**FORCING PERENNIALS**

**Species:** Hosta  
**Common Name:** Hosta, plantain lily

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

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**Figure 1.** Hostas thrive in shade gardens.

**Figure 2a, 2b.** Plant size influences growth and flowering of Hosta. Single-eye divisions yield small plants with low flowering percentages (left), while multiple-eye divisions yield larger, more vigorous plants with higher flowering percentages (right).

**Figure 3a.** All *Hosta plantaginea* plants emerged when grown at 68°F (20°C) without a cold treatment.

**Figure 3b.** 'Golden Tiara' plants required a minimum of 3 weeks of cold at 41°F (5°C) for all plants to emerge from dormancy.

**Figure 3c.** 'Tokudama' gold plants required a minimum of 6 weeks of cold at 41°F (5°C) for all plants to emerge from dormancy.

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<tr>
<th><strong>HOSTA PLANTAGINEA</strong></th>
<th><strong>HOSTA 'GOLDEN TIIARA'</strong></th>
<th><strong>HOSTA 'TOKUDAMA' GOLD</strong></th>
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<td><strong>WEEKS COLD 5C</strong></td>
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HOSTA shoots emerge in the spring to unfold a lush display of foliage in myriad color combinations. Hostas have long been the perennial plants of choice for shade gardens where few other ornamentals thrive (Figure 1). But these popular perennials are no longer solely delegated to the dense shade of woodland gardens because cultivars suitable for partial and full sun exposure are now widely available.

Collectively, hostas are the best-selling herbaceous perennials. Their immense popularity is largely due to their versatility and adaptability. Culturally, hostas thrive in various degrees of sun and shade, tolerate variable soil moisture levels, require minimal care, and endure vast climatological differences.

Hostas are native to China, Japan, and Korea, and were brought to the U.S. in the early to mid-1800s. They are well adapted to the North-American climate and are hardy across much of the continental U.S., from USDA hardiness zones 3 to 8.

These plants are enormously diverse in form, growth habit, and cultural requirements. Similarities in growth habit and flower structure often led taxonomists to classify them with Hemerocallis in Liliaceae.

More recently, hostas have been classified in a distinct

by BETH FAUSEY, ARTHUR CAMERON, ROYAL HEINS, and WILL CARLSON

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Weeks of cold at 41°F (5°C) required for 100% emergence</th>
<th>Required photoperiod for continual growth and flowering</th>
<th>Plant responses at recommended forcing temperatures</th>
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<tbody>
<tr>
<td>'Lancifolia'</td>
<td>0</td>
<td>≥14 hours or NI</td>
<td>64-75 (16-24) 4-7 9-11 12-15 6 (16) 18-22 (45-55)</td>
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<td>plantaginea</td>
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<td>70-70 (21-26) 3-4 9-12 12-14 10-12 (25-30) 16-18 (40-45)</td>
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<tr>
<td>'Royal Standard'</td>
<td>2-4a</td>
<td>≥14 hours or NI</td>
<td>64-75 (16-24) 9-14 7-10 10-13 8-10 (20-25) 20-24 (30-60)</td>
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<td>'Francee'</td>
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<td>64-75 (16-24) 4-5 7-9 10-12 6-7 (15-18) 14-15 (35-38)</td>
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<td>'Golden Scepter'</td>
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<td>≥13 hours or NI</td>
<td>9-13 6-7 10-12 10-12 (25-30) 24-26 (60-65)</td>
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<tr>
<td>'Golden Tiara'</td>
<td>3</td>
<td>≥14 hours or NI</td>
<td>4-5 4-9 9-14 7-8 (18-20) 20-28 (50-70)</td>
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<td>'Fortune Hyacinthina'</td>
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<td>10-15 5-8 8-12 3-4 (8-10) 12-14 (30-35)</td>
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<td>'Undulata Variegata'</td>
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<tr>
<td>'Tokudama' gold</td>
<td>6</td>
<td>≥14 hours or NI</td>
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<tr>
<td>'Tokudama' green</td>
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Figure 4a. Emergence percentages were low under all photoperiods for uncooled plants of cold-requiring hostas such as 'Hyacinthina.' Vigor and flowering percentages were low for the plants that did emerge.

