Figure 1.

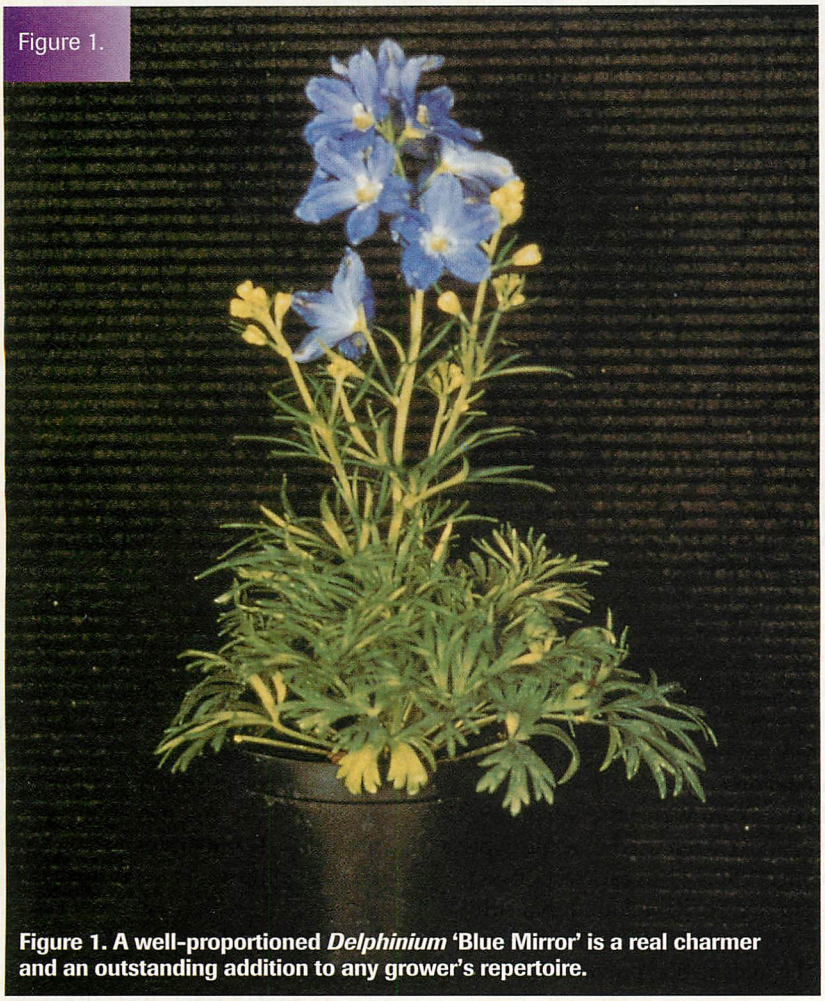

Figure 1. A well-proportioned *Delphinium* 'Blue Mirror' is a real charmer and an outstanding addition to any grower's repertoire.

Editor's note: Michigan State University and GREENHOUSE GROWER bring you a second series on forcing perennials. This group of articles will be bound into another GGPlus booklet: Firing Up Perennials II. Part two of this series features* Delphinium grandiflorum *'Blue Mirror.'

FORCING PERENNIALS

– Crop By Crop –

Species: *Delphinium grandiflorum* 'Blue Mirror'
Common name: Delphinium

by ***ALISON FRANE, SHI-YING WANG, ROYAL D. HEINS, WILL CARLSON,*** *and* ***ARTHUR CAMERON***

THE tall spikes of delphinium are popular as a backdrop in many a perennial garden. Although cultivated in gardens since 1578, delphinium, along with hundreds of other perennial species, is experiencing a resurgence in popularity (Figure 1).

The name delphinium comes from the Greek for "Dolphin flower," perhaps because of the shape of the spur on the upper part of the flower. The showy parts of the inflorescence are not actually petals, but bracts – modified leaves that form below the flower. The petals themselves are often of a contrasting color, clustered in the throat of the flower and are sometimes called the "bee."

There are many "wild-type" delphiniums that are

Figure 2. *Delphinium grandiflorum* 'Blue Mirror' can be successfully grown as a bench-run crop. Shown here planted in 4-inch pots, these plants were given 5 weeks of cold treatment at 35°-41°F (0°- 5°C), followed by forcing under natural days at about 68°F (20°C).

sometimes grown in the garden, but most of our horticultural cultivars come from *Delphinium elatum* (e.g. 'Blue Nile,' 'Magic Fountains,' and the Pacific series). These have tightly packed spikes of flowers, and come in a wide variety of colors, ranging from white to light blue and pink to purple and "true blue." Other species in cultivation include *Delphinium grandiflorum* ('Blue Butterfly' and 'Blue Mirror') with flowers in looser spikes, and *Delphinium x belladonna*, a hybrid of *D. elatum* and *D. grandiflorum*.

