Over the past 40 years, amounts of salt used for deicing roadways in winter have increased with greater traffic flow and growing concern for public safety. On heavily traveled highways, 40-80 tons of salt per lane mile per year may be applied. Most people are only too aware of the corrosive effects of salt on automobiles and road surfaces. In addition, salt injures many plants growing along roadsides. The following information describes the nature and symptoms of salt injury to plants and suggests measures to minimize it.

**WHAT IS DEICING SALT?**

Most deicing salt is unrefined rock salt containing about 98.5% sodium chloride, 1.2% calcium sulfate, 0.1% magnesium chloride, and 0.2% rock. In some cases, a trace (0.02%) of sodium ferro-cyanate may be used as an anticaking agent. Calcium chloride is applied to roads alone or in addition to rock salt when extremely low temperatures are expected. Calcium chloride is 8 times more expensive than rock salt, however, and is used sparingly. Unless otherwise specified, the term salt as used in this bulletin refers to rock salt (sodium chloride).

**HOW DOES SALT INJURE PLANTS?**

Salt causes plant injury if it accumulates to excessive amounts in soil near the root system. This frequently happens when salt-laden snow is plowed off of streets and sidewalks and onto adjacent landscapes. Anyone who has tried to get table salt out of a wet shaker knows that salt readily absorbs water. Rock salt exhibits the same property in the soil, and it absorbs much of the water that would normally be available to roots. Thus, even though soil moisture is plentiful, high amounts of salt can result in a drought-like environment for plants. When salt dissolves in water, sodium and chloride ions separate, and the chloride ions are readily absorbed by roots. These ions are carried through the sap stream to actively growing portions such as leaf margins and shoot tips where they accumulate to toxic levels. In leaves, this toxic buildup results in a characteristic marginal scorch. Excess sodium in soil decreases plant health and vigor in several ways. High amounts of sodium cause soil to lose its capacity to aggregate into clumps and it easily becomes compacted. Thus, access to water and oxygen is severely restricted, and roots cannot function to their full potential. Besides restricting the amount of water and oxygen available to plants, excess sodium also obstructs the availability of important nutrients. Most plants only need a small amount of sodium in order to survive. They need considerably larger amounts of magnesium and potassium. All three of these elements use the same chemical route, a shuttle system of sorts, to move from the soil into the plant. Excessive sodium from dissolved salt can tie up the shuttle system and restrict uptake of magnesium and potassium, two chemicals that are essential for making chlorophyll. Potassium deficiencies, in particular, are common in plants suffering from salt injury. When salt is deposited on plants by spray from passing cars and trucks, salt may enter plant cells or the spaces between cells.
directly. One result of salt application by this route is that buds and small twigs of some plant species lose cold hardiness and are more likely to be killed by freezing. In addition to the direct effects that salt has on plant growth, affected plants also suffer reduced vigor. They are more susceptible to attack by insect pests and diseases and are more sensitive to other adverse environmental factors such as drought and air pollution.

**Symptoms of Salt Injury**

Symptoms of excessive salt resemble those caused by drought or root injury. Stunted, yellow foliage, premature autumn leaf coloration, death of leaf margins (scorch), and twig dieback are common. When conifers are injured by winter deposits of salt spray, the affected foliage turns yellow or brown in early spring. If spray is the primary means of salt deposit, discolored needles are soon masked by the new year’s growth. However, if salt is also excessive in the soil, the new needles may die as chloride ions accumulate in them. This could be lethal to the entire plant if it happens for several consecutive years. One characteristic of salt injury that aids in diagnosis is that it is often confined to branches facing the road. Trees closer to the road suffer more damage than those set farther back.

**How Can Salt Damage Be Prevented?**

If salt were not used to deice roads in winter, salt damage to plants would be minimal. However, the expense of this solution in terms of human life and safety precludes it. (One might also speculate on the number of roadside plants killed or maimed by errant, skidding vehicles during a snow storm.) Thus, the problem is one of adapting to an undesirable but necessary circumstance. Calcium chloride is reported to be less toxic than sodium chloride. However, serious problems with the handling and storing of calcium chloride preclude its use by many road maintenance agencies. Foremost among these is that calcium chloride absorbs moisture and cakes even more readily than sodium chloride. It must be kept absolutely dry until use, or it will plug conventional application equipment. Calcium chloride is also much more expensive than sodium chloride—a limiting factor for many agencies with restricted road-clearing budgets. In many cases, sand, light gravel or cinders provide adequate traction for pedestrian and vehicular traffic. These materials are being used with increasing frequency in place of or in combination with salt to minimize plant injury. Late-season salt applications (after March 1) are most detrimental to vegetation and should be kept to a minimum. That time of year is when plants are breaking dormancy and their roots are actively absorbing nutrients and water from the soil to provide an adequate supply for the soon-to-follow new leaves. Toxic chloride ions, which are usually leached from soil rapidly, are most likely absorbed at this time. Avoid piling salt and snow around plants or in places where the resulting salt water will drain into plants when the snow melts. If weather permits, it is a good idea to flush the area around roots exposed to salt with fresh tap or well water as soon as the snow melts. The root zone area on young trees is approximately equal to the area contained within the dripline of the crown. On older trees, it may be twice as large. Where new trees and shrubs are to be planted and where exposure to salt is likely, select species or cultivars resistant to salt injury (see listing). This list was compiled from a number of sources, and tolerance testing was not uniform. Tolerance varies with many factors, including exposure, soil texture and plant age. Thus, the list should be used only as a guide. Intolerant species should not be planted within 30 feet of roads or on slopes below roadbeds. Some injury may still occur on moderately tolerant and tolerant species along heavily salted roads. Proper planting is important when attempting to establish trees or shrubs along often-salted roads. Newly planted trees are under some stress as a result of the transplanting process itself and are less able to cope with external factors (such as salt) until new roots are established. The well created by settling of new transplants is an excellent place for salty water from melting snow to accumulate. Such wells should be leveled as soon as new transplants become established.
**TOLERANCES OF PLANTS TO DEICING SALT**

