

FORCING PERENNIALS

– Crop By Crop –

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.

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ALWAYS 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

Figure 1.



Figure 1. *Echinacea purpurea* 'Bravado' makes an excellent flowering potted perennial.

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-

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cluding *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

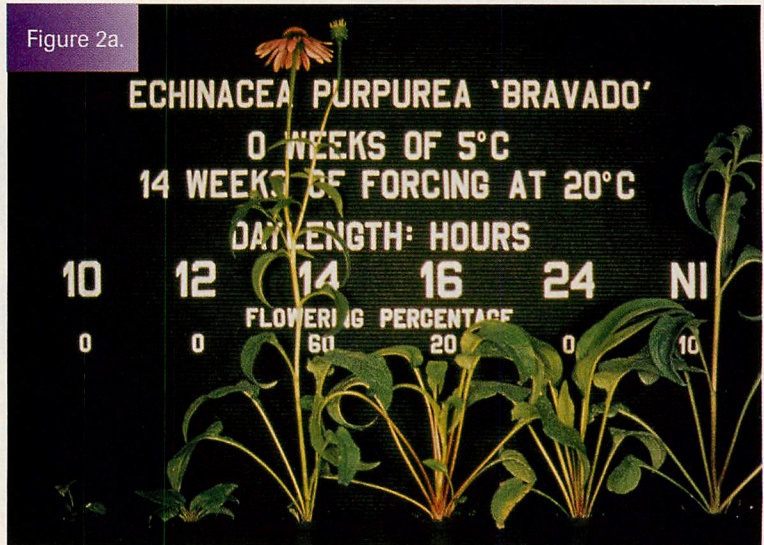


Figure 2a. Influence of different photoperiods on flowering of *E. purpurea* 'Bravado.' The plants shown received no cold treatment and were placed directly into a 68°F (5°C) greenhouse under seven different photoperiods. The highest percentage of flowering occurred under 14 hours. Photos 2a. and 2b. courtesy of Erik S. Runkle.

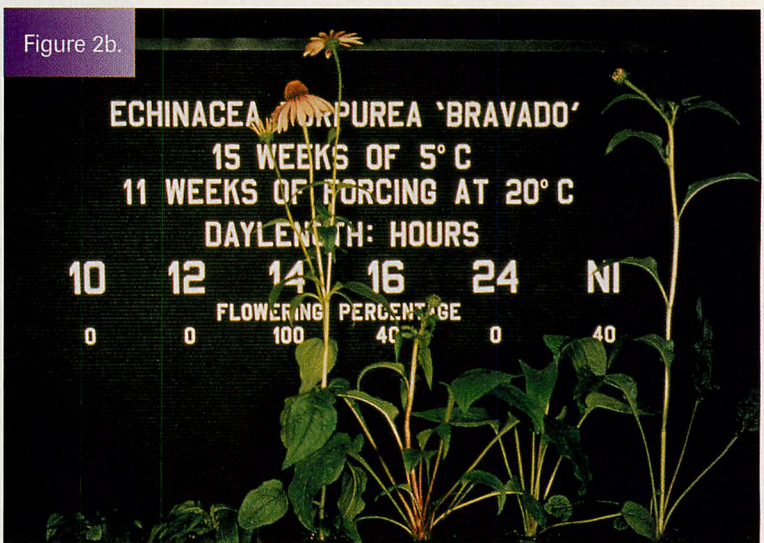


Figure 2b. Influence of different photoperiods on flowering of *E. purpurea* 'Bravado.' The plants shown received a 15-week cold treatment at 41°F (5°C) and then were grown in a 68°F (20°F) greenhouse under seven different photoperiods. 100% flowering occurred under 14 hours.

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.



Figure 3. Influence of cyclic lighting on flowering of *E. purpurea* 'Bravado.' Plants were much shorter when given only 30 minutes of NI lighting during the middle of the dark period. Photo courtesy of Erik Runkle.

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.

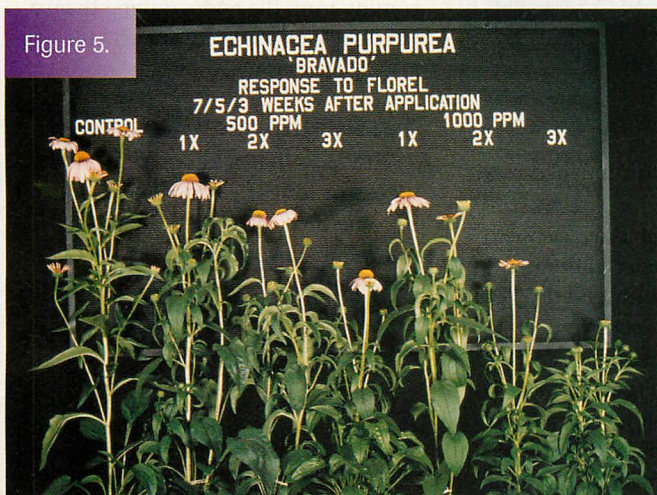


Figure 5. Repeated applications of Florel at 750-1000 ppm can control height of 'Bravado.' Photo courtesy of Takahiro Hayashi.



