Home & Garden
Pest Management Guide
For British Columbia

2019 Edition

Chapter 9

Plant Disorders Not Caused by Pests (Abiotic Disorders)

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Many plant disorders are not caused by living organisms and cannot be transmitted from plant to plant. They are sometimes called abiotic disorders, physiological disorders, or non-pathogenic disorders. Common causes of abiotic disorders include nutrient deficiencies or toxicities, chemical injuries, and environmental damage. Many abiotic plant problems are not reversible once they have occurred, while others, such as nutrient deficiencies, can be successfully treated. Abiotic disorders are often hard to diagnose and it is important to keep in mind that there may be more than one underlying cause of the symptoms observed. Abiotic disorders may also weaken plants making them more susceptible to attack by pathogens and insect pests.

Chemical Injury

Pesticides and fertilizers applied incorrectly are capable of doing physical damage. When pesticides are applied at higher than recommended rates, at the wrong time, or during very hot parts of the day, damage may appear as red, yellow or brown spots on the leaves, brown leaf tips or margins, stunted or misshapen plants, fruit damage, or overall browning and death of a plant.

Glyphosate herbicide injury to cherry, caused by misapplication

Herbicide drift or misapplication may cause injury or death to non-target plants if the dose is sufficiently high. Herbicide injury symptoms depend upon the plant and the herbicide involved. For example, herbicides commonly applied to lawns to kill dandelions may injure other broad leaf plants causing elongated, pointed leaves with raised veins, and twisted or stunted new growth. Glyphosate (Round-up) drift injury will cause various symptoms including chlorosis, leaf desiccation, wilting, and stunting of new growth. On woody plants, symptoms may appear the following year, when growth on affected branches appears abnormal, stunted and strap like.

Picloram herbicide damage to potato caused by persistent residues in composted manure added to soil. Note fiddle-head like shoot growth.

Some plant species and cultivars are very sensitive to pesticide injury, while others are more tolerant. For example, apricot can be injured by sulphur sprays that are well tolerated by other stone fruit. Other chemicals such as spilled gasoline may also kill plants. Fertilizers applied at higher than recommended rates may also cause injury to plants by burning roots and/or foliage.

Drought

Drought symptoms on blueberry. Note the damage to the leaf margins.

Inadequate soil moisture will produce drought symptoms when loss of water through the leaves exceeds uptake of water by the roots. Symptoms include wilting, off-coloured foliage with necrotic edges, reduced vigour, stunting, and sometimes plant death. Drought-stricken trees usually die from the top down. Trees in this condition are more susceptible to damage by insects and diseases, including root rots once water is restored. Shallow-rooted plants are most susceptible to drought.

Do not plant shallow-rooted species in areas of low rainfall or on sandy soils with a low water table. Water ornamental trees and shrubs once a week after transplanting until the roots have had time to establish in the soil then periodically as needed.

Frost and Cold Injury

Spring frost injury to pear fruit (frost ring)

Some plants cannot sustain frost injury without serious damage, while other plants are very tolerant of frost. Frost injury may cause browning of leaf tissue, puckered leaves, damaged flower and fruit parts, deformed plants, or complete death of a plant, depending on severity of the frost and sensitivity of the plant. An early fall or late spring frost, when trees are actively growing, can injure or kill soft stem tissue, leaves and buds. Most trees can survive this injury, but the growing tips may be temporarily lost, growth rates may be reduced and flower buds may be lost for one year. Frost damage to foliage is usually apparent soon after the damage takes place. Some types of frost injury may show up later. For example, frost damage during apple or pear bloom may result in fruit with russet damage or "frost rings" later in the season.

Cold injury may occur when sensitive plants are exposed to very cold, but not freezing temperatures for extended periods. Flower parts and young seedlings are particularly sensitive.

