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TERRY BONAR

2009 USGA Green Section Award Recipient

Contents

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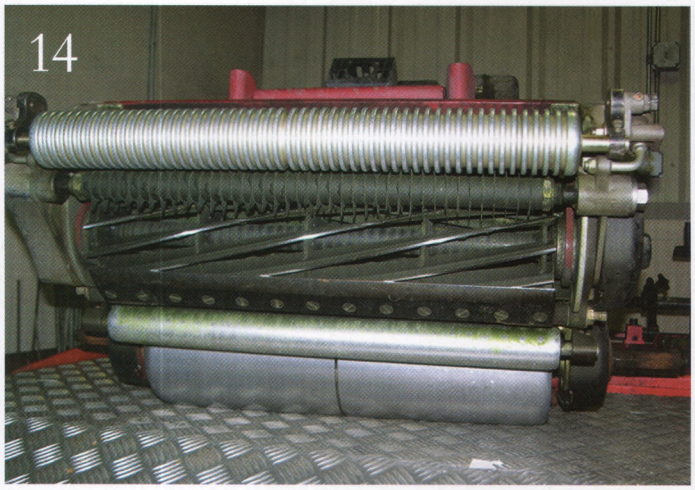


2009 GREEN SECTION EDUCATION CONFERENCE

It's All About the Economy! Good Ideas to help You Tighten Your Belt.

February 6, 2009 • New Orleans, Louisiana

For the 32nd consecutive year the annual Green Section Education Conference was held in conjunction with the Golf Industry Show. This year, more than 800 people attended the Green Section's program on Friday, February 6, at the Ernest N. Morial Convention Center. Ty McClellan, Mid-Continent Region agronomist, served as moderator for the morning's program of nine speakers who addressed this year's theme, "It's All About the Economy! Good Ideas to Help You Tighten Your Belt." The articles contained in this issue summarize the presentations.

Cover Photo

The 2009 USGA Green Section Award was presented to Terry Bonar, superintendent of Canterbury Golf Club in Shaker Heights, Ohio. During his long tenure at Canterbury, Terry has been a mentor and innovator — truly a superintendent's superintendent.

COVER PHOTO: © USGA/GARY YASKI

Terry Bonar

2009 Green Section Award Recipient

"His golf course is always one of the best conditioned facilities that I visit. Terry is current, creative, and caring — he always has time to assist those who seek his counsel." — Bob Brame

PHOTOS: © USGA/GARY YASKI

Terry Bonar is a superintendent's superintendent. Having worked at the Canterbury Golf Club in Shaker Heights, Ohio, since 1961 (with a stint in the U.S. Air Force from 1963 to 1967), he is still going strong with his border collie Molly at his side. He works, inspires, maintains, teaches, manages, and cares!

Terry was born on December 30, 1940, the same date as Tiger Woods but just a generation older. He grew up in Steubenville, Ohio, and graduated from Steubenville High School in 1957. A year or two later he attended the two-year turf program at Penn State University, interned at Oglebay Park Golf Course, and graduated from Penn State in 1961. Afterward, he worked on the crew at Canterbury Golf Club and became the assistant superintendent there in 1963. After serving for four years as an intelligence analyst in the U.S. Air Force, he returned in 1967 to Canterbury as an assistant superintendent, and in 1984 he was appointed its golf course superintendent.

Terry truly embodies what is good about the game of golf. He has worked hard throughout his career, gaining the trust, respect, and loyalty of so many people in the industry. A man of great integrity, Terry continues to improve upon the past year and consistently generates a top-level product. His quiet demeanor neither seeks attention nor requires publicity, but fittingly he has been recognized by his peers. The Ohio Turfgrass Foundation honored Terry with its annual Professional Excellence Award in 1996, presented to highly deserving individuals who have made significant contributions to the turfgrass industry. In 2003, Terry received the prestigious Mal McLaren Award, the highest honor bestowed by the Northern Ohio Golf Course Superintendents Association, and given only sparingly when a truly outstanding candidate is identified. Terry was nominated for *Golf Magazine*'s "Superintendent of the Year Award" and came in a close second. He also has served as a volunteer on the USGA's Green Section Committee for 12 years.

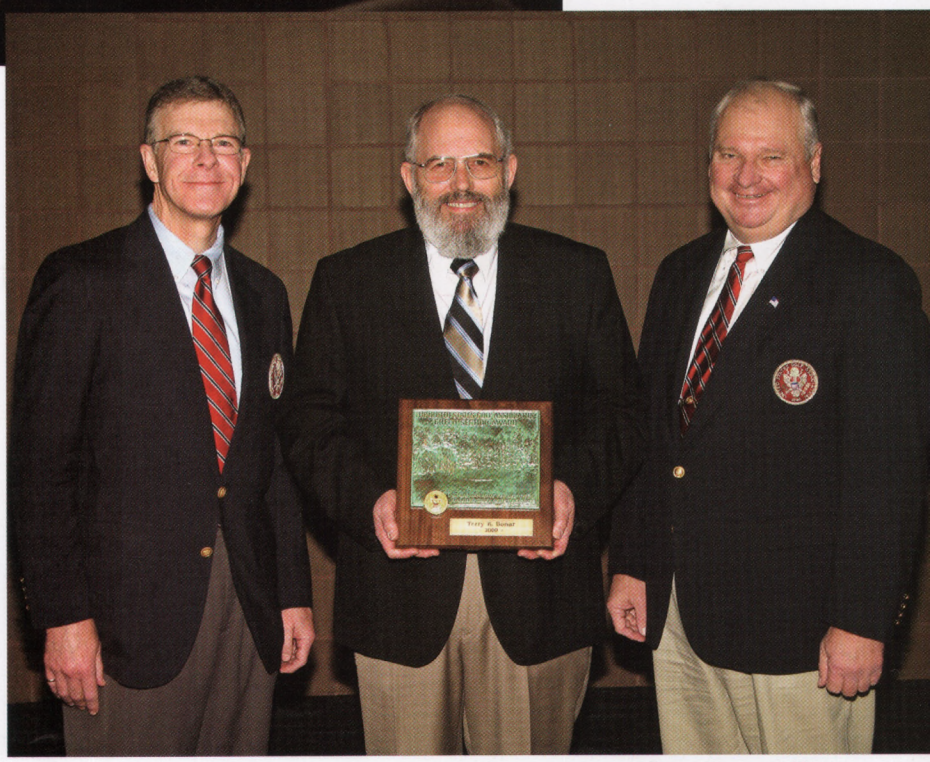
In his long tenure, Terry has helped Canterbury host numerous championships, including the 1979 U.S. Amateur Championship and the 1996 U.S. Senior Open, the 1973 PGA Championship, the Senior TPC in 1983, '84, and '85, and currently is directing the club's preparations to host the 2009 Senior PGA

Terry Bonar has mentored scores of assistants and interns. Many have gone on to become superintendents at other golf courses, while some have stayed with him for decades.

Championship. Terry has never jumped to invite large numbers of volunteers at his club's championship events, preferring to count on his own outstanding crew and a few nearby colleagues.

Bonar has mentored many employees in the golf course maintenance industry, and he has seen more than 50 assistants or former interns move on to other positions in golf, including 18 current superintendents at other courses around the country. He doesn't push them out after a two-year stint, but prefers to keep them for a few years to help build a veteran and efficient crew. Some have stayed for decades! Many of those who do move on to new venues establish themselves and mentor their own group of superintendents. This makes Terry "The Dean" of many golf course superintendents!

In addition to his mentoring programs and his skills with his crew, Terry is an innovator. Stan Zontek, longtime USGA agronomist, said this of him: "Terry was the first golf course superintendent that I visited in my 37 years with the USGA who took a holistic approach to maintaining a golf course. That is, he maintained the *entire golf course*. That was a most unusual and groundbreaking concept in those days. Terry provided the golfers with smooth, true putting and consistent greens, high quality and closely cut tees, high quality bentgrass fairways, and roughs that were the best anywhere. The roughs were grass . . . not weeds and not infested with pests and diseases, and they were not a forgotten part of the golf course property. That was novel thinking at the time. It is much more common and accepted as a standard today. The result — a renowned championship venue maintained to the highest standards."



Over the years, Terry Bonar has crossed paths with many Green Section agronomists. Bob Brame (left) and Stan Zontek were on hand as Terry accepted the 2009 Green Section Award.

In addition, Bonar has long been viewed as an efficient user of water, with the goal of providing firm and fast playing surfaces for Canterbury's golfers. He also was among the early pioneers to adapt the use of lightweight mowers to maximize turf health and playability on fairways.

"Terry has been the essence of what a golf course superintendent should be," said Jim Snow, national director of the USGA Green Section. "He has excelled in every phase of the profession and has left his mark on the industry in so many ways."

WATER, WATER EVERYWHERE!

Overwatering of fine turf areas has concrete costs. Intangible impacts of overwatering may be more difficult to quantify, but ultimately they impact the bottom line.

BY DARIN S. BEVARD

Irrigation of amenity turf is viewed by some as a waste of water. However, well-maintained irrigation systems deliver water efficiently and help reduce water use and the cost of irrigation.

In many parts of the United States, water resources are regularly in short supply. Even in areas where supplies are more generous, droughts occur, and who gets to use available water resources is controversial. When water is in short supply, irrigation of golf course and other amenity turf is viewed by many as a waste. Do we indiscriminately irrigate golf courses with no thought of our water resources? No. Does overwatering occur for a variety of reasons? Yes. Additionally, the cost of water is increasing, making it more expensive to irrigate golf courses where water must be purchased for this purpose. Water costs, public scrutiny, and environmental consciousness are obvious reasons to pay close attention to water inputs on golf courses. However, there are indirect costs (some easily quantifiable, others more intangible) to overwatering that affect budgets, course conditioning, and the daily playing conditions of a golf course.

Electrical costs for pumping water vary. Some have pressurized water mains or gravity systems that require no electrical input for irrigation. Others pay hundreds of thousands of dollars just for the electricity to pump water out of wells and the additional cost to run the pump station. Some golf courses pay nothing for water; others have a water budget approaching $1 million annually. In the Mid-Atlantic Region, water is generally plentiful and irrigation mostly is done to supplement natural rainfall rather than replace it; some courses spend $150,000 annually on water and electric expenses. Obviously, reducing water use by only 10% would result in thousands of dollars in savings. This would be magnified in the Southwest Region of the country. What about the impact of overwatering on other budget items?

