



Fall/Winter Freezes

Freezing temperatures will kill all warm season annuals and many poorly adapted perennials and woody plants that are left outdoors unprotected. Many gardeners treat these perennials and woody plants as annuals and replant them each spring (i.e. Lantana, Gazanias, etc.). Others have frost tender plants such as lemon trees and tropical cactus in pots and need to move them into protected locations when winter sets in. Various other frost protection strategies can be employed, such as mulching, floating row covers, and hot caps.

Other plants are said to be “cold hardy” and have various adaptations that allow them to survive low temperatures. This is often a period of dormancy when physiological processes are modified and metabolic activity is drastically reduced. Native cold hardy plants have been genetically selected over millennia to survive the climate in which they have evolved. Landscape plants are often non-native and gardeners like to experiment with species they had enjoyed in other gardening climates. However, each plant species has a cold tolerance threshold (exposure time and temperature) below which permanent damage and/or death will occur.

The cold hardiness of a species is usually considered to be the lowest midwinter temperature plant tissues can endure. This is not the only consideration. Plant injury frequently occurs during autumn or spring when the plant is not at its maximum hardiness. Minimum temperatures can only be tolerated if the plant has had time to acclimate through gradual changes in metabolic processes. This gradual acclimation to cold is sometimes called “hardening off”.

Most landscape plants acclimate or develop hardiness to freezing temperature in response to changes in day length and temperature. Acclimation is a two-stage process. The first stage is initiated by shorter days and results in partial hardiness. Leaves are the receptors of the short-day signal. After growth stops, the short-day photoperiod triggers a hardening signal that is transferred from the leaves to the stems and branches. The short-day signal results in partial cold hardiness.

The second stage is initiated by cold temperatures and results in full hardiness and acclimation. Cool temperatures initiate the accumulation of sugars, modification of proteins and changes in cell membrane permeability. While most plants require short photoperiods and lower temperatures to develop full hardiness, some harden only in response to low temperature regardless of photoperiod.

Cold damage can be caused by a variety of processes. Low temperatures can cause intra- or extra-cellular ice formations within the plant. When intra-cellular ice is formed, crystals originate within the protoplasm of plant cells. This type of ice formation occurs infrequently and only when the temperature decreases very rapidly. If the ice formation is extensive or ice remains for a long period of time, cells can rupture and die.

Desiccation injury occurs when water is lost from plant faster than it can be replaced through absorption of water by roots. Desiccation often occurs when leaf and air temperatures are high and relative humidity is low. Wind movement across plants often increases the rate of moisture loss. These conditions regularly occur during winter in northern Arizona.

Cold injury to conifers (cone-bearing evergreens) is most often seen as shoot desiccation. Unlike deciduous trees, conifers continue to photosynthesize through the winter. Photosynthesis requires a steady supply of water. Water becomes more viscous when it is near freezing and therefore moves more slowly. Under these conditions, roots may not be able to absorb water fast enough to replace that lost to transpiration during cold, dry winter days. This is why it is critical to provide some irrigation to landscape evergreens during extended dry winter periods. The evidence can take months, e.g. pine trees not irrigated adequately in winter may not show evidence until they decline or die in June and July.

To avoid cold injury, keep trees well cared for so they can acclimate properly. During winter, deep water all woody plants monthly (twice per month for evergreens). Valued specimens or fruit trees can be covered to conserve heat reradiated from the soil surface at night. Large, evergreen, trees provide a little bit of frost protection, as do eaves, porch roofs and a location next to the house.

- Place frost tender potted plants inside a garage, shed or house if a hard freeze is expected, since they are much more susceptible to freeze damage.
- Protect tips of frost sensitive cacti by putting a Styrofoam cup on each growing tip to protect these most susceptible areas.
- Never water succulents directly in advance of a freeze. Most hardy succulents survive freezing temperatures best if the soil around them is dry.

Additional Resources

[Western Regional Climate Center](#) contains historical data, including freeze date probabilities

June 17, 2022

Adapted from original Backyard Gardener publications by Jeff Schalau, Agent, Agriculture & Natural Resources, University of Arizona Cooperative Extension, Yavapai County

The University of Arizona is an equal opportunity, affirmative action institution. The University does not discriminate on the basis of race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, or genetic information in its programs and activities.