Nokes (1986) reports semihardwood cuttings of evergreen sumac treated with an auxin-talc preparation of 0.8 gg⁻¹ IBA have rooted. It appears no attempts to root cuttings of goldenweed have been published. This study was conducted to determine the effect of timing and IBA concentration on the rooting of stem cuttings of the four species.

MATERIALS AND METHODS

To avoid ambiguity in softwood and semihardwood terminology, leafy terminal stem cuttings 10 to 15 cm long were taken from single cultivated plants 4, 8, 12, and 16 weeks after budbreak for each plant. Test plants were selected based on desirable characteristics, a dark flower color for Mexican redbud and an apparent rapid growth rate for the remaining species. Except littleleaf ash, all plants were at least 7 years old, had bloomed for several years, and were in the adult growth phase. The littleleaf ash was also 7 years old but had not bloomed. Cuttings from each collection date were wounded by pressing the basal 10 mm against a replacement blade for an electric
razor, producing eight parallel cuts about 1.2 mm apart perpendicular to the stem axis. Cuttings from each collection date were divided into six groups of 20 cuttings each and each group dipped for 5 seconds in one of six solutions containing 0 to 25 gliter\(^{-1}\) IBA (potassium salt) in deionized water at 5 gliter\(^{-1}\) increments. Cuttings were then stuck in a medium of equal parts perlite and vermiculite (by volume), previously drenched with a 250 mg liter\(^{-1}\) active ingredient solution of benomyl, in individual 0.3 liter containers. The containers were placed in a ventilated high humidity chamber (Milbocker, 1983; Milbocker and Wilson, 1979). The quonset chamber measured 5.2 x 9.1 x 2.4 m high at the center and was covered with polyethylene and 50% shade fabric. A Humidifan Model 110 (Jaybird Manufacturing, Centre Hall, Penn.) provided the necessary fog and one 61 x 61 cm motorized inlet shutter and two 41 x 41 cm exhaust fans rated at 1.3 m\(^3\)sec\(^{-1}\) provided ventilation when ambient temperature at cutting level reached 37 C.

The experimental design for each species was a randomized complete block design with two blocks and 10 cuttings per plot (cutting age). Cuttings of Mexican redbud, larchleaf goldenweed, and littleleaf ash were evaluated after 4 weeks and cuttings of evergreen sumac after 6 weeks. Cuttings with a minimum of two roots each at least 2 cm long were considered to have rooted. Percent rooting was determined for each block and transformed to SIN\(^{-1}\) (percent rooting / 100\()^{1/2}\) for analysis. Untransformed results are reported.

**RESULTS AND DISCUSSION**

Cuttings of Mexican redbud rooted only 4 weeks after budbreak so the transformed response was related to IBA concentration by polynomial regression. The transformed response of the remaining three species was related to cutting age (weeks after budbreak) and IBA concentration by a quadratic polynomial response surface. However, lack of fit mean square was significant for all three species. No rooting occurred in 12-week-old cuttings of larchleaf goldenweed or 4-week-old cuttings of littleleaf ash or evergreen sumac. Restricting the data sets to exclude these data resulted in nonsignificant lack of fit mean squares and was preferable to increasing the degree of polynomial response surface (Tables 1 and 2).