Diseases such as *pythium* and brown patch are encouraged when excess moisture is present. These diseases cause significant turf injury unless

Above left: The most damaging diseases of cool-season turf are favored by humidity and excess moisture. Overwatering may encourage these diseases, especially in areas such as rough that are not treated with fungicides. Above right: Repeated irrigation cycles that maintain wet conditions in the upper portion of the soil profile can lead to detrimental conditions such as black layer. However, subtle effects on rooting and overall turfgrass health are much more common impacts from overwatering.

fungicides are applied to prevent and control them. Overwatering can encourage these diseases, requiring more frequent or higher-rate fungicide applications. This is a subtle impact of overwatering that may go unnoticed.

Roughs and green surrounds that often are not treated with fungicides are especially susceptible to damage. Fairway fungicide applications may cost $400 per acre, depending on the products selected for application. For 25 acres of fairways, this equates to a cost of $10,000. Eliminating one fairway fungicide application for your pesticide program each year can provide significant savings, at the same time limiting disease damage to the grass.

Turfgrass health also is affected by overwatering. Saturated soils are lower in oxygen, which is detrimental to root development and turfgrass vigor. Wet wilt can occur when oxygen levels become so low that the turf no longer cools itself through transpiration. Additionally, saturated soils have a greater temperature increase under high air temperatures than properly irrigated soils under the same temperatures. From a turf health and management perspective, there really is no advantage to having soil moisture levels higher than necessary at any time, and in some instances it is absolutely detrimental to the health of the turf. In the Mid-Atlantic Region, we see more turfgrass decline caused by too much rather than too little water.

Wet conditions can result in mechanical damage from direct rutting of the soil and more subtle impacts such as scalping caused by a mower sinking into a soft turf surface. Scalping leads to thinner, weaker turfgrass. Overwatering also may necessitate increased mowing frequency to keep up with increased clipping yield compared to maintaining dryer conditions. It is often the case that drivers of golf carts find wet spots during their travels, creating further damage that must be repaired. Again, while subtle, there is a cost associated with making these repairs. There is nothing worse than trying to explain why certain areas of the golf course are excessively wet and subject to this type of mechanical damage during a period of dry weather.

Some of the biggest hidden impacts of overwatering are its effects on playability. Overwatering creates soft playing conditions that most golfers hate. It is frustrating to hit a towering drive down the middle of the fairway, only to have the ball hit the fairway with a "splat" and no roll. Worse yet, the ball can just plug. Most of us have discussed playing conditions at certain golf courses where you hear other golfers state the familiar refrain of, "It's a nice

Scalping and other mechanical damage to the turf are more likely under wet conditions. Nothing is worse than having to exlain self-inflicted damage in a wet area that was created by too much irrigation water.

Ultimately, the enjoyment of the golf course by the players is most important. Within reason, playability is best under drier conditions. An added benefit is reduced water cost and a potential reduction in other turfgrass problems.

course, but it's always wet." This is not a compliment. Considering that many golfers make their decision regarding where to play based on course conditioning, a chronically wet golf course may encourage players to look elsewhere for regular play. Unfortunately, many golfers do not appreciate a golf course with isolated areas of brown, dormant grass, even when it does not impact playability. This perception by golfers dictates that superintendents often err on the side of overwatering rather than underwatering.

When evaluating irrigation practices, it is imperative to evaluate the system that delivers the water. Not all systems are created equal, and even the best irrigation system needs to be supplemented with hand watering. If you are not hand watering at some point during the growing season, you are probably overwatering! The performance of irrigation heads should be monitored over time to be sure that water is applied as efficiently as possible.

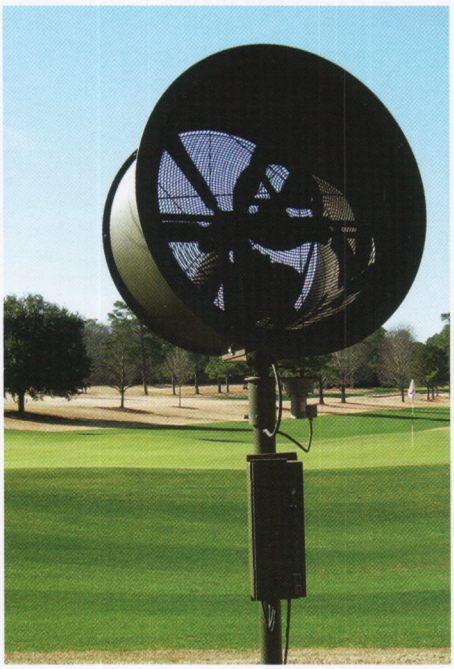
What is the cost of applying too much water on your golf course? The concrete cost of overwatering depends on many different factors, including turfgrass species, region of the country, and overall budget. The intangible costs for public relations and playability are much harder to quantify. The perception of golf course water use by the non-golfing public is often negative. Anything that can be done to reduce water use can only help combat this problem. Use water resources as efficiently as possible; you will save money if you do. Within reason, a dryer golf course is just better. Better turfgrass health, better resistance to disease and traffic, and better playability are obvious reasons not to overwater!

DARIN S. BEVARD *is a senior agronomist in the Mid-Atlantic Region and sees the direct and indirect impacts of excess moisture all too often.*

The Costs of Blowing Wind

A guide to the selection, installation, and operation of fans for better summer performance of bentgrass putting greens.

BY PATRICK M. O'BRIEN



Above left: A combination motor starter and disconnect switch is installed on the upper fan pole on this three-phase motor fan. Since three-phase motors don't have thermal protection, it is essential to install these devices to protect the fan motor. Above right: Concrete is used to secure the four-foot ground pole that attaches to the fan pole. The concrete provides a long-term stable foundation for the fan.

Limited air movement is one of the major contributing factors to summer bentgrass decline. More than 20 years of research and field observation has demonstrated that fans are a successful tool to improve air circulation and sustain turfgrass quality of creeping bentgrass putting greens in the summer months.

Although most golf courses in the Southeast with creeping bentgrass putting greens use one or more fans today, fan use is expanding into other parts of the country. The purpose of this article is to guide the reader through the process of fan selection, delivery of electrical power, installation, and annual operating costs. A thorough understanding will lead to more effective and efficient decision-making at golf courses throughout the country.

PRODUCT SELECTION AND SITE LOCATION

Many types of fans are available for putting greens today, but the most popular fans have 5- to 7.5-horsepower motors and the ability to oscillate for more coverage. These fans have the capability to produce a two to three mph wind over the turf canopy, up to 150 feet from the fan.

Usually one fan per green site is required to produce a wind vortex at approximately four feet above the turf canopy. This wind vortex replaces more humid air with less humid air in order to maintain leaf evapotranspiration. The top technical reps provided by most fan companies will assist with selection and placement of the fan to optimize agronomic benefits.

DELIVERY OF POWER

Once the fan has been chosen and the position determined at the putting green, the next step is to plan how to get electrical power to the site. It is advisable to hire a licensed electrician to assist with these plans, due to the complexity of the electrical issues.

First, the electrician must identify the power source closest to the putting green. If available, three-phase power is better, as it is the most efficient way of supplying the voltage to the fan motor and turning the fan impellor. Three-phase motors are less complicated as they lack mechanical start switches and capacitors, more dependable due to this simpler design, and less costly than single-phase motors. Also, since three-phase motors draw fewer amps than their single-phase counter-

A backhoe or front-end loader easily lifts the fan for assembly to the fan pole. A fork attachment on the loader is a plus to help lift and maneuver the fan. Remember, some type of device also will be needed to transport the fans on and off the golf course for off-season storage.

Table 1
Cost considerations for installing a fan

Trenching
Cement footing for pole, includes valve box, ground rod, and splice kit
Power supply setup (normally no cost) and circuit breaker
Fan hookup and disconnect (for three-phase, combination motor starter and disconnect)
Fan cover
Wire
Fan
Timers
Equipment rental

parts, due to their higher electrical efficiency, conductors needed are considerably smaller and thereby reduce wire costs. Due to the cost of copper, wire costs increase significantly as amperage needs increase.

Most golf courses do not have easy access to three-phase power, except at the pump station and the clubhouse area, but its availability is on the rise. Residential areas surrounding most golf courses are supplied, by and large, with single-phase power. Sometimes the power company may upgrade to three-phase power at no charge if requested. Typically, the power company doesn't charge to provide power unless they have to restructure their service, an unlikely event. Even if there is a charge to install three-phase power, the savings on usage would pay for itself in the first one or two years.

Single-phase motor fans still provide excellent performance, and although wire costs will be higher initially, the annual operational costs will be similar to fans using three-phase power.

INSTALLATION COSTS

Most golf courses install fans with their maintenance staff, but in some cases a contractor does a turnkey project. Typically, a licensed electrician will do the final hookup of the wire to the fan. Work performed includes digging the trenches for the wire; purchasing and laying the wire; installing the meters, breakers, ground wires, and disconnects; digging the hole for the fan base; pouring concrete at the fan base; and erecting the fan (Table 1).

Trenches for the wire are typically 24 to 36 inches in depth, depending on local regulations. Doing the trenching by the golf course maintenance staff will save some money versus a contractor, as normally the work is done during the winter or early spring when more time is available for these special projects.

Concrete-secured, four-foot ground poles are installed, to which the fan pole is attached. Concrete costs are only $10 to $15 per fan for materials. A valve box, in less than 10% of the projects, is installed for the ground pole. An electrical disconnect switch to turn the power supply on and off is surface mounted on the fan pole for single-phase power motors. Combination disconnects and starters are installed on the poles with three-phase motors for electrical overload protection, since single-phase motors have built-in thermal protection to automatically turn off the motors. Junction boxes located inside the disconnect box split the power for the fan and oscillator motor. Electrical disconnects in the ground or a valve box are not recommended due to potential water

Wire materials and installation are the most expensive costs for a fan project. Installing the wire to the proper depth and according to local electrical codes is essential to supply consistent power to fans.

