Photoperiod, Irradiance, and Temperature Influence Flowering of Hamelia patens (Texas Firebush)

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Abstract. Hamelia patens Jacq. (Texas firebush) is a long-day plant for flower initiation and flower development; however, flower development is more sensitive to photoperiod than is flower initiation. The critical photoperiod for flower development at 25°C is between 12 and 16 hours. Flowering was delayed under low light conditions, and plant dry weight was heavier and flowering time was earlier for plants grown at a constant 25 or 30°C than at 20°C. A greenhouse environment with a 16-hour photoperiod and moderately high temperature (25°C) would be appropriate for production of H. patens.

Hamelia patens is a woody shrub belonging to the Rubiaceae family and native to South America. Plants grow 1.5 to 3 m tall and bear whorled leaves and bright scarlet flowers arranged in a 3–5 rayed terminal cyme (Bailey, 1951). Plants are being used as landscape plants in the southern United States and in the tropics. They are most floriferous in the summer months under long days (LD) and warm weather, and the spectacular flowering display makes this a potential potted plant for year-round or summer sales to supplement other crops.

The ability to flower the plant on demand is a prerequisite to successful introduction of any new crop, regardless of sales time. As expected with a species of tropical origin, observation showed that flowering is enhanced significantly by moderately high temperatures (>22°C), while lower temperatures delay flowering and growth. No information was found on environmental control of flowering of Hamelia; however, some data on other ornamental species of Rubiaceae have been published. Pentas lanceolata Benth. (galaxy flower) flowered 7 to 10 days earlier under LD than short days (SD). Six weeks of high-intensity discharge light during daylight hours also significantly accelerated flowering (Armitage, 1988). When root temperature of Ixora coccinea L. was increased from 34 to 40°C, shoot : root weight ratio increased and shoot sugar : starch ratio decreased. In general, 34°C appeared to be the optimum root temperature (Ingram et al., 1986). Bouvardia xdomestica Salisb., a greenhouse cut-flower crop, is a SD plant with a critical photoperiod for flower initiation between 10 and 12 h (Vonk Noordegraaf, 1983, 1985).

Vegetative growth is promoted by LD lighting with incandescent lamps or by cyclic lighting (Vonk Noordegraaf, 1985).

The objectives of these studies were to determine the influence of photoperiod, irradiance, and temperature on the production of Hamelia patens as a potted plant.

Materials and Methods

Photoperiod. Photoperiod experiments were conducted during 1992 and 1993. Cuttings of stock plants were taken in early June in both years and rooted under intermittent mist and a 25°C 75% perlite mixture. Forty-five rooted cuttings were selected for uniformity and potted in 385-ml (10-cm) pots in a commercial greenhouse medium (Fafard #2; Conrad Fafard, Agawam, Mass.). Plants were grown in the greenhouse where average cycles were 26°C day/22°C night. About 6 weeks after the cuttings were taken, the terminals of all plants were pinched to four nodes to remove latent flower buds. Fifteen plants were placed in growth chambers at 107 ± 7, 210 ± 10, or 325 ± 25 µmol-m⁻²-s⁻¹. The photoperiod in each chamber was 18 h and was set at 25 ± 3°C day and night. Plants were irrigated and fertilized as discussed above. The time to visible bud was determined, and plant height, leaf surface area, and dry weight of the aboveground portion were measured when flower buds were first visible. The experiment ended 100 days after placement in the chambers.

Temperature. For the temperature experiments, cuttings of stock plants were taken on 24 Aug. 1990 and rooted as discussed above. Forty-five rooted cuttings were selected for uniformity and potted in 385-ml pots in the medium noted above. Plants were grown in the greenhouse for 6 weeks where average cycles were 24°C day/21°C night. On 15 Oct., the terminals of all plants were pinched to four nodes. Fifteen plants were placed in growth chambers at a constant 20, 25, or 30 ± 2°C and a 16-h photoperiod. Plants were irrigated and fertilized as discussed above. The time to visible bud was determined, and plant height, leaf surface area, and dry weight were measured when flower buds were first visible. The experiment ended 100 days after placement in the chambers.

In all experiments, data were tested by ANOVA, and Tukey’s w mean separation (hsd), P = 0.05, was used when applicable.

Results and Discussion

Photoperiod. Although flower buds were formed under all photoperiods, not all plants within a treatment reached visible bud by 100 days (Table 1). At the 16-h photoperiod, 100% of the plants initiated flowers, but only about

Table 1. The influence of photoperiod on flowering and growth of Hamelia patens. Experiment ended after 100 days.

<table>
<thead>
<tr>
<th>Photoperiod (h)</th>
<th>Visible bud % Days to</th>
<th>Anthesis % Days to</th>
<th>Plant ht (cm)</th>
<th>Leaf surface area (cm²)</th>
<th>Dry wt (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>60</td>
<td>74</td>
<td>0</td>
<td>23.5</td>
<td>1254</td>
</tr>
<tr>
<td>12</td>
<td>73</td>
<td>70</td>
<td>20</td>
<td>23.5</td>
<td>1101</td>
</tr>
<tr>
<td>16</td>
<td>100</td>
<td>67</td>
<td>100</td>
<td>20.0</td>
<td>1131</td>
</tr>
</tbody>
</table>

1 Tukey’s w mean separation, P = 0.05.
2 Nonsignificant.
two-thirds of the plants responded under 12- and 8-h photoperiods (Table 1). While initiation occurred in at least 60% of the plants with 8 and 12 h, flower development was totally arrested in the 8-h photoperiod and only 20% of the plants under 12 h reached anthesis. In both of these short photoperiods, flower development was erratic and few flowers completely opened. Leaf surface area was similar under all treatments, but plants were taller with the 8- than the 16-h photoperiod. Dry weight was highest under 8 h. These differences may be attributed to the longer growth time the plants remained in the chambers when grown under SD.

Irradiance. The main difference between irradiance treatments was the significant delay of flowering under low light compared to plants subjected to high and medium irradiances (Table 2). The flowering response was similar for plants under high and medium irradiances. Plants under low irradiance were significantly taller than plants under high light, but no other height differences occurred. Plants grown under low irradiance had a lower dry weight and a smaller leaf surface area than plants in other treatments. These data combined with the delay in flowering suggest that Hamelia does not tolerate low-light conditions.

Temperature. Growth at 25 or 30°C accelerated flowering of Hamelia compared to production at 20°C (Table 3). Leaf surface area and dry weight were reduced at 20°C compared with growth at the other temperatures tested (Table 3). Such a response is not surprising considering that Hamelia patens is native to warm regions of Mexico, Paraguay, and the West Indies.

Our data suggest that Hamelia patens is a quantitative LD plant with a critical photoperiod between 12 and 16 h. The effect of LD appears to be more critical to flower development (time from visible bud to anthesis) than to flower initiation (to visible bud). This result resembles those with chrysanthemum [Dendranthema × grandiflorum (Ramat) Kitamura] (Schwabe, 1951) and velvet sage (Salvia leucantha Cav.) (Armitage and Laushman, 1989). Plants may be forced to flower for pot plant or bedding use under continuous LD, high light, and warm conditions. During winter months in the northern hemisphere, flowering plants may be produced with manipulation of photoperiod. Supplemental lighting during the LD phase would also be useful but not a necessity. The economics of maintaining a warm environment might be questionable for growers in temperate climates; however, southern areas of the United States and producers in tropical areas would have little problem. Also, as the data support, Hamelia would be particularly useful as a landscape or potted plant for summer production.

### Literature Cited


