The Effects of De-icing Chemicals on Turfgrass - 1996 Trial

David D. Minner and Barbara R. Bingaman

Runoff from de-icing products applied to walkways and other hard surfaces results in damaged and dead turfgrass borders. The purpose of this study was to assess the level of damage caused by several common de-icer products. Our approach was to simulate a brine runoff by spraying salt solution directly on turf plots throughout the winter and evaluating injury during the growing season. In addition, we applied the de-icers in granular form to turf plots.

The first year of this study was conducted in the winter and early spring of 1996 at the Iowa State University Horticulture Research Station north of Ames, Iowa. The experimental plots were in an area of established common Kentucky bluegrass.

Brine solution de-icer study:

Individual experimental plots were 2 x 4 ft with three replications. Because of possible de-icer runoff, each individual plot was completely surrounded by a 1-foot border. Treatments containing potassium chloride, 30% urea + 70% $CaCl_2$, 50% urea + 50% $CaCl_2$, 67% urea + 33% $CaCl_2$, urea, rock salt, Safe Step (50% salt + 50% potassium chloride), magnesium chloride, and $CaCl_2$ pellets were evaluated. A control was treated with only water for comparison. Application rates of 2, 4, and 8 oz/yd^2 were used to simulate typical amounts of product used in the ice melt industry (Table 1). Treatments were randomly placed within each replication.

The de-icers were dissolved in water and applied using a carbon dioxide backpack sprayer. TeeJet flat fan EVS #8008, white nozzles were used at 45 psi. Windbreak ‘cages’ were employed to prevent drift of the materials. No runoff or drift was observed after treatment differences became apparent. Nine applications were made beginning February 22 and ending March 19, 1996. A deer ‘cannon’ was placed to minimize browsing damage.

Turfgrass ‘plugs’ were taken from each plot in replication 2 after the fifth application of materials. Two plugs were taken for each treatment. The plugs were placed into pots and maintained on a mist bench in the greenhouse until the grass began to green-up. This non-replicated evaluation was used for preliminary injury data half-way through the treatment period.

Granular de-icer study:

Individual experimental plots were 2 x 2 ft with three replications. Because of possible de-icer runoff, each individual plot was completely surrounded by a 1-foot border. Treatments containing potassium chloride, 30% urea + 70% $CaCl_2$, urea, rock salt, Safe Step (50% salt + 50% potassium chloride), magnesium chloride, and $CaCl_2$ pellets were evaluated. An untreated control was included for comparisons. Application rates of 1, 6, and 12 oz/yd^2 were used to simulate typical amounts of product used in the ice melt industry (Table 2). Compared to the brine solution study, the granular study covered a broader range of application rates. Treatments were randomly placed within each replication.

The amount of de-icer products equivalent to 10 individual applications was applied (Table 2). The materials were spread evenly over the plots. The products were applied on March 15, 1996. A deer ‘cannon’ was placed to minimize browsing damage.

Phytotoxicity and percent living plant material data were taken for the both the brine and granular studies on April 10 and May 9 (Tables 1 and 2). Phytotoxicity was assessed using a 10 to 1 scale: with 10 = no injury and 1 = foliage completely brown. Percent living material was estimated as the percentage of green plant material per plot. Some of the plots, especially those treated with rock salt, were damaged by deer browsing. In these plots, the remaining plant material was considered to represent the entire plot in the data collection.

On April 15, Kentucky bluegrass percent recovery data were taken on the plugs from the brine study that were maintained in the greenhouse. Recovery was assessed using a 10 to 1 scale: 10 = best recovery and 1 = no living plants (Table 1).

Percent turf cover, percent weed cover, percent bare soil, turf quality, and turf color data were taken July 1 and August 28 for the brine (Tables 3 and 4) and the granular studies (Tables 5 and 6). Percent turf cover was assessed as the percentage of area per plot covered by turfgrass species and percent weed cover as the percentage of area per plot covered by weed species (broadleaf and grass species). Any areas devoid of turf or weeds were recorded as the percentage of bare soil per plot. Turf quality was measured using a 10 to 1 scale: 10 = best quality, 2 = weeds only, and 1 = no green material. Turf color was determined using a 9 to 0 scale: 9 = best, 1 = worst color, and 0 = no turf present.