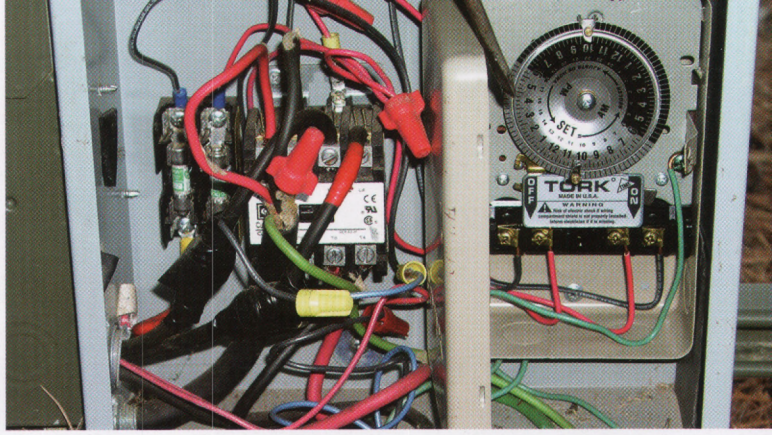
issues. The only specialized equipment needed may be a trencher or a motorized posthole digger. A backhoe or front-end loader can lift the fan for assembly.

The greatest installation cost is the wire. Wire is sized by the electrical current it must carry over a specified distance from the voltage source. As the distance from the power source increases, so does the wire size necessary to provide current to the fan. Voltage drops in the wire occur over long distances, and the use of large wire helps maintain amperage. Fans drawing lower amperage lessen the wire conductor size and the amount of copper, reducing costs. Since three-phase motors draw fewer amps than single-phase motors, wire costs are significantly less, typically 50% lower. A popular cost estimate for wire for three-phase power is $3 per linear foot, as compared to $7 per linear foot for single-phase power. Be aware that the price of copper, and thus wire, fluctuates widely, and cost estimates should be sought before proposing a project. Electricians sometimes can save money by purchasing wire in bulk from a wholesaler.

Other ancillary costs could include easements and the extra expense to bore under hard surfaces. Timers are installed in a few instances, but most fans are operated 24 hours per day during the summer months.

ANNUAL ELECTRICAL COSTS

Annual electrical costs to operate fans will vary per power company. Most courses budget $60 per fan for every HP per month based on fan operation for 24 hours per day. As an example, this equates to $300 per month for a 5 HP fan. Be sure to include meter fees, even in months when the fans are not operational. These monthly fees average about $20 per green site. In the Southeast Region, fans generally operate from Memorial Day to Labor Day.



Above left: As the primary power for the fan, the power company's electric meter and breaker master switch are located on a pole close to the putting green. Wire from the power supply takes either single-phase or three-phase power to the fan. Top right: Timers are sometimes mounted in a box, either on the fan pole or near the fan to modulate fan operation times. Above right: Weatherproof covers are used to protect the fan motor and belts during the off-season when indoor storage facilities are not available.

PREVENTATIVE MAINTENANCE COSTS

Preventative maintenance on fans is not a huge undertaking. The factors and features of the design affect the overall time spent tending to fans. Belt-driven fans need a belt replacement every two years or so. Estimated cost is $40 per fan. Less popular direct-drive models do not have belts. However, the bearings inside every electric motor require periodic maintenance, although direct-drive fans have fewer loads on the bearings. Belt-driven fans have external (pillow block) bearings that need to be maintained along with the belt tension. Belts seldom need adjustment after the initial break-in.

Repainting of the fans should be done about every three to five years with a brush or spray gun. Aerosol touch-up paint provided by the manufacturer is available for yearly maintenance. Fan blades are metal and should last 10 to 20 years, and motors should last approximately 10 years or more.

FAN STORAGE

The storage of fans in the offseason is another consideration. Some courses spend labor hours taking down the fans and storing them off the golf course. Other golf courses prefer to keep the fans installed and place weather-protecting covers on them. The cost of covers ranges from $200 to $275.

CONCLUSION

Careful planning and the estimation of costs are essential after identifying a putting green site that will benefit from air movement. Following the guidance offered in this article will assist in understanding the components, steps, and costs involved in the installation of fans. When all is done, the air force delivered will be another step in maintaining healthy bentgrass putting greens in the summer.

PATRICK O'BRIEN *is director of the USGA Green Section Southeast Region.*

Golf course maintenance budgets are under closer scrutiny than ever before. Wise turf managers have realized employing the BCSR approach to interpreting soil tests may result in misdirected use of golf course funds while chasing the "ideal" cation.

Overcome Your Infatuation with Base Saturation

Does it make sense to apply all that calcium?

BY BRIAN WHITLARK

A frequent topic of conversation on USGA Turf Advisory Service visits is soil test interpretation and the resulting recommendations for turfgrass fertility and soil amendments. In my experience, the greatest inconsistencies with regard to soil testing are firmly grounded in the interpretation phase. The purpose of this article is to provide a brief description of two different methods for soil test interpretation and review recent research data that should help turf managers decide what method is best for them.

TWO BASIC APPROACHES

One approach to interpreting soil data is the *basic cation saturation ratio* method (BCSR), which suggests an ideal ratio "balance" of calcium (Ca), magnesium (Mg), and potassium (K) on the soil exchange complex. On the other hand, the *sufficiency level of available nutrient* (SLAN) approach interprets the amount of individual plant-available nutrients in the soil and determines levels where fertilizer applications will likely produce a response and levels where additional nutrient applications are unwarranted.

THE BCSR PERSPECTIVE

The foundation from which the BCSR approach was formed goes back to research conducted in the mid-1940s by Bear and Toth, who proposed the following basic cation percentages: 65% Ca, 10% Mg, 5% K, and 20% H. From these percentages the following cation ratios were formed: Ca:Mg 6.5:1, Ca:K 13:1, and Mg:K 2:1. In 1959, Graham suggested broadening the basic cation percentages to a more realistic range, 65-85% Ca, 6-12% Mg, and 2-5% K. Therefore, the cation ratios change accordingly to Ca:Mg (5.4-14.1), Ca:K (13:1-42.5:1), and Mg:K (1.2:1-6:1).

Proponents of the BCSR theory state that the concept of cation balance is important with regard to plant growth and provides important information relative to the nutrient-supplying power of the soil. In addition, the BCSR theory states that plants accumulate cations in accord with their ratios in the soil solution, which is why certain ratios of the ions need to be maintained on the cation exchange sites.

FINALLY, SCIENTIFIC DATA!

Those in the SLAN camp claim there is a lack of scientific evidence in support of the BCSR theory. A recent study (St. John and Christians) revealed some interesting data with regard to the validity of the BCSR approach. The soil data listed below show a silica sand soil with several of the basic cations outside their "perfect balance" or "ideal ratios."

Silica sand soil containing the following cation percentages and ratios. The "ideal" percentage and ratios are provided in parentheses (St. John and Christians).

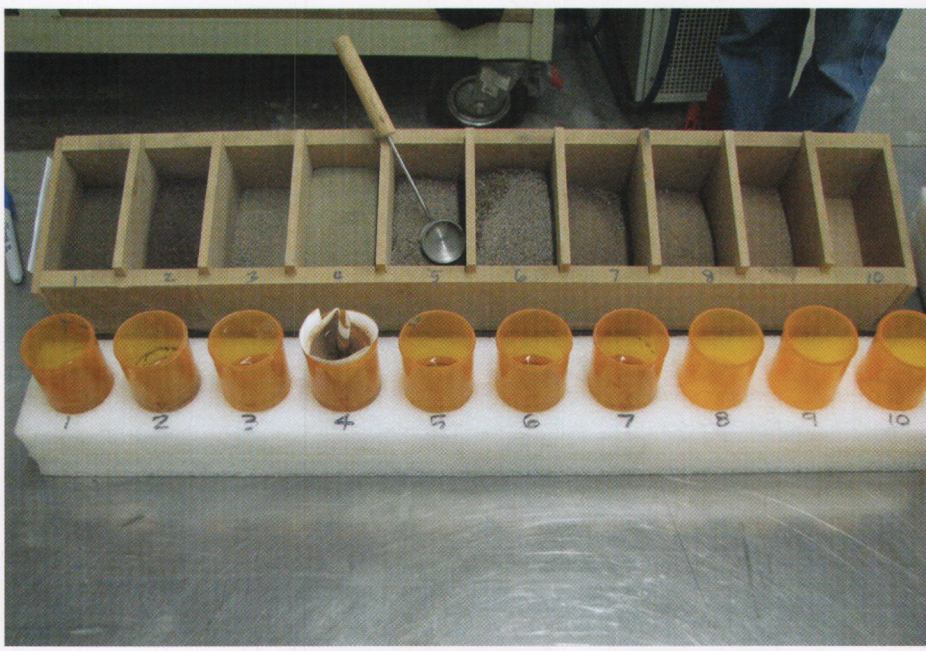
- Ca = 21% (ideal = 65-85%)
- Mg = 7% (ideal = 6-12%)
- K = 73% (ideal = 1-5%)
- Ca:Mg ratio = 3:1 (ideal = 5.4:1 - 14:1)
- Ca:K ratio = 0:1 (ideal = 13:1 - 42.5:1)
- Mg:K ratio = 0.1:1 (ideal = 1.2:1 - 6:1)

Applying the BCSR approach to the scenario presented above reveals that Ca is low at only 21%, Mg is ideal, and K is high. An appropriate fertilizer recommendation based on these data and utilizing the BCSR theory may be to apply some form of calcium and no addition of Mg and K. However, as is frequently the case, employing the BCSR method, following such recommendations would have resulted in an unnecessary Ca addition and a missed K application, resulting in K deficiency in the leaf tissue, as follows:

Leaf Ca, Mg, and K concentrations of Pencross creeping bentgrass grown on the same silica sand soil as in the first example. Ideal tissue levels for bentgrass are provided in parentheses (St. John and Christians).

- Ca = 1.3% (ideal = 0.5 - 0.75%)
- Mg = 0.46% (ideal = 0.25 - 0.3%)
- K = 0.47% (ideal = 2.2 - 2.6%)

This example shows the leaf Ca concentration is in fact high, even though the saturation percentage in the soil was only 21% and both the Ca:Mg and Ca:K ratios were lower than ideal. Leaf K levels are deficient, although the BCSR percentage was very high at 73%. This example provides data from just one soil, but further investigation of the data from St. John reveals a similar scenario for all 28 treatments where leaf Ca levels in silica sands averaged 1.2% (0.5-0.75% is optimal), yet all but one of the soil samples had Ca percentages less than the "ideal soil" range of 65-85%. In other words, in 27 of the 28 samples, employing the BCSR method would have resulted in needless Ca applications. Moreover, leaf K levels averaged only 0.87% (2.2-2.6% is optimal) in all 28 samples, yet none of these samples called for a K application under the BCSR strategy.



The debate between those who subscribe to the BCSR approach versus those who employ the SLAN method to interpreting soils tests is ongoing.

