

Red Rock Country Club is a good case study of how a variety of methods to manage bicarbonates were combined with great success. The three courses at Red Rock are now irrigated with buffered water and treated biweekly with a direct application of synthetic acid. The courses have reversed their negative trend and are now responding to the management decisions as a typical course would in the Midwest.



By David McPherson

Battling bicarbonates

Superintendents have a number of weapons at their disposal to keep calcium viable in the soil.

Bicarbonate levels are often overlooked in irrigation water analysis. You don't need a Ph.D. in pH levels to manage bicarbonates, but understanding a little about water chemistry helps. The most important thing when dealing with water issues is that the soil takes on the characteristics of the water. So, analyze your water first, then look at your soil.

Bicarbonates are toxic to the roots and reduce the shoot growth of the turf. High bicarbonates can also affect the effectiveness of fungicides and particularly insecticides you spray because the half-life of the product is often reduced by high pH levels. Bicarbonates also reduce the uptake of phosphorous and many other micronutrients



RED ROCK COUNTRY CLUB

that grasses need. Bicarbonates react with calcium to form calcium carbonate. Every time bicarbonate hits calcium and magnesium it keeps it in a carbonate form. In a carbonate form, it's hard for calcium to work into the soil.

"Calcium is an important building block in the plant just like it is in our body," explains George Frye, president of TransGolf Inc. "When we break a bone in our body, it's slow to repair. If a plant doesn't have the right amount of calcium, every time we mow or damage that plant, it has trouble replenishing that calcium."

Frye was the superintendent at Kiawah Golf and Country Club in South Carolina for 15 years. While there, he dealt with what he considers the "worst water in the world."

"I didn't know anything about water until I started dealing with it," he says. "I had bicarbonates of 1,100 ppm and a Sodium Absorption Ratio of more than 90. Everything got locked up because of the high bicarbonates. It was a long learning process."

Frye subscribes to the philosophy that for every cause there is an effect. Every situation is different and there is no single solution.

"You really need to have your soil and water tested to make an informed decision," he says. "Look at your circumstances and design your program based on what your infrastructure is.

"Look at your circumstances and design your program based on what your infrastructure is. You can't answer the bicarbonates issue in one sentence." — George Frye, TransGolf Inc.

You can't answer the bicarbonates issue in one sentence. There are so many other variables – if you have tunnel vision, while addressing it, you could cause other problems."

Mike Huck, owner of Irrigation & Turfgrass Services, and a former superintendent, feels greenkeepers sometimes spend too much time worrying about bicarbonates.

"Everyone thinks when they have bicarbonates, you've got to remove them and that's not always necessarily the case," he says. "The question becomes whether your particular problem is significant enough that you want or need to inject your water with an acid or something, or do you want to take a different approach with your fertility programs. It really is a balancing act. Ask first whether the quantity of bicarbonate you are dealing with

Right: Before using Burst Turf at Tonto Verde Golf Club, Scottsdale, Ariz., the soils were tight and hard to penetrate. Bottom: After starting the program in June 2008, superintendent Robert Davis reported better moisture penetration, allowing him to water deeply and infrequently. Soil sampling and aerification became easier, too. The photo was taken during overseeding, thus the brown turf conditions.



treat effluent, especially during the summer months when irrigation cycles increased. "We needed a system that could effectively treat our water no matter the time of year or the amount of water being consumed," he says.

By 2008, Swanson's bicarbonate problems reached a boiling point. Turf loss was prolific and rampant and large areas on the three courses were void of grass and crusted over with either a calcium or sodium bicarbonate layer. It took him six months of intense investigation and testing before determining a two-pronged plan. First, he attacked the water at the point of delivery. Second, he addressed the problem in the field with direct applications.

"Our first, and most significant decision, was the installation of a sulfuric acid injection system," Swanson says. "After doing countless titration tests with our Brookside Laboratories consultant, Corey Angelo, we found sulfuric acid was by far the most effective means to attack our alka-



Swanson

linity and bicarbonate problem.”

