This Journal of Environmental Horticulture article is reproduced with the consent of the Horticultural Research Institute (HRI – www.hriresearch.org), which was established in 1962 as the research and development affiliate of the American Nursery & Landscape Association (ANLA – http://www.anla.org).

HRI’s Mission:

To direct, fund, promote and communicate horticultural research, which increases the quality and value of ornamental plants, improves the productivity and profitability of the nursery and landscape industry, and protects and enhances the environment.

The use of any trade name in this article does not imply an endorsement of the equipment, product or process named, nor any criticism of any similar products that are not mentioned.
to proceed faster in plants which had experienced quiescence, however. Photoperiodic growth response in Koelreuteria was similar to Acer rubrum L. (red maple) grown under similar conditions (2).

Dalbergia grown under ND ceased growth in mid October, whereas those grown under LD continued growth until mid December when temperature presumably became a limiting factor for this species (Fig. 2). LD and ND plants resumed vegetative growth simultaneously in late February. In Dalbergia, as in Swietenia mahagoni (L.) Jacq. (West Indian mahagony) (1), and Tabebuia caraiba (Mart.) Bur. (silver trumpet tree) (2), LD allowed continued vegetative growth in the fall, but all growth ceases once average minimum temperatures drop below 15 °C (59°F).

Fall and winter vegetative growth patterns in seedling Bucida showed that ND plants were significantly taller than LD plants during most of the experimental period (Fig. 2). This is unusual since in older specimens of this species, growth flushes occur almost exclusively during the spring and summer months.

Significance to the Nursery Industry

In mild climates such as that of southern Florida, many landscape tree species are capable of year round growth, but may not do so because of unfavorable photoperiods. By providing an artificial LD photoperiod it may be possible to produce saleable sized trees of certain species in much less time and thereby reduce production costs. Growth response to photoperiod varies considerably among species, however, and of the 7 species examined in this study, only Dalbergia and Koelreuteria appear to be good candidates for growth enhancement by photoperiod manipulation.

Literature Cited


Effect of Fall Temperature and Lighting on Growth of Rhododendron Rooted Cuttings

Laurie Menzel Kasperek1 and John R. Havis
Department of Plant and Soil Sciences
University of Massachusetts
Amherst, MA 01002

Abstract

Summer-rooted rhododendron cuttings were forced into growth using natural photoperiod, incandescent light or red light (660nm) as a night break between 2200 and 0100 hours at both 17 °C (63 °F) and 10 °C (50°F) minimum night temperature (MNT) for 3 weeks beginning September 28, 1982. Longer shoots were produced on Rhododendron ‘PJM hybrids’ under incandescent light than under red light or natural photoperiod. Rhododendron ‘Roseum Elegans’ produced longer shoots under both light regimes than under natural photoperiod and longer shoots at 17 °C (63°F) MNT than at 10 °C (50°F) MNT. Neither temperature nor light treatments significantly increased the number of breaks per plant of either cultivar. Spring growth of Rhododendron ‘Roseum Elegans’ was delayed by both red and incandescent fall light treatments, but not by the high temperature fall treatment.

Index words: Phytochrome, growth induction, photoperiod, spring carry-over, temperature

Introduction

Attempts to accelerate fall growth of summer-rooted rhododendron cuttings have utilized incandescent light breaks to interrupt the dark period, various temperature regimes and a spring or fall induction period of 2 weeks at 17 °C (63°F) (4). For both Rhododendron ‘PJM hybrids’ and ‘Roseum Elegans,’ an incandescent light break of 3 hours during the induction period at 15.6 °C (60°F) increased total shoot growth, but plants held at this temperature were the last to initiate growth in the spring (4). This delay can be as much as one month (1). Much of the forced fall growth was elongated shoots from a few lateral buds, which had to be pinched back

1Received for publication January 16, 1986; in revised form March 10, 1986.
2Former graduate student and Professor, resp. Current address of the senior author; RD 3, Owego, NY 13827.
in the spring to produce more breaks. Recent work indicates that red light can be used to obtain greater lateral branching and production of cuttings in various horticultural crops (2, 3, 5). It is possible that a red light break interrupting the dark period in the fall may increase the number of lateral bud breaks per cutting of rhododendron; normally produced by pinching back the terminal shoots in the spring. Red light creates a phytochrome photoequilibrium inhibitive to elongation, yet stimulative to lateral branching (6). The objectives of this study were to determine whether red light as a night break would produce increased numbers of lateral bud breaks per cutting, without the elongation obtained under incandescent light, and to determine whether fall red light breaks produced less of a spring delay than that produced by fall incandescent light breaks.

