A2970

Salt injury to landscape plants

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Injury due to salt is most common on landscape plants growing near highways, streets, sidewalks, and driveways that are regularly salted during the winter for ice control. Most of the salt used for deicing is sodium chloride—ordinary rock salt or table salt.

On highways the major problem to plants is caused by salt spray kicked up by fast-moving traffic on wet, salted roads. The salt spray is deposited on nearby plants causing dehydration of the tissue.

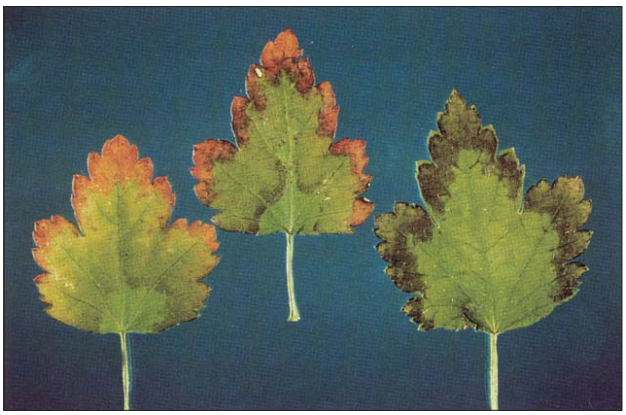
In the city, where traffic speeds are slower, the major problem is salt runoff washing into the soil or salt-laden snow plowed or shoveled onto parkways. Salt in the soil may be absorbed by the roots and cause direct toxic effects or may simply prevent roots from taking up water. The symptoms become evident as growth begins in the spring and may take several years to fully develop. Salt applications made after March 1, when plants are beginning to break dormancy, cause the most damage because plants are actively growing and taking up soil water.

Symptoms and effects

Salt spray

Symptoms of salt injury often appear suddenly in early spring once the weather begins to warm. The symptoms may develop progressively over several years and often multiple symptoms occur simultaneously.

On deciduous plants, salt spray can kill buds and twigs. New shoots grow from the base of the branch producing dense clusters of twigs known as "witches' brooms." Often when flowering plants repeatedly fail to bloom, the cause may be attributed to bud injury by salt spray. When vegetative buds die, plants may become misshapen as the absence of branches on the side of the plant that receives salt spray becomes apparent. Landscape plants may also show slowed growth or thinning of the crown as twigs and sometimes large branches begin to die.



Excess soil salt caused this leaf burn. Symptoms on deciduous plants typically appear during hot, dry weather when soil moisture is limited.

The discolored trees next to the highway have been injured by salt spray. On evergreens, symptoms are most evident in early spring.

In conifers, salt spray causes browning or yellowing of the needles and twig dieback. These symptoms become evident in late February or early March. Initially, only the tips of the needles show discoloration. As spray damage worsens, the discoloration moves from the tip of the needle inward, eventually discoloring it completely. Once new growth begins to develop, affected trees appear to recover. However, close examination will reveal that the damaged needles remain discolored; only the new growth is green.

Salt spray causes dehydration of plant tissue, impairing the tissue's ability to survive over winter. For example, buds that normally tolerate cold temperatures may be killed by those same cold temperatures when subjected to salt spray.

Salt in the soil

Salt that enters the soil harms plants differently than salt spray. Salt disrupts the balance of nutrients and water between the soil and the plant, causing plant decline. Salt causes soil particles to absorb moisture in the same way a salt shaker attracts moisture under humid conditions. Because the soil particles hold water more tightly, less water is available for uptake by the plant.

Damage caused when salt enters the soil is slower acting and plants may not show symptoms for several years. Symptoms on deciduous plants grown in soil with high salt concentrations include browning along the edges of leaves. Leaf burn usually appears in late summer or during periods of hot, dry weather when soil moisture becomes limiting.

Long-term symptoms of excess salt in the soil may be more subtle. Plants may be stunted, showing a general lack of vigor. Affected plants may produce fewer, smaller leaves that are often chlorotic. In addition, you may see premature fall coloration and leaf drop. All of these changes decrease the plant's capacity to convert light into sugar, causing a further decline in plant health. Another symptom of plant decline caused by high salt levels is reduction in the size of the flowers and fruit produced.

High salt concentrations restrict the uptake of potassium and magnesium by the plant, causing general plant decline. Roots growing in salty soils absorb toxic levels of the sodium and chloride ions that make up common deicing salt. These ions accumulate in needles, buds, and twigs causing dehydration and an imbalance of nutrients.