Swanson says this decision did not come easy since sulfuric acid is very corrosive and dangerous. But, after weighing the options, they settled on the Werecon acid injection system for all three courses, which proved to be very safe. “Its effectiveness is astonishing,” Swanson says. “The system is essentially a

self-monitoring system that adjusts on the fly without human contact. The rate of acid injection is not based on flow, but rather on pH by continuously monitoring pH sensors installed downstream to determine sulfuric acid injection needs.

“This option was very important as our water quality varies hour-to-hour and season-

Troubleshooting bicarbonate levels

There are a number of ways a superintendent can address the bicarbonate levels at their facility. Mike Huck, owner of Irrigation & Turfgrass Services, offers some of the methods to manage bicarbonates.

Acid injection of sulphuric acid. You usually have a company that comes in and services it, so the greens crew doesn't touch the product other than adjusting the microprocessor on the injection equipment to fine-tune the pH output.

Urea sulphuric acid. This is sold under the trade name n-PHURIC acid. One example is pHirst from Your Growing Solutions (www.yourgrowingsolutions.com). President Warren Shafer says his company designs and builds the injection systems. “We install and build a storage tank, so whenever the superintendent gets low, we go back out and fill their storage tank; the superintendent doesn't even need to touch the product.”

Soil sulphur applications. An old standby, says Huck, but you need to get the right amount down at a safe rate that won't burn the turf. Typically, between 50 and 200 pounds per acre. This needs to be timed properly and put down in the right season. It's typically applied during the fall or spring because it converts into raw sulfuric acid in the soil. As soils warm, it slowly converts. If you put it down in the middle of July and August when soils are warm, it can convert too fast and can cause burning of the turf.

Acidifying fertilizers. “If you only have a small amount accumulating over the year, you can attack them with acidifying fertilizer and convert them to calcium carbonate, sodium carbonate or magnesium carbonate,” says Huck.

Synthetic acids. While Huck says these newer products may be the greatest thing since sliced bread, the companies do not label what are in them, so you have no idea what the chemistry is in these products. “Their rates for application on the label make no sense because they are not based on anything other than the acreages,” he says. “With any acid products you are going to inject in water, the only proper way to determine your rate is through a laboratory titration.”

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to-season,” Swanson adds. “This ability to self-monitor based on pH instead of flow rates significantly reduces potential corrosion problems that could develop from the over application of sulfuric acid into your irrigation system.”

Swanson says they now consistently and accurately apply sulfuric acid treated water

on their courses at a consistent pH reading of 6.0 to 6.5, which is a big improvement over the 8.0 to 9.0 pH untreated water that was previously used.

The second approach Swanson applied was the use of a synthetic acid, settling on applying and spraying applications of Aquatrols Burst Turf wall-to-wall biweekly. Burst is strictly



The Wereco computerized pumping system Red Rock installed. This system utilizes a vacuum technology to eliminate the delivery of sulfuric acid at high pressures into the irrigation system.

a pH adjuster; it drops the bicarbonates. In that process it is neutralized like a normal acid. After it does its work, there is no longer any acid left. “This was a daunting and labor intensive task considering the economy was at the start of a severe contraction and labor resources were being scrutinized in all departments,” Swanson says.

To overcome this economic labor “hiccup” Swanson completely changed their fertilization program – abandoning the traditional granular programs and fertilizing the entire course biweekly via a sprayer. “Taking this approach has increased our labor needs, yet those expenses have been offset through reduced fertility costs,” he says. “Expensive poly- and sulfur-coated granular fertilizers have since been replaced by inexpensive raw materials such as ammonium nitrate, potassium nitrate and ferrous sulfate.”

With all the changes in place, the three courses at Red Rock Country Club are now irrigated with buffered water (bicarbonates in check) and treated biweekly with a direct application of synthetic acid. “These are by far the best changes I have ever implemented on a course,” Swanson says. “The return on investment has been amazing. The courses have reversed their negative trend and are now responding to our management decisions as a typical course would in the Midwest.” **GC**

David McPherson is a freelance writer based in Toronto.

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