FORCING PERENNIALS

Species: Echinacea purpurea 'Bravado'
Common name: Purple Coneflower

Editor's note: Michigan State University and GREENHOUSE GROWER bring you our second series on forcing perennials. This group of articles will be bound into another GGPlus booklet: Firing Up Perennials II. Part eight of this series features Echinacea purpurea or Purple Coneflower.

by LESLIE FINICAL, ERIK S. RUNKLE, ROYAL D. HEINS, ARTHUR CAMERON, and WILL CARLSON

A showstopper in the garden, Echinacea purpurea, or purple coneflower, provides long-lasting color throughout the summer. Echinacea, a member of the Asteraceae or sunflower family, is native to the prairies and dry plains of North America. The plants are upright, clump-forming, and produce hairy, coarsely toothed basal leaves that grow 6 inches long.

Large flowers are born atop sturdy stalks reaching up to 4 feet. The flower heads consist of a raised central cone of bronze-colored disc flowers encompassed by intensely colored ray florets. Coneflowers grow in USDA Zones 3-10 and perform best in full sun and well-drained soil.

The most common cultivars of Echinacea purpurea are 'Bravado,' 'Magnus,' and 'White Swan.' 'Bravado' (Figure 1) is a sturdy cultivar with a deep bronze-colored cone and slightly reflexed rosy red petals. 'White Swan' features gold to brown-colored cones with white petals. 'Magnus,' chosen as the Perennial Plant Association plant of the year for 1998, has a petal display that is distinct from other cultivars. Rather than the drooping ray florets characteristic of many Echinacea, 'Magnus' sports wide, flat, and more upright deep pink petals.

There are several other available species of Echinacea, in-
including *E. angustifolia*, a narrow-leaved purple coneflower; *E. pallida*, a pale purple coneflower with strongly reflexed petals; and *E. paradoxa*, a rare species with bright yellow-ray flowers. Cultivars of the species *Echinacea purpurea* are the most popular choices for the garden.

All suggested production information is based on observed responses of *E. purpurea* 'Bravado.' Because flowering requirements within *Echinacea* could vary, other species and cultivars of *Echinacea* may not respond in the same manner. But ongoing studies with ‘Magnus’ show a very similar response to that of ‘Bravado.’

1. **Propagation**

*Echinacea purpurea* ‘Bravado’ may be propagated by seeds, basal cuttings, rooted cuttings, or division. Most *Echinacea* produced commercially are propagated from seed, although ‘Magnus’ is propagated vegetatively. Seeds must be moistened and stratified for 4 weeks at 40°F. Germinate seeds between 65°F and 70°F (18°–21°C) in a moist medium. Seeds can be exposed to light or covered lightly during germination. Seedlings should be grown at cool temperatures (70°F) and transplanted after 6-8 weeks.

Cuttings can be removed in spring when shoots are 4-6 inches long and treated with 1000 ppm IBA in powdered form. Root propagation can be performed by taking pencil-sized root sections during late fall or early winter. Cover root sections with medium and hold at 60°F. Divide clumps in early spring.

2. **Plant Size**

Juvenility is not a significant problem for flowering *E. purpurea* ‘Bravado.’ Seedlings with only four leaves (128-cell plugs) flowered under a 14-hour photoperiod or with a 4-hour night interruption (NI), both provided with incandescent bulbs. ‘Bravado’ is best suited to 6-inch or 1-gallon pots with three plants per pot. A finished plant can grow as tall as 40 inches (100 centimeters). We have found that height increases with increased container size.

3. **Cold Treatment**

Cold treatment is not necessary for flowering of ‘Bravado,’ but plants flower 2-3 weeks earlier following a 10-week cold treatment at temperatures between 32°F (0°C) and 45°F (7°C) in a minimally heated greenhouse or lighted cooler. Extending the cold treatment to 15 weeks decreases the time to flower slightly further, but it is not necessary. Plugs tolerate cold temperatures well if plants are not stressed. Overwatering can cause rot and disease problems. In our coolers, plugs received 9-hour days with about 50 footcandles of light from cool-white fluorescent lamps. Higher light levels in a cold greenhouse are not a problem.

4. **Photoperiod**

‘Bravado’ is an intermediate-day plant. This means plants flower the most completely, rapidly, and uniformly under an intermediate photoperiod. Plants exposed to 12 hours of light or less, or 16 hours of light or longer, flower poorly. No flowering is observed under continuous light. The most rapid and uniform flowering occurs when plants are exposed to 14-hour photoperiods (Figures 2a and 2b). Night-interruption lighting (NI) is also effective in promoting flowering.
While 30 minutes to 4 hours of NI are effective, plants are much shorter when given only 30 minutes of NI (Figure 3). When photoperiods are 12 hours or less, we recommend providing NI lighting for 30-60 minutes during the middle of the dark period. Plants exposed to 4 hours of NI lighting will also flower, but they will be taller. Avoid photoperiods longer than 15 hours because not all plants will flower.