Do not plant frost sensitive annuals and vegetables until after the risk of frost has passed in the spring. Alternatively, row covers may be used in the spring to protect plants from wind and frost and to enhance growth. Plant native or well-adapted species that have developed resistance to this injury. Do not fertilize, prune, or water heavily late in the growing season. This can encourage late-season growth that is more susceptible to winter damage.

Winter Injury and Southwest Injury

Trees, shrubs and perennial plants may suffer winter injury under certain conditions. Plant species differ in cold tolerance, and should only be planted in hardiness zones recommended for the particular species. Even plants that are well suited for a climatic area may suffer winter injury in years with extreme temperatures, particularly when sudden cold temperatures occur in the fall before plants have fully hardened off. Early fall freezes are most likely to affect the roots or crown, since plants harden off from the top down. Proper mulching will provide some root system protection.

An early spring warm spell may also cause injury by allowing movement of plant sap to the point where a subsequent drop in temperature can damage phloem and cambium (vascular tissue). This type of injury (also called "southwest injury" or "winter sunscald") is most likely to occur on the south or southwest side of a tree as it is warmed by the sun. Injury appears as discolouration or cracking of the bark. Thin-barked trees such as beeches, maples and *Prunus* (stone fruit) are most susceptible to this type of injury.

Protect trees from southwest injury by wrapping the trunk with paper designed for tree wrapping to shade it and reduce the warming of bark during the day. Whitewash or white latex paint is also effective. It should be applied in the fall to trees up to 10 years old. Thick support posts on the south side of newly planted trees will also protect the most vulnerable portion of the trunk. Trees that have had lower limbs removed are more susceptible to sunscald. It may be worthwhile to wrap these trunks for the first 2 or 3 winters after extensive de-limbing.

Winter injury can also occur in the form of ice and/or snow damage. Snow removal from trees like pyramidal cedars may be needed to prevent breaking or permanent bending.

Frost Crack is a form of winter injury is more prevalent in the northern B.C. and affects both hardwood and softwood tree species. A sudden drop in winter temperature causes the outer layer of wood to contract more rapidly than the inner layer, resulting in a long vertical crack in the trunk. Frost cracking can occur repeatedly in the same place causing a buildup of callus tissue. Measures that promote early dormancy will reduce bark splitting caused sudden cold temperatures.

Needle Drop of Conifers

Conifer needles usually live 3 or more years before they die and drop off. During the autumn, needle drop is a normal condition and is no cause for concern. The trees may look sparse but will fill out again with new growth next spring. Needle drop may be more severe after dry summers.

A heavy loss of needles less than 3 years old during the growing season may indicate pest or disease problems or cultural problems such as drought, poor drainage or low soil fertility. Maintain the tree's vigour by using a balanced fertilizer in the spring and provide adequate water during the summer.

Desiccation Injury to Evergreens (Winter Drying)

Most evergreens are susceptible to winter browning caused by desiccation. This is most often apparent on cedars and junipers, but may also affect broadleaf evergreens such as holly and rhododendron. Symptoms include brown or reddish discolouration of needles and leaf margins in late winter and early spring. Warm air temperatures during dormancy may cause the aboveground portions of evergreens to become active. Water is lost from the leaves by transpiration, however the roots remain frozen in the soil and can not replace the water. Winter browning is more likely to occur with wide temperature fluctuations or strong winds. Portions of plants most severely affected are those facing south, west, or the prevailing winds and above the level of continuous snow cover. At the Coast, winter burn on both conifers and broad-leaved evergreens occurs during cold, bright conditions with prolonged outflow winds from the east or northeast.

Avoid planting tender evergreens where sudden temperature changes may occur or where there is direct exposure to strong winds. Water and mulch in the fall to ensure that evergreens go into the winter with adequate moisture reserves. Wrap susceptible small trees and shrubs in burlap or other porous material during the winter to reduce loss of water from foliage. During extremely cold and windy weather, the burlap can be sprayed briefly with water. This creates an "igloo" which protects the plant during sub-zero weather and then melts away when conditions improve.

