WINTER DEICING SALTS AND THEIR EFFECTS ON TURF

Paul E. Rieke
Department of Crop and Soil Sciences
Michigan State University

The use of salts to cause melting of ice (deicing) in winter on roads and sidewalks is widely practiced in Michigan and other northern states. This is the cheapest and most effective means of ice and snow removal on large scale areas. Calcium chloride ($CaCl_2$) and sodium chloride (NaCl) are the two most widely used deicing salts. Ammonium nitrate and urea have also been used as deicers to a limited extent on surfaces where the ice can melt and drain onto adjacent turfs. The cost of the fertilizer and the lack of uniform application of the nitrogen are arguments against such use, however.

Deicing salts act by lowering the freezing point of water. This causes the ice to melt at temperatures below freezing. Comparing calcium chloride and sodium chloride, calcium chloride is more soluble at 32°F, has a lower freezing point (because of a higher heat of solution), can more readily absorb moisture out of the air (deliquescent), is more effective at temperatures below 20°F, and reacts more quickly than sodium chloride (2, 4). But sodium chloride lasts longer and costs considerably less. Sodium chloride dries more readily, forming a white residue and blows as a dust into the surrounding environment. The result is greater potential for injury to plant materials above ground than with calcium chloride (2, 4).

The use of these salts as deicers leads to safer winter driving conditions, but salt damage to vehicles and highways as well as injury to plants in adjacent areas and potential for water pollution are strong offsetting factors.

Storage of salt supplies exposed to natural precipitation and drainage has also been a significant problem in localized areas. There have been numerous cases of runoff from such locations causing serious loss of plant materials and even water contamination. Careful selection of stockpile sites and covered storage can be used effectively in reducing this problem.

Injury. When soluble salt levels in the soil are marginal salt injury on turf plants results in a discoloration and thinning of the turf in an irregular pattern usually most apparent in the lowest areas where water will concentrate. High salts affect the osmotic pressure in the plant cells which causes the plant to act as if a moisture deficiency is present. High salt levels also cause shortening of the root system. The result is a turf (or other plant) that wilts even when there is sufficient moisture in the soil. Many plants will have a characteristic tip burn (death of the edges of the leaves). The plants usually stop growing as well. As the salt concentration increases (with further contamination or as the soil dries) the plant begins to die.

In many cases salt injury to plants is not recognized until it is too late. The salt reaches the plant leaves and soil around the root system when the plant isn't actively growing during the winter. When the time arrives for the plant to begin growth in the spring the plant may already have been injured beyond the point of survival. Often the plant will begin to leaf out followed by some tip burn and gradual death as temperatures warm up. Some plants will not actually die until summer during the period of maximum moisture stress.

Alternatives. What are the alternatives on a site where salt injury could be predicted or perhaps has already occurred? This depends on the plant and the site conditions.

1. A soil test can determine the presence of excess soluble salts and sodium in the soil.

2. Where the injury to plants occurs as a result of direct splash from salted roadways the plants could be protected by various types of screens. Proper planning in locations of salt tolerant and susceptible species should be practiced.

3. Since salts are soluble in water the area can be watered to leach the salts out of the soil. This requires a means of applying considerable excess water in late winter to early spring before any growth occurs. The soil must be well drained so the salts can actually be leached out of the rootzone. This practice is seldom practical because of the volume of water needed and restricted drainage conditions that are common in areas of disrupted soils. If the salt level in the soil is only moderate, natural rainfall may provide sufficient leaching.

Several years ago vandals applied sodium chloride to the turf at the M.S.U. Spartan Stadium in early October. The soil was a loamy sand with unrestricted drainage, ideal for leaching. Although the grass died in the areas receiving salt, by December the salts had been leached out of the rootzone by some irrigation and natural rainfall. Many soils, especially finer-textured soils, would not respond to such treatment so readily, however. By spraying some green paint on the injured area the condition was sufficiently masked that few fans were aware of the problem.

Soil sámples taken from a home lawn contaminated by runoff from a salt pile in southeastern Michigan during May, 1975, had soluble salt tests (based on 2 parts water to 1 part soil, volume basis) of 149 to 350 in June, 1975. The higher the test the more severe the injury observed. An area of reasonably good turf was contaminated but tested only 84. This is compared to a normal soluble salts test of 15 or less under typical outdoor conditions. Some salt injury could occur at levels somewhat below 150 in certain situations. When soluble salts test above 150 under outdoor conditions injury to salt sensitive plants would be predicted. In this soil, the sodium tests ranged from 160 to 500 ppm which is very high.

In April, 1976 these soils were tested again and were all below 150 except for a subsoil sample in a heavily contaminated area which still tested 200. This indicated the salt was being leached to some degree from the surface of this soil although the soil was a silty clay loam with a very tight clay subsoil. In spite of this leaching some further injury to the turf and trees in the landscape continued through 1975.

4. Good planning for drainage and contouring of a site can prevent runoff of salt contaminated water thus protecting susceptible plants.

5. Planting of salt tolerant species in areas of potential salt problems is suggested. There are wide ranges in salt tolerances among the ornamentals. Younger plants are normally more susceptible than older plants. Those plants which are native to dry climates tend to be more salt tolerant.

Among the grasses there are also wide ranges in salt tolerance. For low intensity use areas such as highways, which are exposed to high salt contamination, the grasses suggested are 1) alkaligrass (Puccinellia distans or Puccinellia lemonii) and possibly saltgrass (Distichlis stricta). It may be difficult to obtain seed for these grasses, however. Although it has not been compared for salt tolerance to the above grasses quackgrass showed good salt tolerance on the home lawn cited above. It was the only plant material surviving in some areas of the lawn although some injury on the leaf tips was apparent. If quackgrass can be established in such areas this would provide a useful "native" grass for use in such areas in Michigan.

Among the more salt tolerant turfgrasses are bermudagrass and St. Augustinegrass, both of which are warm season grasses and are not adapted to Michigan, and creeping (1, 3). Medium salt tolerance is exhibited by tall fescue and perennial ryegrass.

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