Too much salt in the soil can alter the physical structure of the soil. Excess sodium prevents soil from forming clumps. Poor clumping makes soil vulnerable to compaction, reducing soil permeability and aeration and increasing the likelihood of soil erosion and surface runoff.

Diagnosis

When making a diagnosis of salt injury, keep in mind that similar symptoms may result from several other causes. Construction injury, winter desiccation, air pollution, nutrient imbalances, improper planting, and root, vascular or canker diseases, all produce symptoms similar to those of salt injury. Fortunately there are certain patterns associated with salt injury that distinguish it from other causes.

Salt spray injury

- The severity of damage increases with the volume and speed of traffic and the amount of salt used.
- The side of the plant facing the road is more severely damaged.
- Damage is more severe on plants growing downwind from the road.
- Most damage occurs within 30–50 feet of the road and decreases with distance from the road.
- Branches that were covered with snow show no signs of damage.
- Branches growing above the spray drift zone are not injured.
- On dense plants where salt spray can penetrate only a short distance in, damage appears only on the outer portions.
- Sheltered plants show no signs of injury.

Soil salt injury

- Damage increases with the amount of salt used.
- Most damage occurs within 30–50 feet of the road and decreases with distance from the road.
- Plants growing in poorly drained soils or in areas where highway runoff collects are injured more severely.
- Plants that are only marginally hardy for the area are injured more severely than other marginally hardy plants grown away from the road.

If you suspect salt injury, a soil test or tissue test should be done to confirm the diagnosis. Submit soil samples very early in the spring before rain washes salts down into the soil and out of the sampling area. Tissue samples should be collected in midsummer and submitted for chloride analysis. Be careful to avoid contaminating the sample. Use clean plastic gloves when handling the sample or prune the leaves directly

into a clean plastic bag. Contact your county Extension office for specific instructions on soil testing and tissue testing.

Preventing injury

The best method for preventing salt injury to plants is to reduce the amount of salt used. Limit applications to high risk locations such as high-speed roads, intersections, hills, steps, and walkways. Avoid applying pure salt; instead, mix salt with an abrasive material such as sand, ash, or cinders. Salt mixtures are particularly appropriate on low-volume roads and when temperatures are so cold that salt is ineffective. Or, consider using one of the products listed in table 1 as an alternative to rock salt.

When applying a deicer, wait until after you've finished shoveling and plowing. If possible, wait until after the threat of more snow has passed before spreading salt. This will help reduce the movement of salt from the pavement into the landscape. However, early applications of small amounts of salt can be very effective at preventing ice from freezing to the pavement.

Do not use fertilizers to deice. The large amount needed to effectively melt ice can damage adjacent plants. Anti-desiccants or anti-transpirants are not effective in reducing salt injury and, in some cases, may actually increase damage.

Cultural control

New plantings

Planning before planting is the best way to prevent salt injury to landscape plants. When planting in areas subjected to salt spray or runoff, consider these suggestions to minimize damage.

- Select plants with high salt tolerance. See tables 2 and 3 for common woody landscape plants grouped by relative salt tolerance.
- Plant on berms to prevent salty runoff water from moving into root zones.
- Place plants with low salt tolerance at least 60 feet from highways and 30 feet from city streets.

Existing plantings

For existing plantings, the following suggestions will help reduce damage caused by salty spray and runoff water.

- In late fall, place barriers (such as snow fences, burlap, or plywood) around plants to reduce exposure to salt spray.
- Avoid shoveling piles of salt-laden snow over the root zones of sensitive plants.
- Flush high-saline areas with water in early spring to move salt out of the plant's root zone.
- Alter drainage patterns to direct salty runoff water away from plants.

Table 1. Alternative products for ice control

Product	Advantages	Disadvantages
Calcium chloride	■ Effective to –59°F ■ No visible residue when dry ■ Will not damage soil structure ■ Dissolves easily and acts quickly	■ Costs up to 10 times more than rock salt ■ Injures plants ■ Highly corrosive
Magnesium chloride	■ Effective to –25°F ■ Fast acting at low temperatures ■ Less corrosive than calcium chloride and sodium chloride	■ Costs twice as much as rock salt ■ May cause chloride toxicity ■ Absorbs moisture readily; must be stored in dry area
Calcium magnesium acetate (pelleted deicer made from dolomitic limestone and acetic acid)	■ Biodegradable; not harmful to the environment ■ Less corrosive than sodium chloride ■ Can increase soil permeability	■ Expensive—costs 30 times more than rock salt ■ Less effective than salt in colder temperatures
Abrasive materials (sand, ash, or cinders)	■ Inexpensive ■ Not harmful to trees and shrubs ■ Works at very low temperatures where salt is ineffective	■ Will not melt ice ■ Requires reapplication to maintain effective traction ■ Bulky; must be removed from gutters each spring