Figure 4. Influence of plant growth regulators on the height of *E. purpurea* 'Bravado.' Only Bonzi was ineffective in controlling plant height. But leaf discoloration may occur when using Cycocel. Proper timing of the applications is critical for successful height control. The rates indicated are not necessarily those recommended. Photo courtesy of Erik Runkle.

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-

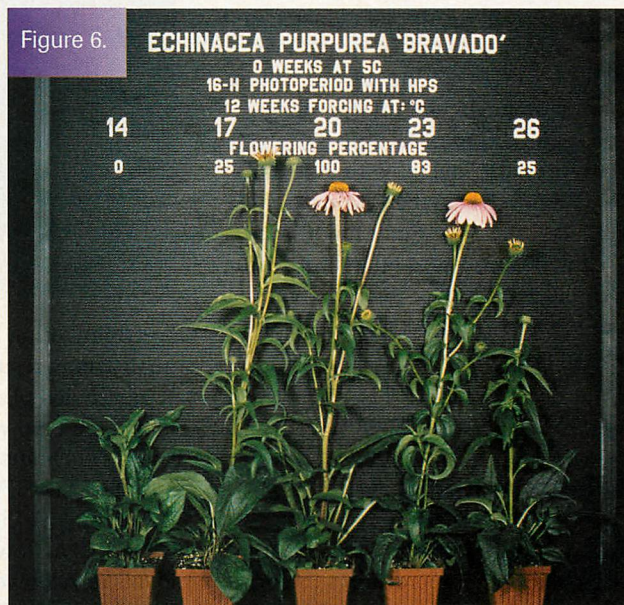


Figure 6. Influence of forcing temperature on flowering of *E. purpurea* 'Bravado.' Plants flowered quickest at temperatures below and above this range. Photo courtesy of Erik Runkle.

Table 1.

***Echinacea purpurea* 'Bravado' Production Schedule**

Growing Time	Cultural Practice	Temperature	Photoperiod
4 weeks	Chill seeds	40°F (4°C)	Any
2 weeks	Sow seeds Germination	68°F (20°C)	Natural daylengths
- OR - Purchase Plugs			
6-8 weeks	Grow until at least four leaves have formed	68°F (20°C)	Daylengths ≥14 hours or night interruption
Begin Forcing			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
↓	↓	↓	
↓	68°F (20°C) Flower in	73°F (23°C) Flower in	
63°F (17°C) Flower in 17-18 weeks	14-15 weeks	14-15 weeks	

tainers is producing a plant that is not too tall for the pot. Plants may reach 40 inches in a pot. We have found that growth regulators can effectively reduce plant height. Application timing is critical for success, and repeated applications are required when plants begin to bolt. A-Rest, B-Nine, Cycocel, and Sumagic all controlled plant height (Figure 4), but Cycocel can cause leaf discoloration in 'Bravado.'

Late applications of B-Nine or Cycocel can also cause deformed inflorescences or black-tipped petals. Florel at 750-1000 ppm applied every 2 weeks beginning at the start of bolting controls stem elongation (Figure 5).

Short durations of NI lighting can effectively control height with little or no delay in flowering when plants are flowered under short day conditions. Usually, 30 minutes of NI lighting using incandescent lights or high-pressure sodium lamps at 10 footcandles is sufficient to produce uniform flowering. Using short durations of NI lighting is not helpful during long summer days.

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, de-

Formula For Success: Purple Coneflower

1. Match starting material to desired final size. 128-cell plugs are appropriate for 4- or 5-inch pots. Larger plugs are suitable for 1-gallon pots.
2. Provide plants with 14-hour photoperiods or short durations (30-60 minutes) of NI lighting after the cold treatment, with a minimum light intensity of 10 footcandles.
3. Provide plants with supplemental lighting from high-pressure sodium lamps during the dark winter months.
4. For greatest height control, apply growth regulators when plants begin to elongate.
5. Force between 64°F and 74°F (17°-23°C).

layed 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 leaf 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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