Materials and Methods

July-rooted cuttings of Rhododendron 'PJM hybrids' and 'Roseum Elegans' were placed in 10.2 cm (4 in) square plastic pots in an unsterilized 1:1 (by vol) mixture of peatmoss and sand on September 10, 1982. The cuttings were stored for 18 days in a glasshouse under normal photoperiod, during which time they were fertilized twice with a 20N-8.7P-16.6K (20-20-20) soluble fertilizer at 200ppm N. Beginning September 28, one group of 33 rooted cuttings of 'PJM hybrids' was exposed to 10°C (50°F) MNT for 3 weeks in a polyethylene covered house. Another group of 33 rooted cuttings was simultaneously exposed to 17°C (63°F) MNT in a glasshouse. During each induction, 11 rooted cuttings were exposed to natural photoperiod, 11 were given additional 15 μE·m⁻²·sec⁻¹ (2 Klx or 185 fc) incandescent light between 2200 and 0100 hours, and 11 were given additional 5 μE·m⁻²·sec⁻¹ red light (660 nm) between 2200 and 0100 hours. Red lighting was supplied by two, GE 34 watt cool white fluorescent tubes in fixtures enclosed in poly-vinyl-acetate filter. Beginning September 28, groups of 20 'Roseum Elegans' rooted cuttings were exposed to the same temperature and lighting treatments as described above for 'PJM hybrids.' On October 19 all rooted cuttings were placed at 10°C (50°F) MNT without a light break in a polyethylene covered house. The MNT was lowered to 1°C (33.4°F) on November 9, 1982 and raised to 5°C (41°F) on February 1, 1983. On February 15 all 'Roseum Elegans' plants were transferred to a glasshouse where they were stored at 17°C (63°F) MNT for a two-week induction period.

Ten plants from each fall temperature/photoperiod treatment received supplemental incandescent lighting between 2200 and 0100 hours and the remaining 10 plants from each treatment received natural photoperiod. On March 1 all plants were returned to 5°C (41°F) MNT in a polyethylene covered house.

Results and Discussion

Rhododendron 'PJM hybrids' averaged 1.1, 1.2, and 1.5 shoots per plant from fall treatments of no light break, red light and incandescent light, respectively. The averages were not significantly different. Also, the number of shoots were not different between plants in the two temperature regimes (data not shown). Timmerman (4) reported that a light break during an induction at 18.3°C (65°F) MNT for 10 days increased the number of shoots on rooted cuttings of 'PJM hybrids,' suggesting that a longer exposure to high MNT's may allow for greater initiation of growth in buds ready to expand. The results of this study do not support this hypothesis.

Incandescent light produced elongated shoots of 'PJM hybrids' while the red light and natural photoperiod treatments were not significantly different (Table 1). Maintaining the lower MNT of 10°C (50°F) for the 3 week period did not influence the length of the shoots in any of the treatments. Heins and Wilkins (2) reported that increased far red wavelengths, such as from incandescent sources, produced elongated growth of chrysanthemums. Heins, Wilkins and Healy (3) observed that incandescent light had a high far red-to-red wavelength ratio which inhibited secondary shoot development on Dianthus carophyllus. Although our red light treatment kept the shoots as short as the natural photoperiod treatment, there was no accompanying increase in breaks beyond that obtained with the incandescent treatment.

An average 1.8 buds per plant grew on 'Roseum Elegans' to November 10, but differences among means in the temperature or lighting treatments were not significantly different from each other (Table 2). Both types of lighting produced longer shoots than the natural photoperiod treatment.

Table 1. Effect of temperature and lighting on fall shoot length (cm) of Rhododendron 'PJM hybrids.'

