ADJUSTING PH THROUGH THE IRRIGATION SYSTEM

What do you do when you've tried everything in the book to lower your soil pH, but turf still won't grow on your course? When all else fails, you might be willing to try anything - even if it involves adding sulfuric acid to your irrigation water. Several golf courses around the country, especially in the Southwest, have done just that. The results are dramatic.

This procedure is an option only for those situations in which all other methods of lowering pH have failed. Do not take lightly the highly caustic nature of concentrated sulfuric acid.

PROBLEM WATER

In arid regions, water for irrigating turf generally has high pH and high salt content. In some locations, irrigation water may have a pH of 7.4 to 10.4. In extreme cases. soil in these areas may show a buildup of white deposits of calcium carbonate (calcite). The first inch of soil can have the same pH as the irrigation water or, in many cases, it can be much higher.

Water may be so alkaline that turf and ornamentals die. Stressed ornamentals may lose their leaves. Rhizomes of stressed bermudagrass may refuse to root. The problem can be so severe that whole greens and fairways show stress and turf loss. As many as 60 percent of newly planted ornamentals may have to be replaced within the first month.

On highly alkaline sites seeded with bentgrass, bermudagrass or ryegrass, germination was poor. In some areas, seed failed to germinate.

Many of these situations have been traced to soil pH, but the problem seems to start with high-pH-irrigation water having high concentrations of calcium and bicarbonate ions.

TREATING THE PROBLEM

Generally, there are two accepted methods for controlling soil pH:

•You can apply elemental sulfur or a sulfur-containing compound that can be oxidized to the sulfate ion, forming excess hydrogen ions in the process. (Remember, the sulfate ion, SO4 2 - , does not provide the acidification. It is the oxidation of the sulfur to sulfate ions that provides the hydrogen ions.)

•You can apply nitrogen in the form of ammonium ions from ammonium nitrate or ammonium sulfate or from ammonium producing fertilizers such as urea, urea formaldehyde, methylene ureas, etc. The ureas are converted to ammonical nitrogen, NH, or NH4, but the acidification comes from the oxidation of the ammonical nitrogen.

Whether you use nitrogen fertilizer or sulfur, oxidation must take place in order to produce hydrogen ions. Four variables determine the success of these processes:

•Soil moisture

•Temperature

•Oxygen concentration in the soil , and

•Application rate

During winter in the Southwest, many facilities operate at their peak. When soil temperature is low, conversion of materials used to control pH is slow, at best. Because of this slow conversion rate, many managers over apply acidifying material in an attempt to lower pH.

The problems resulting from such over applications may not be seen until late spring or summer because all material could not be converted at the lower temperatures. As the soil temperature increases, however, the conversion rate increases so fast that the soil pH may be lowered to 2.0 or 3.0.

The application of granular or spray materials to control pH may be inconsistent because of over application of material, overlap in the application pattern, or buildup of material in tight soils or low areas.

The crux of the problem is controlling the addition of the proper amount of acidifying material. The material added must offset the pH of the irrigation water and, at the same time, lower the soil pH and maintain it at the desired level. When sulfur or ammonical nitrogen are applied to control pH, the ideal balance exists for only short periods of time.

A POSSIBLE SOLUTION

One possible answer is direct pH control of irrigation water using sulfuric acid or urea-sulfuric acid. This method is not new. Acidifying irrigation water with sulfuric acid and, in some cases, spraying the soil directly with concentrated sulfuric acid solutions have been used for some time in Arizona agriculture to reclaim extremely alkaline soils.

The present system is designed to handle water with a pH as high as 11.0, bring it down to 6.8 and maintain the irrigation water at a set value.

As irrigation water pH was lowered to 6.8, pH control systems produced results like these in the leaves:;

•Phosphorous concentration increased greatly

•Sodium concentration decreased

•All metal ion concentrations generally w[illegible] more unchanged

All these changes took place while the ion concentration in the soil remained virtually unchanged.

