

Growing Blueberries in Cold Climates

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It is tempting to assume that the presence of wild blueberry plants in a locality is a good indicator of success for their commercial cousins (Figure 1). However, just because wild plants grow in an area does not imply that cultivated plants will thrive. The large amount of genetic diversity in wild plants allows particular types to survive in some unbelievably harsh habitats, from windswept rocky roosts to boggy bottoms. Commercial varieties, though very stress tolerant, usually do not have the resiliency to tolerate exceptional conditions. Breeding advances have increased tolerance to some extent, but special considerations must be made to produce fruit superior to wild berries using currently available cultivars in cold climates.

Low temperatures present a significant challenge, not only because of the direct effect of cold on the plant, but due to the indirect effect of the reduction of moisture availability. Extremely cold temperatures, coupled with high winds, can desiccate buds and kill plant tissue. Few woody plants of any species can tolerate temperatures below -40°F. The hardiest blueberries will be damaged below -20°F, unless they are covered with snow. Growers living in climates where the mid-winter low temperature consistently approaches -20°F should plant only on sites that have good air drainage, and use only hardy varieties such as Patriot, Jersey and Northland. Low-statured half-high varieties (e.g. Northblue) can also be successful in cold climates because plants are frequently covered with snow that protects against desiccation in mid-winter. In Quebec, varieties that tend to produce fruit on lower branches, such as Duke and Reka, are often successful, even though they are not particularly hardy, because lower branches are usually protected by snow during extremely cold weather.

In addition to low temperature extremes, fluctuating temperatures can be damaging as well. Once the chilling requirement has been met, buds are able to grow when the weather warms. The first step in the growth process is for free water to move into the cells and vascular system at the base of the buds. If the temperature drops suddenly and the water freezes, the bud will expand and the ice may rupture cell walls and disrupt vascular connections. The result can be permanent damage to the bud even though visible damage may not show up until late spring when rapid growth begins. Avoid planting on a steep southern exposure as this location can exacerbate temperature fluctuations. Researchers in Michigan have been recording the hardiness of blueberries after exceptionally cold winters, and after severely cold springs. The ranking of varieties differs considerably between years, indicating that varieties tolerant of severe cold in winter are not necessarily tolerant of fluctuating temperatures in spring. Late-fruiting varieties are more tolerant of spring frosts than the typically winter-hardy varieties.

Growing blueberries in cold climates presents growers with many challenges due to low temperatures, fluctuating temperatures, and low moisture. Timing and severity of injury varies, but there are ways for growers to reduce crop damage in cold climates.

Woody plants growing in cold climates often have many of the same adaptations as desert plants (thick leaves, narrow vessels, small stomata, ability to store salt in leaves), because the fundamental problem in both climates is the lack of water. In the desert it does not rain; in cold climates during winter, the soil water is in the form of ice and the air is exceptionally dry. Blueberries have several adaptations that allow them to tolerate a relatively large amount of water stress and desiccation. Despite these adaptations, adequate soil moisture is necessary during the growing season in order to realize a reasonable yield. It is also important to make sure that plants are well irrigated going into the winter to compensate for inevitable water loss that occurs when temperatures and humidity fall. Preventing desiccation by using windbreaks can also help minimize winter damage. Some growers use a floating



Figure 1. This blueberry plant appears to be a natural hybrid between lowbush (*Vaccinium angustifolium*) and highbush (*V. corymbosum*) blueberry and is growing in the Adirondack Mountains in a very cold region of New York State.



Figure 2. Overwintering half-high blueberries under a floating row cover in Minnesota.



Figure 3. Raised beds help prevent stunting and disease development in wet sites.



Figure 4 (left). Phomopsis canker often infects plants through winter-injured wood.

Figure 5 (center). Vascular collapse of an entire cane on a young plant infected with Phomopsis canker.

Figure 6 (above). Cold temperatures during winter have killed the floral buds.

row cover over half-high blueberries to increase survival in cold climates (Figure 2). Excessive nitrogen fertilizer or late applications can make plants susceptible to cold temperatures too. Balanced nutrition, determined with a foliar analysis, will help ensure that plants have the capacity to harden properly as winter approaches.

Mulches help conserve moisture and protect roots when snow cover is absent. Mulch is particularly important for young plantings that have not yet established a strong root system, as it prevents extreme temperature fluctuations in the soil. Repeated soil freezing and thawing can heave out new blueberry plants, causing a significant economic loss. This will most likely occur with fall planting.

Excessive soil water can be problematic as well, particularly when roots are

growing. Root growth involves respiration, which in turn, requires oxygen from the surrounding air pockets in the soil. If air spaces are filled with water, then no oxygen is available and roots accumulate toxic metabolic waste. Flooded or saturated soil brings a risk of oxygen starvation. Although 60°F is optimal for root growth, roots grow at temperatures as low as 43° F. So, even if the plant appears to be dormant, some root growth may be occurring. If the soil is flooded in fall when the plant is attempting to move starch and nitrogen compounds in to the roots for winter storage, then plant growth the following spring may be compromised. Installing drainage or planting on raised beds can be good practices for blueberries, even though they are less prone to soil diseases as some other fruit crops (Figure 3).

It is unusual for a mature blueberry plant to die suddenly from cold temperature injury; the decline is most often gradual. First, shoot growth is reduced and, as a result, a low number of floral buds are produced on the shoots. Since the floral buds are formed at the tips of shoots, and winter injury always starts at the tips and works down, the first buds to die are flower buds. Vegetative buds are hardier than floral buds. Blueberries growing in cold climates may exhibit reasonable vegetative growth, but little fruiting. Winter-injured blueberry plants are susceptible to cane diseases, particularly Phomopsis canker (Figure 4). This fungus can invade canes through dead buds and further weaken the plants. But even without canker, repeated winter injury will result in poor shoot growth and low yields.

A second level of winter injury occurs when plants appear to be healthy in spring, but shoots suddenly collapse and die when the weather warms significantly. Although Phomopsis canker can cause these symptoms (Figure 5), they also may be due to vascular collapse as previously injured vascular tissue is unable to support the rapidly growing shoot. Active connections are too few, so the shoot wilts, despite what may be abundant water in the soil.

A third level of injury occurs when the temperature drops low enough at the wrong time of the year so that both floral (Figure 6) and vegetative buds are killed. Although new canes will usually develop from buds below the ground, injury of this degree will set back the planting by several years.

Growers with established plantings can minimize winter injury with windbreaks, and ensure that nutrients and water are managed properly. Planting

low-statured varieties on good sites may enable growers to produce blueberries in regions once considered too cold for commercial production, particularly if row covers and windbreaks are used.

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