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WEATHER-ASSOCIATED PROBLEMS OF ORNAMENTAL TREES AND SHRUBS

When we think of problems with woody ornamental trees and shrubs, we generally think of insects and diseases, living agents that cause problems. However, for the past few years at least 50% of the problems we have seen on woody plants have been caused by factors other than insects and diseases. The primary culprit here has been the weather.

For several consecutive years, weather extremes have played key roles in plant problems. This has been evident in the headlines of our local newspapers with titles such as "Hey Mother Nature! What gives with the weather?" "Weather Seemed Weird...", and "Coldest spring in 20 years". Some of this unusual weather includes: excess water, drought, and extreme temperature fluctuations and lack of snow cover. Singly and in combination, all of these weather factors resulted in significant stress and plant damage.

This fact sheet focuses on problems associated with three kinds of weather extremes: winter injury, drought, and excess water.

WINTER INJURY:

Winter injury is a result of many environmental factors which have little in common but that they occur during the winter. These causal factors are very diverse. Examples include late spring frosts, a cool summer followed by a warm fall and a sudden drop in temperature, excessive or late season fertilization, excessive temperature fluctuations), abnormally cold temperatures during winter, drying winds, and lack of snow cover. One type of winter injury is excessive drying. This is quite common on evergreens and results from factors which create a water deficit in a plant. This type of injury occurs when water evaporates from leaves or needles on windy or warm sunny days during the winter or early spring. Drying occurs because this water is not replaced since the roots cannot take up enough water from cold or frozen soil.

Winter injury is important in and of itself but it also predisposes the plants and renders them more vulnerable to secondary or opportunistic pests. Another important characteristic of winter injury

is that quite often, the symptoms are not evident until sometime **after** the injury has occurred. This can make diagnosis difficult.

Winter injury occurs on a wide range of plants. However, it has been especially prevalent on the evergreens, both broadleaved evergreens such as rhododendron and mountain laurel and on needled evergreens such as hemlock, yew, pine, and juniper. Winter injury has also been observed on deciduous trees and shrubs such as flowering cherry and almond, maple, and dogwood. It has also appeared on ground covers such as ivy and pachysandra.

What are the symptoms of this type of injury? Symptoms of winter injury are quite variable and depend upon the type of plant. Woody plants which are damaged by winter injury will often show tip and branch dieback, foliar browning, sunscald, and bark splitting. On broadleaved evergreens such as rhododendron and mountain laurel, the most familiar leaf symptom is characterized by a marginal browning and longitudinal rolling along the mid-vein. Entire branches can be affected in some cases. Needled evergreens exhibit a slightly different symptom with browning of the tips of needles, needle drop, and tip and twig dieback.

On deciduous trees and shrubs, bark may be injured by cold weather. Dead areas appear in the bark and the bark begins to peel away from the trunk as the tree grows in spring and summer. This type of damage is common on crabapples, cherries, and maples. Injured deciduous trees and shrubs also fail to leaf out properly in the spring. Sometimes leaves on these trees are small and new branches suddenly wilt and begin to die back by early to mid-summer.

We obviously can't control the weather but there are steps that we can take that are aimed at minimizing the effects of winter injury. These include: 1) select the appropriate site for planting and maintain optimum growth by using proper growing practices; 2) have sufficient moisture in the root zone before the soil freezes- this can be accomplished by giving the shrubs (esp. evergreens) a deep watering before the ground freezes in the fall; mulching also helps to increase moisture retention in the winter; 3) avoid late summer and early fall fertilization- this stimulates and encourages growth late in the season which may not harden-off properly for the winter; 4) prune and remove any dead twigs or branches which can serve as sites for secondary invaders or opportunistic pests, and 5) provide physical protection from water loss and drying winds- this is especially important for new transplants or plants in exposed locations; burlap wraps and sprays of anti-transpirants can be used.

DROUGHT:

Dry soil conditions during a prolonged drought result in root damage and death. During drought, soil water becomes deficient. As a consequence, a water deficit develops in the plant. If one examines the root system of a woody ornamental, one sees a hierarchy of roots. This includes framework roots which consist of primary and secondary woody roots, transport and storage roots, non-woody feeder roots, and root hairs. The feeder roots and root hairs are the most important part of the root system for uptake of water and nutrients from the soil. Unfortunately, they are also particularly sensitive to drying and are the first portion of the root system to be affected by drought. It is important to remember that quite often, 99% of the root system of a

tree is located in the top three feet of the soil, and a good portion of these are in the top 12 inches! This is especially true of the feeder roots. When dry soil conditions occur, the feeder roots and root hairs shrivel and become non-functional. As a consequence, a water deficit develops in the plant since the roots can no longer provide sufficient water to the top of the plant.

One important aspect of drought, like winter injury, is the fact that the symptoms are often not evident in the top of the tree or shrub until some time after the event has occurred- **even as much as one to two years later!** In addition to direct root damage, a significant secondary affect of drought is that it weakens plants and predisposes them to secondary invaders and opportunistic pests such as fungal tip blights and needle casts.

Native plants growing naturally in wood lots or forested areas are usually adapted to regional and seasonal fluctuations in the amount of precipitation and only *unusually* severe drought causes problems for them. However, planted landscape trees and shrubs often show symptoms of drought and severe water stress. There are many reasons for this. We often plant ornamentals in slightly unfavorable sites or we plant them too deep, too shallow, or just not quite right.

