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EDITOR

DE-ICING SALT VERSUS PLANTS

"Trees which have resinous or sunken buds appear to be more tolerant of salt spray."

by, Glen P. Lumis, Assistant Professor Department of Horticultural Science University of Guelph

DECIDIOUS TREES	INJURY RATING
Horse-chestnut Aesculus hippocastanum **L.**	1
Tree of Heaven Ailanthus altissima [**Mill.**] **Swing**	1
Norway maple Acer platanoides **L.**	1
Cottonwood Populus deltoides **Bartr.**	1
Black locust Robinia pseudoacacia **L.**	1
Honey locust Gleditsia triacanthos **L.**	1-2
Red oak Quercus rubra **L.**	1-2
Supar maple Acer msaccharum **Marsh**	1-2
English walnut Juglans regia **L.**	1-2
Black walnut Juglans nigra **L.**	1-2
Shagbark hickory Carya ovata [**Mill.**] **K.Koch**	1-2
Choke cherry Prunus virginiana **L.**	1-2
White ash Fraximus americana **L.**	2
White Elm Ulmus americana **L.**	2
Black willow Salix nigra **Marsh**	2
Mountain ash Sorbus **spp.**	2
Poplar Populus **spp.**	2
Silver maple Acer saccharinum **L.**	2
Chinese elm Ulmus pumila **L.**	2
Red maple Acer rubrum **L.**	2-3
Lombardy poplar Populus nigra italica **Muenchh.**	2-3
Basswood Tilia americana .	2-3
White birch Betula papyrifera **Marsh**	2-3
Gray birch Betula populifolia **Marsh**	2-3
Catalpa Catalpa speciosa **Warder.**	2-3
Pear Pyrus **spp.**	2-3
Quince Cydonia oblonga **Mill.**	2-3
Trembling aspen Populus tremuloides **Michx.**	3
Largetooth aspen Populus grandidentata **Michx.**	3
Crabapple Malus **spp.**	3
Golden willow Salix alba tristis **Gaud.**	3-4
Bur oak Quercus macrocarpa **Michx.**	3-4
Apple Malus **spp.**	3-4
Hawthorn Crategus **spp.**	4
Manitoba maple Acer negundo **L.**	4-5
Allehgeny service berry Amelanchier laevis **Wieg.**	4-5
White mulberry Morus alba **L.**	4-5
Beech Fagus grandifolia **Ehrh.**	5
Siberian pea-tree Caragana arborescens **Lam.**	1
Staghorn sumac Rhus typhina **L.**	1-2
Japanese lilac Syringa amurensis japonica (**Maxim.**] **Fr. & Sav.**	1-2
Common lilac Syringa vulgaris **L.**	1-2
Honeysuckle Lonicera **spp.**	1-2
European cranberry-bush Viburnum opulus **L.**	1-3
Russian olive Elaeagnus **spp.**	1-3
Mock orange Philadephuls **spp.**	1-3
Japanese barberry Berberis thunbergii atropurpurea **Chenault**	2
Burning bush Euonymus alata [**Thunb.**] **Sieb.**	2
Forsythia Forsythia x intermedia **Zab.**	2-3
Privet Ligustrum **spp.**	2-3
Alder buckthorn Rhamnus frangula L.	2-3
Speckled alder Alnus rugosa [**Du Roi**] **Spreng.**	3
Flowering quince Chaenomeles lagenaria [**Loisel.**] **Koidz.**	3-4
Bumalda spirea Spirea x bumalda **Burv.**	3-4
Beauty bush Kolkwitzia amabilis **Greabn.**	3-4
Gray dogwood Cornus racemosa **Lam.**	3-4
Red osier dogwood Cornus stolonifera **Michx.**	4-5

CONIFERS	INJURY RATING *
Blue spruce Picea pungens **Englem.**	1
Jack pine Pinus divaricata [**Ait.**] **Dumont**	1-2
Mugo pine Pinus mugo **Turra**	1-2
Austrian pine Pinus nigra **Arnold**	2
Tamarack Larix laricina [**Du Roi**] **K. Koch**	2
Juniper Juniperus **spp.**	2-3
Norway spruce Picea abies [**L.**] **Karst.**	3
White cedar Thuja occidentalis **L.**	3-4