In the summer of 1996, the brine and de-icer experimental plots were sprayed with Roundup. The dead plant material was removed and the plots were seeded with perennial ryegrass at 2 lb/1000 ft^2 using a drop spreader. Ryegrass seedling vigor and percentage ryegrass cover data were taken October 10 for the brine and granular studies (Tables 7 and 8). Ryegrass seedling vigor was assessed using a 10 to 1 scale: 10 = best and 1 = worst vigor. Percent ryegrass cover was determined as the percentage of area per plot covered by ryegrass.

Results:

Two separate experiments, brine spray and granular, were conducted to produce seven de-icer application rates: 0, 1, 2, 4, 6, 8, and 12 oz/yd^2. Repeated applications from the brine spray study combined with the single application from the granular study resulted in total winter application rates of 0, 10, 18, 36, 60, 72, and 120 oz/yd^2.

De-icer treatments applied during the winter caused a bleaching and light tan appearance to the dormant turf. This appearance remained visible for some treatments during spring green-up and was rated as phytotoxicity. The average of phytotoxicity on April 10 and May 9 indicated that all treatments had significantly more turf injury than the untreated control (Table 1). Urea-$CaCl_2$ 30/70 at 18 oz/yd^2 had significantly less phytotoxicity than all other treatments except KCl.

Percent turf cover and weed cover (Table 3) and turf quality and color (Table 4) were evaluated to determine recovery following de-icer affects. The average percent turf cover for July and August indicated that at the 18 oz/yd^2 rate urea-$CaCl_2$ 67/33, urea, and $MgCl_2$ had significantly less turf cover than the untreated control.

De-icer treatments that resulted in poor turf cover also had higher weed cover. Treatments with high rates of urea (trts 7, 9, 10, 15, and 16) substantially reduced both turf and weed cover and resulted in plots with mostly bare soil showing (Table 3).

Average turf quality and color for July and August, 1996 are presented in Table 4. At 18 oz/yd^2 all urea + $CaCl_2$ combinations, KCl, rock salt, Safe Step, and $CaCl_2$ were statistically similar to the untreated control. Urea and $MgCl_2$ had inferior turf quality.

At 36 oz/yd^2 all de-icer treatments had significantly poorer turf quality than the untreated control, however, urea + $CaCl_2$, 30/70, KCl, and Safe Step were superior to urea + $CaCl_2$ 50/50 or 67/33, urea, rock salt, and $MgCl_2$.

At 72 oz/yd^2 all de-icer treatments were similar and had very poor turf quality.

The elements in some de-icer compounds are also essential elements for plant growth. Turf color was evaluated to determine if any beneficial color enhancement occurred, especially from urea treatments containing nitrogen. Urea combinations with $CaCl_2$ enhanced turf color. Urea + $CaCl_2$ 50/50 provided the best color enhancement and was superior to the untreated control (Table 4).

In the fall of 1996, the entire study area was reseeded with perennial ryegrass to determine if winter de-icer products inhibit fall re-establishment. Turf re-established from the slicer seeding for most treatments. Treatments 7, 9, 10, 14, 15, 16, and 19 had significantly less turf cover after fall seeding than the other treatments. Treatments with poor re-establishment confirmed high rates of urea or rock salt.

Brine de-icing treatments were repeated in the winter of 1997 on the ISU campus. The preliminary results from 1996 indicate that there are significant turf quality and phytotoxicity differences among de-icer compounds and rates.

Data were analyzed using the Statistical Analysis System (SAS) version 6.08 and the Analysis of Variance (ANOVA) procedure. Fisher's least significant difference (LSD) tests were used to test for treatment effects on turfgrass factors.