EXCESS Ca FERTILIZATION MAY DO MORE HARM THAN JUST WASTE DOLLARS

Excessive Ca fertilization in a scenario where K or Mg soil levels are low could potentially exacerbate the problem by removing these ions from exchange sites, causing plant deficiencies. Excess Ca applications may also result in reduced phosphorus (P) availability when calcium carbonate (lime) is present, as insoluble Ca-P precipitates are formed. This same principle is also appropriate under problematic sodium (Na) conditions, where Ca fertilization in the presence of calcium carbonate may actually reduce Ca levels and aggravate Na problems.

FEED THE SOIL FOR IMPROVED FLOCCULATION

Base saturation purists theorize this methodology is an integrated soil/plant approach that promotes soil flocculation, allowing for better air and water movement. In the absence of elevated Na levels, the addition of Ca and/or Mg to achieve levels several-fold greater than those generally needed to fulfill turfgrass fertility requirements will not benefit the grass, improve soil physical properties, or stimulate soil microbial activity.

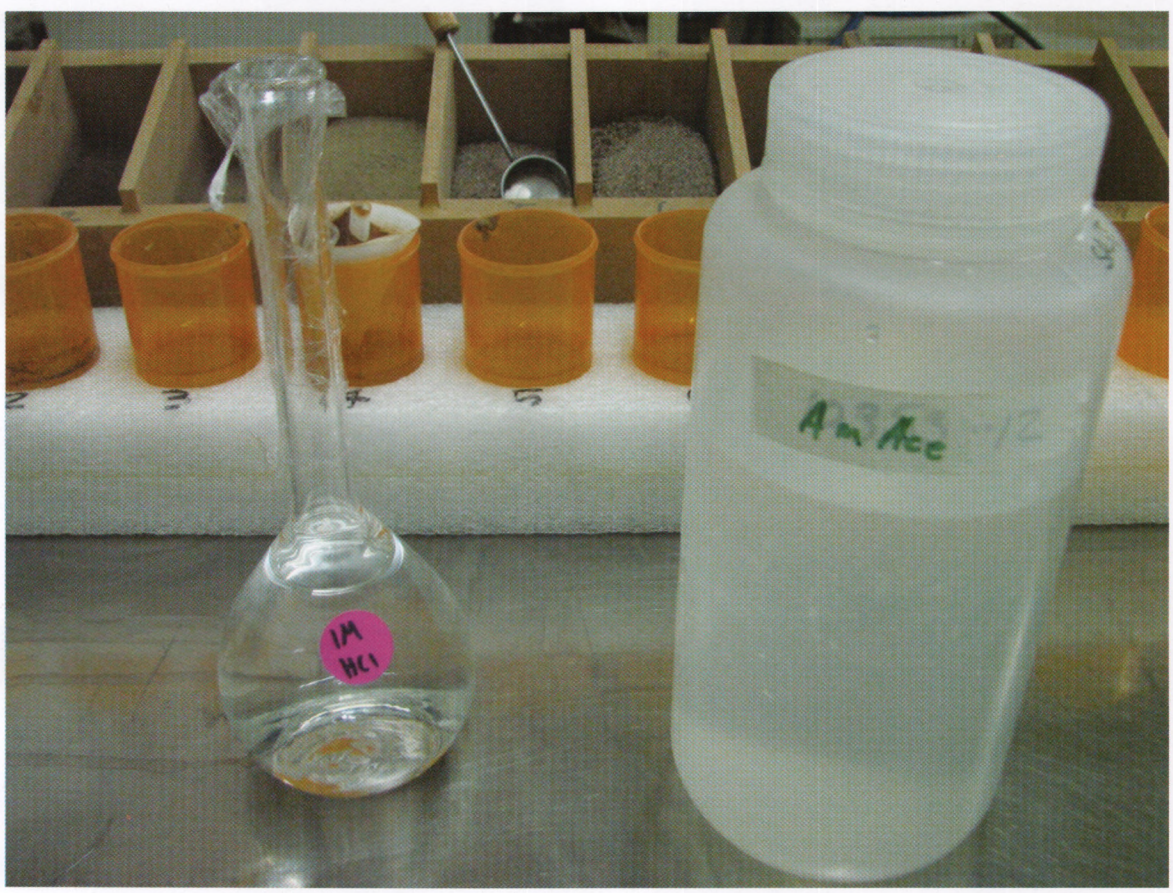
UTILIZING THE BCSR APPROACH FOR MANAGING SALTS

The BCSR methodology is functional in a scenario where Na-laden water is used for turfgrass irrigation. The percent Na on the soil exchange complex, better known as the Exchangeable Sodium Percentage (ESP), can be used in conjunction with the total soluble salts to indicate the potential to cause structural breakdown of soils. In such situations, Na and soluble salt accumulation may occur and must be properly dealt with.

FINAL THOUGHTS ON BCSR

The base saturation concept is a Ca-dominated approach to interpreting soil nutrient levels and therefore often requires Ca applications in the absence of real need. The definitive plant nutrition reference by Marschner (*Mineral Nutrition of Higher Plants*) indicates the Ca requirement for grasses is met at pH 6.3. Clearly, the evidence is overwhelming that the BCSR theory is just that — a theory that lacks scientific and substantive evidence. The percentages and ratios of Ca, Mg, and K are simply not important for turfgrass growth, rather the amount of these exchangeable cations in the soil is important. This may seem a rather abrupt opinion, but researchers exploring the validity of the BCSR approach have concluded similar findings:

- "The results strongly suggest that for maximum crop yield, emphasis should be placed on providing sufficient, but non-excessive levels of each basic cation rather than attempting to attain a favorable BCSR which evidently does not exist" (McLean, Hartwig, and Eckert).
- "The crops were much more responsive to the amounts of exchangeable Ca and Mg than to their % saturations" (Kussow).



Collecting representative soil samples and choosing a laboratory that uses extraction methods appropriate to your soils ensure the data on your soil reports will be useful, but it is the interpretation phase where costly errors are typically made.

- "No relationship was observed between the clipping yield and visual quality of either turfgrass (bermudagrass and perennial ryegrass) and the Ca to Mg ratio of the soil" (Sartain).
- "Bermudagrass and perennial ryegrass will tolerate a wide range in soil Ca to Mg ratios without exhibiting detrimental effects" (Sartain).
- "It is recommended that the results of BCSR soil testing not be used as the final determining factor in developing fertility systems for sand-based golf course greens" (St. John and Christians).

WHY THE SLAN APPROACH IS SIMPLY THE BEST

The Sufficiency Level of Available Nutrients (SLAN) approach to soil test interpretation is the most tried and true method that has been validated from many decades of research on a variety of soil types and crops, including turfgrass. The SLAN approach essentially states that the probability of a response to fertilization increases with decreasing soil test level — simply right! Soil testing laboratories typically categorize exchangeable nutrient levels as very low or critical, low, medium, high, and very high or toxic, based on research for a particular soil type and plant. As an example, it is estimated that a fertilizer application made in response to a soil test level registering very low will have an 85% probability of response. A fertilizer application with a low reading may provide a response 60-85% of the time, whereas reaction from an application with a very high soil test rating will likely occur only 15% of the time. Therefore, it is recommended to focus on very low or critical soil extractable levels when interpreting soil test results.

GET YOUR SLAN SUFFICIENCY LEVELS HERE!

If your soil testing lab does not provide you with sufficiency levels for your turf, you can find this information by reading one of the following references:

- Carrow et al., 2004 — http://www.gcsaa.org/gcm/2004/jan04/PDFs/01Clarify3.pdf
- Textbook: *Turfgrass Soil Fertility and Chemical Problems — Assessment and Management* by Carrow, Waddington, and Rieke, 2001.
- PACE Turf — http://www.paceturf.org/index.php/public/C29/

Laboratories typically provide both exchangeable cation nutrient levels and the percent those cations occupy in the soil exchange complex. It is up to the end-user to determine how to interpret the data and make the appropriate applications in the field.

FINAL THOUGHTS ON SOIL TEST INTERPRETATION

What information on the soil test report is most important and accurate for assessing soil nutrient status? The quantity of plant-available nutrients ranks at the top. These readings are accurate, repeatable, and have the best scientific basis for making fertilizer recommendations. The SLAN is a pragmatic method based on research conducted on a wide variety of soil and turfgrass types and should be used as the basis of any fertilization plan.

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With a Good Mechanic, It Will Run Forever

A great mechanic is not a substitute for regular replacement of equipment.

BY CHRIS HARTWIGER

Golfers may not know their golf course mechanic can fix anything. However, they will see less than top-quality turf if a mechanic is required to spend an inordinate amount of time repairing old, worn-out equipment. Constant repairs mean that preventative maintenance and quality-of-cut tasks are deferred, delayed, or skipped.

A tour of a golf course maintenance facility with substantial quantities of equipment in need of replacement often yields the following comment by a course official, "Don't worry, our mechanic is fantastic. He can fix anything." This is great news. Or is there another side to the story?

THE COST OF FIXING

When a mechanic spends the day perfecting his ability to fix anything, there are both direct and indirect costs to the maintenance operation and to the golfers who enjoy the golf course. The first cost is in decreased productivity. Every time a piece of equipment breaks down, the golf course mechanic must shift his focus from preventive maintenance and quality of cut issues to repair. Not only is a broken machine not out on the golf course working, but the mechanic delays, defers, or omits other tasks.

The second cost is an increase in money spent on equipment parts and an escalation of the maintenance and repair budget. Replacement parts for golf course equipment are expensive. I have seen courses using outdated equipment spend upwards of six figures per year on maintenance and repair. Compare this with the maintenance and repair costs for a fleet of equipment leased or replaced regularly, and one can see that constant repairs are a hindrance to the budget.

A final and indirect cost involves the golfer in the form of lower quality playing conditions, and it eventually comes full circle back to the maintenance staff in the form of a poor perception. It has been said many times that to golfers, the golf course is only as good as it was during their most recent round. If the mechanic who can fix anything spends his days fixing everything, what happens to turf quality on the golf course? It suffers. Heroic repair efforts are not visible at all to golfers. They just see the disruptions to the conditions they have come to expect that result when older, less reliable equipment is used. Maybe the greens are not getting a good cut, the rough is higher than normal, or the fairways are scalped. This can lead to a negative attitude toward the entire maintenance staff. Does this change the fact that the course employs an incredible mechanic who can fix anything? No, but it does reinforce the fact that the condition of the equipment is not sufficient to reliably produce expected conditions.

