Water Test Results As A Second Language

by Dave Burkhart

I am sure most golf courses on the Eastern Shore have plenty of fresh clean irrigation water to use this summer. No salts. No sodium. No pfisteria. I suspect, however, there are a few golf courses that may have some water quality problems and Hog Neck happens to be one of them. I found out that trying to understand what was important on a water analysis report wasn't always clear. At least not until I took the GCSAA Irrigation Water Quality seminar taught by Dr. Clark Throssell from Purdue University and Dr. David Kopoec from the University of Arizona. The following is an attempt to summarize that seminar and hopefully make your water testing a little less testy.

The main components of water quality are salt concentration, sodium hazard, bicarbonate content, toxic ion concentration, and pH. The last two, toxic ions and pH, rarely cause problems. Chlorine and boron are usually cited as the problem ions but turfgrasses are quite tolerant to them. A pH range of 6.5 to 8.4 is recommended for turf but not much is known on its effects on turf growth. However, a higher pH can signal other problems such as elevated sodium and bicarbonate levels.

Salt concentration and sodium levels seem to cause the most problems in our area. The potential of water to move from an area of low salt concentration to high salt concentration can starve a plant of water. This occurs when the salt content in the soil solution is higher than in the root of the plant and the water will not move into the root system. Sodium affects the soil structure by taking over sites occupied by calcium and magnesium on individual particles. The soil will deflocculate, losing large pore space and begin to tighten up. This can also occur when bicarbonate levels are extremely high in irrigation water. The bicarbs combine with calcium and magnesium to form carbonates. When they leave their sites on the soil particle, the sodium takes their place and comprises the soil structure.

Salt concentration, sodium levels, and bicarbonate levels are the blood and guts of your water analysis. The units these three are measured in may differ depending on your lab. Salt concentration is measured by electrical conductivity (EC) and/or total dissolved solids (TDS). The units for conductivity are decisiemens per meter (dSm-1) or millimhos (mmhos cm-1). These units are equal meaning 1 dSm-1 is equal to 1 mmhos cm-1. The same is true for TDS in which the units, part per million (ppm) or milligrams per liter (mg1-1), are equal. If you wish to convert from TDS to EC or back the conversion factors for salt concentration is as follows: TDS x .0016 = EC or EC x 640 = TDS.

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The sodium hazard is determined by the sodium absorption ratio (SAR). This represents the proportion of sodium to calcium and magnesium. When the SAR increases so does the sodium hazard and the soil begins to tighten. The third factor in evaluating your water analysis is residual sodium carbonate (RSC). This figure you will have to determine on your own using values provided in your test results. The RSC compares the amount of carbonates and bicarbonates in your water to the amount of calcium and magnesium in the water. When the carbs and bicarbs are higher, they will pull Ca++ and Mg++ from the soil creating space for Na+ to attach itself. The formula for RSC is (carbonates + bicarbonates) - (Ca++ + Mg++) = RSC. All values are measured in milliequivalents per liter (meq l-1). For example, one of my test results read calcium 0.81, magnesium 0.73, carbonates 0, bicarbonates 2.64. The result is 2.64 - (8.1 +.73) = 1.1 meg 1-1.

So what does all this mean? By taking the three values for salt concentration, SAR and RSC we can determine the suitability of a water source for irrigation. The charts below can be used as guidelines to interpret your water analysis.

Electrical Conductivity as mmhos cm-1

0 - 0.25	low hazard
0.25 - 0.75	medium hazard
0.75 - 2.25	high hazard
> 2.25	very high hazard

Sodium Hazard as SAR

0 -10	low
10 - 18	medium
18-26	high
> 26	very high

Residual Sodium Carbonate as meq 1-1

0 - 1.25	low
1.25 - 2.5	medium
> 2.5	high

Other factors that may affect your water quality include suspended solids (silt and clay) which can impede infiltration and pesticide contamination which is rare and quite expensive to test for. Salt, sodium, and carbs/bicarbs are the backbones of your water testing. With these factors understood, it is easier to understand what you are dealing with and how to address any problems with your water supply.

Management practices for salt affected water include using salt tolerant grasses, improving drainage, leaching excess salts, and blending a poor quality water with a better quality water. Dealing with sodium also includes water blending as well as the use of soil amendments like sulfur and calcium compounds to remove sodium for the soil particle and allow Ca++ and Mg++ to take its place. Strategies for water with a high RSC value are the same as high sodium water but also includes acid injection to the irrigation system.

Hopefully, this will shed a little light on the complexities of a water analysis report. I would strongly recommend taking the Water Quality Seminar. In retrospect, I think it would be extremely beneficial to take one of your own lab reports to the seminar. Numbers seem to mean more when they are your own.

Sanctuary

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The water testing can be done in house, or through an outside company. The testing offers the golf industry an opportunity to amass data from many clubs that can be used to demonstrate the public and local legislative bodies that golf courses don't contaminate ground or surface waters.

The last category, Outreach and Education, focuses on disseminating information to members and the general public on the golf industry's responsible reaction to environmental concerns. At Bethesda we have put together bulletin board displays, issued an informational brochure and sponsored Travilah Elementary School in Audubon International's Cooperative Sanctuary Program for schools. We would like to eventually have guided tours or nature walks for members and school children, and we are hoping for some positive publicity in the local press. Publicizing this type of program would reflect well on golf in general.

Helping Bethesda Country Club receive certification as an Audubon Cooperative Sanctuary has been very satisfying, but the real reward comes when I ride around the course. I feel good knowing we are working hard to avoid contaminating our water supplies, and I am happy we are supplying a good home for wildlife, but I am also pleased with how much better the course looks. The wildflowers are beautiful, and to watch a dozen Goldfinches suddenly fly up from feeding and quickly scatter always makes me smile. They weren't even here several years ago.

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