**High Tolerance**

*Acer platanoides* (Norway maple)  
*Aesculus hippocastanum* (Horse chestnut)  
*Betula alleghaniensis* (Yellow birch)  
*B. lenta* (Cherry birch)  
*B. papyrifera* (Paper birch)  
*B. populifolia* (Gray birch)  
*Caragana arborescens* (Siberian pea tree)  
*Elaeagnus angustifolia* (Russian olive)  
*Fraxinus americana* (White ash)  
*Gleditsia triacanthos* (Honey locust)  
*Larix decidua* (European larch)  
*L. leptolepis* (Japanese larch)  
*Lonicera tatarica 'Zabelii’* (Zabel's honeysuckle)  
*L. xylosteum* (European fly honeysuckle)  
*Parthenocissus quinquefolia* (Virginia creeper)  
*Picea glauca* (White spruce)  
*P. pungens* (Colorado blue spruce)  
*Pinus mugo* (Mugo pine)  
*P. nigra* (Austrian pine)  
*P. ponderosa* (Ponderosa pine)  
*Populus acuminata*  
**P. alba** (White poplar)  
*P. balsamifera* (Balsam poplar)  
*P. deltoides* (Cottonwood)  
*P. grandidentata* (Big tooth aspen)  
*P. nigra*  
*P. nigra 'Italica’* (Lombardy poplar)  
*P. tremuloides* (Trembling aspen)  
*Potentilla fruticosa 'Jackmani i’* (Jackman's potentilla)  
*Quercus alba* (White oak)  
*Q. macrocarpa* (Bur oak)  
*Q. rubra* (Red oak)  
*Ribes alpinum* (Alpine current)  
*Robinia pseudoacacia* (Black locust)  
*Rosa rugosa* (Rugosa rose)  
*Salix fragilis*  
*S. viminalis* (Common osier)  
*Shepherdia argentea* (Buffaloberry)  
*Spirea X Vanhouttei* (Vanhoutte's spirea)  
*Symphoricarpus albus var. La evigatus* (Garden snowberry)  
*Tamarix pentandra* (Fiestamen tamarisk)  
*Ulmus glabra* (Wych elm)

**Moderate Tolerance**

*Acer ginnala* (Amur maple)  
*A. negundo* (Boxelder)  
*A. saccharinum* (Silver maple)  
*Alnus glutinosa* (Black alder)  
*Fraxinus pennsylvanica* (Green ash)  
*Juniperus virginiana* (Red cedar)  
*Pinus sylvestris* (Scots pine)  
*Prunus serotina* (Black cherry)  
*Rhus glabra* (Smooth sumac)  
*Salix alba* (White willow)  
*S. pentandra* (Laurel leaf willow)  
*Spirea bumalda 'Froebeli’* (Froebel's spirea)  
*Synnega vulgaris* (Common lilac)  
*Thuia occidentalis* (Eastern white cedar)  
*Ulmus americana* (American elm)

**Low Tolerance**

*Acer rubrum* (Red maple)
A. saccharum (Sugar maple)
Alnus rugosa (Smooth alder)
Abies balsamea (Balsam fir)
Carpinus caroliniana (American hornbeam)
Carya ovata (Shagbark hickory)
Celtis occidentalis (Hackberry)
Cornus stolonifera (Red Osier dogwood)
C. stolonifera 'Flaviramea' (Yellow twig dogwood)
Euonymus alatus (Winged euonymus)
Juglans nigra (Black walnut)
Ligustrum vulgare (Common privet)
Malus 'Hopa' (Hopa crabapple)
Picea abies (Norway spruce)
Pinus resinosa (Red pine)
P. strobus (White pine)
Pseudotsuga menziesii (Douglas fir)
Sambucus racemosa (European red elder)
Tilia americana (American linden)
Tsuga canadensis (Eastern hemlock)
Viburnum trilobum (American highbush cranberry)

Would you like additional information?

Additional information is available on-line. Please see MSU Extension-Oakland County’s publications as well as MSU Extension’s Bulletin Office on campus.

Contact our Plant & Pest Hotline (248/858-0902) for assistance with plant identification, pests and diseases, weeds, trees and shrubs, lawn, flowers, fruits, vegetables, grasses and groundcovers, native plants, plant propagation, and many other gardening topics.

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