Table 2. Salt spray tolerance of common woody landscape plants

High tolerance	Moderate tolerance	Low tolerance
Ash, white *(Fraxinus americana)*	**Alder,** speckled (*Alnus rugosa)*	**Arborvitae** (*Thuja occidentalis)*
Aspen, bigtooth (*Populus grandidentata)*	white (*A. incana)*	**Barberry** (*Berberis thunbergii)*
quaking (*P. tremuloides)*	**Ash,** green (*Fraxinus pennsylvanica)*	**Beech,** American (*Fagus grandifolia)*
Cottonwood, eastern (*Populus deltoides)*	**Barberry,** Korean (*Berberis koreana)*	**Boxwood** (*Buxus sempervirens)*
Currant, alpine (*Ribes alpinum)*	**Birch,** grey (*Betula populifolia)*	**Cherry,** black (*Prunus serotina)*
Euonymus, winged (*Euonymus alata)*	paper (*B. papyrifera)*	sand (*P. besseyi)*
Honeylocust (*Gleditsia triacanthos)*	sweet (*B. lenta)*	**Chokecherry** (*Prunus virginiana)*
Horsechestnut (*Aesculus hippocastanum)*	yellow (*B. alleghaniensis)*	**Coralberry,** indiancurrant (*Symphoricarpus orbiculatus)*
Juniper, Chinese (*Juniperus chinensis)*	**Boxelder** (*Acer negundo)*	**Crabapple** (*Malus spp.)*
Larch, European (*Larix decidua)*	**Catalpa** (*Catalpa speciosa)*	**Dogwood** (*Cornus spp.)*
Lilac, Japanese (*Syringa reticulata)*	**Douglasfir** (*Pseudotsuga menziesii)*	**Elder,** American (*Sambucus canadensis)*
Locust, black (*Robinia pseudoacacia)*	**Elm,** American (*Ulmus americana)*	European red (*S. racemosa)*
Maple, Norway (*Acer platanoides)*	Siberian (*U. pumila)*	**Euonymus,** European (*Euonymus europaea)*
silver (*A. saccharinum)*	**Forsythia** (*Forsythia X intermedia)*	**Filbert** (*Corylus spp.)*
Mockorange (*Philadelphus spp.)*	**Honeysuckle** (*Lonicera tatarica)*	**Fir,** balsam (*Abies balsamea)*
Mountain ash (*Sorbus spp.)*	**Juniper,** creeping (*Juniperus horizontalis)*	**Ginkgo** (*Ginkgo biloba)*
Mulberry (*Morus spp.)*	**Lilac,** common (*Syringa vulgaris)*	**Hackberry,** common (*Celtis occidentalis)*
Pine, Austrian (*Pinus nigra)*	**Linden,** American (*Tilia americana)*	**Hawthorn** (*Crateagus spp.)*
Jack (*P. banksiana)*	**Maple,** amur (*Acer ginnala)*	**Hemlock,** eastern (*Tsuga canadensis)*
mugo (*P. mugo)*	red (*A. rubrum)*	**Hickory,** shagbark (*Carya ovata)*
Poplar, black (*Populus nigra)*	sugar (*A. saccharum)*	**Hornbeam,** American (*Carpinus caroliniana)*
silver-leaved (*P. alba)*	**Oak,** bur (*Quercus macrocarpa)*	**Linden,** littleleaf (*Tilia cordata)*
Redcedar, eastern (*Juniperus virginiana)*	English (*Q. robur)*	**Oak,** pin (Quercus palustris)
Rose, rugosa (*Rosa rugosa)*	**Pear,** ornamental (*Pyrus spp.)*	red (*Q. rubra)*
Russian-olive (*Elaeagnus angustifolia)*	**Pine,** ponderosa (*Pinus ponderosa)*	white (*Q. alba)*
Snowberry (*Symphoricarpus albus)*	**Privet** (*Ligustrum vulgare)*	**Pine,** red (*Pinus resinosa)*
Spruce, Colorado (*Picea pungens)*	**Serviceberry** (*Amelanchier spp.)*	Scots (*P. sylvestris)*
Sumac, fragrant (*Rhus aromatica)*	**Viburnum,** American cranberrybush (*Viburnum trilobum)*	white (*P. strobus)*
smooth (*R. glabra)*	arrowwood (*V. dentatum)*	**Quince,** flowering (*Chaenomeles speciosa)*
staghorn (*R. typhina)*	European cranberrybush (*V. opulus)*	**Redbud,** eastern (*Cercis canadensis)*
Virginia creeper (*Parthenocissus quinquefolia)*	nannyberry (*V. lentago)*	**Redwood,** dawn (*Metasequoia glyptostroboides)*
Walnut, black (*Juglans nigra)*	**Willow,** black (*Salix nigra)*	**Rhododendron** (*Rhododendron)*
	white (*S. alba)*	**Spirea,** Vanhoutte (*Spiraea X vanhouttei)*
		Spruce, Norway (*Picea abies)*
		white (*P. glauca)*
		Tuliptree (*Liriodendron tulipifera)*
		Viburnum, wayfaringtree (*Viburnum lantana)*
		Weigela (*Weigela* spp.)
		Yews (*Taxus* spp.*)*