Yew Taxus **spp.**	4
Red pine Pinus resinosa **Ait.**	4-5
Scots pine Pinus sylvestris **L.**	4-5
White spruce Picea glauca (**Moench**] **Voss**	4-5
Hemlock Tsuga canadensis **L.**	4-5
White pine Pinus strobus **L.**	5

☆A rating of 1 indicates no twig dieback or needle browning of conifers and no dieback, tufting, or inhibition of flowering of decidious trees and shrubs. Ratings of 5 represent complete branch dieback and needle browning of conifers and complete dieback, evidence of previous tufting and lack of flowering of decidious trees and shrubs. Under severe conditions plants rated 5 will eventually die. Ratings of 2,3, and 4 encompass slight moderate and extensive gradations of the above injury symptoms.

Highway de-icing salt is an important contributor to the decline of roadside plants. This was the conclusion reached by myself and other workers at the University of Guelph who have studied the effects of de-icing salt along Ontario roadsides and in the laboratory. Drs. G. Hofstra and R. Hall of the Department of Environment Biology and myself have published the results of several studies. One of these was financially supported by the Ministry of Transportation and Communications.

Finding the cause

Our work began in the early 1970's in an attempt to determine the cause of injury to evergreen and decidious plants along highways. Many people had observed injury in the late winter and early spring which we did not think was characteristic of winter injury.

Careful observation

A distinct pattern of damage became evident. Injury was most severe on the side of the tree facing the road. Plants on the downwind side of the road were damaged to a greater extent than similar plants on the opposite side of the road. An intensive study of a pine plantation adjacent to a major highway showed that tree damage decreased as distance from the highway increased. Pine branches which were covered by snow for much of the winter were green

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while higher branches on the same tree were brown. The type of highway had an effect too. As traffic volume and speed increased, so did plant damage. Unlike typical winterkill, injury became obvious on evergreens in late February and March.

Injured by salt

In some of our earlier work we found that the needles of white cedar and white pine trees growing near the road had high levels of sodium and chloride and were more severely injured than those of trees growing well back from the road. In fact there was a direct relationship between injury and salt content. As the salt content of the foliage increased so did the injury. These findings lead us to the conclusion that de-icing salt whipped up by traffic was carred by the wind and deposited on the trees. In a later study we found that trees and shrubs which were severly damaged along the road generally had a higher content of salt in their twigs and needles. An exception was beech (fagus grandifloia) which was severly injured but had low levels of salt in its twigs.

As a result of numerous roadside evaluations we prepared a list rating plants for their susceptibility to injury. This is presented in Table 1 and was first published in an Ontario Ministry of Agriculture and Food Factsheet No. 71-114.

Apple trees sprayed

We found that by spraying apple trees with de-icing salt we could induce injury similar to that observed on trees along the highway. Here again the higher the salt content the greater the injury. Another interesting find was that as we applied more salt sprays to the apple twigs, the number of flowers opening in the spring was less. We were able to determine that injury occured when apple twigs contained more than one half percent chloride.

Weather influences

Recently we found that for the twigs and needles of most of the 12 species studied there was a gradual increase in salt content during January and early February, a more rapid increase reaching a peak in March and early April followed by a decline. This pattern of salt accumulation and loss is due to the frequency of salt application to the highway and also the weather conditions. Warm spells seem to increase salt uptake while rainfall helps to wash the salt out.

Symptoms

Here are some things to look for:

1. Needle browning of conifers beginning at the tip.
2. Dieback and tufting of decidious plants.
3. Injury more severe on the side facing the road.
4. More damage on the downwind side of the road.
5. Injury decreases further back from the road.
6. Less injury below the snow line.
7. Flower buds not opening on the side facing the road.

Protection

Trees which have resinous or sunken buds appear to be more tolerant of salt spray. Wax or bloom on conifer needles seems to add protection. For example, the bluer the spruce the less injury it has.

A word of caution

Let me hasten to point out that all injury evident or presumed on trees and shrubs growing near the roadside is not due to salt. Only after thoroughly evaluating the injury symptoms and considering all the environmental conditions at a particular site can de-icing salt be singled out as the most probable cause of plant damage. Roadside plants are affected by many factors associated with highway construction practices, road use, roadside soil quality and most importantly, excessive exposure to air and soil pollutants. De-icing salt is only one of these factors.