Leaf Scorch and Heat Stress

Heat stress or scorch injury is a common physiological disorder in hot climates, caused by injury from direct sun exposure or very hot conditions. During hot temperatures, plants must carry water from the roots to the leaves and stems, where water vapour passes out the stomata (small openings), a process known as transpiration. This cools the leaves and plant parts and prevents heat stress injury. If enough water cannot be carried up the plant's vascular system, some of the plant's leaf surface may die. If severe enough, plants may be killed. Damage can occur more quickly on light soils, as they don't hold as much available water for plants as heavier soils.

Sunscald on apple fruit

Leaf scorch on trees often appears as browning of the leaf margins. Leaves of maple, ash, oak, elm and horse chestnut can turn yellow or reddish-brown around the edges and between veins. Entire leaves may wither and drop off. Japanese maples purchased from nurseries where they are kept moist may be severely scorched when planted out in open, sunny sites. They will recover once the root system becomes established. Fruit, such as peppers and apples can also be affected by "sunscald" during hot sunny weather.

To avoid heat stress injury, make sure soil moisture is adequate when going into a hot period, paying particular attention to plants in containers. On susceptible plants, such as hosta, use above ground irrigation as a cooling device, turning it on for short periods of time (10-20 min.) during the heat of the day. Avoid planting susceptible species in open areas subject to hot, dry winds.

Mechanical or Physical Injury

Plants can be physically damaged by people, wind, hail, animals, equipment etc. Physical damage varies from minor injuries to plant death. If a plant is damaged by a weed wacker or string trimmer, serious damage can be done to a plants protective bark and vascular system. The result can be a severely weakened tree that will grow slowly or be knocked over by the wind. Buried boulders, slabs of concrete and construction materials may also cause plants to perform poorly.

Every site of plant tissue injury is also a potential entry point for disease. To reduce mechanical/physical injuries on plants, exercise care when you are moving around plants, have windbreak protection if necessary and only prune at the proper times to reduce disease infection.

Damage to cedar hedge caused by feral rabbit feeding

Hail damage to apple

Relative Humidity (RH)

Both low and high relative humidity can cause plant problems. Low RH will generally occur as a problem in combination with high or excessive temperatures, as discussed in the heat stress section above. High RH may cause oedema (a blistering of plant tissue on the underside of the leaf) on susceptible plant species.

Wind Injury

Wind injury in conjunction with cold/winter injury, especially if the humidity is low, can be especially hard on buds of plants. Sandblasting can be a factor where a planting is adjacent to an open field subject to wind erosion. Damage by sandblasting can create entry points for disease. Wind may cause plant parts to rub together, causing surface scarring. Heat stress can be aggravated by wind that increases evaporation from the leaf surface on a hot day. Wind can also be helpful. In moderation it assists pollination, dries plants and hardens off plants. Avoiding windy sites or setting up permanent windbreaks may be the best preventative solutions to wind damage.

Allelopathy

Allelopathy refers to the chemical inhibition of one species by another. When a plant releases an inhibitory chemical into the environment, it may affect the development and growth of surrounding plants. The allelopathic chemicals may inhibit shoot and/or root growth and nutrient uptake. Examples of allelopathic plants are black walnut (*Juglans nigra*), the tree-of-heaven (*Ailanthus altissima*) and tobacco (*Nicotiana rustica*). Allelopathic effects are best known on plants growing under black walnut. Very few plants grow under this tree and those that do may look sickly and chlorotic. This is a sign of the allelotoxin, juglone, at work.