<table>
<thead>
<tr>
<th>Light break</th>
<th>Minimum night temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10°C (50°F)</td>
</tr>
<tr>
<td>None</td>
<td>2.3</td>
</tr>
<tr>
<td>Red⁷</td>
<td>2.9</td>
</tr>
<tr>
<td>Incandescent⁸</td>
<td>4.9</td>
</tr>
<tr>
<td>Mean</td>
<td>3.4</td>
</tr>
</tbody>
</table>

⁷Rooted cuttings were exposed to either 10°C (50°F) or 17°C (63°F) and either natural photoperiod or natural photoperiod plus light break from 2200 to 0100 hours between September 28 and October 19, 1982.

⁸5 μE·m⁻²·sec⁻¹ at 660nm

*Mean is significantly different from no light break at the 1% level. The lighting X temperature interaction was not significant.

Rhododendron to delay growth in the spring. A 3 hour light break in the treatment broke dormancy at an earlier date than either of the fall red or incandescent light treatments. The latter contributed significantly to the number of days to spring growth (Table 3). The fall light treatment means, how­ ever, did not significantly differ from no light break at the 1% level. The lighting X temperature interaction was not significant.

The fall temperature treatments had no significant effect on the number of days to initiate spring growth of Rhododendron 'Roseum Elegans' as counted from February 15 (Table 3). The fall light treatment means, how­ ever, contributed significantly to the number of days to spring growth (Table 3). The fall natural photoperiod treatment broke dormancy at an earlier date than either the fall red or incandescent light treatments. The latter two treatments were not statistically different from each other and they delayed spring growth. This agrees with other work (1, 4) where a fall light break was found to delay growth in the spring. A 3 hour light break in the spring, during the two week induction period, did not overcome the delay, or carryover effect, produced by the fall light breaks. Rhododendron 'Roseum Elegans' averaged 38.8 and 39.3 days to spring growth from February 15 from spring treatments of no light break and incandescent light break, respectively. The averages were not significantly different.

Significance to the Nursery Industry

Red light cannot be recommended as a fall treatment to stimulate growth of Rhododendron cuttings at this time. Although this research indicated a response of

Table 2. Effect of temperature and lighting on fall shoot length (cm) of Rhododendron ‘Roseum Elegans.’

<table>
<thead>
<tr>
<th>Light break</th>
<th>Minimum night temperature</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10°C (50°F)</td>
<td>17°C (63°F)</td>
</tr>
<tr>
<td>None</td>
<td>3.9</td>
<td>5.1</td>
</tr>
<tr>
<td>Red⁷</td>
<td>6.4</td>
<td>6.9</td>
</tr>
<tr>
<td>Incandescent⁸</td>
<td>6.2</td>
<td>7.4</td>
</tr>
<tr>
<td>Mean</td>
<td>5.4</td>
<td>6.5*</td>
</tr>
</tbody>
</table>

⁷Rooted cuttings were exposed to either 10°C (50°F) or 17°C (63°F) and either natural photoperiod or natural photoperiod plus light break from 2200 to 0100 hours between September 28 and October 19, 1982.

The fall minimum night temperature

<table>
<thead>
<tr>
<th>Fall Light break</th>
<th>Minimum night temperature</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>10°C (50°F)</td>
<td>17°C (63°F)</td>
<td>Mean</td>
</tr>
<tr>
<td>None</td>
<td>34.0</td>
<td>35.7</td>
</tr>
<tr>
<td>Red⁷</td>
<td>39.0</td>
<td>41.2</td>
</tr>
<tr>
<td>Incandescent⁸</td>
<td>42.7</td>
<td>41.9</td>
</tr>
<tr>
<td>Mean</td>
<td>38.6</td>
<td>39.6</td>
</tr>
</tbody>
</table>

Rhododendron ‘PJM hybrids’ to fall red light treatments (the shoots were shorter in the red light treatment than in the incandescent light treatment), it did not yield an indication of the same response of Rhododendron ‘Roseum Elegans’ to fall red light treatments. Additional work needs to be done on the duration of the night break lighting, the length of the induction period, and the intensity of the irradiance before it can be stated that branching in rhododendron cuttings does or does not involve the phytochrome system. Both fall lighting treatments failed to increase bud breaks and caused a spring delay in growth. There appears to be no advantage in forcing fall growth on summer-rooted cuttings of Rhododendron ‘PJM hybrids’ and ‘Roseum Elegans.’

Literature Cited


