# Making the Right Spending Decisions When Tackling Soil and Water Quality Problems

## Issues to consider before investing the dollars.

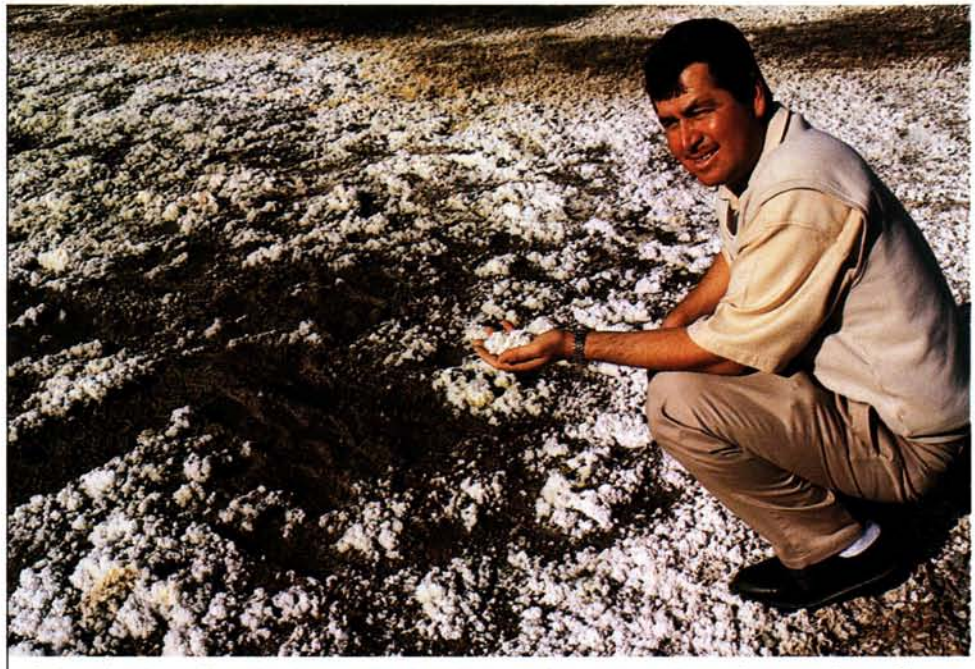
BY PATRICK J. GROSS

Do you want to be on the cutting edge of golf course maintenance technology? A few golf courses are using an exciting new product, and they have never looked better! Here is what this product will do for you:

- It will make water wetter.
- Reduce irrigation by 10% to 40%.
- Save fertilizer.
- Reduce the need for chemical applications.
- Reduce the need to aerify.
- Control algae in your lakes.
- Control fungus, mildew, and root rot.
- Eliminate black layer.
- Improve drainage.

Does the above scenario sound too good to be true? Most definitely, but superintendents fall prey to such outrageous sales tactics and spend thousands of dollars of their employers' money in search of the magic product that solves all their soil and water quality problems with little or no effort.

Soil and water are the two biggest resources that superintendents manage in the production of high quality turfgrass. It makes sense that any efforts to improve soil and water quality will have a corresponding positive effect on turf growth. Concerns are more prevalent today, given the fact that several newer courses are built on sites with adverse soil conditions and the increased use of recycled water or poor quality well water. It is only natural that superintendents are looking at ways to improve soil and water quality. With so many options, the question becomes which product to choose.



Salt- and sodium-affected soil is a major obstacle to producing top-quality turfgrass conditions. The white powder on the surface of the soil in the above photograph is not snow — it is salt!

### IS THERE A PROBLEM?

Before jumping on the bandwagon with the latest treatment device or product, it is important to analyze your situation to see if there is an actual problem. Questions you may want to ask include:

- Are there signs of poor soil permeability or water ponding throughout the course?
- Does your turf show salt stress symptoms and decline?
- Does your water or soil have a high pH that limits nutrient availability?
- Is the entire course affected or are problems restricted to certain areas?

If you are convinced there may be a problem, the next step is to have an independent laboratory test the chemistry of the soil and water to see if amendments or treatment devices are warranted. The laboratory you choose should be experienced in evaluating saline and sodic conditions for soil and water. While many of the same companies that manufacture products or equipment will offer to test your soil and water free of charge, it is best to use an independent laboratory that does not have a stake in selling you anything. Using such a laboratory insures that you

are receiving unbiased information to form the basis for any future spending decisions. A few hundred dollars spent for unbiased laboratory testing can save a golf course thousands of dollars in unnecessary equipment or ineffective products.

## TREATMENT OPTIONS

The chemical evaluation of your soil and water quality will guide you toward the best treatment options for your situation. The following sections provide a brief overview of some options to improve soil and water quality at your course.