CHEMICAL REACTION

Waters to which the pH system technology have

been applied are high in both bicarbonate and calcium ions; pH is high and there are higher salt concentrations.

When both pH and salt concentration are high (water EC values of 3.5), the processes associated with salt buildup in the soil are compounded when anions, such as bicarbonate or carbonate, are present in the irrigation water.

A precipitation reaction of calcite (calcium carbonate) takes place, which seems to restrict water flow through the soil layer. A co-precipitation of materials like calcium phosphate seems to occur with calcite as seed crystal (a site on which the phosphate begins to crystallize).

ADJUST PH (CONT.)

High evapotranspiration conditions compound this formation of salt deposits near the surface. As the soil dries, the concentration of dissolved salts reaches the saturation point, and the precipitate begins to form. Usually, this material is calcium bicarbonate that, as it dries in basic solution, forms calcium carbonate.

As calcium carbonate builds up in the soil, it alters the complete soil chemistry. Soils that began as sand or sandy loam can become rich in carbonates, and the processes that normally move salts are much less effective. In some cases, water movement is essentially stopped.

When the pH of irrigation water has been lowered and maintained between 6.5 and 6.8, results are dramatic. The precipitation reaction of carbonates is retarded as bicarbonate becomes more stable at the lower

Deposited carbonate salts can be dissolved quite rapidly, if necessary, by controlling the pH at 6.5 or even 6.0 for a short time. The lower pH provides extra hydrogen ions to react with the deposited calcite. Now it is possible to add fertilizer for the plant, rather than to control the pH.

IMPLICATIONS

When you can control water pH as you irrigate, soil pH can be lowered in a regulated, easily monitored, step-by-step procedure. When you maintain the pH at a set value, fertilizer efficiency is increased. Plant stress, which opens the door to pest problems, will decrease. You will be able to manage your turf and ornamentals fertilizer program without having a soil pH problem.

Article by Tom Lubin, chemistry department, Cypress College, as seen in Rub of the Green, Feb. 1990.

MEMBERSHIP UPDATE

At a recent Board meeting for the purpose of reviewing our present membership, it was noted that quite a few of our members are qualified to take their class A&B exams. It is the goal of any good association to grow and prosper in order to survive. Ours is no exception. Too merely become a member is not enough. The Board realizes that due to the nature of our business it is sometimes hard to schedule the time to take your exam. The Board is also sensitive to the fact that some people have trouble taking exams. Trust me, you are not alone. It is for this reason we are setting up a special study session to help our members prepare for their exams. If you are interested in participating in the study session in September, please call Pete Galea, CGCS, at Crystal Springs GC, (415) 342-4188. Remember, this isn't only for the benefit of the association, it's for yours as well. Take the time and get involved.

ALL APPLICATIONS TO UPGRADE TO ANOTHER CLASS, MUST BE IN THE OFFICE BY SEPTEMBER 6 IF YOU PLAN TO TEST AT THE STUDY SESSION ON SEPTEMBER 18, 1990.

OUR HOST SUPERINTENDENT FOR AUGUST

Our host Superintendent Dave Sexton, CGCS, first golf course experience was as member of the grounds at Paso Robles Golf & CC while a senior at Cal Poly at San Luis Obispo. I received my BS degree in Ornamental Horticulture in December 1976 and was hired as the assistant Superintendent for the Ojai Valley Golf & CC in March 1977. On the second day on the job the Superintendent left to advance his career in the desert and I was given the position of Superintendent which I held for 4 years until moving to the Meadow Club in 1981.

The Meadow Club is a private Country Club setting in the coastal hills surrounding Marin county. It is a par 71, 6257 yard golf course designed by Dr. Alister MacKenzie in 1927.

The golf course has been the focus of a continuing renovation program. So far 53 of 65 bunkers have been completed, 7 teeing areas have been leveled, lengthened and realigned, all the bridges have been refinished, irrigation system was replaced in 1984, a lake was added, more than a mile of cart path has been replaced with concrete and several miles of drains installed, as well as several hundred trees and landscaping.