5. Lighting And Spacing
In the garden, ‘Bravado’ grows best with full sun, but it will tolerate partial shade. In the greenhouse, high light levels are recommended, and supplemental lighting from high-pressure sodium lamps will improve the quality of the crop during dark winter months. Space 5-inch pots on at least a 7-inch center. Adequate spacing helps minimize the likelihood of disease and, more importantly, it reduces stretching.

6. Media, Fertilization, And Irrigation
‘Bravado’ is well-adapted to dry areas and soils that provide good drainage. Plants should not be allowed to sit in excess water. Echinacea, though, require large quantities of water once they begin to bolt, especially at warm temperatures. ‘Bravado’ grows well in a soilless media and at a pH of 6.0 or slightly above. Problems with ‘Bravado,’ such as leaf distortion, can occur when the pH drops below 6. A constant feed of 100-150 ppm from a balanced fertilizer (e.g., 20-10-20) is adequate for good growth.

7. Plant Height Control
One of the major difficulties in forcing E. purpurea in con-

Figure 5. Repeated applications of Florel at 750-1000 ppm can control height of ‘Bravado.’ Photo courtesy of Takahiro Hayashi.

Figure 6. Influence of forcing temperature on flowering of E. purpurea ‘Bravado.’ Plants flowered quickest at temperatures below and above this range. Photo courtesy of Erik Runkle.
### Table 1. Echinacea purpurea ‘Bravado’ Production Schedule

<table>
<thead>
<tr>
<th>Growing Time</th>
<th>Cultural Practice</th>
<th>Temperature</th>
<th>Photoperiod</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 weeks</td>
<td>Chill seeds</td>
<td>40°F (4°C)</td>
<td>Any</td>
</tr>
<tr>
<td>2 weeks</td>
<td>Sow seeds Germination</td>
<td>68°F (20°C)</td>
<td>Natural daylengths</td>
</tr>
<tr>
<td>6-8 weeks</td>
<td>Grow until at least four leaves have formed</td>
<td>68°F (20°C)</td>
<td>Daylengths ≥14 hours or night interruption</td>
</tr>
</tbody>
</table>

**Begin Forcing**

- ↓
  - 68°F (20°C)
  - Flower in 14-15 weeks
  - 63°F (17°C)
  - Flower in 17-18 weeks

- ↓
  - 73°F (23°C)
  - Flower in 14-15 weeks

- 14 hours of light or a 30-minute to 4-hour night interruption

  **Number of days from visible bud to flower**
  - 63°F (17°C): 27 days
  - 68°F (20°C): 25 days
  - 73°F (23°C): 24 days

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8. **Temperatures And Crop Scheduling**

Under inductive photoperiods, the average daily temperature is the primary factor influencing time to flower. Increasing the temperature usually decreases time to flower, and while this may seem desirable, delayed flowering and diminished plant quality may result.

Noncooled plants of ‘Bravado’ with four leaves, grown under optimum day lengths (14 hours or with a NI of 30-60 minutes), take 17-18 weeks at 64°F (17°C), and 14-15 weeks at 68°-73°F (20°-23°C) to flower (Figure 6, Table 1). Plants develop very slowly at 60°F (14°C) or lower. Temperatures above 79°F (26°C) reduce flower quality and uniformity and should be avoided. We have not determined if cooler night temperatures can overcome detrimental effects of high day temperatures. Cooled plugs flower 2-3 weeks faster at all forcing temperatures.

9. **Disease And Insect Pests**

We have observed very few insect or disease problems with ‘Bravado,’ but slugs or aphids can cause problems. Echinacea is susceptible to “yellows” disease, which is caused by pathogenic microorganisms called phytoplasmas, and it is spread by leafhoppers. Affected plants generally show yellowing, reddening, and stunting in the early stages of disease development. Plants may have extremely numerous, small, and branched axillary shoots coming from the nodes, giving them a “bunchy” appearance. Flowers may also appear bunched.

10. **Postharvest Concerns**

‘Bravado’ has a bloom season of 6 weeks or longer. Lower leaves may become unsightly with time, especially if plants are crowded. In addition, flowers that open under low light conditions have decreased size and color intensity.

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