COLD TEMPERATURE DAMAGE ON WOODY ORNAMENTALS

The enduring beauty and structural presence of woody ornamentals are essential elements in gardens and landscapes. However, these plants are not impervious to the ravages of winter. Cold damage poses a significant threat, necessitating a comprehensive understanding of causal factors, diagnostic techniques, post-damage care, as well as preventive strategies and plant selection.

UNDERSTANDING PLANT COLD HARDINESS

The ability of plants to adapt to and withstand the cold is central to knowing how to mitigate the impacts of cold on woody ornamentals. Cold hardiness is genetically determined. Environmental factors and cultural practices also shape a plant's cold hardiness. Plants that have the genetic capacity for cold hardiness respond to environmental cues that allow them to resist or adapt to the season's changing temperatures. The key **elements of cold hardiness are *cold acclimation*, *maximum mid-winter hardiness* and *deacclimation*.**

In hardy woody ornamentals, as in trees and shrubs, ***cold acclimation*** is typically a two-stage process. The first begins in response to the shorter days of the late growing season and generates partial hardiness in plants. The second stage is a response to subfreezing temperatures, and **results in *maximum or ultimate cold hardiness***.

> ***Cold acclimation*** occurs as days shorten and temperatures drop. The process generates physiological changes in the plant, including increased sugar concentration, modifications to proteins, and changes in the plasma membrane of plant cells. As temperatures fall, ice forms in the spaces between the cells in hardy plants. Water in cells also moves through the plasma membrane to these intercellular spaces to create more ice crystals. Plant cells shrink as they lose water. These physiological changes transform plants from vulnerable to freeze damage to freeze tolerant. Cold acclimated plants tolerate the dehydration caused by the movement of water across the plasma membrane.
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> ***Deacclimation*** is the loss of a plant's cold hardiness initiated primarily by warming temperatures. In spring's warming temperatures, plants deacclimate, terminate dormancy and start to grow. Plants can also deacclimate when warm periods occur in winter. When cold temperatures return, cold injury can result if plants are not able to reacclimate quickly enough.

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WHAT CAUSES COLD DAMAGE?

- The primary culprit behind cold damage is **low temperature**. When temperatures drop, intracellular and extracellular ice formation occurs, leading to cell rupture and tissue death. This can manifest in the form of necrosis and plant death, particularly **when the temperature fluctuation is abrupt**. When temperatures change quickly, plants have no time to become fully dormant and have not become fully acclimated.

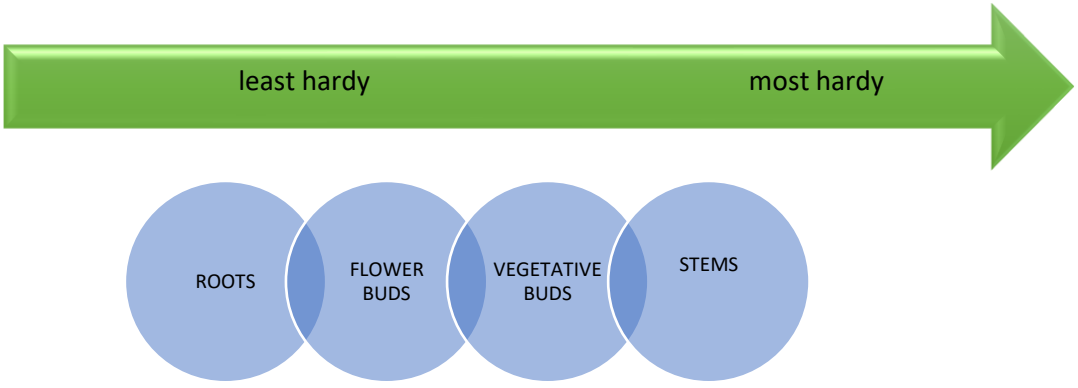
- Temperature fluctuations are also significant challenges to hardy plants, especially during **freeze-thaw cycles**. The rapid changes in temperature cause the expansion and contraction of plant tissues, leading to frost cracks and structural damage. This is particularly problematic when warm daytime temperatures are followed by freezing nights. Cold snaps in late winter and early spring threaten hardy plants that have started to deacclimate in response to overall warming temperatures.

- **Drought stress and dessication** are also critical factors. **Winter winds can cause dessication** of plant tissues when water is lost from foliage faster than it can be replaced.