Figure 4b. Following 15 weeks of cold at 41°F (5°C), all 'Hyacinthina' plants emerged regardless of photoperiod treatment. Only plants grown under photoperiods >14 hours continually produced new leaves and flowered while plants grown under photoperiods <13 hours entered a vegetatively dormant state.


family, the Hostaceae. The genus has been divided into approximately 40 species and more than 2000 named cultivars, with new introductions annually. Many plants that were once considered true species are now considered cultivars originating in gardens or through hybridization in the wild. Hostas traditionally have been grown exclusively for their ornamental foliage. However, flowers are important when hostas are forced for sale or show, crossed with plants that have incongruent flowering times, or are propagated.

Our guide to forcing is based on the responses of nine cultivars and two species – only a small representation of the diversity within Hosta – to experimental conditions in our research program (Table 1).

1. Propagation
Hostas can be sexually or asexually propagated. Most plants hybridize readily and produce many viable seeds in each seed capsule. Seed propagation is reserved for breeding because all hostas, except Hosta ventricosa, do not come true from seed.

Asexual propagation methods must be used to retain the distinctive characteristics of each hosta, such as leaf shape, size, color, and substance. All vegetatively propagated hostas are genetically identical clones originating from a single individual.

Hosta clones can be produced in large quantities from tissue culture or division. Division involves removing a section of the crown tissue containing at least one bud and several associated roots, and is usually performed in the spring or fall. Buds that form on the hosta crown can be terminal or lateral.

A terminal bud is a large, central bud formed on plants that do not flower during the growing season. A large, central shoot will emerge from divisions with a single terminal bud.

Lateral buds develop in each leaf axil, where the leaf is attached to the crown, and potentially form new shoots. When the hosta's growing point is removed and the plant flowers, growth of the original shoot ceases and new, smaller shoots emerge from the lateral buds.

Growth of lateral and latent buds formed on the hosta crown can be initiated following applications of benzyladenine, a cytokinin. The amount of benzyladenine needed for shoot development varies with concentration, chemical formulation, and application method. The number of offshoots produced on a single hosta division following application depends on the cultivar.
2. Rooting

Commercial producers harvest most bare-root hostas in late summer or early fall. They are cooled during storage, shipped to growers the following spring, and forced for sale. Bare-root hostas generally root slowly after planting. Plants from bare-root divisions may have a full foliage canopy and appear ready for sale but sometimes can be pulled out of the container easily.

More growing time is needed to improve rooting of newly planted divisions. Rooting of divisions planted in the summer or early fall is not as problematic because plants become established in containers and are overwintered before forcing in the spring.

3. Plant Size

Crown maturity and plant size influence growth and flowering of Hosta. In our experiments, small, single-eye divisions developed into small plants with low flowering percentages (Figure 2a). When we bulked these same plants outside under 50% shade for 5 summer months, the hostas developed into larger, more uniform plants with higher flowering percentages (Figure 2b). For example, the flowering percentages for ‘Golden Scepter’ and ‘Golden Tiara’ increased from 20% and 40%, respectively, in their first year to 100% in their second year.

Although flowering is not a goal for most growers, starting crown size will influence foliage size. Incidentally, most cultivars require multiple growing points to fill a 5-inch or larger pot.

4. Cold Treatment

Hostas naturally become dormant in the fall as the daylength shortens, and most require a cold treatment to reinitiate growth. The amount of cold needed for growth depends on the cultivar. All cultivars we tested required 6 weeks or less of cold at 41°F (5°C) to break vegetative dormancy (Table 1). Not all plants of each cultivar emerged when given an inadequate cold treatment.

Cold was not required for flowering of Hosta. A cold treatment generally reduces time to flower and improves flowering uniformity, overall vigor, and plant quality. We suggest a 6-week cold treatment for all Hosta, unless the specific cold requirement is known.

Hosta plantaginea ‘Royal Standard’ and ‘Lancifolia’ did not require a cold treatment (Figure 3a). Hosta plantaginea’s native habitat is in the warm, humid climate of southern China (25°-30° N latitude). ‘Royal Standard’ is a seedling of H. plantaginea, while the origin of ‘Lancifolia’ is unknown. The parental species of several hostas that required cold temperatures for complete emergence are native to Korea and Japan (35°-45° N latitude), areas that receive periods of cold temperatures (Figures 3b and 3c).

