**FORCING PERENNIALS**

**Species:** *Penstemon digitalis* ‘Husker Red’  
**Common Name:** Bearded Tongue

*Editor's note: Michigan State University and GREENHOUSE GROWER bring you our third series on forcing perennials to flower.*

by EMILY CLOUGH, ARTHUR CAMERON, ROYAL HEINS, and WILL CARLSON

The Penstemon genus has more than 250 diverse species that include small woody shrubs as well as herbaceous perennials. Most are native to the western United States and Mexico and are excellent choices for gardeners in dry regions because the plants prefer alkaline soil, low humidity, and full sun.

For more than a century, gardeners in England have cultivated Penstemon hybrids (mostly derived from Mexican species) and have developed several that are more amenable to a wetter climate: *P. hartwegii*, *P. gentianoides*, *P. campanulatus*, and *P. isophyllus*. A Penstemon species native to the eastern half of North America, from Maine to Texas, that enjoys wetter climates is *P. digitalis*.

In 1976, a *P. digitalis* that was growing in a garden in Hardy, NE, had typical white flowers and red leaves and stems. From this plant, Dale Lindgren of the University of Nebraska-Lincoln collected seeds and selected deeper pigmentation. After two years of selection, a single seedling was chosen, propagated, and evaluated at several locations. This selection was named ‘Husker Red’ after the university’s nickname and the color of the foliage.

Its small white flowers with purple lines inside the throat of the corolla contrasts with its bur-

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**Figure 1.** The red stems and red-tinged leaves contrast nicely with the bright white flowers of *Penstemon digitalis* ‘Husker Red.’

**Figure 2.** When *P. digitalis* ‘Husker Red’ plants were grown without cold treatment under a 16-hour photoperiod provided by high-pressure sodium lamps, 50% flowered.
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Figure 3a. Flowering time decreases as cold-treatment duration increases. These plants received three weeks of cold treatment at 41°F (5°C) and flowered in 11 weeks.

Figure 3b. After P. digitalis 'Husker Red' received a 15-week cold treatment, it flowered in six weeks.

gundy red leaves and stems to make an attractive show in the garden or in a pot (Figure 1).

1. Propagation
   'Husker Red' does not come true from seed. Vegetative propagation is by stem cuttings, division, or tissue culture.

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Table 1. *Penstemon digitalis* ‘Husker Red’ Production Schedule

<table>
<thead>
<tr>
<th>Growing time</th>
<th>Cultural practice</th>
<th>Temperature</th>
<th>Photoperiod</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two weeks</td>
<td>Root cuttings</td>
<td>65°-70°F (18°-21°C)</td>
<td>Natural daylength</td>
</tr>
<tr>
<td>Three to four weeks</td>
<td>Grow in plugs</td>
<td>65°-70°F (18°-21°C)</td>
<td>Natural daylength</td>
</tr>
<tr>
<td>- OR - Purchase plugs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nine to 15 weeks</td>
<td>Cold treatment</td>
<td>35°-45°F (2°-7°C)</td>
<td>Natural daylength or nine hours of light in cooler</td>
</tr>
</tbody>
</table>

**Begin forcing**

- 63°F (17°C) Flower in eight weeks
- 72°F (22°C) Flower in six weeks
- 86°F (30°C) Flower in four weeks

2. Plant Size

Juvenility was not a problem for *P. digitalis* ‘Husker Red’ flowering. All plants that we received in 72-cell plug trays, with an average of 14 leaves, flowered following a sufficient cold treatment. Plants attain a height of 20 to 24 inches (50 to 60 centimeters) and are suited for six-inch pots. Larger starting material, such as field-grown bare-root plants with several eyes per plant, are best suited for one-gallon pots.

3. Cold Treatment

Without a cold treatment, flowering depended on light intensity. In our experiments, we grew *P. digitalis* ‘Husker Red’ plants under two different light treatments. In one experiment, we provided plants a 16-hour photoperiod using natural light supplemented with day extension from high-pressure sodium (HPS) lamps. In another experiment we tested seven different photoperiods, ranging from 10 to 24 hours, as well as a four-hour night interruption from 10 p.m. to 2 a.m.

In this second experiment, photoperiods were provided with natural light supplemented with HPS lamps and day extension from incandescent (INC) lamps. When the plants were grown without a cold treatment under day extension from INC lamps, there was very minimal flowering (0% to 30%). However, when plants without a cold treatment were grown under day extension from HPS lamps, flowering percentages were higher (50% to 70%, Figure 2).

Cold treatment has a dramatic influence on flower timing. The plants that flowered without a cold treatment did so in about 100 days. Plants

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**Figure 4.** *P. digitalis* ‘Husker Red’ is a day-neutral plant. After a 15-week cold treatment, plants under 10- to 24-hour photoperiods and a four-hour night interruption all flower at the same time.
with a cold treatment as short as three weeks at 41°F (5°C) flowered in approximately 85 days (Figure 3a). As cold duration increases, flowering time decreases. After 15 weeks at 41°F (5°C), plants flower in about 50 days (Figure 3b).

Cold treatment also can influence plant height. The first time this experiment was conducted, plant height increased from 24 inches (60 centimeters) for plants that had been cold-treated for nine weeks to 31 inches (80 centimeters) for plants that had been cold-treated for 15 weeks. When this experiment was repeated the following year, plant height remained between 20 and 24 inches (50 and 60 centimeters) regardless of cold-treatment duration.

4. Photoperiod
After a 15-week cold treatment, *P. digitalis* 'Husker Red' behaves as a day-neutral plant, flowering in about 50 days, regardless of the photoperiod (Figure 4).