## BASIC AGRONOMIC PROGRAMS

Sound cultural programs should be the basis for treating problems associated with high salinity, which are the most prevalent soil and water quality problems observed in the arid Southwest. Soil tests typically show a high ECe (>4.0 dSm) and a low sodium hazard (ESP<15%). Controlling soil salinity requires attention to the following agronomic programs:

- Aeration.
- Leaching.
- Drainage.
- Fertility.

The goal is to dilute the accumulated salt with extra water and move it down through the soil, away from sensitive turf roots. A good irrigation system with proper distribution uniformity is essential to manage high salinity situations. While it may seem easier to apply a promising new product to solve the problem, very few products perform as well as an aerifier in conjunction with good irrigation practices. Aeration and leaching also are critical programs that must be employed for the treatment of sodic or saline-sodic soils.

## GYPSUM

Gypsum is most often recommended to treat the following conditions:

- Sodic or saline-sodic soil conditions (ESP>15%).

Gypsum injectors are typically used to treat sodic or saline-sodic soil conditions, water sources with high SAR, or very pure water sources.

- Water with a high SAR (>10) that contributes to poor water infiltration and surface sealing.
- Very pure water sources (ECw<0.5 dS/m).

Gypsum can be surface applied if there are only marginal problems with sodium-affected soil or water. For chronic problems, solution-grade gypsum can be mixed with water and injected into the irrigation system. The following is a general estimate of the cost to purchase and operate a gypsum injection system:

- Equipment cost: $7,000 to $15,000 or more.
- Solution-grade gypsum: $120 to $200 per ton.
- Annual cost for gypsum: approximately $10,000 to $20,000 per year or more, depending on the recommended application rate based on soil and water tests.

## ACIDIFYING TREATMENTS

An acidifying amendment is typically recommended for the following situations:

- Sodium-affected soil with poor infiltration (ESP>15%) where there is adequate free lime present in the soil.
- Water with a high adjusted SAR and a residual sodium carbonate (RSC) level greater than 1.25.
- Reducing the pH of the soil and water.

There are several options for applying acidifying amendments, including surface-applied sulfur, acidifying fertilizers, the use of a sulfurous generator to treat water in the irrigation reservoir, or the direct injection of sulfuric acid into the irrigation mainline. The following is a general estimate of the cost to purchase and operate a sulfurous generator:

- Equipment cost: $12,000 to $16,000.
- Sulfur: $250 to $350 per ton.
- Annual cost for sulfur: $3,000 to $5,000 or more per year, depending on the volume of irrigation water used and the amount of sulfur recommended by soil and water tests.

The use of a sulfurous generator is generally considered simple and cost effective if it can be justified by soil and water testing. A few issues to consider are the uniformity of mixing the acidified water in the lake and the aesthetics of the generator, which produces smoke and is often placed in a visible location on the shore of the irrigation lake.

Another option for acid treatment is the direct injection of sulfuric acid into the irrigation mainline. The following is a general estimate of the cost to purchase and operate an acid injection system:

- Equipment cost: $15,000 to $18,000.
- Acid: $1.00 to $1.75 per gallon.
- Annual cost for acid: $8,000 to $25,000 per year, depending on the volume of irrigation water used and the amount of acid recommended by soil and water tests.

Direct injection of acid into the irrigation mainline improves the uniformity of mixing, but there are safety concerns with handling concentrated sulfuric acid. The safety issue is often addressed by using a sulfuric acid product that is mixed with urea, commonly referred to as N-phuric acid. The acidification properties are the same, although the cost of the material is generally higher. The results achieved with the use of N-phuric acid are often misleading because most people will notice the nitrogen response and assume it was the acid and not necessarily the urea. Other points to consider include providing adequate space at the irrigation pump station for acid storage tanks and injection equipment. The storage tanks also must be accessible to delivery trucks.

## DO YOU NEED AN INJECTION SYSTEM?

Before you invest in an expensive injection system, it is important to test the chemical properties of the soil and water to see if such a system is necessary. Surface applications of gypsum or sulfur in test plots also can be made as preliminary treatments to evaluate the long-term effectiveness of an amendment program. Consider the following advantages and disadvantages regarding injection systems:

## ADVANTAGES

- Injection of amendments into the irrigation system reduces the dust associated with granular applications.
- Reduced labor requirements for application.
- Acid injection reduces the burn potential on low-CEC soils.
- Acid injection equipment also can be used to inject liquid fertilizers.

