MINNESOTA TREE LINE Agricultural Extension Service University of Minnesota

# Minimizing Salt Injury to Shade Trees

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Each winter over 100,000 tons of salt, both sodium chloride (NaCl), the primary source; and calcium chloride ($CaCl_2$) are applied to state and municipal roads in Minnesota to provide a safe, dry pavement for high-speed traffic. In some years, the total amount of salt has been as high as 200,000 tons. Deicing salts are also used in large quantities within metropolitan areas on streets, driveways, and sidewalks. This extensive use of deicing salts in Minnesota during winter months causes widespread damage to trees and shrubs along highways and may be responsible for the death of thousands of city shade trees.

Injury occurs when salts are deposited by spray or drift on dormant stems and buds of deciduous trees and on stems, buds, and needles of evergreens, or when excess amounts of salts leach into the root zone. Both spray-salt and soil-salt cause disfigurement, reduce plant growth, and can cause plant death.

Spray-salt damage is most evident along heavily traveled highways where high speed traffic has deposited salt spray on adjacent plants, causing dehydration of the tissue. Damage is most severe within 60 feet of the road, although it can extend to 150 feet or more.

In metropolitan areas, where traffic speeds are slower, the greatest threat is from the slow build-up of soil salt and the build-up of excess sodium and chloride in the tissue of trees and shrubs along city streets, driveways, and sidewalks. Salt runoff washing into the soil or salt plowed and shoveled onto boulevards and lawns may be absorbed by the roots and cause direct toxicity or simply prevent roots from absorbing water.

Unrelated factors, such as Dutch elm disease, overmaturity, and drought make the problem more severe in metropolitan areas. For example, Dutch elm disease forces removal of elms, thus young replacement trees along salted streets are subject to spray damage and accumulation of soil in their planting holes. As trees age they lose their ability to tolerate soil/salt-related stresses. And, prolonged drought interacts with soil salts to cause widespread damage and death of susceptible species.

Losses in growth and aesthetic qualities of city shade trees and shrubs are expensive because salt-related damage means increased maintenance costs for pruning, fertilizing, and other extra care. And, while salt-tolerant species may be planted, there are few of such species to select from. Consequently, chances to match species to soil characteristics are limited, and the risk of a single disease or insect pest destroying a large percentage of trees is increased.

## SYMPTOMS

Salt spray causes bud death and twig dieback in deciduous plants. Subsequent shoot growth results in the development of "witches brooms" (tuft-like growths) from the basal section of branches facing the road. The symptoms become evident when growth resumes in the spring. In conifers, salt spray causes moderate to extreme needle browning, beginning at the tips and twig dieback occurring on the side facing the road. Browning usually is first evident in late February or early March and becomes more extensive through spring and summer.

Soil salt damage often becomes evident late in the summer following the growing season in which the salt damage occurred, or during periods of hot, dry weather. However, the injury may not appear for several years. The symptoms include an initial blue-green cast to the foliage, marginal leaf burn progressing toward the mid-vein of affected leaves, needle tipburn, reduction in leaf, flower and fruit size, premature fall coloration and defoliation, stunting, and a general lack of vigor.

Since the symptoms of salt injury are similar to injury caused by other stresses, suspect salt injury should be carefully checked against injury patterns that are associated with salt damage to verify the cause of the injury. General salt injury patterns in metropolitan areas include:

1. Damage increases with the volume and speed of traffic and the amount of salt applied.
2. Injury is more severe on the side facing the road and plants are often one-sided due to branch dieback.
3. Most injury is within 30 to 50 feet off the road and decreases with distance from the road.
4. Branches covered by snow or above the spray-drift zone are not injured or are injured less.
5. Injury to conifers becomes apparent in late winter but injury to deciduous plants is not evident until spring.
6. Salt spray penetrates only a short distance into dense plants and plants in sheltered locations lack injury symptoms.
7. Less winter-hardy plants are injured more severely.
8. Plants at street intersections, at the foot of a hill, near major drainages from the street or on poorly drained soils are injured more severely.
9. Plants damaged over several years lack vigor and soon begin to die.

## MINIMIZING SALT INJURY

Salt damage to shade and ornamental trees in metropolitan areas can be minimized or largely eliminated by:

1. Avoiding deicing salts completely (often not feasible or realistic), reducing quantities applied by mixing the salt with an abrasive such as sand, cinders, or ash, or limiting application to high risk locations such as high speed roads, intersections, hills, steps and walkways; using alternative deicing salts such as calcium chloride rather than sodium chloride; or, using alternative methods of snow and ice removal.
2. Improving the structure and drainage of poorly drained soils by adding organic matter, activated charcoal, or gypsum and thoroughly leaching the soil or washing the plant parts in the spring as soon as the frost has left the ground.
3. Protecting susceptible plants by constructing physical barriers made of plastic, burlap, plywood or window screen on or in front of the plants.
4. Avoiding high risk sites by planting shade and ornamental trees away from the spray drift zone or areas where salt-laden snow will be deposited.

