

Effects of Cold January Temperatures on Landscape Plants

Ron Kujawski, Extension Educator

UMass Extension Landscape, Nursery and Urban Forestry Program



For the past ten years or so, our winters have been characterized by relatively mild temperatures, or at least by a lack of extreme cold. That run came to an abrupt halt this past January when temperatures dipped to near record lows of minus 25° F in parts of western Massachusetts and minus 10° F on Cape Cod and in the Boston area.

According to the Northeast Regional Climate Center at Cornell University, this January was the coldest that Boston has experienced in fifty years. The average temperature for January 2004 in Boston was 20.7 degrees, compared to a normal average of 29.3 degrees.

Because of the extreme cold, many in the Green Industry have been asking about the impact such temperatures have had on plant materials in the landscape. That kind of question is always difficult to answer with any certainty. There are just too many variables to be definitive. Cold injury varies with plant species, age, general vigor of the plant, and site and soil characteristics. Still, a review of potential damage to trees and shrubs may be beneficial to those in the field. Keep in mind that much of the damage that may have occurred will not become apparent until spring when new growth begins. By then, many people will have forgotten about January, especially if we have a mild spring, and may not relate the visible damage in spring to the extreme events of winter.

Before proceeding with a discussion of potential cold injury, there are some factors that may be eliminated. First, it is unlikely that cold injury could have occurred to plants in January because they were not hardened. The weather conditions of last fall favored proper hardening of plants. While there was a moderately warm period prior to the onset of frigid weather, the transition was gradual enough that physiological changes in plants that would result in reduction of hardiness did not occur.

It is also unlikely that the cold had much if any impact on native plant materials in their natural habitats. The geographic range of native plants is determined by extreme temperatures and not by average temperatures. Having said that, it is entirely possible that native species which have been planted in urban or suburban landscapes where soils and environmental factors are vastly different from their normal habitat could have experienced cold injury due to stresses on the plants imposed by these exotic habitats.

Most woody ornamental species used in Massachusetts landscapes are non-native species. Nursery operators and landscape contractors rely on hardiness ratings to determine the potential survivability of each species in particular regions of the state. The ratings are usually based on field trials of the species in USDA-defined hardiness zones. Hardiness zones are determined by average low temperatures for a given region of the country, and not by extreme low

temperatures. As such, planting a species rated hardy to Zone 6 in a Zone 6 area does not guarantee survival when the plant is exposed to extreme temperatures. Those species that are marginally hardy to a particular zone are especially vulnerable to cold injury. Keep that in mind when assessing plant problems this spring.

January was characterized not only by being very cold but, during the period of lowest temperatures, there was little or no snow cover. In Great Barrington, temperatures dropped to minus 23° F at a time when there was no snow cover at all. Could there have been significant root kill that will affect the survivability of landscape plants?

Again, that is difficult to answer. It is known with certainty that roots of plants are much less hardy than are the shoots. However, soil is a pretty good insulator and in most winters soil provides enough protection for roots to ensure plant survival. Once frozen, soil temperature remains fairly constant, at least at depths greater than 6 inches. If low temperatures affect roots, it is the roots nearest the surface that will be killed. The roots killed are feeder roots, since these are typically closest to the surface. The amount of damage will depend upon many factors: root hardiness, general depth of rooting for the species, soil texture (most root kill in response to cold seems to occur in sandy soils rather than clay soils), and the presence or absence of mulch. It should be noted that death of feeder roots during winter is not unusual. Kozlowski and Pallardy (*Physiology of Woody Plants*, 1997, Academic Press) state that the greatest mortality of small roots occurs during the cold months. Therefore, the question is not whether roots have been killed but to what extent they have been killed. The answer should become apparent in spring.

While roots of plants in the landscape are afforded some protection against low temperatures by the surrounding soil, the roots of plants in above-ground planters or containers are much less protected. All of the roots within the container are subject to direct injury or death from the cold.

It may be that the greatest damage to roots will have happened as a result of frost heaves. The lifting of soil that occurs when it freezes can break apart roots. Un-mulched fall planted trees and shrubs are most susceptible to injury from frost heaves because of the absence of extensive anchoring roots. This writer observed considerable frost heaving this winter.

The amount of injury to above ground parts of plants in direct response to low temperatures is as uncertain as is the amount of damage to roots. As with roots, shoot injury will not usually become apparent until spring.

One type of cold injury that is most certain is the killing of flower buds on those trees and shrubs that are marginally hardy. Flower buds are typically less hardy than leaf buds. It has often been stated that the flower buds of forsythia and peaches are prone to winter kill when temperatures drop to minus 15° F. The precision of that temperature threshold can be argued, especially when one considers cultivars and site factors, but there is no question that temperatures in many parts of Massachusetts were well below that level in January. Death of leaf buds is possible but again, that will be limited to those species, such as redbud, that are marginally hardy.

Buds are not the only structures where differences in hardiness exist. In mid-winter, living xylem

tissue tends to be less hardy than cambium and phloem tissue. It is xylem in smaller branches that is most prone to damage from low temperatures. If such damage has occurred, affected branches will be slow to leaf and/or flower in spring, or they may die. The xylem of cold damaged branches will appear to be black or darkened.

Cold injury such as sun scald and frost cracks often occurs in response to sudden and wide fluctuations in temperature of wood. This typically takes place on cold days when the sun warms the sunny side of the trunk to a temperature above freezing, causing some expansion of the wood. According to Harris (*Arboriculture*. 1992. Regents/Prentice Hall Publishing), the temperature of wood may differ by as much as 18° F from the air temperature on sunny days. For expansion of wood to take place due to warming, the temperature of the wood would have to rise to above freezing. The cold spell in January was such that temperatures in most areas remained so far below freezing throughout the period that warming and expansion of wood on sunny days may not have been widespread. Nevertheless, such injury could have occurred in some parts of the state and practitioners should examine the trunks and branches of woody plants for sun scald and frost cracks this spring. It may help explain future problems in the growth and health of the affected plants.

In conclusion, the impact of winter events on the subsequent health and survival of woody plants is difficult to predict prior to spring growth. However, those events and the possible kinds of damage that they could cause to plants should be kept in mind when evaluating plant growth or death in spring.

From Hort Notes (Vol. 15, #1), March 1, 2004