Most of our research has been conducted on *D. grandiflorum* 'Blue Mirror' (Figure 2), although other cultivars have been used in some experiments. While we expect responses to be similar, we have found that cultivars often vary in their response.

The information provided here is for *D. grandiflorum* 'Blue Mirror' only, unless otherwise stated. 'Blue Mirror' is a day-neutral plant that can bloom without cold, but benefits from a short cold treatment to shorten flowering time in the greenhouse. Another cultivar, *D. elatum* 'Magic Fountains' is also day-neutral but requires cold to flower.

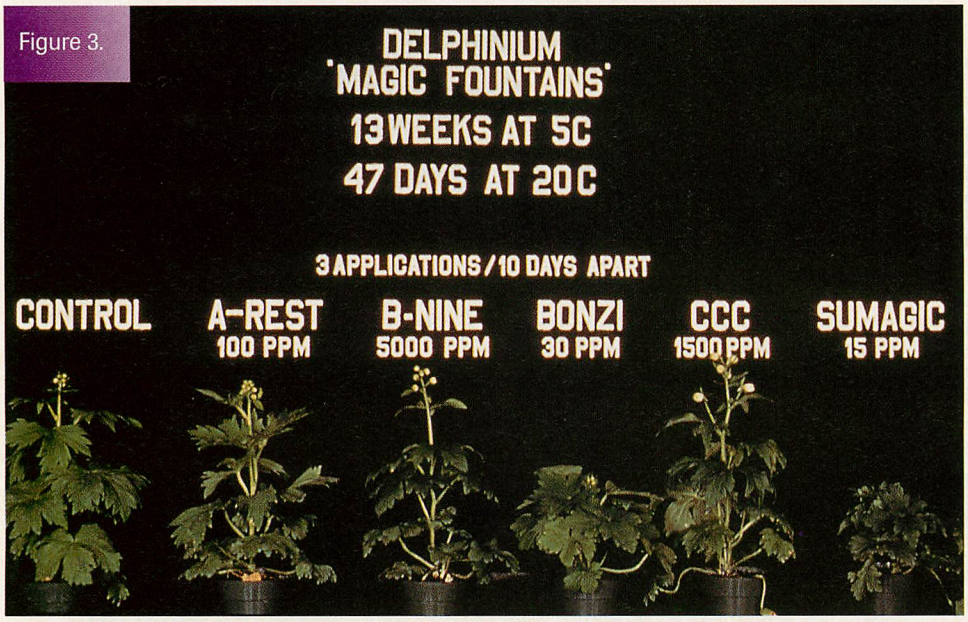

Figure 3. Effect of growth regulators on *Delphinium elatum* 'Magic Fountains' (not flowering): Although we have not performed a formal growth regulator screen on the cultivar *D. grandiflorum* 'Blue Mirror,' we have found that *D. elatum* 'Magic Fountains' responds best to Sumagic and Bonzi.

1. Propagation

'Blue Mirror' is commercially propagated from seed, although germination percentages are typically lower – 60%-70%. The seeds need no particular pretreatment, but if stored should be kept cool and dry. It is commonly double-sown into a 128-cell flat and germinated in the dark at 60°-65°F (15°-18°C). Emergence usually occurs in 12-14 days, and the total time for the crop is about 8 weeks.

2. Plant Size

'Blue Mirror' does not appear to have a juvenility period: starting material with as few as four or five leaves will go on to flower. It bolts before blooming, and so doesn't increase in lateral vegetative size as such. Since the basal rosette is rather small, this plant may look better planted

Figure 4.

