

# FORCING PERENNIALS

– Crop By Crop –

**Species:** *Geranium dalmaticum*  
**Common name:** Dalmatian Geranium

Figure 1.



Figure 1. *Geranium dalmaticum* makes an excellent flowering potted plant. Photo courtesy of Leslie Finical.

**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 five of this series features *Geranium dalmaticum* or *Dalmatian Geranium*.**

by **LESLIE FINICAL, ALISON FRANE, PAUL KORMAN, ARTHUR CAMERON, ROYAL D. HEINS, and WILL CARLSON**

**H**ARDY geraniums have become very popular in recent years and have many great garden plant qualities. They are tough, versatile, and resilient, and will grow in climates ranging from USDA zones 4 to 9. They are free-flowering plants with a wide range of foliage and flower color. Perennial geraniums grow from 4 inches to 3 feet tall depending on the species.

Smaller species are excellent as dense, weed-smothering ground covers, while the taller varieties make choice accent plants in a perennial border. Some of the smaller species even exhibit potential as potted flowering plants. The leaves are deeply lobed and almost fern-like and often turn bright red in the fall. The flowers are usually 1-2 inches in diameter, and range in color from white to shades of pink and even hues of blue.

Geraniums usually prefer full sun although will tolerate partial shade. They are hardy perennials not to be confused with tender geraniums, which are actually in the genus *Pelargonium*. *Pelargoniums* do not overwinter in Northern gardens.

Hardy geraniums are members of the geranium family. The geranium family is divided into six subfamilies, which includes the genus *geranium*. The true geranium species, which number 456, are found in every continent of the world. About 150 geranium species are in cultivation around the world.

*G. dalmaticum* is a small, long-lived species native to the Balkan Peninsula which grows about 6 inches tall. *G. dalmaticum* has received England's prestigious Royal Horticulture Society's Award of Garden Merit. *G. dalmaticum* spreads rapidly by rhizomes to form a carpet of foliage, but is generally not invasive.

The leaves are very fragrant with a dark, glossy green color that turn orange and red in the fall and winter. The flowers are pale to medium pink and about 1 inch in diameter. There is also a white-flowered cultivar of *G. dal-*

PRODUCTION  
FORCING PERENNIALS

*maticum* called 'Album.' *G. dalmaticum* is compact and tidy, and is an excellent choice for the garden and for forcing as a potted perennial.

The information provided here is for *G. dalmaticum* only. We have not conducted research on the cultivar 'Album.' *G. dalmaticum* is a facultative long day plant, which benefits from a cold treatment to shorten flowering time in the greenhouse and improve overall appearance.

### 1. Propagation

In the garden, *G. dalmaticum* is propagated by division in the spring or fall. Plant division helps rejuvenate old clumps, and increases or controls the number of plants. Clumps are best divided in early spring or after flowering. *G. dalmaticum* is vegetatively propagated by stem cuttings or division.

Obtaining production-quality cuttings from *G. dalmaticum* is fairly simple. We have found the best production quality cuttings can be obtained from stock plants grown under photoperiods less than 12 hours. Commercially, most growers take *G. dalmaticum* cuttings from June to July, when days are longer. We propagated a small number of plants by taking 1- to 2-inch cuttings and dipping each in a 0.1% IBA powder. The first signs of rooting were observed within 7 days.

Winter-propagated plants could respond differently to treatments, although we have not tested that possibility. The plant material we used in our experiments was commercially propagated during the months of June and July and received in October.

### 2. Plant Size

Juvenility has not been a factor for us in flowering *G. dalmaticum*. Plants with six leaves per shoot in 128-cell plugs flowered under 16-hour day-extension lighting.

Time to flower is similar for different size starting material, although final plant size and flower number will differ (refer to Figures 2a and 2b to note plant size and flower number differences). We also found that 128-cell plugs averaging 6-8 leaves per shoot have an average of 15 flowers per plant, whereas 70-cell plugs averaging 12 leaves per shoot have an average of 32 flowers per plant.

*G. dalmaticum* is best suited for finishing in a 5-inch pot when started from 70-cell (9-12 leaves per shoot) or 50-cell (12-15 leaves per shoot) plug trays. When started from 128-cell plugs, finishing in a 4-inch pot may be more appropriate. We recommend starting with plugs larger than 128s (more than eight leaves per shoot) to achieve the best end result. One plug is sufficient to fill a pot, so using multiple plugs per pot is not recom-

**Figure 3. Influence of different durations of cooling at 41°F (5°C) on flowering time and flower number of *G. dalmaticum*.** Shown are plants cooled for 0, 3, or 6 weeks, then placed in a 68°F (20°C) greenhouse under 16-hour day-extension lighting with high pressure sodium lamps. *Photo courtesy of Leslie Finical.*

Figure 2a.

