SALT DAMAGE TO ROADSIDE PLANTS[1]

by G.P. Lumis, G. Hofstra, and R. Hall

During the past two winters and springs many trees and shrubs growing along major highways in Ontario appeared to have more injury than could be reasonably attributed to winterkill. By observing the injured plants closely, 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 plantation of pines adjacent to Highway 401 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 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 did not become obvious on evergreens until late February or early March. Apparently warmer temperatures induced injury symptoms.

Injury symptoms on evergreens appear as browning of the needles. The browning begins at the tip of the needle and works its way to the base. As injury continues, the branches become bare and the plant has a distinctly one-sided appearance. This dieback usually occurs over several years. Damage is not evident on deciduous trees and shrubs until the buds begin to open in the spring. Affected branches have new growth at the base only; the buds further out on the branch fail to open. Injured plants thus have a tufted appearance since all the new shoots come from the base of the branch.

Spring-flowering trees and shrubs growing near the highway and affected by salt usually develop a characteristic growth habit. On the side of the plant away from the road the twigs are completely leafed-out and flowers are blooming. In the center, the shoots are leafed-out but there are no flowers. Often flower buds are present but they do not open. Twigs on the side facing the road are leafed-out only at the base. Much of the previous season's growth is dead.

All of the above observations suggest that salt spray whipped up by traffic is being blown onto plants adjacent to roadways and causing injury. Many reports have considered the primary damage to be caused by runoff of salty water and salt absorption into the plant via the roots. However, several studies have been published to indicate that aerial salt spray is the cause. These studies include one by Hoftstra and Hall in the April 1971 issue of the Canadian Journal of Botany. Studies by the authors have shown that injury symptoms as described here can be induced by spraying pines with a solution of highway salt (NaC1). In addition, pine needles from the windward side of the tree have higher levels of NaC1 than those on the sheltered side.

All injury which is 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 highway salt be singled out as the most probable cause of damage. Salt is only one of numerous environmental and plant factors which cause injury or death of roadside vegetation.

Trees and shrubs which have been injured by salt spray produce very characterisitc symptoms.

Symptoms specific to evergreens:

1. needle browning moderate to extreme, beginning at the tip;
2. needle browning and twig dieback on the side facing the road but none or very little on the back side;
3. no needle browning or dieback on branches near the ground under continuous snow cover;
4. needle browning and twig dieback less severe further from the road;

[1]Reprinted from Ontario Ministry of Agriculture and Food, Factsheet, 279/690.

5. browning usually first evident in late February or early March and becoming more extensive through spring and summer.

Symptoms specific to deciduous plants:

1. leaf buds on the terminal part of branches facing the road very slow to open or do not open:
2. new growth arises from the basal section of branches facing the road, resulting in a tufted appearance;
3. flower buds on the side facing the road do not open but flowering normal on back side.

General injury patterns:

1. injury more severe on side facing the road, plants one-sided due to branch dieback;
2. damage more pronounced on downwind side of highway;
3. plants further from road injured less;
4. branches covered by snow not injured;
5. injury to evergreens apparent in late winter, injury to deciduous plants not evident until spring;
6. branches above the spray-drift zone not injured or injured less;
7. damage increased with the volume and speed of traffic and the amount of salt applied to highway;
8. plants damaged over several years lack vigor and soon begin to die;
9. less winter-hardy plants injured more severely;
10. salt spray penetrates only a short distance into dense plants;
11. plants in sheltered locations lack injury symptoms.

From the work preceding this report, it is evident that most of the salt injury to plants is from aerial spray. In most cases runoff of salty water could not account for the injury symptoms which were observed with such consistency from one location to another. The basis for plant resistance to salt spray is not known; however, several factors seem to be intimately involved. Increased amounts of wax or bloom on spruce needles seem to add protection. For example, the bluer the spruce the more resistant it is to salt spray. Deciduous trees and shrubs with resinous buds or with buds submerged in the twig are resistant. Plants with naked buds (lacking scales) are susceptible to salt spray.

Trees and shrubs to be planted along Ontario roadways where salt spray could be a potential problem should be selected from those given a rating of 1 or 2 in Table 1. Resistant evergreens or dense deciduous shrubs could be used as screens to trap salt spray and thereby protect more sensitive plants.

Department of Horticultural Science and
Department of Environmental Biology
University of Guelph
Guelph, Ontario, Canada

TABLE 1. Species list of roadside trees and shrubs rated for their resistance to air-borne highway salt spray

DECIDUOUS 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
Sugar maple *Acer saccharum* 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 *Fraxinus 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* L.	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
Bur oak *Quercus macrocarpa* Michx.	3-4
Apple *Malus* spp.	3-4
Hawthorn *Crataegus* spp.	4
Manitoba maple *Acer negundo* L.	4-5
Allegheny serviceberry *Amelanchier laevis* Wieg.	4-5

White mulberry *Morus alba* L.	4-5
Beech *'Fagus grandifolia* Ehrh.	5

DECIDUOUS SHRUBS	INJURY RATING*
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 angustifolia* L.	1-3
Mock orange *Philadelphus* 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 buckthron *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* Graebn.	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 mago* 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 deciduous 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 deciduous 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.

2,4,5-T HEARINGS[1]

by Harold M. Collins

On June 24, 1974, Mr. John Quarles, Deputy Administrator, United States Environmental Protection Agency, announced at a conference in Washington, D.C. that the EPA, which handles pesticide programs, recommends termination of its proceedings concerning 2,4,5-T. A notice in the June 28, 1974 Federal Register confirmed this action. After reading a transcript of the conference proceedings I conclude that unless future research produces substantiated scientific evidence that 2,4,5-T-containing products are an imminent hazard to the public, we can assume that the legal Federal controversy over the compound is ended.

Following Mr. Quarles' announcement at the hearing, Dr. William Upholt, senior science advisor to the assistant administrator for Water and Hazardous Materials, elaborated on the facts leading to the above decision. My interpretation of this discussion is as follows: There is insufficient evidence demonstrating the presence of residues of 2,4,5-T and dioxin (TCDD) in the environment to warrant cancellation of presently registered uses of the 2,4,5-T-containing pesticides. As a result, industry may continue to sell 2,4,5-T for all uses listed on the current product label. Use areas include rice, rangeland and rights-of-way such as highways, power and communication transmission lines, pipelines and railroads.

Considering that 2,4,5-T has been used since the late 1940's and that there is presently no detectable toxic residue in our environment, continued future use is justified. While birth defects have been induced in rats and mice that were chronically exposed to 2,4,5-T, Dr. Upholt

1. Paper presented at the 50th International Shade Tree Conference in Atlanta, Georgia, August 18-22, 1974.