Table 3. Soil salt tolerance of common woody landscape plants

High tolerance	Moderate tolerance	Low tolerance
Ash, white (*Fraxinus americana)*	**Arborvitae** (*Thuja occidentalis)*	**Alder,** speckled (*Alnus rugosa)*
Cherry, black (*Prunus serotina)*	**Aspen,** bigtooth (*Populus grandidentata)*	white (*A. incana)*
Chokecherry (*Prunus virginiana)*	quaking (*P. tremuloides)*	**Barberry** (*Berberis thunbergii)*
Currant, alpine (*Ribes alpinum)*	**Birch,** grey (*Betula populifolia)*	**Beech,** American (*Fagus grandifolia)*
Honeylocust (*Gleditsia triacanthos)*	paper (*B. papyrifera)*	**Boxwood** (*Buxus sempervirens)*
Horsechestnut (*Aesculus hippocastanum)*	sweet (*B. lenta)*	**Douglasfir** (*Pseudotsuga menziesii)*
Juniper, Chinese (*Juniperus chinensis)*	yellow (*B. alleghaniensis)*	**Elm,** American (*Ulmus americana)*
Locust, black (*Robinia pseudoacacia)*	**Boxelder** (*Acer negundo)*	Siberian (*U. pumila)*
Oak, bur (*Quercus macrocarpa)*	**Cherry,** sand (*Pinus besseyi)*	**Euonymus,** European (*Euonymus europaea)*
pin (*Q. palustris)*	**Cottonwood,** eastern (*Populus deltoides)*	winged (*E. alata)*
red (*Q. rubra)*	**Crabapple** (*Malus spp.)*	**Filbert** (*Corylus spp.)*
white (*Q. alba)*	**Fir,** balsam (*Abies balsamea)*	**Hemlock,** eastern (*Tsuga canadensis)*
Pine, Austrian (*Pinus nigra)*	**Honeysuckle** (*Lonicera tatarica)*	**Hornbeam,** American (*Carpinus caroliniana)*
mugo (*P. mugo)*	**Juniper,** creeping (*Juniperus horizontalis)*	**Larch,** European (*Larix decidua)*
Redcedar, eastern (*Juniperus virginiana)*	**Lilac,** common (*Syringa vulgaris)*	**Linden,** American (*Tilia americana)*
Rose, rugosa (*Rosa rugosa)*	Japanese (*S. reticulata)*	littleleaf (*T. cordata)*
Russian-olive (*Elaeagnus angustifolia)*	**Maple,** amur (*Acer ginnala)*	**Maple,** red (*Acer rubrum)*
	Norway (*A. platanoides)*	sugar (*A. saccharum)*
	silver (*A. saccharinum)*	**Pine,** red (*Pinus resinosa)*
	Pine, ponderosa (*Pinus ponderosa)*	white (*P. strobus)*
	Scots (*P. sylvestris)*	**Spirea,** Vanhoutte (*Spiraea X vanhouttei)*
	Poplar, black (*Populus nigra)*	**Spruce,** Colorado (*Picea pungens)*
	silver-leaved (*P. alba)*	Norway (*P. abies)*
	Privet (*Ligustrum vulgare)*	white (*P. glauca)*
	Redbud, eastern (*Cercis canadensis)*	**Tuliptree** (*Liriodendron tulipifera)*
	Viburnum, European cranberrybush (*Viburnum opulus)*	**Viburnum,** American cranberrybush (*Viburnum trilobum)*
		arrowwood (*V. dentatum)*
		nannyberry (*V. lentago)*
		wayfaringtree (*V. lantana)*
		Walnut, black (*Juglans nigra)*

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