

# Day-Neutral Vernalization

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In the last two articles of this series, we discussed several practical aspects of delivering cold treatment to herbaceous perennial plants. We also described the major flowering response categories of perennials based primarily on their response to vernalization and secondarily to photoperiod.

Based on their vernalization responses, herbaceous perennials can be categorized into the following three groups:

- 1 Plants that do not have a flowering response to a cooling treatment.
- 2 Plants that have a facultative or quantitative vernalization requirement. These plants flower without cooling treatment, but cooling improves flowering characteristics such as percentage of plants flowering, reduced time to flower and increased flower number.
- 3 Plants that have an obligate or qualitative vernalization requirement. These plants do not flower without a cooling treatment.

Plants with an obligate vernalization requirement can be further categorized into two groups based on their photoperiodic response after vernalization:

n Plants that are day neutral and therefore flower under any photoperiod after vernalization.

n Plants that require long days to flower after vernalization.

In this article, we describe specific responses of plants that require vernalization and are day neutral following the cooling treatment.

Researchers at Michigan State University have screened hundreds of perennials for determining their vernalization response types and have found that many commercially important perennials require vernalization and are day neutral. Some examples include select cultivars of bugleweed (*Ajuga reptans*), sea thrift or sea pink

(*Armeria maritima*), columbine (*aquilegia* hybrids), false spirea (*astilbe* hybrids), cheddar pinks (*Dianthus gratianopolitanus*), coral bells (*heuchera* hybrids) and foamy bells (*heucherella* hybrids).

## Time To Flower

When herbaceous perennials with an obligate vernalization response are forced, they are often propagated by cuttings or grown from seed, then grown for some period of time, cooled and subsequently forced and sold as actively growing perennials in flower. The final goal is to obtain a high-quality, floriferous plant that is large enough to fill the pot so it is aesthetically appealing. Therefore, attaining the desired plant size and maximizing flower number are very important to ensure marketability. In general, the amount of vegetative growth and number of flowers produced depend on the time required to flower following vernalization.

Specifically, we have defined two primary flowering time responses. The first response type consists of plants that bloom at the onset of spring, which we refer to as early-spring ephemerals. The second response category consists of late-spring perennials that bloom later in the spring.

## Early-Spring Ephemerals

Vernalization-requiring, day-neutral perennials flower only following a cooling treatment. Photoperiod does not regulate flowering. Due to this singular control of flowering, many species in this category flower early in the spring in their natural habitats or in the garden. In the greenhouse we have observed that following vernalization, many early-spring ephemerals flower within two to six weeks of forcing. For example, in our trials *Ajuga reptans* 'Bronze Beauty' flowered within two weeks and *Dianthus gratianopolitanus* 'Bath's Pink' flowered in four to

five weeks of forcing at 68°F (20°C).

Some perennials need to develop vegetative growth prior to cooling for them to be of sufficient size at flowering. For example, if rooted cuttings of *dianthus* 'Bath's Pink' are grown for four or five weeks before vernalization, they will not adequately fill a 5 ½-inch container when forced. Also, the plants will only produce a handful of flowers. Therefore, *dianthus* 'Bath's Pink' does not achieve its aesthetic potential when vernalized and forced without an extended period of bulking. Most spring ephemerals should be bulked for at least six to 10 weeks prior to vernalization treatment.

A common strategy to produce spring ephemerals is to pot plants in their final containers during summer or fall and bulk them before cooling. In the Northern states, plants are usually grown in a greenhouse or hoop house for several weeks and then temperature is slowly lowered during autumn. Plants are then vernalized in a cooler or a protective structure such as a minimally heated hoop house and then forced. In Southern states, this entire process of bulking, cooling and forcing can take place outdoors.

A key limitation with an outdoor cooling strategy is the possibility that a vernalization requirement may not be completely met in a mild winter, especially in the mid-South. For northern states such as Michigan, however, this is not a concern as the winters are long and cold enough to satisfy the cooling requirement.

Another cooling strategy is to grow perennials outdoors in the ground and harvest them as bare-root perennials, preferably after the first frost. When properly packed, the bare-root plants can be stored in a cooler (usually at 28°F) for several months. Bare-root field-grown plant material of desired size can be purchased

## PRODUCTION

### PERENNIALS

as starting material. We have trialed several bare-root perennials with great success. For example, *Dicentra eximia* 'Luxuriant' exhibited a fantastic display of flowers when started from bareroot divisions. Bareroot starting material may be particularly useful if resources to bulk and cool spring ephemerals are unavailable.

#### Late-Spring Perennials

There are a handful of species that require vernalization and are day neutral but are relatively slow to flower. In their natural habitats, such slow-flowering species tend to flower later in the spring. *Campanula* 'Birch Hybrid,' *Delasperma cooperi* and *veronica* 'Red Fox' are some examples of these late-spring perennials.

Most of the late-spring perennials that we have tested produce considerable vegetative growth during forcing. Therefore, these can be vernalized as plugs and, when potted after vernalization, still produce a satisfactory crop. Although we have found only a few species and cultivars belonging to this category, they are important due to their lack of a bulking requirement. For example, when *campanula* 'Birch Hybrid' rooted tip cuttings were cooled for five to seven weeks at 41°F (5°C), they produced a beautiful display of thousands of flowers that lasted for three to four weeks at 68°F (20°C).

We tested the vernalization response of *campanula* 'Birch Hybrid' to a range of temperatures and durations. *Campanula* 'Birch Hybrid' flowered when plants were vernalized for five to seven weeks at 32°F to 46°F (0°C to 7.5°C). Interestingly, complete flowering occurred at temperatures as high as 55°F (12.5°C) when plants were vernalized for 12 weeks. Thus, *campanula* 'Birch Hybrid' can be effectively vernalized at a relatively broad range of temperatures (between 32°F to 55°F), depending on the duration of the treatment. In contrast, *veronica* 'Red Fox' flowered only when vernalized between 32°F to 46°C (0°C to 7.5°C), and longer durations at warmer vernalization temperatures resulted in incomplete flowering. Thus, although the effective vernalization temperature ranges vary between species, most can be vernalized successfully between 32°F to 46°F (0°C to 7.5°C).

#### Potential To Rebloom

Most early-spring ephemerals and late-spring perennials produce one flush of flowers and they do not produce a second flush unless vernalized again. Therefore, many of these species should be precisely scheduled and sold before the flowering period is over. An important consideration is educating the buyers to expect a single flush of flowers in the spring, similar to spring-flowering bulbs. A few exceptions exist, including some new hybrids of *heuchera* and *campanula* 'Kent Belle,' which may rebloom in the garden. GG

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Forced plant

Following five to seven weeks of vernalization treatment at 41°F (5°C), *campanula* 'Birch Hybrid' produces a fantastic display of thousands of flowers, even when started from a small tip cutting.



Tip cutting



Complete flowering of *Ajuga reptans* 'Bronze Beauty' was achieved within just two weeks of forcing following vernalization treatment.

#### Continued Online

To learn more on day-neutral spring-flowering perennials, please visit [www.greenhousegrower.com](http://www.greenhousegrower.com) and click on Grower Tools. There you'll find:

- Information on vernalization and flowering of day-neutral spring ephemerals varieties.
- Study findings on day-neutral plants that are vegetatively propagated and that do not require bulking prior to vernalization.
- Tips for forcing aquilegia cultivars.
- More photos of research findings.