**GERANIUM DALMATICUM**  
6 WEEKS COLD 5°C  
9 WEEKS FORCING 20°C  
16 HR PHOTOPERIOD  
% VISIBLE BUD  
100



**Figure 2a. Influence of starting material size on finished *G. dalmaticum* plants.** Plants were cooled at 41°F (5°C) for 6 weeks as 128-cell plugs with an average of 6-8 leaves per shoot. The plants were then grown for 9 weeks in a 68°F (20°C) greenhouse under 16-hour day-extension lighting with high pressure sodium lamps. *Photo courtesy of Leslie Finical.*

Figure 2b.

**GERANIUM DALMATICUM**  
16 HR PHOTOPERIOD  
WEEKS COLD 5°C  
6  
WEEKS OF FORCING 20°C  
9



**Figure 2b. Influence of starting material size on finished *G. dalmaticum* plants.** Plants were cooled at 41°F (5°C) for 6 weeks as 70-cell plugs with an average of 9-12 leaves per shoot. The plants were then grown for 9 weeks in a 68°F (20°C) greenhouse under 16-hour day-extension lighting with high pressure sodium lamps. *Photo courtesy of Leslie Finical.*

Figure 3.

**GERANIUM DALMATICUM**  
16 HR PHOTOPERIOD  
WEEKS COLD 5°C  
0 3 6  
WEEKS OF FORCING 20°C  
12 9 6



Figure 4.

## Flower Timing

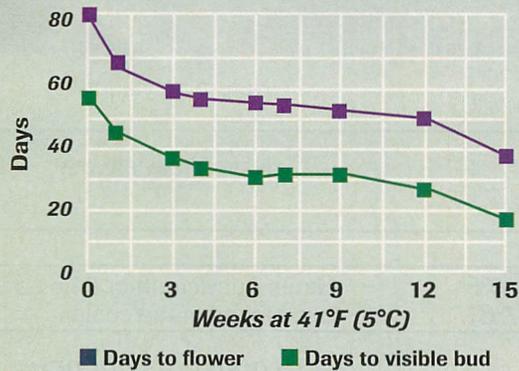


Figure 4. Influence of long durations of cooling at 41°F (5°C) on flowering of *G. dalmaticum*. Time to flower decreases only slightly after long durations of cold. Plants were grown in a 68°F (20°C) greenhouse under 16-hour day-extension lighting with high pressure sodium lamps. Graphic courtesy of Leslie Finical.

mended. A finished plant will usually grow to 6 inches in height.

### 3. Cold Treatment

At least 6 weeks of cold at temperatures between 32°F (0°C) and 45°F (7°C) in a minimally heated greenhouse or a lighted cooler is recommended for flower induction. Without cold, there is less than 100% flowering, flowers open on short stalks and remain obstructed by the foliage, and flower number is very low. After a cold treatment, time-to-flower decreases, flower number increases, and all plants flower (Figure 3).

Average time-to-flower decreases from 84 days without cold, to an average of about 50 days after 6 weeks of

cold. Longer cold treatments will continue to decrease the time to flower only slightly (Figure 4). To a botanist, *G. dalmaticum* would be categorized as "cold-beneficial." To a horticulturist, *G. dalmaticum* requires a cold treatment.

Plugs tolerate exposure to cold well if water stress is prevented. In our cooler the plugs received 9-hour days with about 50 foot-candles of light from cool-white fluorescent lamps. Plugs were stored for 20 weeks in our coolers with no deleterious effects observed.

### 4. Photoperiod

*G. dalmaticum* is a facultative long-day plant after cold treatment. Plants will bloom under short or long days but time to flower is quicker under long days. Plants grown under 16- and 24-hour photoperiods, and a 4-hour night interruption (NI), bloomed faster than plants grown under 10-, 12-, 13-, and 14-hour day-extension lighting. Without a cold treatment, no flowering was observed under any photoperiod that was extended with incandescent bulbs.

After a 15-week cold treatment at 41°F (5°C), the most rapid and uniform flowering occurred under 16-hour day-extension lighting and NI lighting. The

number of flower buds per plant is not affected by photoperiod. We recommend 16-hour day-extension lighting or 4-hour NI for *G. dalmaticum*.

### 5. Lighting And Spacing

*G. dalmaticum* grows best in full sun conditions but will tolerate partial shade in the garden. Supplemental lighting from high pressure sodium (HPS) lamps will improve the crop quality during dark winter months. Plants that received no cold treatment failed to flower when grown with 16-hour day-extension lighting with incandescent bulbs. Plants that received no cold treatment and were grown under 16-hour day-extension lighting with HPS lamps achieved 30%-75% flowering.

Using high intensity lighting, such as HPS lamps, to provide photoperiodic lighting may decrease the time to flower and improve the overall quality of the crop. 70-cell plugs given a 15-week cold treatment at 41°F (5°C) and then grown in a 68°F (20°C) greenhouse under 16-hour day-extension lighting from HPS lamps flowered in an average of 45 days. 52-cell plugs given the same cold treatment, then placed in the greenhouse under 16-hour day-extension lighting from incandescent bulbs, flowered in an average of 54 days. The minimum light intensity for successful photoperiodic lighting is 10 footcandles.