Nutrient Deficiency or Excess (Imbalances)

Plants react to nutrient imbalances in different ways. A deficiency of a major or minor nutrient may result in poor growth and various symptoms that are dependent on the nutrient(s) involved and the plant species. For example, nitrogen deficiency results in poor growth and may cause foliage to be pale or generally yellowed, while iron deficiency may cause leaves to be yellow with green veins. If a nutrient is present in excessive amounts it may cause toxicity symptoms in some plants. Plants can be stunted, deformed or suffer from burning of the leaf tips and margins. An imbalance in one nutrient can make another one unavailable. Soil pH can also affect nutrient availability. Nutrient imbalances may look similar to diseases, chemical injury or sun scald in some situations. For example, bitter pit in apples is a calcium deficiency problem, but looks much like a disease.

Bitter pit on apple, caused by calcium deficiency

Iron deficiency symptoms in blueberry caused by an incorrect pH. Correcting the pH will make the nutrients available for uptake by the plant.

A soil test at a laboratory is the best way to diagnose nutrient imbalances and determine what nutrients need to be added and in what amount. Soil conditions should be amended before seeding/planting occurs.

For more information on nutrient deficiencies and plant nutrition, refer to Chapter 7 - Soil Management and Composting.

Soil Problems

Physical and chemical soil problems can cause problems with plant growth. Soil compaction and low organic matter are examples of physical soil problems. High salts and high or low soil pH are examples of chemical problems.

Too much fertilizer will cause needle or foliar burn and defoliation.

Compacted soil can cause root deformation and makes the soil difficult to work. Compaction can also cause water to flood the soil, or percolate slowly into the soil, causing saturated conditions which may lead to root rots. Clay soils tend to give the most concern with compaction and the addition of organic matter will help most situations. Addition of sand to clay soils can also be helpful. Low organic matter can be a problem in any type of soil. This is best corrected prior to planting.

High salt levels in the soil can cause plant health problems. Typical symptoms include small, stunted slow growing plants and leaf tip burn. The only way to determine a high salt problem is to have a soil test done. Ideally this should be done before planting so corrections can be made.

Most plants have a preferred pH range, and will not do well if the soil is too acid or basic. For example, blueberries prefer a slightly acidic soil (pH 4.5-5.2). If the pH is outside of this range, this interferes with nutrient uptake causing nutrient imbalances and unthrifty plants. In soils with high pH, it is common to see symptoms of iron deficiency chlorosis.

Refer to Chapter 7, "Soil Management and Composting" for more information on maintaining healthy soils.

Salt Injury

Salt injury occurs near the ocean and in areas where salt is used frequently for de-icing roads. Salt that blows onto the foliage or is absorbed through the roots will cause a browning of the tree on the side facing the road or ocean. Symptoms may include marginal leaf scorch, early fall coloration and defoliation, and dieback of twigs and branches.

Plant tree species which are tolerant to salt, such as black cherry, red oak, white oak, *Juniperus virginiana*, black locust, largetooth aspen, paper birch, white ash, American linden, American hornbeam, Norway maple, red maple, shagbark hickory and tamarack. Avoid planting salt-sensitive trees such as beech, birches (other than paper birch), hemlock, red pine, white pine and sugar maple near the ocean or near roadways where salt is applied.

Road salt or deicing salt injury.
Photo courtesy of Joseph Laforest, University of Georgia, bugwood.org

Grass burned by dog urine. Many diseases can show similar symptoms.

Chimeras and Reversions

Chimeras are noticeably different plant parts caused by spontaneous genetic change (or mutation) in meristematic tissue. This can result in more than one genotype (genetic makeup) within the same plant. Variegated plants are a common type of chimera, some of which are propagated for their beautiful foliage. Fasciation, or flattening of stems is another type of chimera that occurs occasionally in many species of plants.

Reversion is a condition where the plant cells revert back to the form of the parent plant. For example, a plant that is variegated may grow an all green branch. Hosta, variegated maples and variegated dogwood are plants where this is commonly observed. If this occurs, just prune the green branch off at the point of occurrence. Often the green form is more vigorous and will overtake the plant if this isn't pruned out, spoiling the looks of the plant.

Reversion in Euonymous

Fasciation (flattening) of a blueberry stem caused by genetic mutation