- **Snow and ice accumulation add physical stress** to plants. The weight of snow and ice can cause branches to break or bend, leading to long-term structural damage and increased susceptibility to diseases and pests.

HOW TO DIAGNOSE COLD DAMAGE

Diagnosing cold damage in woody ornamentals requires a keen eye and understanding of plant physiology and structure. **Different plant parts have different hardiness levels**, which can make diagnosing cold injury a challenge. Flower buds may be damaged, where vegetative buds and stem tissues remain unharmed. As a general rule of thumb, **roots are the least hardy, and stems are the most hardy parts of a plant, with vegetative buds hardier than flower buds.**



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While damage to cold hardy roots is typically not a problem in established landscape plants, those in pots or containers are more likely to have freeze-damaged roots. Plants in containers or pots can lose hardiness by as much as two zones lower than one's planting zone area. Plants in smaller containers are more vulnerable.

Physical Symptoms:

- ***Cracks in the bark, broken branches, and split stems****:* result from the expansion of frozen water within the plant tissues.
- ***Discoloration***: Leaf discoloration, such as browning or blackening indicate winter burn or frost damage
- ***Sunscald****:* occurs with periods of extended cold weather and bright sunshine, during which plants can experience a type of rapid de-acclimation. Both leaves and bark can experience sunscald.

Delayed Growth: Often the full extent of cold damage may not be visible until spring. Symptoms such as delayed bud break, dieback of branches, and poor leaf emergence can indicate that the plant suffered significant winter injury.

Plant Recovery:

Care is crucial to help plants recover and thrive after cold temperature injury but gardeners must also be cautious not to move too quickly. Injured plants may be slow to leaf out and gardeners should investigate before responding. **Scratch a small portion of bark** with a fingernail or small knife. If green tissue is visible, a wait and see approach is advisable. Growth may resume. If tissue beneath the bark is brown, the branch is likely severely injured or dead and proper pruning can take place. Fertilize if and as needed.

Green tissue, likely to survive.

Brown tissue is dead/severely injured

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PREVENTION OF DAMAGE

Our plant choices and appropriate cultural practices can help to protect woody ornamentals from cold damage.

Choose Plants to Minimize Cold Damage:

- ***Hardiness Zones***: Choose plants rated for the specific hardiness zone of your garden. Plants suited to the local climate are more likely to survive harsh winters. Plants that are marginally hardy in your zone are more likely to be damaged or killed by winter cold. If you choose to plant marginally hardy plants, take additional care to provide protection and avoid cultural practices that spur late season growth, such as fertilizing and pruning.
- ***Native Species***: Opt for native or well-adapted species, which are inherently more resilient to local climate conditions. Native plants have evolved to withstand the specific challenges of the region.
- ***Cold-Hardy Varieties***: Select cultivars known for their cold tolerance and resistance to winter damage. Plant breeders have developed many varieties with enhanced cold-hardiness.
- ***Diverse Planting***: Planting a mix of species can reduce the risk of widespread damage and promote a resilient landscape. Biodiversity helps create a more robust ecosystem capable of withstanding various environmental stresses.

Watering: Ensuring adequate watering, especially during dry periods, is vital. Moist soil is warmer than dry soil. Ensure that the soil is not dry going into fall and early winter, irrigating as necessary. Watering during winter thaws, if the ground is not frozen, can help alleviate desiccation stress. Adequate watering during the growing season also supports recovery.

Mulching: Applying mulch around the base of plants helps retain soil moisture and regulate temperature. Mulching protects roots from extreme temperature fluctuations and aids in moisture retention, especially in areas with minimal snow cover.

Proper Planting: Plant woody ornamentals in sheltered locations and at appropriate depths to protect roots from extreme temperatures. Avoid planting in low-lying areas where cold air tends to settle.

Proper Cultural Practices: do not prune, fertilize or water heavily late in the season. Plants that have been encouraged into active growth by early fall fertilization and pruning can be susceptible to cold injury. Such cultural practices can generate delayed dormancy and acclimation, leaving plants vulnerable to cold damage.

Windbreaks: Physical barriers like burlap screens or windbreaks protect plants from harsh winter winds. Windbreaks reduce the desiccating effects of cold winds on foliage.

Understanding the complex interplay of factors that contribute to cold damage in woody ornamentals is essential for their protection and care. By diagnosing damage accurately, implementing effective post-damage care, employing preventive strategies, and choosing the right plants, gardeners can ensure that their woody ornamentals not only survive but thrive through the harshest winters.

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