A New Sodicity Index for Improving Risk Assessment and Management of Saline and Sodic Soils

Doug Soldat, Ph.D.

Will Bleam, Ph.D.

University of Wisconsin-Madison

- A new SAR equation is being tested and compared to three existing SAR equations
- The new equation appears to be much more robust (stable) as water evapo-concentrates than the existing equations
- Soil type is having a larger than expected impact on composition of soil solution following eight months of incubation

There is no bigger challenge facing the golf industry than water use. We believe that one day, use of potable water for golf course (and landscape) irrigation will be considered indefensible, even in water-rich parts of the world. This means that alternative sources of potentially poor water quality will become the norm. Alternative sources of irrigation include primary, secondary or tertiary effluent and harvested water from surface runoff. These sources have considerable spatial and temporal variation in their chemical composition. A plethora of management guides can be found for using poor-quality water for turfgrass irrigation; however, very little research has been conducted as to how the specific water quality parameters affect golf course soils. We recently discovered flaws in the SAR and SARadj equations which lead to inaccurate assessments of sodic hazard and faulty recommendations. For this project, we will test a new equation that corrects the flaws of the previous equations using an experimental approach in the laboratory that allows us to observe exactly what happens to saturated hydraulic conductivity as sodium and salinity levels change during evapo-concentration. The results of this research are expected to demonstrate a more accurate way of estimating sodic hazard and will improve our understanding of and ability to assess poor irrigation water quality in golf course soils.

In 2016, we identified golf courses that had soil types that would be ideal for testing. We sampled soils and waters and tested the waters for ion composition and calculated SAR using three established methods and a new method which we feel addresses serious flaws in the established methods (Table 1). We the concentrated the waters to 4 dS/m via evaporation and re-tested them for ion composition and SAR (Table 2). The evaporation simulates the concentration that happens in a drying soil. Finally, we have been incubating the waters and soils for eight months and the extracting the soil water and analyzing the ionic composition of the solution for calculation of SAR (Table 3).

The results suggest that the new equation is more stable than the established equations as the water concentrates, suggesting it is better able to accurately predict the precipitation of ions from solution. However, we are surprised at the large differences in SAR found when the waters are incubated in soils for eight weeks. This suggests that soil type has a large and controlling impact on sodium hazard and soil factors must be considered when attempting to estimate the impact of poor quality irrigation water. We plan to continue investigating the dynamics and interactions of the waters and soils in 2017.

Table 1. Comparison of the SAR of several irrigation waters based on three established calculation methods and a new method of calculation

Water	Original SAR	Bower Equation	Suarez Equation	Soldat/Bleam Equation
Olive Grove	4.31	6.60	11.49	8.57
Gila	8.82	18.97	28.24	14.42
Pecos	4.06	6.67	18.26	9.43
Grand	10.71	18.11	40.20	38.43
Sevier	5.82	12.94	16.14	10.78
Lee Park	6.38	8.56	24.33	18.90
Britton	1.95	3.12	7.76	5.87

Table 2. Comparison of the SAR of the same irrigation waters in Table 1, but concentrated to 4 dS/m.

Water	Original SAR	Bower Equation	Suarez Equation	Soldat/Bleam Equation
Olive Grove	7.92	12.93	19.91	8.90
Gila	12.06	13.31	32.65	14.61
Pecos	4.55	6.59	20.46	9.16
Grand	60.10	63.54	168.71	75.46
Sevier	11.89	23.63	26.85	12.01
Lee Park	13.51	17.14	45.06	20.06
Britton	3.51	5.81	13.75	6.15

Table 3. SAR (Soldat/Bleam Equation) of soil solution after eight weeks of incubation using three soil types and two irrigation waters. The waters were evapo-concentrated to 4 dS/m prior to incubation.

Irrigation Water	Troxel Soil (WI)	Barnes Soil (SD)	Cecil Soil (VA)
Britton	3.07	6.83	4.37
Grand	12.18	9.40	21.12