Because the plants are compact, spacing can be fairly close. Spacing of

Figure 5.

## GERANIUM DALMATIUM

12 WEEKS COLD AT 5°C  
PHOTOPERIOD: 16 HRS (HID)  
8 WEEKS FORCING AT

17C      20C      23C      26C      29C  
10      100      90      100      30  
PERCENTAGE FLOWERING



Figure 5. Influence of forcing temperature on flowering of *G. dalmaticum*. Production time from start of forcing to opening of first flower is approximately 8 weeks at 64°F (17°C), 7 weeks at 68°F (20°C), or 6 weeks at 74°F (23°C). Photo courtesy of Alison Frane.

Figure 6.

## Geranium dalmaticum

12 weeks cold at 5°C  
photoperiod 16 hrs (HID)  
forcing temperature:  
29°C      17°C



Figure 6. Influence of forcing temperature on flower size of *G. dalmaticum*. Flower size increases dramatically at cooler temperatures (64°F and 84°F). Photo courtesy of Alison Frane.

Table 1.

**Geranium dalmaticum Production Schedule**

<b>Growing time</b>	<b>Cultural practice</b>	<b>Temperature</b>	<b>Photoperiod</b>
3-4 weeks	Vegetative cuttings	72°-76°F (22°-24°C)	Natural daylength
4-5 weeks (128-cell plug) Longer for larger	Bulk or pinch to increase vegetative growth of plugs	68°-72°F (20°-22°C)	Natural daylength
<b>-OR- Purchase plugs</b>			
6-15 weeks	Cold treatment	32°-45°F (0°-7°C)	Natural daylength or 9 hours of light in the cooler
<b>Begin forcing</b>			<b>≥16 hours of light or a 4-hour night interruption</b>
↓ ↓ ↓ ↓ ↓ ↓	↓ ↓	↓	
64°F (17°C) Flower in a average of 59 days (8 weeks)	68°F (20°C) Flower in a average of 49 days (7 weeks)	74°F (23°C) Flower in a average of 41 days (6 weeks)	<b>Number of days from visible bud to flower</b> 64°F (17°C) - 29 days 68°F (20°C) - 23 days 74°F (23°C) - 18 days

about 1-2 inches between pots will help to minimize the occurrence of disease and stretching.

## 6. Media, Fertilization, And Irrigation

*G. dalmaticum*, like most hardy geraniums, is well adapted to dry areas and well-drained soils and will tolerate extended drought stress. *G. dalmaticum* grows best in a well-drained, bark-based media with a pH between 6.0 and 6.5. A constant feed of 100 ppm of a 20-10-20 fertilizer is adequate for good growth.

Although *G. dalmaticum* should not be overwatered, no incidents of crown or root rot were observed on well-watered plants.

## 7. Plant Height Control

Because *G. dalmaticum* grows to only 6 inches, no height control is necessary.

## 8. Temperatures And Crop Scheduling

Under long-day conditions, average daily temperature is the primary factor influencing flower development. The time to flower of *G. dalmaticum* was about 8 weeks at 64°F (17°C), 7 weeks at 68°F (20°C), or 6 weeks at 74°F (23°C). Plants will flower faster at the warmer temperatures up to 78°F (26°C) (Figure 5).

Although increasing the temperature to speed up the crop may seem desirable, there are negative consequences that result from growing the crop too warm. *G. dalmaticum* will experience heat delay of flowering at

temperatures of 78°F (26°C) or above (Figure 5). During forcing, we suggest temperatures of 64°-74°F because plant and flower size are larger at cooler temperatures (Figure 6).

## 9. Disease And Insect Pests

No disease or insect pests were observed on *G. dalmaticum* during the course of this research.

## 10. Postharvest Concerns

*G. dalmaticum* will hold the initial flush of flowers for approximately 2-3 weeks, beyond which new flowers will continue to emerge sparsely. Because flowers are small, their immediate removal upon finishing is not necessary.

However, removing spent flowers may encourage new flowers under well-lit conditions. Because the plant is fairly drought-tolerant and sturdy, the overall appearance should remain acceptable for quite some time under retail conditions. Cutting the plants all the way back to the base will result in a quick new flush of vegetative growth but with limited flowering. **GG**

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### Formula For Success: Dalmatian Geranium

1. Use larger plugs for superior quality plants - 70 50-cell plugs with more than nine leaves per shoot are appropriate for 5-inch pots.
2. Provide plants with at least 6 weeks of cold temperature between 32°F (0°C) and 45°F (7°C) before long day (LD) treatment.
3. Provide plants with long days after the cold treatment. LD can be provided by natural or extended photoperiods of 16 hours or by night interruption from 10 p.m. to 2 a.m. with a minimum light intensity of 10 footcandles.
4. Force between 64°F and 74°F (17°C and 23°C) for best quality.
5. Provide plants with supplemental lighting from high pressure sodium lamps during the dark winter months. Supplemental lighting increases flower number and overall plant quality.