## DISADVANTAGES

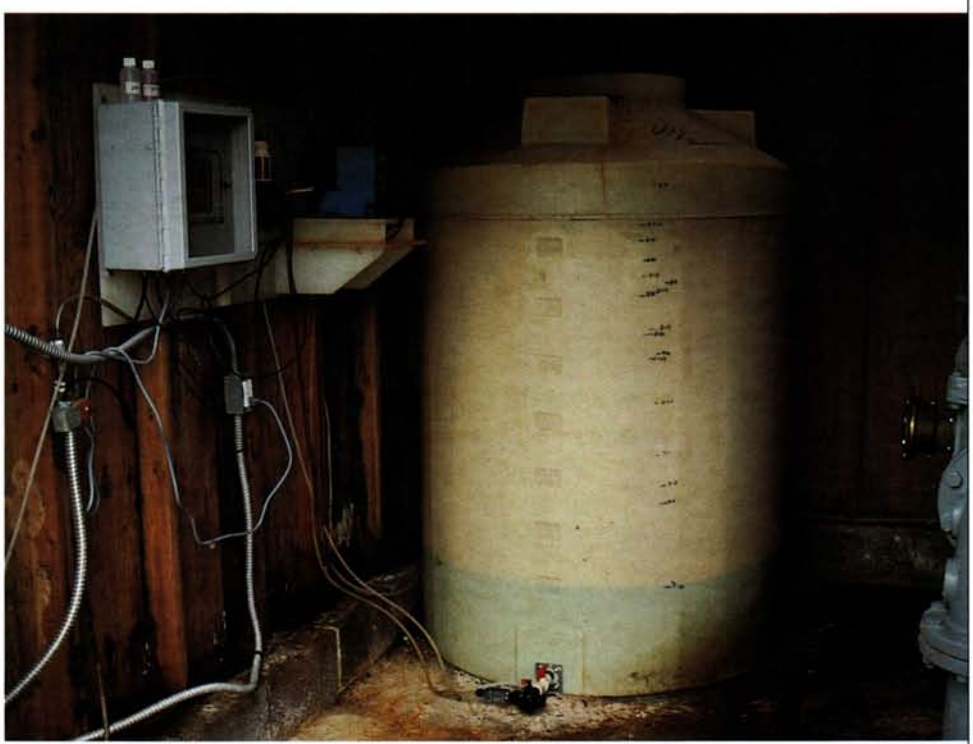
- Liquid amendments are more expensive than dry products.
- The initial expense of the equipment and ongoing costs for repair and replacement of parts.
- Corrosion of irrigation equipment.
- The hazard involved with handling concentrated acid.
- The uniformity of the irrigation system is critical for accurate application.

## OTHER OPTIONS FOR SOIL AND WATER TREATMENT

In addition to injection systems and the surface application of soil amendments, there are other avenues that can be explored to address soil and water quality problems, including:

- The use of surfactants and soil wetting agents to treat localized dry spots and to improve water infiltration where sodium levels are not a concern.
- Blending different water sources to improve chemical properties and reduce the percentage of sodium and soluble salts.
- Plumbing a separate irrigation line to the greens to supply potable water, assuming the potable water quality is better than the irrigation source.
- Planting salt-tolerant grasses.

Some golf courses have installed in-line pipe devices and other types of water treatment hardware in an effort to improve water quality and turf performance. The cost of such devices is often very high ($40,000 to $50,000 or more), and there is very little peer-reviewed scientific research to justify manufacturer claims. It also is difficult to obectively evaluate these products in the field since a large section of the course or the entire course is treated, leaving no opportunity for an untreated check area for comparison. In such a



The direct injection of sulfuric acid into the irrigation mainline from a nearby storage tank is another method to introduce acidifying amendments. The hazard of handling concentrated acid must be considered along with the need to provide adequate space at the pump station for the storage tank and access by delivery trucks.

The use of a sulfurous generator is one option to treat sodium-affected soil or irrigation water high in bicarbonates. A few issues to consider are the uniformity of mixing the acidified water in the lake and the aesthetics of the generator, which produces smoke and is often placed in a visible location on the shore of the lake.

situation, it is suggested for buyers to proceed with caution.

## CONCLUSION

The marketplace is full of products aimed at improving soil and water quality, and it is difficult for superintendents to decide which products would aid their situation. If your golf course is experiencing difficult soil and water quality issues, do yourself and your employer a favor by taking the following actions:

- Obtain a thorough chemical analysis of your soil and water from an independent laboratory that has no stake in selling you any treatment products or equipment.
- Purchase and read the book *Salt-Affected Turfgrass Sites — Assessment and Management* by Dr. Bob Carrow and Dr. Ronny Duncan, which describes and explains the various soil and water interactions and provides a sound agronomic rationale for treatment options.
- Take the GCSAA class on "Managing Salt-Affected Turfgrass Sites" to enhance your knowledge of soil and water quality problems and their treatment.
- Seek the advice of soil and water quality experts to help evaluate your test results and offer unbiased recommendations.
- Protect the interest of your employer when considering soil and water treatment options and spend the money as if it were your own.

## REFERENCES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