ON THE RIGHT TRACK?

Every golf course has some type of equipment replacement program. The effectiveness of the program may be another story. Below is a series of questions to assist course officials in determining if the existing equipment

replacement program is meeting their needs.

Does your course have an equipment inventory list with current age and a recommended replacement date? The notion that your superintendent will let you know when something needs to be replaced is not a viable replacement program. An inventory list with equipment age and desired replacement date is a prerequisite before developing a replacement program.

Can expected course conditions be attained consistently with the current fleet of equipment? If the answer is no, then refer back to the section on direct and indirect costs and begin a plan to revamp the current program.

Are maintenance and repair costs increasing faster than the rate of inflation? If the answer is yes, then the current equipment replacement program is not meeting your needs and is costing you serious money.

Have the different approaches to fleet management, including scheduled replacement by purchase and replacement by leasing, been thoroughly reviewed? Although it is above and beyond the scope of this article to differentiate between these two methods of fleet management, it is advisable for each golf course to study and contemplate its approach to fleet management. An excellent article by Gilhuly and Gray, entitled "Fleeting Moments," that appeared in the September/October 2008 issue of the *Green Section Record*, is a worthy reference for those studying equipment replacement options. The article can be accessed online at http://www.usga.org/turf/green_section_record/2008/sep_oct/fleeting_moments.pdf.

CONCLUSION

Golfers today are fortunate to enjoy the game in an era when turf conditions have never been better. Excellent playing conditions do not happen by accident, and hope is not a plan to create them. All the components can be in place for success, but if the equipment is not in place to carry out the tasks, the course will underperform. A great mechanic is of tremendous value to any golf course, but ultimately the regular replacement of equipment will allow his talents to be seen on the golf course.

CHRIS HARTWIGER *is a senior agronomist in the Green Section's Southeast Region.*

Preventative maintenance is a daily requirement. Repeated repairs of old equipment significantly drive up parts and repair costs. A great mechanic at a course with a solid equipment replacement program will have lasting impact on turfgrass quality.

Bunkers: Can Your Golf Course Afford Them?

Due to the high cost of maintaining them, bunkers are an obvious place to look for ways to save money.

BY JIM MOORE

If you are looking to save maintenance dollars in a tight economy, look no further than the nearest bunker.

Should the predictions prove true that the economic challenges already facing the golf industry will continue to worsen, most courses will have to implement steps to reduce labor costs. Buying cheaper fertilizer and using generic pest control products can save some money and are worth consideration, but the "800-pound gorilla" in every maintenance budget is labor. Facilities that have to make big reductions in expenses are almost certainly going to have to reduce the number of hours spent on taking care of the course. The obvious step is to look for areas in which labor hours can be reduced without hurting the playing quality or long-term agronomic health of the course. Fortunately, most courses will not have to look very hard to find such areas — they are called "bunkers."

Many top courses now maintain bunkers to a level that raises the question as to whether or not they are still hazards. The Rules of Golf may continue to define bunkers as hazards, but certainly they are not maintained as such, nor do they pose the challenge of their predecessors. The golfers' incessant cries that the bunkers are *inconsistent* has been answered with bunkers in which every lie is exactly the same. No longer must the player make a decision about the type of bunker shot he must execute based on varying sand depth, sand moisture, or the makeup of the sand itself. Balls seldom remain on steep slopes and instead roll to the flat bunker floor. Fried-egg lies are considered *unfair* and a sign of poor maintenance.

As usual, the tour-stop courses seen on television set the standards for the

Bunker liners are not a cure-all. Unless a great deal of labor is expended to keep plenty of sand on the bunker face, the liner can become exposed and snagged by golfers. To prevent maintenance equipment from damaging the liner, labor-intensive hand-raking of bunkers is recommended when liners are used.

rest of the golfing world. The bunkers at these courses pose only slightly more challenge than the turf around the greens, with the players getting up and down from the bunkers an astonishing 48% of the time (http://www.pgatour.com/r/stats). On those courses that maintain high, tough rough around the greens, the player who misses the green can only hope the ball ends up in the "hazard."

To achieve such consistency in bunkers, extraordinary amounts of labor must be utilized. Simple edging (necessary to define the margins of the hazard) and raking are not enough. Maintenance tasks now include packing the bunker faces, removing leaves, maintaining a specific depth of the sand on the bunker face, and even controlling the moisture of the sand. This type of maintenance regime requires hundreds of labor hours per week.

Even with such large outlays of labor, maintenance alone cannot provide the perfect lies that many golfers now demand from bunkers. Construction and sand selection must also be taken to new levels. Manufactured sand (sand that is crushed to create extreme angularity and thereby is less prone to soft lies) is typically twice the cost of the same sand before the crushing process. And instead of using a local sand that requires minimal trucking expense, courses often pay extraordinary hauling fees to import sand from hundreds of miles away. Bunker construction can easily exceed $4.00 per square foot (*USGA Green Section Record*, July-August 2008, "The Money Pit").

During a telephone survey of 12 superintendents from top courses in the country, the superintendents at these courses revealed a painful fact — they are spending more of their available resources to care for their bunkers than they are for their greens. These courses averaged more than 200 labor hours per week to prepare the bunkers (during their golfing season). With total labor costs easily exceeding $10 per hour, the math is straightforward.

The bottom line is that golfers demand and expect higher quality bunkers today than ever before in the history of the game. The irony is that bunkers are one of the few areas of the course in which golfers historically have played an active role in maintenance. Fixing ball marks, replacing divots, and raking the bunkers after play are simple tasks that can have a tremendously positive impact on the overall playing quality of every course. Unfortunately, most superintendents testify that golf etiquette is at an all-time low (*USGA Green Section Record*, November-December 2008, "An Appeal for the Return of Golf Course Etiquette").

The good news is that as the golf industry looks for ways to tighten our belts, we don't have to look very hard or very far — simply to the nearest bunker. The combination of minimal bunker maintenance (monthly edging to define the margin and weekly raking to prevent weeds from taking hold) and golfer willingness to smooth the bunker after use can save many thousands of dollars in labor costs for all but the most minimally maintained courses.

Should minimal bunker maintenance become an economic necessity, there is a simple solution for golfers who feel they deserve a perfect lie in a hazard. Abandon the Rules of Golf and pick up the ball, pack and rack your lie in the bunker to your satisfaction, and replace the ball on your carefully prepared surface. My guess is that you won't see your sand-save percentage improve in the slightest, but maybe it will reduce the whining.

JIM MOORE *is director of the Green Section's Construction Education Program.*

What Inorganic Soil Amendments Really Have to Offer

When it comes to inorganic vs. organic amendments, consider carefully.

BY BUD WHITE

Many inorganic amendments are relatively new products to the turf industry over the last 10 to 15 years. Some, however, have a much longer history. One of the calcined clays, for example, with the brand name of Turface, was used by many superintendents as far back as the mid to late '60s. At that time, the calcined clay was incorporated into aeration holes, ostensibly to provide drainage and moisture retention.

It was claimed that this product would be tremendously helpful in improving soil/water/turf management. But university research had not verified their benefits or stability in the field, and in fact the product caused major problems for greens that received it. Quite simply, the calcined clays were not processed well, and their stability or structure was not permanent.

Today we have a variety of inorganic amendments, including the porous ceramics (formerly called calcined clay), diatomaceous earth, and clinoptilolite zeolite products. All make various claims and benefits, but superintendents must weigh these benefits in the field in relation to price. They are expensive, and not all situations justify the cost in comparison to sound, basic soil management and appropriate cultural practices.

The inorganic amendments are used in various ways in the field. One of the more popular uses is blending inorganics in the putting green rootzone mix in place of peat moss or other organic products. For an 18-hole putting green renovation, it is not uncommon for these products to add as much as $100,000 compared to the cost of peat moss. Significantly, university research clearly shows that inorganic products do not perform any better than peat moss, and in some cases are not as good as organic amendments when used with sands in a putting green rootzone. See http://turf.lib.msu.edu/2000s/2000/000707.pdf. This research article shows that organic and inorganic rootzone blends provide comparable performance.

These two golf course workers applied a blend of sand and inorganic amendment and are brushing it into the aeration holes. This technique has been a very effective means of treating localized dry spots.

One claim tries to justify the cost of an inorganic product in new construction by stating that the material improves performance in a putting green by allowing the elimination of the gravel layer and by reducing the mix depth from 12 inches to 10 inches. This certainly would save money, but eliminating either one or both of these would compromise the proper function of the USGA green, which is clearly the best researched and most effective green construction method.

The other current use for inorganics is in the renovation or resurfacing of greens, where the sod is stripped off, an inorganic material and sand are added to the top, and the materials are blended to a depth of five to six inches. This method has produced some good results, particularly on a straight sand profile where no organic had been added during initial construction. Needless to say, it is essential to test and determine the proper amount of inorganic material to be added.

Yet another use for inorganic materials is their incorporation into aeration holes on straight sand or poor quality sand-based profiles to improve moisture retention in localized dry spot areas or to improve drainage in

wet areas. Inorganics are incorporated in conventional aeration holes as well as deep drill and fill types of aeration with good success.

It is important to weigh the advantages and disadvantages of inorganic amendments with cost, making sure the greater expense of these products is justified by their benefits in your particular situation. Begin by testing the product with an accredited lab; the inorganics should be tested for their compatibility with the existing sand (modification or resurface) or a proposed sand that will be used for new construction or renovation. Use an accredited lab to determine the suitable proportions of these materials with a particular sand, just as it is done with peat moss to determine the best rootzone mix ratio.

The same testing is needed when resurfacing, where the material is rototilled into the top five or six inches. Oftentimes, recommendations are made to add a certain amount of inorganic product to the surface and then rototill. This usually results in a much higher percentage, by volume, of inorganic material being used. For example, let's say a lab recommends a 90/10 mixture of sand and inorganic. Without this laboratory procedure, as much as 25% to 35% inorganic material could easily be blended into the upper five to six inches by applying too much to the surface. A 10% rate applied and rototilled into the surface is surprisingly light by appearance. A drastic change in rootzone mix composition, comparing the rototilled zone and the existing mix below, can disrupt downward water flow.

Before incorporating an inorganic product into aeration holes, it should be mixed with a high quality topdressing sand. That's because inorganic material alone is more expensive, and there are long-term benefits of having a mixture of sand and inorganic in the holes, as opposed to inorganics alone. The results of rootzone performance and moisture management are improved when an appropriate 10/90 to 30/70 mixture of inorganic and sand are incorporated into aeration holes — verified by lab testing.