Rooting of cuttings of Mexican redbud taken 4 weeks after budbreak followed a cubic response to IBA concentration (Fig. 1). The maximum predicted response was 88% rooting at 21 gliter\(^{-1}\) IBA. The lower 99% mean confidence limit for the maximum response was 76% rooting, which is predicted to occur at IBA concentrations above 15 gliter\(^{-1}\). Maximum predicted percent rooting was 99% for cuttings of larchleaf goldenweed taken 6 weeks after budbreak and treated with 16 gliter\(^{-1}\) IBA (Fig. 2A), 86% for cuttings of littleleaf ash taken at least 16 weeks after budbreak and treated with 17 gliter\(^{-1}\) IBA (Fig. 2B), and 24% for cuttings of evergreen sumac taken at least 16 weeks after budbreak and treated with 5 gliter\(^{-1}\) IBA (Fig. 2C). The lower 99% mean confidence limits for the maximum response of larchleaf goldenweed, littleleaf ash, and evergreen sumac were 92%, 67%, and 11% rooting, respectively. For larchleaf goldenweed, this response is predicted to occur in 5- to 8-week-old cuttings treated with 6 to 25 gliter\(^{-1}\) IBA. Corresponding values for littleleaf ash and evergreen sumac are 12- to at least 16-week-old cuttings treated with 10 to 25 gliter\(^{-1}\) IBA and 8 to at least 16-week-old cuttings treated with less than 15 gliter\(^{-1}\) IBA, respectively. Rooting response of littleleaf ash and evergreen sumac increased with increasing cutting age, indicating the maxima might be beyond 16 weeks.

Percent rooting was high for cuttings of Mexican redbud, larchleaf goldenweed, and littleleaf ash, but low and variable for evergreen sumac. Timing was most critical for Mexican redbud; apparently cuttings should be taken as soon as possible after budbreak. Timing was less critical for larchleaf goldenweed, but cuttings taken 5 to 8 weeks after budbreak were still softwood since the stem was still growing. Cuttings of littleleaf ash and evergreen sumac taken 12 weeks after budbreak, or later, were semihardwood since growth had stopped and the stem was firm. Cuttings of evergreen sumac taken between 8 and 12 weeks after budbreak were not quite semihardwood since growth was continuing. Evergreen sumac also often begins a second growth flush between 12 and 16 weeks after the initial budbreak, and cuttings from this flush, avoided in this test, would be softwood.

The geographical distributions of all four species are characterized by highly isolated, disjunct populations in a variety of habitats; conditions suitable for ecotypic variation among populations. While this experiment represented a limited genetic base and future tests may be influenced by environmental and cultural conditions, the results nevertheless prove the potential for vegetative propagation of all four species and suggest starting points for future endeavors such as treating softwood cuttings of Mexican redbud and larchleaf goldenweed, and semihardwood cuttings of littleleaf ash with moderate to high IBA concentrations and semihardwood cuttings of evergreen sumac with low IBA concentrations.
NOTE

This research was conducted at the Texas A&M University Research and Extension Center at El Paso.

REFERENCES


Table 1. Polynomial regression analysis of variance for the effect of IBA concentration on percent rooting of cuttings of Mexican redbud taken 4 weeks after budbreak.

<table>
<thead>
<tr>
<th>Source</th>
<th>df^2</th>
<th>Mean square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
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<td>2172.78**</td>
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<tr>
<td>Total Error</td>
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<td>16.22</td>
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<tr>
<td>Lack of Fit</td>
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<td>37.45ns</td>
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<tr>
<td>Pure Error</td>
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<td>7.32</td>
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</table>

Degrees of freedom.
NS, Nonsignificant, or significant at P = 0.01, respectively.

Table 2. Polynomial regression analysis of variance for the effect of cutting age (weeks after budbreak) and IBA concentration on percent rooting of cuttings of larchleaf goldenweed, littleleaf ash, and evergreen sumac.

<table>
<thead>
<tr>
<th>Source</th>
<th>df^2</th>
<th>Larchleaf goldenweed</th>
<th>Littleleaf ash</th>
<th>Evergreen sumac</th>
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</thead>
<tbody>
<tr>
<td>Model</td>
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<td>2004.5**</td>
<td>798.7**</td>
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<td>Total error</td>
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<tr>
<td>Lack of fit</td>
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<td>Pure error</td>
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<td>36.4</td>
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</table>

Degrees of freedom.
NS, Nonsignificant, or significant at P = 0.01, respectively.
Fig. 1. Rooting response of cuttings of Mexican redbud taken 4 weeks after budbreak to IBA concentration with 99% mean confidence belts.
Fig. 2. Larchleaf goldenweed (A), littleleaf ash (B), and evergreen sumac (C) percent rooting in response to cutting age (weeks after budbreak) and IBA concentration.