5. Lighting And Spacing
As mentioned above, light intensity plays an important role in flowering for plants that have not received a cold treatment. Increased light intensity also can influence flower number. In the first year, *P. digitalis* 'Husker Red' that was grown under day extension lighting from HPS lamps had $2^{1/2}$ times more flowers than plants grown under day extension from INC lamps. But in the second year, the type of lamp used for day extension did not influence flower number for *P. digitalis* 'Husker Red.'
We found that providing a 16-hour photoperiod by using day extension from HPS lamps increased flower number for several other Penstemon species as well. Flower number of *P. barbatus* 'Elfin Pink' and *P. campanulatus* 'Garnet Red' was greatly increased when plants were grown under day extension with HPS lamps rather than a four-hour night interruption using INC lamps or a nine-hour short day.

During forcing, plants can be spaced closely together initially, but will require more spacing as they grow. A five- to six-inch spacing between pots should be sufficient for reducing spread of any disease and for light penetration into the canopy to prevent unwanted stretching.

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**6. Media, Fertilization, And Irrigation**

Although in the garden *P. digitalis* ‘Husker Red’ tolerates wet climates and humidity, like their other Penstemon relatives, they prefer a well-drained soil. Plants in our experiments performed considerably better when grown in a porous soilless medium of sphagnum peat moss, perlite, vermiculite, and bark compared to a medium with more peat moss, some perlite, and no vermiculite or bark.

We fertilized at every irrigation using a fertilizer of 125 ppm N, 12 ppm P, and 125 ppm K, which was sufficient for plant growth and development. We maintained pH levels between 5.8 and 6.2.

**7. Plant Height Control**

The natural height of *P. digitalis* ‘Husker Red’ is rather tall (up to 24 inches or 60 centimeters), so plants would benefit from height control. We tested five different commercially-available plant growth regulators (PGRs): A-Rest at 100 ppm, Bonzi at 30 ppm, B-Nine at 3,000 ppm, Cycocel at 1,500 ppm, and Sumagic at 15 ppm.

Plants were first cooled for 15 weeks, allowed to establish for two weeks, and then sprayed every 10 days for a total of three applications before the first flower opened. All PGRs except Cycocel controlled height, but some were more effective than others (Figure 5).

For example, plants sprayed with B-Nine attained a height of 15 inches (38 centimeters), while those sprayed with A-Rest or Bonzi were both approximately 10 inches (26 centimeters) tall. In comparison, the unsprayed control plants had an average height of 18.5 inches (47 centimeters). Sumagic also controlled height but slowed development significantly. Plants sprayed with Sumagic flowered about two weeks later than unsprayed plants or plants sprayed with any of the other PGRs.

The rates and application frequencies that we used in this screen are not recommendations. They were used only to determine these PGRs’ effectiveness on *P. digitalis* ‘Husker Red.’

**8. Temperatures And Crop Scheduling**

Temperature is one of the primary factors controlling plant development. At warmer temperatures, plant development occurs much more quickly than at cooler temperatures. Plants of *P. digitalis* ‘Husker Red’ flower in four weeks when grown at 86°F (30°C), in six weeks when grown at 72°F (22°C), and in eight weeks when grown at 63°F (17°C) (Table 1).

Forcing temperature influences plant quality as well as flower timing. For many species, plants grown at warm temperatures are shorter with sparse, small flowers, while those grown at cool temperatures are tall with many large flowers.

The same is true for *P. digitalis* ‘Husker Red,’ although the effect of
Penstemon digitalis ‘Husker Red’

1. Provide a cold treatment of nine to 15 weeks at 41 °F (5 °C) for rapid flowering.

2. Provide supplemental lighting of 400-500 footcandles if growing under low light.

3. Force at temperatures between 75 °F and 86 °F (24°C and 30 °C) for minimal time to flower and height control.

4. Ship before the first flower opens.

Disease And Insect Pests

In several cases, phytophthora was found on *P. digitalis* ‘Husker Red’ as well as *P. campanulatus*, causing stem blackening and eventual plant death. Phytophthora did not infect *P. barbatus* ‘Elfin Pink’ or *P. campanulatus* ‘Garnet Red.’

No insects were particular pests of *P. digitalis* ‘Husker Red’ or any other Penstemon species.

Postharvest Concerns

Plants should be shipped before the first flower opens. *Penstemon digitalis* ‘Husker Red’ remains in flower for about three to four weeks. Many of the spent flowers remain on the flower stalk, turn brown as they dry, are very unattractive, and should be removed promptly to maintain a neat appearance for sale. Once flowering has finished, plants will not flower again until the following year.

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Temperature on flower number is not as dramatic as it is for many other species (Figures 6a and 6b).

Plants grown at 86°F (30°C) were about 14 inches (35 centimeters) tall and had about 84 flowers per plant. At 63°F (17°C) plants had an average height of 20 inches (50 centimeters) and produced almost two times the number of flowers that plants produced at 86°F (30°C). In comparison, when *Oenothera fruticosa* ‘Younghi-lapsley’ was grown at 65°F (18°C), plants had five times as many flowers as those grown at 86°F (30°C).

Growing *P. digitalis* ‘Husker Red’ at warm temperatures (≥ 75°F [24°C]) offers another way to control plant height. Unlike many species, *P. digitalis* ‘Husker Red’ grown at warmer temperatures were more attractive than plants grown at cooler temperatures, despite the lower flower number since they did remain more compact. We recommend forcing temperatures between 75°F (24°C) and 86°F (30°C) for minimizing flower timing and controlling plant height.

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