



Winter Injury and Winter Protection of Woody Ornamental Plants

by Dr. Laura G. Jull, Department of Horticulture, University of Wisconsin–Madison

Cold injury can be a problem during the winters in the northern U.S. Plants may suffer in the north due to either extremely cold winter temperatures over a longer than normal period, extreme fluctuations in winter temperatures with no snow cover or minor amounts of snow cover, or late winter/early spring freezing temperatures, just as the plant is coming out of dormancy. In addition, bright, sunny days and drying winds in winter can quickly desiccate foliage causing winter burn injury, especially evident on broad-leaved and narrow-leaved evergreens. Ultimately, winter hardiness is genetically controlled and is quite variable among species. There are different types of winter injury and ways of preventing winter injury. These will be addressed below.

Types of winter injury:

1. **Aboveground tissue injury:** Flower and vegetative buds, twigs, trunk tissue, and leaves on woody species will suffer damage if not sufficiently acclimated to cold temperatures. Shortening of the day length and cooler temperatures signal plants to begin the process of acclimation or hardening-off of tissues. The rate of acclimation to cold varies with the species, with many native plants beginning to go dormant in autumn earlier than some exotic species. Freezing temperatures will kill hardy species if the temperature extreme occurs when the plant is actively growing or if the extremes occur when the plant is leafing out in spring or early in the fall before the plant has fully hardened off. Deacclimation occurs in late winter (March) to early spring as temperatures and day length start to increase. Typically this is a gradual process, however, if extended warm temperatures occur in early spring, some early spring-flowering plants may begin to flower earlier than normal, such as magnolias, cherries, and rhododendrons. These emerging flowers and leaf tissues become quite susceptible to frost injury. Planting these species on a northeastern or eastern exposure may actually help delay flowering by a week or more than plants located on the opposite side of a building—a time delay that may help the plant escape frost injury to the flowers. Border forsythia (*Forsythia x intermedia*) flower buds are up to one cold hardiness zone less hardy than the vegetative buds. Forsythia flowers in early spring but often the majority of flowers are

located below where the snow line occurred due to snow providing insulation to the plant. There are flower bud cold hardy forsythias on the market, such as the hybrids Sunrise, Happy Centennial, and Meadowlark. Twig and branch dieback may also result on species that are not fully hardy in our area or if temperature extremes occur too early in autumn or as the plants are leafing out in spring. Pruning of these dead twigs will be needed.

2. **Root injury:** Roots have even less cold hardiness than the tops of plants. Root injury and death occurs in some species at temperatures as high as 28°F while others tolerate colder soil temperatures. It is very important to bring plants growing in containers into either a heated garage or indoors if you plan on overwintering these plants. Plants that suffered severe root winter injury may appear normal in spring, but as the buds break and the plant flowers and leafs out, the flowers and leaves collapse, wilt, and die due to no water reaching the top of the plant. These plants will not recover and are best removed.
3. **Winter burn:** Foliage on broad-leaved evergreen species, like rhododendrons and boxwood, as well as with narrow-leaved evergreen species, like yews, arborvitae, and hemlock, may suffer desiccation during winter. Drying winds and bright sunlight may dry out the foliage. Even when the ground is frozen, plants, both deciduous and evergreen, require moisture during winter. When the ground is frozen and the root system is insufficient enough to supply water to the tops of the plants, the foliage will dry out resulting in brown, dry leaves that start at the edges or needle tips that later fall off in spring. Foliage on broad-leaved evergreens can heat up to 50°F or more during sunny days in winter, causing tissue deacclimation. When the sun sets and temperatures drop sharply, the leaf tissue freezes rapidly causing death. The leaves on the outside of the plant and leaves facing the south, west, or southwest side of the plant will be most affected. The sun, as well as the harsh winter winds, causes the injury.
4. **Sunscald and frost cracks on trunks of trees:** Sunscald occurs on sunny days in winter. The bark on the southern or southwestern side of a thin, smooth-barked species, such as honeylocust, red and Freeman maples, mountain-

ashes, ashes, lindens, crabapples, and magnolias heat up during sunny, winter days. When the sun goes down and the temperatures drop, the tree's bark and cambial tissues freeze rapidly resulting in damage or death of tissues. Sunscald is more common on trees that are stressed, newly planted, and young. Frost crack can occur as well, but recent research has shown that it is often due to root or stem injury from improper pruning, flush cutting branches, trunk and root injury, and deep planting rather than the temperatures alone. Rarely do you see frost cracks on trees growing in the wild. Historically, use of tree wrap has been used to prevent frost cracks and sunscald. Research by Dr. Bonnie Appleton and others has proven the use of this material and other wraps placed closely against the trunk of trees can cause more injury than if nothing was done. Wrapping material placed against the trunk prevents proper aeration of the trunk tissue, inhibits some amount of photosynthesis directly under the bark of young trees, and can lead to increased occurrence of stem cankers and insect injury. Use of drain tile, PVC pipe, chicken wire mesh or other plastic material placed around the trunk of trees, buried below the ground line, and extending well above the snow line can be used, especially in areas prone to rabbit and vole browsing. Make sure this material does not constrict the trunk, allows for air circulation, and is removed the following spring. Do not use plastic tree guards that spiral around the trunk of a tree. These materials can girdle the trunks and have resulted in twisting of the trunk tissue as it expands in spring along the wrapping material, creating a spiraled trunk.

