Project: Changes in soil chemical factors following rainfall and calcium chloride applications.

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Summary:

A study was designed to evaluate the impact of moderate rainfall and the effectiveness of calcium chloride as a sodium management tool, particularly in those cases where the use of gypsum is avoided due to high soil sulfur levels. We found that winter applications of calcium chloride (a total of 325 lb/A), in combination with rainfall of 2.5 inches, led to a 30% reduction in sodium, a 43% reduction in chloride, a 34% reduction in soil sulfur, and a significant drop in pH, from 8.2 to 7.9. However, overall soil salinity was not significantly reduced.

These results suggest that calcium chloride, when applied during rainfall periods, can have a positive effect on soil quality, especially in high sodium soils (greater than 110 ppm and 6% of the total extractable cations) that also have excessive sulfur (greater than 800 ppm for ryegrass overseeded bermuda fairways). The potential problem of accumulation of chloride in the soil was not an issue under these conditions. The fact that overall soil salinity was not significantly reduced indicates that either more rain and/or additional applications of calcium chloride will be required before overall salts are reduced.

A further discussion on the use of calcium chloride as a sodium management tool can be found on the PACE Turf member website at: http://www.paceturf.org/member/Documents/05_soil.pdf.

Materials and methods:

Soils from four ryegrass-overseeded fairways were sampled at the 150 yard mark on 12/15/2008 (before rainfall) and on 1/26/2009 (following 2.5 inches of rainfall). Samples were collected using a 1.25-inch diameter soil auger to a depth of approximately 4 inches. Eight auger samples were collected for each fairway and combined into one composite sample to represent each fairway. Soils were analyzed by Brookside Laboratories, New Knoxville, OH using standard analytical methods.

Calcium chloride was applied two times during the period of investigation. Applications were made on 12/13/2008 (150 lb/acre), and 1/21/2009 (175 lb/acre). A total of 325 lbs of calcium chloride was applied. At approximately 35% calcium, about 114 lbs of calcium was applied resulting in a theoretical increase of about 57 ppm calcium. About 211 lbs of chloride were applied and if the chloride did not leach following rainfall, we would expect an increase of about 106 ppm chloride.

Results:

Following a modest series of rainstorms that totaled 2.5 inches precipitation, soil salinity was unchanged at 4.8 dS/m (The target maximum salinity for ryegrass is 6 dS/m), when before and after rainfall samples were compared. However, there were significant shifts in the composition of several key soil chemical factors (Table 1).

Soil sodium fell 30%, from 1095 ppm to 766 ppm. Prior to rainfall, the soil was classified as sodic with 17% sodium. Following rainfall and calcium chloride applications, soil sodium was reduced to 13% sodium, and was no longer classified as sodic (>15% sodium). However, the target soil sodium percentage is less than 6% for ryegrass fairways. The target soil sodium for ryegrass-overseeded fairways to help suppress infection caused by rapid blight (*Labyrinthula terrestris*) is 110 ppm. Thus, additional rainfall and calcium amendment is needed to improve soil conditions.

Calcium chloride application delivered sufficient calcium to theoretically increase soil levels by 57 ppm or about 2.9 meq. However, soil calcium levels were not significantly different at the end of the trial, probably for three reasons. First, the rates of calcium chloride applied were relatively low; in most cases, much higher amounts (a total of 1200 lb/A, made in 6 monthly applications of 200 lb/A each; this would deliver 420 ppm or 11 meq of calcium) would be recommended before a significant increase in soil calcium levels would be seen. Second, the rainfall of 2.5 inches undoubtedly caused some calcium to be removed from the system. Third, The salt content of the soil at 4.8 dS/m is considered saline and with more rainfall, significant levels of many of the cations and anions would be reduced. However, The favorable shift in cation composition is beneficial even though soil salts were not significantly lower following rainfall.

Table 1. Changes in soil salinity following rainfall and calcium chloride applications.

Values highlighted in green are significantly lower after amendment and rainfall while values highlighted in yellow are significantly higher after amendment and rainfall ($P<0.05$). Values represent the average of four fairways sampled before and after amendment and rainfall. Initial before rainfall samples were collected on 12/15/2008. After rainfall samples were collected on 1/26/2009. Calcium chloride was applied on 12/13/2008 (150 lb/A) and 1/21/2009 (175 lb/A). A total of 2.5 inches of rain fell during the course of the trial.

Parameter	Before Rainfall	After Rainfall	P[1]
pH	8.2	7.9	0.010
Organic Matter (OM%)	2.7	2.8	0.928
Sulfate (SO4-S ppm)	966	634	0.032
Phosphorous (P Bray ppm)	277	318	0.005
Calcium (Ca ppm)	3516	3260	0.168
Magnesium (Mg ppm)	569	522	0.045
Potassium (K ppm)	278	245	0.133
Sodium (Na ppm)	1095	766	0.000
Calcium percentage	61	64	0.087
Magnesium percentage	16	17	0.214
Potassium percentage	2.5	2.5	0.919
Sodium percentage	17	13	0.014
Electrical Conductivity (EC dS/m)	4.8	4.8	0.808
Chloride (Cl ppm)	555	319	0.001
Boron (B ppm)	3.0	2.5	0.000
Iron (Fe ppm)	240	219	0.072
Manganese (Mn ppm)	70	57	0.010
Copper (Cu ppm)	1.8	1.6	0.007
Zinc (Zn ppm)	4.2	4.4	0.788
Ammonium nitrogen (NH4 ppm)	2.9	5.6	0.016
Nitrate nitrogen (NO3 ppm)	33	29	0.607
Total nitrogen (TOTN ppm)	36	35	0.900

[1]P = Fisher's Protected LSD probability that the values are the same