After an inorganic is incorporated into aeration holes, thorough watering of the putting greens is needed immediately. These materials have a tremendous affinity for holding water and can cause rapid turf desiccation as they absorb water from the surrounding soil.

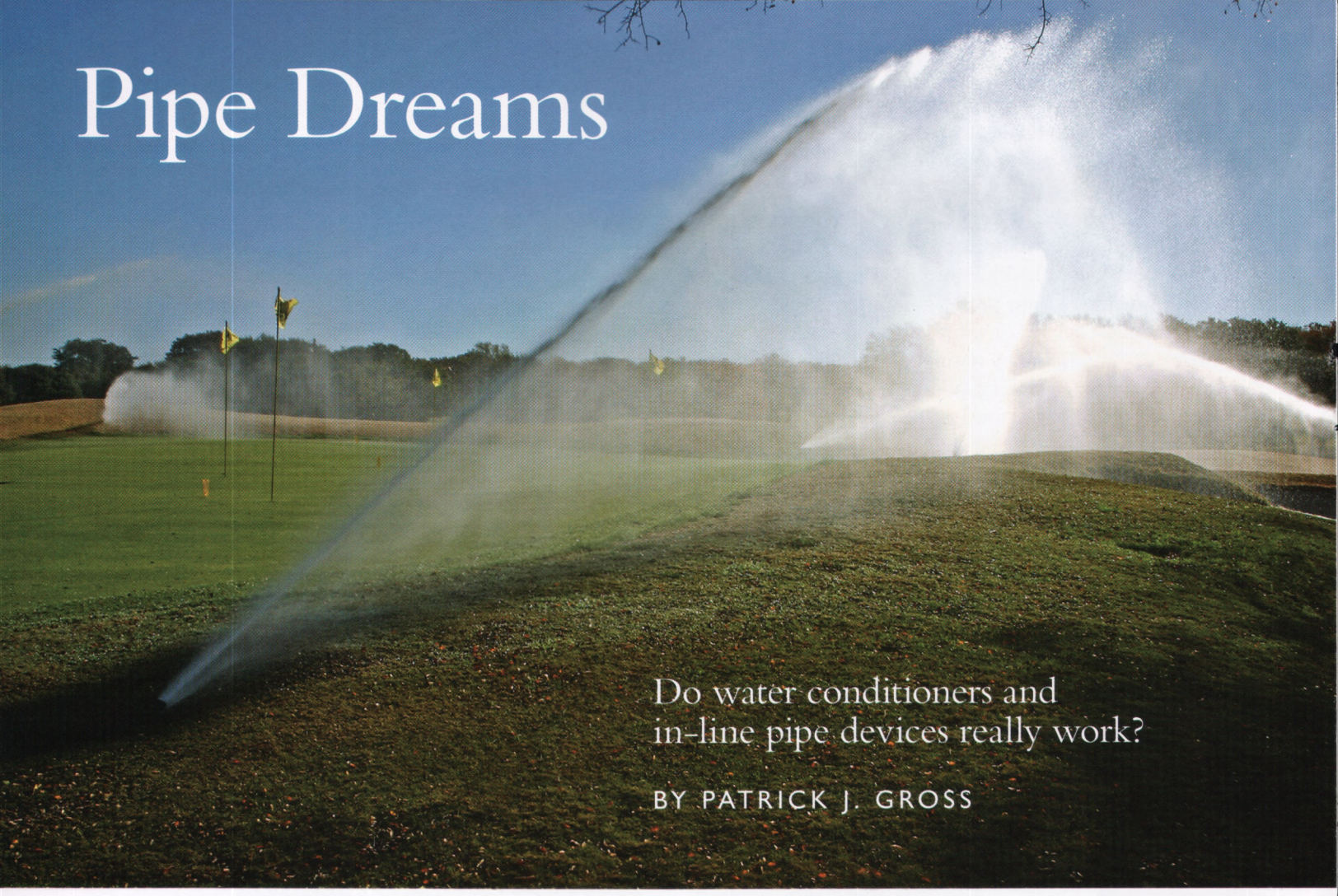
In closing, it is important for superintendents to carefully weigh the advantages of inorganic amendments as compared to traditional organic amendments. There are only a few scenarios where the inorganics have been shown to be advantageous vs. organics as a part of a management program with aeration. In these days of cost-cutting, it is even more important for superintendents to carefully weigh expenditures to ensure the maximum value for the dollar.

BUD WHITE *is director of the Green Section's Mid-Continent Region.*

The Drill and Fill aeration machine was first developed by Ray Floyd's father in the early 1970s. It drills 10" to 11" deep and then completely fills the hole with the selected sand or sand/inorganic amendment blend.

When applied as a topdressing material, inorganic amendments alone can create a layer that holds too much water at the surface. This condition can lead to algae or increased disease incidents.

Pipe Dreams



Do water conditioners and in-line pipe devices really work?

BY PATRICK J. GROSS

Considering that water is applied to turfgrass far in excess of any other material, it is not surprising that there is considerable motivation to improve water quality and its corresponding benefit to turf. Such is the premise behind many of the water conditioners and in-line pipe technologies that are on the market today. Non-chemical water conditioners and in-line pipe devices are marketed as methods to easily and effectively treat irrigation water. Manufacturers claim that the treatment process will provide many benefits, such as improved water penetration, reduction of soluble salts, healthier turf growth, reduced labor, and lower overall water use. The question is, do these devices really work?

TYPES OF CONDITIONERS AND DEVICES

Water conditioning devices work on different principles and can be classified into four broad categories: magnetic/electromagnetic devices, electrostatic precipitators, catalytic devices, and ozone/oxygen treatment devices (Duncan, 2009). Following is a brief summary of the various claims made by the manufacturers of these devices:

- **Magnetic/Electromagnetic Devices:** Magnets placed on the outside of the pipe or within the pipe are reported to break the bond between minerals and water molecules to increase the solubility of water. This is claimed to reduce surface tension for better water penetration and more uniform spray coverage. (Hahn Application Products, LLC)
- **Electrostatic Precipitators:** These pipe devices are connected to an electrical source and induce a significant electrical charge into the water. This is reported to add electrons to the water, thereby improving water infiltration and producing a positive impact on turf health. (Brochure: *The Science of E.S.P.*)
- **Catalytic Devices:** A turbulent flow of water is created over dissimilar precious and semi-precious metal to cause a change in the calcium carbonate mineral that is reported to reduce scale deposits. In turf applications, this is claimed to allow soil pores to open, reduce soil

compaction, and leach excessive salts from the soil. (Fre-Flo Water Systems, Inc.; Zeta-Core USA, LLC)

- **Ozone and Oxygen Treatment:** These are generally electronic devices that inject ozone into water, creating hydrogen peroxide and nitric acid. This is reported to increase the solubility and dispersion of solids and mineral salts. Manufacturers report significantly higher dissolved oxygen levels in treated water, which is thought to improve plant growth. (Brochure: *Nitrox GTS*, 1999)

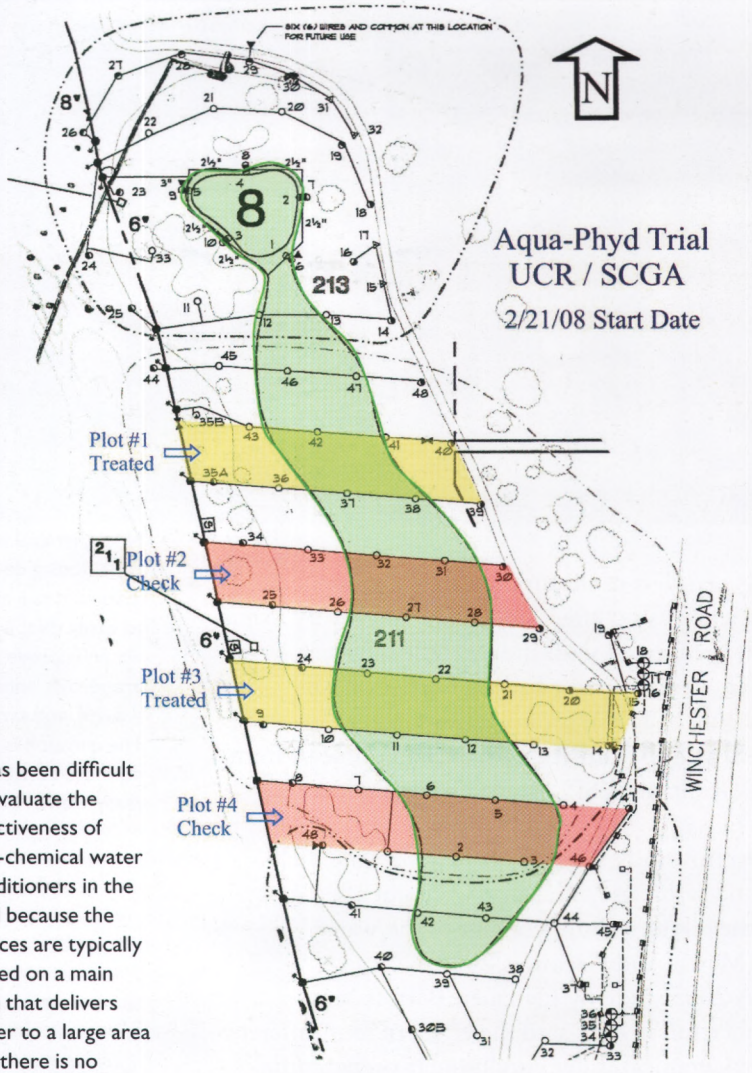
WHAT DOES THE RESEARCH SAY?

There are very few peer-reviewed scientific studies performed on non-chemical water conditioner devices. Following is a brief summary of the limited tests conducted in a turfgrass environment:

- A 1994 study by Shepard, Edling, Reimers, and Meckling investigated the ability of magnetically treated water to affect surface tension, capillary rise in four soil types, and percent oxygen saturation. No differences were observed. (Shepard, Edling, and Reimers, 1995)
- A 2003 study by Martin and Gazaway evaluated the short-term effects of using a non-chemical catalytic device (Carefree Water Conditioner) for treating poor-quality irrigation water in combination with deficit irrigation treatments on Tifway bermudagrass. They evaluated turf visual quality, growth, and water use efficiency. The results of the study indicated:
  - Regardless of the amount of water applied, there was no effect on Tifway quality by using water treated with the catalytic device.
  - The treated water had no impact on soil salinity (TDS), sodium adsorption ratio (SAR), sodium content, exchangeable sodium percentage (ESP), or electrical conductivity (EC_w).
  - In this study, Tifway quality, clipping yield, and water use efficiency were not affected by the salt or sodium content of the water. (Martin and Gazaway, 2003)
- A 2005 study by Leinauer, Barrick, and Robertson investigated the effect of four different non-chemical water conditioners on perennial

Non-chemical water conditioning devices are marketed as a method to easily treat irrigation water, improve soil properties, enhance turf growth, and save water. The question is, do these devices really work?

