

## Unlocking the Secrets of Plant Dormancy

by Dr. H. Marc Cathey

FOR TEMPERATE-REGION gardeners, the miracle of spring never gets old, no matter how many times we experience it. There's something truly amazing in the way plants lie dormant through winter and then, on cue, begin popping out of the ground and setting flowers.

Our understanding of the successful blooming and fruiting requirements of many plants we grow—both edible and ornamental—is based largely on observations by naturalists and horticulturists. Over time these researchers painstakingly unraveled the physiological processes that control seed germination, flower production, and fruit set.

A major discovery was that many plants require vernalization—or exposure to a period of low temperatures—in order to break dormancy or to flower. For instance, plants classified as biennials require vernalization as part of their two-year life cycle. Following seed germination, biennials typically develop a rosette of leaves at ground level the first season. Then, after vernalization over winter, they develop elongated stems that bear flowers and fruit. After fruiting, the plant dies. Examples of biennials include foxgloves (*Digitalis purpurea*), honesty or money plant (*Lunaria annua*), and herbs such as parsley (*Petroselinum crispum*).

In the cut-flower industry, artificial vernalization is used to stimulate flowering in biennial plants such as stock (*Matthiola incana*), which requires a minimum of three weeks at between 40 and 50 degrees Fahrenheit to flower.

### JUST CHILLIN'

Most spring-flowering bulbs require a period of exposure to low temperatures in

order to flower properly, even though the flower buds were already formed in the dormant bulbs the previous year. The low temperatures are necessary to overcome dormancy and initiate the lengthening of the flower stem. That's why bulbs to be grown indoors in containers or for growth in warm regions such as Florida and southern California must be "pre-chilled" in refrigerators in order to bloom.

Most fruit trees also require a period of vernalization to set fruit successfully, but researchers have developed "low-chill" varieties that will produce fruit for gardeners who live in warmer climates.



Like many spring bulbs, daffodils require an extended cold period to flower.

Over the years, scientists have discovered that vernalization is a much more complex procedure than it first appeared, involving not only cooling temperatures, but varying sequences and durations of daylength (photoperiodism). So no single vernalization procedure works for all plants; in fact, each species and variety seems to have its own requirements, which can only be confirmed through careful study.

### LEADING THE WAY

Many noted plant physiologists have helped unravel the vernalization requirements of specific plants, but one of the pioneers was T.D. Lysenko, a Russian

scientist who is credited with preventing mass starvation in Russia in the 1920s by subjecting winter wheat seeds to low temperatures so that they could be sown as a spring crop rather than a winter crop. This reduced the amount of wheat seeds lost to hungry birds in winter, and thus increased the amount of wheat that could be harvested. Lysenko is also credited with coining the term "vernalization," which is derived from the Russian word *yarovizatsya*, which means "to make or become spring."

Then, in the 1930s and '40s, F. G. Gregory and O. N. Purvis of the Chelsea Physic Garden in London, England, advanced the understanding of vernalization through studies of a particular strain of rye cereal. These researchers discovered that vernalization affected the plant's sensitivity to daylength and could be used to speed up the initiation of flowering in winter rye.

In seeking ways around vernalization requirements, plant physiologists discovered that certain plant growth regulating chemicals, including auxins and gibberellins, could be used as substitutes for chilling requirements in some plants. They also began using high-pressure sodium lamps to reduce or change photoperiod requirements. The search for shortcuts to vernalization has been aided by plant explorers and breeders, who are actively seeking out and developing new forms of plants that have low-chilling requirements or are not as sensitive to daylength changes.

So as you enjoy the spring flowers in your garden this year, say a quiet thank you to the unsung researchers who unraveled the secrets of vernalization and increased the bounty of plants we can grow for food and ornament.

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