5. Photoperiod

Hostas are obligate long-day plants for continued leaf formation and flowering. Following cold, plants produce an initial flush of leaves when grown under short-day photoperiods and then enter a vegetatively dormant state (Figure 4a). Plants of all cultivars we tested actively produced new leaves and flowered only when the daylength exceeded 13 or 14 hours (Figure 4b). We recommend growing hostas under photoperiods greater than 14 hours or with a 4-hour night interruption when the natural daylength is less than 14 hours, unless dormancy is desired.

The natural daylength varies with latitude and is approximately 14 hours or less from September 4 to April 8 at 42° N latitude (East Lansing, MI) and from August 24 to April 19 at 33° N latitude (Atlanta, GA). Extending the daylength or providing night-interruption lighting requires 10 footcandles of light from incandescent or high-pressure sodium lamps.

Long-day photoperiods will promote an increase in the number of shoots per pot, effectively bulking the crown if plants flower. The number of new shoots depends on the cultivar.

6. Media, Fertilization, And Irrigation

All plants performed well in our experiments when grown at a pH of 5.8-6.2 with moderate fertility levels of 100-150 ppm N, 10-20 ppm P, and 100-150 ppm K delivered at each watering. Hostas required adequate moisture levels and developed marginal leaf burn when they were drought stressed.

Marginal leaf necrosis was noticeable on newly divided plants with poorly developed root systems. Necrosis on small plants was exacerbated under intense light and high temperature.

Marginal leaf burn was not common on plants growing in a pot for many months, with fully developed root systems. Marginal leaf burn detracts from the quality of the foliage and may render plants unsalable until a new flush of leaves develops.

7. Lighting And Spacing

Hostas look best when they are grown in partial shade. Plants will survive full sun in northern climates, but the foliage may bleach and marginal necrosis may develop. To avoid bleaching and necrosis, grow plants under light levels of 5000 footcandles.
or less in the greenhouse. Plants can be grown pot to pot for several weeks after emergence. Wider spacing may be needed for large-leaved cultivars.

8. Plant Height Control
Height control of hosta foliage is generally not an issue. Dwarf and smaller cultivars can be selected when plant height is a concern.
Flower stalks can be very tall, making height control more problematic. We have not examined using growth retardants to control foliage or flower stalk height.

9. Temperatures And Crop Scheduling
Cool temperatures maximize the appearance of hosta foliage and flowers. Flower and leaf color is more intense between 58° and 74°F (14°-23°C) than at warmer temperatures (Figure 5a). The foliage of gold, blue, and variegated cultivars lost their characteristic colors and became green when plants were grown at 84°F (29°C) (Figure 5b).
Hostas grown at average daily temperatures greater than 80°F exhibit a rosette growth habit. Leaves lose distinctive cultivar-specific characteristics, such as a decrease in leaf size, a narrowing of the leaf blade, and a change in color (Figure 6).
Hostas emerge in response to the root-zone temperature irrespective of photoperiod. Plants will emerge in 1-2 weeks at 64°-79°F (17°-23°C), depending on the cultivar. Cooled plants forced for foliage alone will be ready for sale in 4-6 weeks at 68°-74°F (20°-23°C) and 6-8 weeks at 58°-64°F (14°-17°C). Flower development of most cultivars was fastest at 74°F, with one exception. Flowering of *H. plantaginea* was quickest at 78°F. Time to flower varies with cultivar and can range from 8 to 16 weeks at 74°F. The range of temperatures and the time to flower for each cultivar are presented in Table 1.

10. Disease And Insect Pests
Slugs are the most destructive pest of hosta and were the only pest in the greenhouse. They are easily inadvertently shipped with plant material, which should be inspected upon arrival. Metaldehyde and methiocarb effectively control slugs.
Rhizoctonia root rot was a problem for some newly planted divisions in our experiments. A broad-spectrum fungicidal drench is suggested following planting of newly divided single-eye divisions.

11. Postharvest Concerns
Postharvest of flowers is generally not a concern since most hostas are grown for their foliage, although many cultivars have scented or attractive flowers. Flowers open in sequence from the bottom, lasting 1-3 weeks, depending on the number of flower buds formed.
Spent flowers and flower stalks distract from plant quality and should be removed following flowering. Plants should not be marketed in full sun or be severely water stressed because foliar necrosis likely will develop.

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