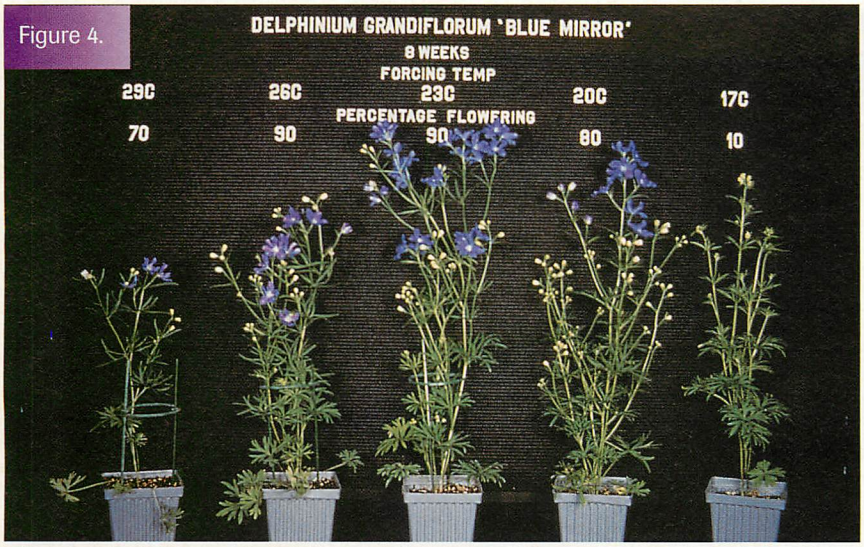

Figure 4. *Delphinium grandiflorum* 'Blue Mirror' flowers fastest at 74°F (23°C). Warmer temperatures cause heat delay, and cooler temperatures slow development. Plants were much more attractive at lower temperatures, however, with larger, more abundant flowers.

in a 4-inch pot, or with multiple plants in a 6-inch or gallon pot. More plants per pot also helps to prevent overwatering.

3. Cold Treatment

A 5-week cold period at about 32°-41°F (0°-5°C) is recommended for 'Blue Mirror.' A longer cold treatment nominally decreases days to flower. Plants can be successfully cooled in a plug tray, provided that they do not experience drought stress.

'Blue Mirror' will flower without a cold treatment, but flowering time is approximately 2 weeks sooner after a 5-week cold treatment. Flower number is similar with and without a 5-week cold treatment. *Delphinium elatum* 'Magic Fountains' will not flower without a cold requirement to flower. We recommend 10-15 weeks at 26°-41°F (0°-5°C).

4. Photoperiod

'Blue Mirror' is a day-neutral plant and as such will flower under any photoperiod. Short days slowed development slightly, but increased flower number. The use of night lighting treatment with incandescent lights is not recommended, as it increases plant height. We, therefore, suggest natural daylengths.

5. Media, Fertilization, And Irrigation

In our experiments, we have had good results with pH between 5.8 and 6.4 and moderate nutrient supplementation. We used a fertilizer solution containing 100-150 ppm N, 10-20 ppm P, and 100-150 ppm K at every irrigation.

Because of its propensity to develop root rot (Pythium sp.), a well-drained media is essential for delphinium. Overwatering can exacerbate root or crown rot, especially when plants are on the small side for the pots (e.g. early in production) or when growth is slowed by cooler temperatures or pH problems.

6. Lighting And Spacing

Delphinium prefers sun, and supplemental lighting from high-pressure sodium lamps at 400-500 footcandles improves quality in the greenhouse, especially during the winter months. 'Blue Mirror' has an upright and open growth habit, so plants can be spaced fairly closely. Don't space too closely, however, or the flower spikes may become tangled.

7. Plant Height Control

'Blue Mirror' is a naturally tall plant, and is beautiful when used accordingly in the landscape. In a pot,

Figure 5.

