RESEARCH LABORATORY TECHNICAL REPORT

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Salt Injury

On Ornamentals

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Salt (*sodium chloride*) applied as a deicing agent on streets and sidewalks can cause severe damage to many species of roadside and lawn-planted woody ornamentals. Damage results when salt, dissolved in runoff water, is leached into the root zone or when it comes in contact with foliage and branches in the form of spray created by passing vehicular traffic. Naturally occurring saltwater and heavy applications of low-grade agricultural fertilizers having high salt indices can cause severe injury in the same manner as deicing salts.

Figure 1: Deicing salt damage on sugar maple

Plant sensitivity to salt varies greatly among species and among individuals of the same species. Many ornamentals exhibit a very high degree of tolerance while others, particularly shallow-rooted species and evergreens, are readily injured (Figure 2). Injury is dependent upon the concentration of salt within the soil or upon the foliage, and symptoms are usually evident only after salt has accumulated to a toxic level for the given species.

Symptoms

Symptoms of salt injury may not always be well-defined and often resemble those caused by other adverse environmental factors, particularly drought or air pollution. Affected plants commonly exhibit some or all of the following symptoms:

- Delay in leaf budbreak and flowering
- Stunted foliage and buds
- Reduced shoot growth
- Tip or marginal foliage browning (Figure 1)
- Crown thinning and tufting of foliage at branch tips
- Premature fall coloration and defoliation
- Twig mortality

Crown dieback, invasion by insect borers and weakly pathogenic fungi, and eventually plant mortality occur

Figure 2: Hurricane salt damage on Leyland cypress (salt spray)

in severe instances. Symptoms are most severe on plantings closest to, or on the downward slope from, the salt source. Injury is most pronounced on the side of the plant facing the salt source and on lower branches, particularly evergreens. If salt application is a fairly recent event, laboratory analysis of soil samples from the root zone of the symptomatic plant can be tested for salt content to determine if it is at damaging levels for the particular plant.

Effect on Vegetation

Salt is reputed to "burn" or desiccate roots and foliage with which it comes in contact. This results from the natural movement of water or sap from an area of low salt or ionic concentration within plant cells to one of higher concentration in the soil or on foliar surfaces. Injury due to desiccation is particularly severe during dry periods when soil moisture or atmospheric humidity is limited.

Other pathogenic roles of salt have been suggested, but further study is needed for confirmation. Recent research indicates that sodium and/or chloride ions themselves may be toxic to plants in quantity. The former element particularly is suspect since, unlike chlorides, which are highly mobile and readily translocated to the leaves where they are shed; sodium is extremely static and will accumulate in soil and plant tissue. High sodium concentration in plant tissues may alter a plant's mineral nutrition balance and inhibit protein synthesis.

Treatments

Resistant Species: In areas subject to deicing salts or natural salt spray, injury can be minimized by proper initial selection of planting stock. A partial listing of commonly planted, resistant species is included in Table 1. State extension services or the Bartlett Tree Research Laboratories can provide a more complete listing for a given area.

Cultural Practices: *Calcium chloride*, an effective deicing agent which is much less toxic to plants, should be substituted for sodium chloride on pavements around ornamentals whenever possible. Large-scale use of *calcium chloride*, however, is prohibitive due to its higher cost and difficulty in application and storage. Other materials including sand and urea are valid, but less effective.

Table 1: Species Tolerant to Salt

Deciduous	
Norway maple	*Acer platanoides*
Horsechestnut	*Aesculus hippocastanum*
Paper birch *	*Betula papyrifera*
Hawthorn	*Crataegus* spp.
Russian-olive	*Eleagnus augustifolia*
Ash *	*Fraxinus* spp.
Honey-locust	*Gleditsia triacanthos*
Mulberry	*Morus* spp.
White poplar	*Populus alba*
Quaking aspen	*Populus tremuloides*
Black cherry *	*Prunus serotina*
White oak	*Quercus alba*
Red oak	*Quercus rubra*
Black locust	*Robinia pseudoacacia*
Weeping willow	*Salix* spp.
Evergreen	
Eastern red cedar	*Juniperus virginiana*
Blue spruce	*Picea pungens*
Mugo pine	*Pinus mugo*
Austrian pine	*Pinus nigra*

* Intermediate to Tolerant

Diverting runoff from salted pavements away from existing plantings is helpful in preventing salt injury. Similarly, protective barriers of burlap, polyethylene, wood, etc. will help prevent salt spray from coming into contact with foliage and branches.

Anti-desiccants reportedly act as a barrier to salt spray; however, results thus far have been extremely variable and inconclusive.

Recognized cultural practices including fertilization, mulching, watering heavily during dry periods and thinning the crown to a level in balance with the ability of the root system to support it will help alleviate salt injury. Care should be taken to select only those fertilizers with low salt indices, which are suitable for ornamentals.

Gypsum: Gypsum (*calcium sulfate*), a naturally occurring compound native to the Southwestern United States, has long been used in agriculture as a source of calcium and sulfur and as an amendment to improve soil structure. Recently, gypsum has been found to counteract salt injury by reacting with toxic sodium ions present in soil and rendering them unavailable to the plant. The negatively charged sulfate ions in gypsum bond with the positively charged sodium ions to form sodium sulfate, a highly soluble salt that is readily leached from soil. The remaining positively charged calcium ions are free to bond with negatively charged clay molecules, thereby acting as a "binding agent" between soil particles and resulting in increased soil permeability and aeration.

Gypsum can be surface-applied with a lawn spreader or applied via deep placement in the same manner as granular fertilizers. Recommended rates vary between twenty and forty pounds per 100 square feet of soil surface, depending upon salt content and soil texture. Gypsum is commercially available from many farm and garden centers.

Founded in 1926, The Bartlett Tree Research Laboratories is the research wing of Bartlett Tree Experts. Scientists here develop guidelines for all of the Company's services. The Lab also houses a state-of-the-art plant diagnostic clinic and provides vital technical support to Bartlett arborists and field staff for the benefit of our clients.