Basic agronomic programs, such as gypsum applications, have proven to be effective for reducing harmful levels of sodium and improving soil properties. Recent scientific studies have not proven a positive effect on soil properties with the use of non-chemical water conditioning devices.



It has been difficult to evaluate the effectiveness of non-chemical water conditioners in the field because the devices are typically placed on a main pipe that delivers water to a large area and there is no option of including a non-treated check area for comparison. A better test would be to include both treated and non-treated areas on a single fairway as noted with this experimental design by Drs. Green and Wu at the SCGA Golf Course.

ryegrass establishment, turf quality, and stress tolerance. The test included the use of both saline and potable water. Devices tested included a magnetic conditioner (MagnaWet), non-grounded catalytic conditioner (FreFlo), and a grounded catalytic conditioner (Zeta-Core). An additional treatment using the Aqua-Phyd conditioner was included in 2007. The results of this study showed:

- There was no statistically significant impact on perennial ryegrass establishment with the use of any of the non-chemical water treatments.
- After three years of turf performance data, the non-chemical water conditioning devices had no consistent effect on turf quality or stress tolerance.
- Treated water had no impact on soil chemical properties in either the saline or potable irrigated rootzones. (Barrick, Leinauer, and Petermeier, 2005; Leinauer, Barrick, and Robertson, 2006)
- Green and Wu initiated a study in February 2008 at the SCGA Golf Course in Murrieta, California. They evaluated the impact of resonant frequency energy waves generated by the Aqua-Phyd treatment device on a highly compacted saline soil. Measurements included water chemical factors (EC, pH, SAR adj, sodium, chloride, boron, bicarbonate, carbonate), soil chemical factors (EC_E, SAR, sodium, calcium, magnesium, potassium, carbonate, sulfate, chloride), soil fertility factors (potassium, magnesium, calcium, sulfur, iron, boron, sodium, pH, CEC), and soil physical factors (organic matter, soil particle size, bulk density, gravimetric soil water content, water infiltration rate, micropenetrometer readings, and compaction readings using the Field Scout Compaction Meter). Final data were collected in January 2009. Although the results still are being analyzed, researchers have not seen a significant difference in the data between the treated plots and the control plots. (R. L. Green personal communication, January 2009)

WILL IT WORK ON THE GOLF COURSE?

It has been difficult to evaluate the effectiveness of non-chemical water conditioners in the field, mainly because the devices are typically placed on a main pipe that delivers water to a large area. This technique will rarely provide an indication of whether the product works because it lacks an untreated check area for comparison. A better test would be to either treat half of a fairway and leave the remaining half untreated, or test adjoining fairways.

Furthermore, it is difficult to separate the many variables involved in such field evaluations. Have maintenance practices changed since the new water treatment device was installed? Has the course purchased a new aerator or other cultivation equipment? Have there been changes to the fertility or soil amendment program? Have there been changes to the irrigation system or scheduling of water applications? All of these variables need to be noted and honestly evaluated regarding their impact on field trials.

If consideration is being given to purchasing a non-chemical conditioner, take the following steps:

As the water crunch becomes more severe, there is considerable motivation to improve water properties and make every drop count. The manufacturers of non-chemical water conditioners claim to "make water wetter" and improve penetration into the soil. Such claims have yet to be proven by peer-reviewed scientific research.

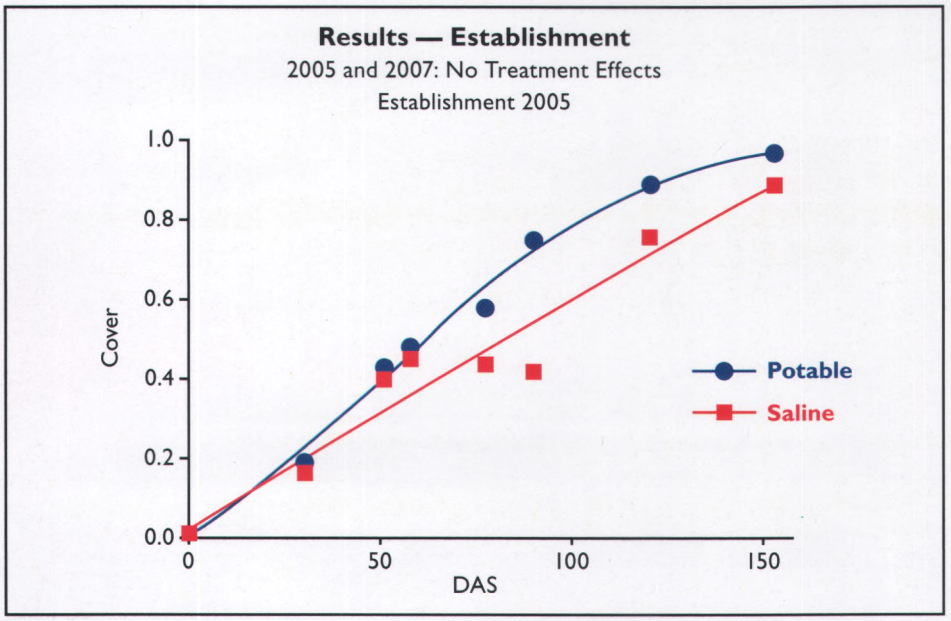
- Do your homework. Look for replicated scientific studies that provide data to support the claims made by the manufacturers. A good reference on water chemistry and a scientific perspective on treatment devices is the Web site by Lower: www.chem1.com/CQ. Many times, manufacturers' literature includes numerous testimonials. Although it is nice to know that some courses have observed a positive effect, such personal observations do not hold up to scientific scrutiny.
- Perform a test on a limited area, preferably one half of a fairway treated and the other half non-treated.
- Compare the cost of the unit with the cost of standard agronomic practices. Will the use of the device eliminate the need for aeration, soil amendments, or wetting agents, or will these products and practices continue to be employed?
- Collect data by testing the soil and water before treatment begins and every three months during the evaluation period.

CONCLUSION

The peer-reviewed scientific studies done on non-chemical water conditioners show that there is no effect on water or soil quality, yet some golf courses using these devices claim to see a benefit. Is this true, or is it just "faith-based agronomy"? Current methods of analysis have been unable to track any significant statistical changes in soil

chemical or physical properties, improvement in water quality, or enhancement of turf growth. Will they work in certain situations? It has yet to be proven. Companies that are willing to submit their products for unbiased scientific testing are to be commended, and future studies may show a statistically positive result.

Is it a pipe dream, or does the technology hold promise? With budgets being slashed and a challenging economy, any course considering such a purchase should be confident that money spent on such devices will produce a positive result. Current scientific studies have not proven that the technology works, making it difficult to justify such an investment.



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Soil Test Results (2007)

	pH	EC	Soluble Salts (dS/cm)	SAR	HCO_3 (ppm)	Na (ppm)	Mg (ppm)	Ca (ppm)	Cl (ppm)
Block	n.s.	*	n.s.	n.s.	n.s.	*	n.s.	**	*
Conditioning	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Water	***	***	***	***	***	***	***	*	***
Conditioning × Water	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Depth	**	***	***	***	n.s.	***	**	n.s.	*
Conditioning × Depth	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Water × Depth	*	*	**	***	n.s.	*	*	*	*
Conditioning × Water × Depth	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

Mowing patterns can be used to highlight terrain features and accent the landscape. There is a cost involved with the use of smaller lightweight mowing equipment to create this "WOW" factor.

Form vs. Function

The "WOW" factor can be costly.

BY KEITH HAPP

The USGA Green Section has always operated under the premise that the Committee should define maintenance standards for the course. These standards define the preparation of the golf course for daily play. With the standards put forth by the Committee, the task at hand calls for allocating the necessary level of funding to achieve the desired outcome. Sounds simple, right? All too often, the ends do not meet.

You may have heard of the "WOW" factor as it pertains to golf course conditioning. The "WOW" factor presents an eye-opening and even jaw-dropping first impression of the golf course to be played. The "WOW" factor is a function of the mowing lines and patterns used to create striking contrast between various features of the course. When viewed from the tee, mowing patterns highlight the landing area of a fairway, help accentuate bunker features or mounds, and showcase the rough. Areas mowed perpendicularly to play can give the impression that they are narrower than they really are, while longer flowing mow lines may give the golfer the impression that an area is wider. The resulting appearance of the final product can vary, but the function of the mowing strategy is consistent and focused; prepare the area for play of the game of golf.

Time is money. Using longer angles and minimizing the number of turns made maximizes the time spent mowing and reduces the time needed for turning. Work management studies have documented that as much as 67% less time is needed to mow a fairway when clippings are returned rather than collected.

Preparing the course in the desired fashion has become increasingly more difficult due to the recent trends in the economy. Operating budgets are being scrutinized, all line items are being reevaluated, and budgets are being cut. The largest line item of most (if not all) golf course maintenance budgets is labor and related costs. The average cost for all labor is often 50% to 60% or more of the total golf course maintenance budget. During trying financial times, this line item is often reduced without consideration to the effect on conditioning. Expectations seldom change, despite the fact that there are fewer resources available to complete the required tasks. Work still needs to be completed to satisfy the golfers, and the superintendent is charged with getting it done.

Creating the "WOW" factor comes with a cost. It requires labor hours to complete mowing practices and it takes more time when smaller mowers are used to create the mowing patterns. If that is what the golfers want, and they are adequately funding operations, then by all means, don't change a thing. However, when budget reductions are mandated, course setup priorities must be reevaluated. The question must be asked: What is more important — playability or aesthetics? Surveys of golfers have provided evidence that playability and conditioning are the priorities. *Golf Digest*'s new definition of conditions for their raters is an example. Raters now evaluate how firm, fast, and rolling the fairways are, and how firm, yet receptive, the putting surfaces are. There is no request for an evaluation of how the course looked. The focus is on playability.