Avoid winter damage:

1. **Choose plants that are hardy to your area.** Unfortunately, some nursery catalogs and plant books overestimate the cold hardiness of a plant. Some books overestimate cold hardiness of some trees and shrubs by as much as one or two cold hardiness zones! Choose plants from a reliable source/nursery that grows their plants under optimum conditions. For native and exotic plant material that is seed-propagated only, make sure your nursery source collected or bought seed from a more northern or colder provenance (geographic seed

source). For example, eastern redbud, *Cercis canadensis*, is native over a large geographic range in the eastern and southern U.S. Obtaining trees or seedlings of redbud from a more southern provenance, such as Tennessee or Georgia, will not ensure proper cold hardiness and the trees may even die over winter, even though the hardiness of eastern redbud is cited as zone 4b. It is critical for seed-propagated material to collect/buy stock from colder climates such as Wisconsin, Illinois or Michigan. Selecting a northern provenance is also important for other seed-propagated species such as red maple, river birch, numerous oaks, Douglas-fir, bald-cypress, black-gum, some pines, and other woody plant species.

- 2. Timing of planting is critical.** Newly planted trees and shrubs are not established and may suffer some winter injury. Avoid planting evergreen species after mid-October as the plants will not have sufficient time to establish new roots before the ground freezes. These species continue to lose water during winter and may suffer winter burn or even death the following early spring. All evergreen species are susceptible to winter burn, but these species are particularly susceptible, including evergreen rhododendrons and azaleas, boxwood, blue holly, groundcovers like wintercreeper and English ivy, and needle-leaved evergreens such as hemlock, yews, arborvitae, eastern white pine, and dwarf Alberta spruce. Even deciduous trees and shrubs need sufficient time after planting to acclimate to their new environment and begin to develop new roots before the ground freezes.
- 3. Protect plants from winter injury.** Protect plants susceptible to winterburn by placing them on the northeastern or eastern side of a building or home. Plants

exposed to winter sun and winter winds are more likely to be injured than plants planted with some shade or out of direct winter winds. Use of evergreen windbreaks can help minimize sensitive plants' exposure to winter sun and wind. Use of burlap, snow fencing, or other protective barrier material can be used next to plants to protect them from prevailing winds and winter sun. Application of an anti-transpirant is not very practical, as the product must be reapplied after each rain/snow event. Some anti-transpirant products can even cause phytotoxicity to plants. These products also clog the stomates in the leaves prohibiting photosynthesis and respiration. If plants with marginal hardiness are used, plant them in protected or sheltered locations such as courtyards, closer to buildings or with an eastern exposure.

- 4. Place mulch around the base of the plant.** Application of 2-4" of loose mulching material, such as pine or hardwood bark, leaf compost, or wood chips helps reduce root injury. Mulch naturally insulates the soil temperature, reduces water loss, and helps protect it from severe temperature fluctuations. Keep all mulch material at least 4" away from the trunk of trees and branches of shrubs. Do not create a mulch volcano (piling of mulch around the base of trees and shrubs) as this will cause injury, create a humid, dark environment suitable for fungi development and insect feeding, and provide a nice home for mice and voles in winter who then girdle the trunks during winter. Spread the mulch out as far as possible, to the drip line or more, if possible. Apply less mulch if your soil is poorly drained, as aeration to the soil is important in preventing waterlogged soils and root rot. Mulching will also help minimize extremes in freezing and thawing of the soil around the plant

which causes some shallow-rooted or newly planted material to heave out of the soil.

- 5. Water plants during fall and early winter.** Watering of plants, especially in autumn helps prevent winterburn on evergreens. Plants that are newly planted, young, on exposed sites, or placed under eaves suffer severe moisture loss during winter as the plants continue to lose water through the leaves. Proper watering of plants, both evergreen and deciduous, throughout the growing season will hydrate the plants. Plants that are well hydrated will be more resistant to winterburn or death of roots. Avoid over-watering of plants, as waterlogged plants are prone to getting root and basal rots. Avoid late summer fertilization with quick-release, high-nitrogen fertilizers as this may result in a late season flush of foliage or inhibit the hardening off process.
- 6. Hold off on pruning until fully dormant.** Avoid pruning plants in late summer as this may encourage a flush of new foliage on species that continue to flush during the growing season. Once plants have lost all their leaves and temperatures remain below freezing, pruning may occur. The best time of year to prune woody trees and shrubs is in late winter when insects and disease organisms are not active. If winter injury has occurred, prune out dead, winter damaged, or dying tissue. Do not use any wound compound or tree paint on fresh wounds as this actually slows down wound closure and can seal in canker-causing fungi. Only use these products if you must prune an oak or elm during the growing season, otherwise oaks and elms, along with other woody plants, should be pruned during the dormant season.