5. Pruning, fertilizing, and watering injured plants that exhibit dieback to prevent stress and increase disease and insect resistance.
6. Using plants sufficiently tolerant of the expected amounts and types of salt that will be applied in adjacent areas. Keep in mind that plants vary in their sensitivity to salt (table 1) and that those resistant to soil salt and those resistant to spray salt are not necessarily the same species and no plants are wholly immune to salt injury.

**Table 1. Relative Tolerance to Soil Salt Damage for Selected Species Commonly Planted as Shade and Ornamental Trees in Minnesota**

(For spray salt tolerance ratings see designations after plant names)

| SENSITIVE | INTERMEDIATE | TOLERANT |
|---|---|---|
| *Acer rubrum (I)*<br>Red Maple | *Abies balsamea (S)*<br>Balsam Fir | **Acer platanoides (T)*<br>Norway Maple |
| *Acer saccharinum (I)*<br>Silver Maple | *Acer ginnala (S)*<br>Amur Maple | **Aesculus glabra*<br>Ohio Buckeye |
| *Acer saccharum (I)*<br>Sugar Maple | *Acer negundo (I)*<br>Boxelder | *Aesculus hippocastanum (T)*<br>Horsechestnut |
| *Amelanchier spp. (T)*<br>Serviceberry | **Betula spp. (I)*<br>Birch | *Elaeagnus angustifolia (T)*<br>Russian Olive |
| *Carpinus caroliniana (S)*<br>Blue Beech | *Catalpa speciosa (I)*<br>Catalpa | *Fraxinus americana (T)*<br>White Ash |
| *Crataegus spp. (S)*<br>Hawthorne | *Celtis occidentalis (S)*<br>Hackberry | **Ginko biloba (T)*<br>Ginko |
| *Juglans nigra (T)*<br>Black Walnut | *Fraxinus pennsylvanica (I)*<br>Green Ash | *Gleditsia triacanthos (T)*<br>Honeylocust |
| *Larix decidua (T)*<br>European Larch | *Juniperus spp. (I)*<br>Juniper | *Picea glauca densata (T)*<br>Black Hills Spruce |
| **Ostrya virginiana (S)*<br>Ironwood | *Juniperus virginiana (T)*<br>Eastern Redcedar | *Pinus banksiana (T)*<br>Jack Pine |
| *Picea abies (S)*<br>Norway Spruce | *Malus spp. (S)*<br>Crabapple | *Pinus nigra (T)*<br>Austrian Pine |
| *Picea pungens (T)*<br>Colorado Spruce | *Picea glauca (S)*<br>White Spruce | *Populus alba (T)*<br>White Poplar |
| *Pinus resinosa (S)*<br>Norway Pine | *Pinus ponderosa (I)*<br>Ponderosa Pine | *Populus spp. (T)*<br>Poplar |
| *Pinus strobus (S)*<br>White Pine | *Pinus sylvestris (S)*<br>Scotch Pine | *Prunus serotina (S)*<br>Black Cherry |
| *Pseudotsuga menziesii (I)*<br>Douglas Fir | *Populus deltoides (I)*<br>Cottonwood | *Quercus alba (S)*<br>White Oak |
| *Quercus palustris (S)*<br>Pin Oak | *Pyrus spp. (I)*<br>Pear | *Quercus marcrocarpa (I)*<br>Bur Oak |
| *Sorbus spp. (T)*<br>Mountain Ash | *Salix alba tristis (T)*<br>Golden Weeping Willow | *Quercus rubra (S)*<br>Red Oak |
| *Taxus spp. (S)*<br>Yew | *Thuja occidentalis (S)*<br>American Arborvitae | *Robinia pseudoacacia (T)*<br>Black Locust |
| *Tsuga canadensis (S)*<br>Canada Hemlock | *Ulmus americana (I)*<br>American Elm | **Syringa reticulata*<br>Japanese Tree Lilac |
| *Tilia americana (I)*<br>American Linden | | |
| *Tilia cordata (S)*<br>Littleleaf Linden | | |

*Species marked with an asterisk show serious inconsistencies because the evaluations are based on a single parameter and insufficient data.

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