Symptoms of drought can appear on a wide range of deciduous and evergreen trees and shrubs. The effects of drought are particularly severe on all types of seedlings and new transplants. This is because their roots occupy the uppermost layers of soil where the most rapid drying occurs. In addition, recent transplants typically lose important feeder roots during the transplant process. Another factor which contributes to their sensitivity is the medium in which the transplant is growing- many of the soilless mixes that are now being used to grow container ornamentals are highly porous and dry out very quickly. This creates moisture stress in the rootball, regardless of the availability of water in the surrounding soil. This problem often continues until the roots grow beyond the rootball. Contrary to popular opinion, it often takes woody transplants two years to become completely established in a new site. Thus, these plants should be given extra care and attention during periods of drought.

Established trees and shrubs are also affected by drought, especially in marginal sites such as those with pavement over their roots, street trees, and those in pockets of soil on ledges or in sandy soils. Problems have also been observed on apparently established trees and shrubs that have survived despite improper planting. Once stressed by drought, these trees quickly decline and often die. Last summer's drought was particularly hard on established Japanese maples, dogwoods, elms, white pines, and hemlocks.

Symptoms of drought are manifest in many different ways depending on the plant species and the severity of the water deficit. Symptoms include loss of turgor in needles and leaves, drooping, wilting, yellowing, premature leaf or needle drop, and dieback. Leaves on deciduous trees often develop a marginal scorch and interveinal necrosis whereas needles on evergreens turn brown at the tips. Trees and shrubs can also exhibit general thinning of the canopy, poor growth and stunting. In extreme cases, drought can result in plant death.

While there is no cure for this problem, the effects of drought can be minimized by following these guidelines: 1) water in periods of low soil moisture: trees and shrubs require approximately

one inch of water per week- this is best applied at one time as a slow, deep soaking; 2) select an appropriate site and follow good planting practices; drought-stress can magnify even the most subtle improper planting practices; 3) select native plants or match plant species to site conditions: drought-sensitive (dogwood, some oaks, arbor vitae) vs drought-tolerant (most pines, many *Prunus* sp., larch, junipers); 4) mulch to maintain soil moisture; 5) prune any dead or weakened tissues to avoid secondary problems; and 6) maintain plant vigor by following good cultural practices.

EXCESS WATER:

Excess water can be a serious problem for woody ornamentals. Roots in flooded or water-logged soils are damaged and die from oxygen deficiency. In addition to this direct damage to the root system, flooding has also been associated with inciting physiological changes in woody plants that influence their growth and other processes. Once again, the important non-woody feeder roots are particularly sensitive and are frequently the first ones damaged by water-logging. Woody roots are more tolerant than non-woody roots to flooding. When feeder roots are damaged, they are unable to provide water to the top of the plant and a water deficit develops. Damage can be sudden or gradual, depending upon the plant and the flooding conditions. This can occur on plants in obviously wet sites and on those in marginal sites or soils with more subtle water problems such as along city streets or in areas where high clay content in the soil impedes drainage. Most trees and woody shrubs cannot grow in water-logged soils for very long and can die if flooded for only a few days during the growing season. Visible symptoms are often not evident until considerably after the damage has occurred, especially when the root damage is gradual.

Symptoms of excess water depend upon the plant and are highly variable. These include epinasty or downward rolling of leaves, stem swelling, chlorosis or yellowing of the foliage, edema, reduced and stunted growth, twig dieback, leaf drop, root death, and in extreme cases, whole plant death.

Seedlings and new transplants are more sensitive to excess water problems than are established plants. Once again, this can be attributed to the lack of an established root system and to feeder root damage during transplanting. Needled evergreens are generally considered more sensitive to water-logged soils than broadleaved deciduous plants. Symptoms of water-logging may not develop in a woody ornamental until water demands on the root system increase, typically during the hot summer months when the canopy is actively losing water through transpiration. This is sometimes exhibited as a sudden collapse of the tree. Other trees appear to lose vigor and slowly decline over a period of years. This can occur on trees that have been otherwise "healthy" for 10-15 years but are growing in poor sites or heavy soils. Dormant plants generally appear to tolerate flooding longer than those in active growth. In addition to direct root damage, trees in flooded soils are predisposed to secondary pathogens and other opportunistic pests such as the fungal roots rots caused by *Phytophthora* and *Armillaria*.

Strategies for minimizing wet soil problems include: 1) selection of an appropriate site and use of proper planting practices; 2) cultural practices that maintain plant vigor and stimulate growth; 3) selection of appropriate species for soil and site conditions: water-tolerant (red maple, larch,

green ash) vs. water-intolerant (crabapple, spruce, hemlock, yew, white pine); and 4) pruning dead or dying tissues to minimize secondary invaders and opportunistic pests.

These unusual weather extremes have certainly taken their toll on many of the woody ornamental trees and shrubs in our landscape. While we have no control over the weather, it is important to realize that there are steps we can take to minimize its adverse affects on these plants. If you have trees, shrubs, or plants with problems and you are uncertain as to the cause of the problem, The Plant Disease Information Office of the Experiment Station can assist you with diagnosis and with outlining strategies for minimizing the problem.

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