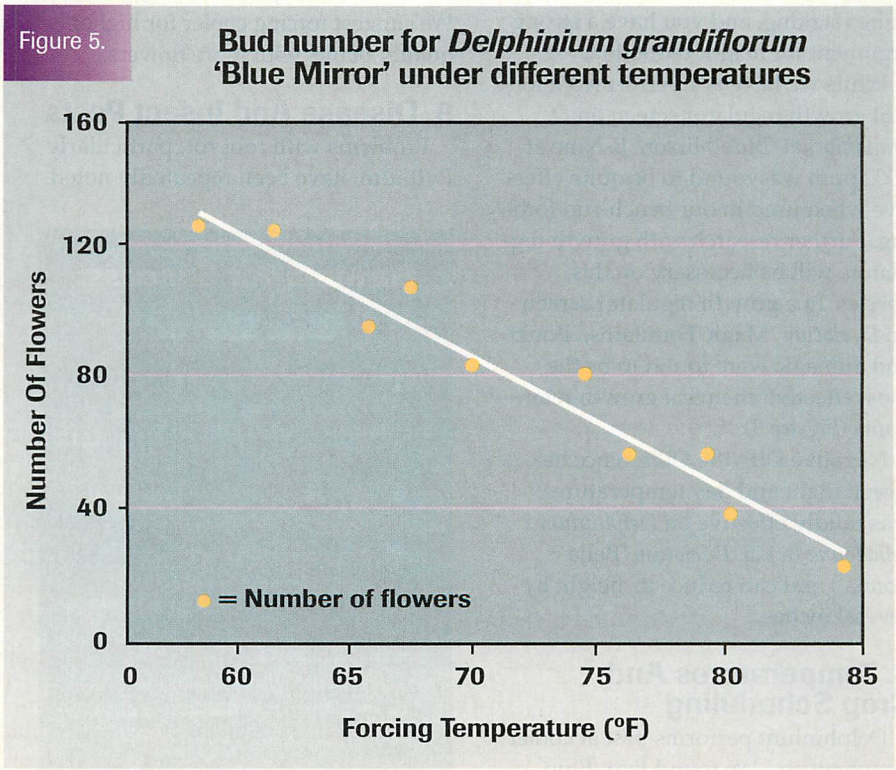

Figure 5. Number of flowers was strongly affected by forcing temperature. Plants grown at cooler temperatures had more than 120 flowers, while at warmer temperatures there were fewer than 40.

Table 1. *Delphinium grandiflorum 'Blue Mirror' Production Schedule*

Growing time	Cultural practice	Temperature	Photoperiod
12-14 days	Sow seeds Germination	60°-65°F (15°-18°C)	Darkness
6 weeks	Grow on in plugs	60°-65°F (15°-18°C)	Natural daylength
	-OR- ***Purchase plugs***		
5 weeks	Cold treatment	35°-45°F (2°-7°C)	Natural daylength or 9 hours of light in the cooler
Begin forcing			***Natural daylength***
↓ ↓ ↓ ↓ ↓ ↓ 59°F (15°C) Flower in 92 days (13 weeks)	↓ ↓ 64°F (18°C) Flower in 77 days (11 weeks)	↓ 70°F (21°C) Flower in 69 days (10 weeks)	***Number of days from visible bud to flower*** 59°F (15°C) - 32 days 64°F (18°C) - 27 days 70°F (21°C) - 21 days

however, we have observed heights up to 20 inches that are decidedly unwieldy. Add to this the fact that it is quite weak stemmed, and often requires staking, and you have a strong argument for height reduction.

While we have not performed a formal growth regulator screen on *D. grandiflorum* 'Blue Mirror,' B-Nine at 3000 ppm was found to be quite effective when used in our bench-run forcing. Further research with growth regulators will be necessary on this species. In a growth regulator screen on *D. elatum* 'Magic Fountains,' Bonzi and Sumagic were found to be the most effective chemical growth retardants (Figure 3).

Negative DIF (the DIFference between night and day temperatures) was mildly effective on *Delphinium x belladonna* (a.k.a. *D. elatum* 'Belladonna') and can reduce its height by several inches.

8. Temperatures And Crop Scheduling

Delphinium performs best at cooler temperatures. We found that 'Blue Mirror' bloomed fastest at 74°F (23°C), but had the most flowers at the lowest temperature we tested, 59°F (15°C) (Figure 4). Plants forced at higher temperatures expressed heat delay and were smaller and had fewer buds than at the lower temperatures (Figure 5). We suggest forcing cooler for higher quality plants with more flowers.

9. Disease And Insect Pests

Problems with root rot, particularly Pythium, have been repeatedly noted. This can be prevented by using a well-drained media and the right plant-to-soil ratio (number of plants per pot and pot size). Apply regular fungicidal drenches for control of Pythium, starting at transplant, and monthly thereafter.

Young plants are sometimes chlorotic, for unknown reasons, but we have not found that this affects final quality. Although we have had no significant problems with insect pests in our experiments, scouting and other preventative maintenance practices should always be followed.

Formula For Success: 'Blue Mirror'

1. Use a well-drained media and watch out for overwatering. Delphinium is quite susceptible to root rot.

2. Provide 5 weeks of cooling at 41°F (5°C) before forcing.

3. Keep the greenhouse below 65°F (18°C) for forcing. Plants at lower temperatures were more attractive and had larger and more abundant flowers.

4. Provide natural photoperiods.

5. Provide high-intensity supplemental lighting if forcing in mid-winter

6. Apply growth retardants when stem starts to elongate. Staking may be necessary.

10. Postharvest Concerns

'Blue Mirror' should be shipped just before first bloom as the first flowers open in sequence within a matter of days. Spent flowers are dropped and may look unattractive scattered about. The plant continues to bloom for several weeks. Staking is often necessary, even on small plants, as they can be weak stemmed and top heavy. **GG**

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