It is estimated that 50% of the annual fuel cost for golf course maintenance is for mowing fairways, approaches, and tees! It makes sense to reduce the amount of time it takes to mow these areas. Although it is agronomically prudent to use smaller equipment on, and closer to, the putting surfaces, larger lightweight 5- or 7-plex machinery can be used effectively to prepare fairway turf when terrain features are not severe. Naturally, controlling mechanical stress (wear) is critical to

turf performance. On greens and approaches it makes sense to use smaller mowers. Clipping removal is more essential to playing quality in these areas of the course. In the more expansive areas of the course — fairways — additional adjustments can be made.

Superintendents are altering their mowing patterns to reduce the amount of turning required to complete their design. Some are returning to the technique of mowing the fairway surface in halves. For example, after mowing is completed, the view from the tee would present one side of the fairway as darker than the other. Time studies have been conducted, analyzing the various angles used to mow fairways. These studies provide evidence that, when turning is minimized, mowing can be completed in much less time. An added side benefit is the reduction in wear and tear on the adjacent rough.

Mowing without baskets is also an option to consider. Time studies have shown that mowing without baskets requires 67% less time to complete compared to the same area mowed with baskets. When labor cost and fuel cost are factored in, the overall impact on time management is significant. As the saying goes, time is money. Productivity with allocated funds can be maximized, and course conditioning can be sustained.

Many turf managers are concerned about the effects of clipping debris on playing quality. There are ways to deal with this issue. Creative drag and blower devices have been fabricated and attached to mowers to disperse clipping debris. Turf tips about drag and blower use presented by the Green Section are available on the USGA website. Returning the clippings to these areas of the course recycles nutrients. Depending upon grass species, 100 to 150 lbs. of nitrogen (N) per acre per year is removed when clippings are harvested. Research has suggested that 50% of applied N is removed when clippings are harvested. Returning clippings may allow fertility inputs to be reduced, thus offering another element of savings. Also, research has found that clippings do not contribute to thatch accumulation problems.

Committees can participate in the process of conditioning the course. A simple strategy is to request that mowing equipment have the right of way to complete mowing tasks with minimal interruptions. Reducing idling time creates a saving over the long term, and mowing in the afternoon minimizes the potential for unsightly clipping debris.

Golf courses are not created equal. Funding levels vary for maintenance programs used to accomplish course maintenance standards requested by golfers. Although the forms of the courses and maintenance programs vary, the function of the courses does not. The game is played the same, regardless of the venue and its presentation. Conditioning expectations can be achieved even if the "WOW" factor cannot be presented as desired. Reducing efforts to produce the "WOW" factor may allow for the use of maintenance practices that beneficially affect the play of the game during tight economic times.

KEITH HAPP *is an agronomist in the Mid-Atlantic Region, visiting courses in the states of Maryland, Pennsylvania, Virginia, and West Virginia. Keith is a graduate of The Ohio State University and has a sub-regional office located in the Pittsburgh, Pa., area, bringing him closer to courses in the western portion of the Mid-Atlantic Region.*

A simple cost-saving strategy is to request that mowers have the right of way to finish their work. This action saves time and money over the long term.

Naturalized Areas: Beauty and the Beast

Developing naturalized areas brings many benefits to the golf course, but beware, maintenance-free they are not!

BY JIM SKORULSKI AND JOHN FOY

Mowing, brush removal, and weed management practices used to keep naturalized areas in acceptable appearance and playing condition can be labor intensive and costly.

Naturalized areas have been an integral part of golf courses since the game was played on the Scottish linksland. Rough areas consisting of native grasses and gorse provided soil stabilization and a low-cost natural hazard. It is easy to understand how these areas influenced early golf course design in North America. Donald Ross himself mentions the virtues of natural areas with the following quote taken from the book *Golf Has Never Failed Me*: "In British courses, heather, whims, and bent grass are in many cases left growing in a diagonal formation, producing a remarkably interesting hazard."

Naturalized grassland/prairie, savannah, scrubland, desert, woodland, and wetland ecosystems continue to be incorporated into new golf course designs and existing golf courses. The GCSAA reported that, on average, 23 percent of total acreage on golf courses is naturalized, while golf courses working with Audubon International have an average of 47 percent of their total acreage in naturalized habitats. These areas provide aesthetically pleasing and challenging design features, along with valuable wildlife habitat. They also offer an opportunity to reduce irrigation, mowing, and pesticide inputs in comparison to more highly managed turf areas. There is a common misconception, however, that naturalized areas are maintenance free.

THE BEAST

The degree and type of maintenance used to manage naturalized areas vary widely among golf courses and depend on the ecosystems in place and the attitudes of the management and golfers. There are some universal tasks that are required to keep naturalized areas playable and visually acceptable. At the least, grassland/prairie systems require annual mowing in fall or spring, brush removal work, and selective

herbicide applications to keep out unwanted vegetation. More frequent mowing, mechanical thinning, and additional herbicide and insecticide applications may be required in areas that receive more play or are more visually prominent. Controlled burning is another management tool used periodically at some golf courses to maintain the integrity and plant composition in naturalized areas, and to thin excess vegetation. Naturalized scrubland, savannah, wetland, and woodland ecosystems require routine maintenance to remove weeds and exotic plants. The semi-naturalized native grass beds sometimes found over large acreages on golf courses in Florida and other semi-tropical regions also can be very labor intensive.

Superintendents from several New England golf courses estimate that labor costs for mowing naturalized acreage they manage range from $50 to $300 per acre. Labor to manually remove brush and weeds from naturalized areas ranges from $30 to $150 per acre, and $20 to $200 per acre is allocated for labor costs associated with chemical applications. Total labor costs at the golf courses surveyed range from $260 to $500 per acre, depending on the site and golfer expectations. Superintendents who manage naturalized scrubland areas in South Florida can spend $1,200 to $2,000 per acre to remove exotic plant material and manage dense vegetation in a 12-month season. Annual mulching and other weed management programs used in the upkeep of native grass beds can be as high as $2,500 per acre.

THE BEAUTY

The challenge facing most golf courses is creating a balanced maintenance plan that satisfies the golfers and neighbors, while remaining affordable and sustainable. The process involves good long-range planning, continual education, and effective communication. Site selection significantly impacts management programs and cost. Difficult-to-

Site selection is a key factor for developing a sustainable management plan. Areas that receive more play or are visually prominent will require more frequent maintenance.

A steep naturalized tee bank is cut annually in fall at Dedham Country and Polo Club in Massachusetts.

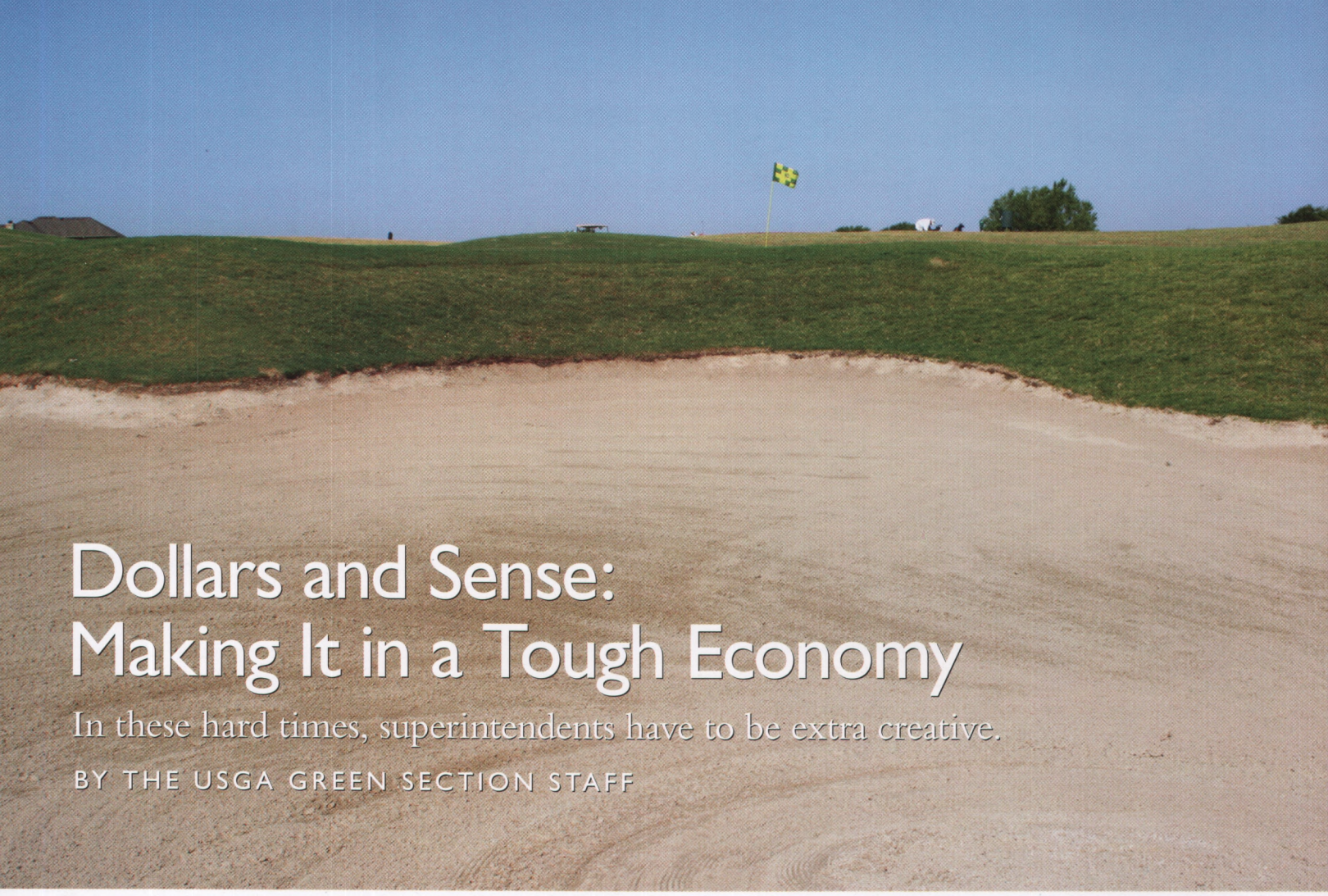
maintain sites, non-irrigated acreage, and environmentally sensitive areas are well suited for naturalization. Consider an area's location in regard to play and traffic. Evaluate soil conditions, drainage, and existing plant materials to determine what the appearance and playing conditions will likely be, once the area is naturalized. Ultimately, there will be some areas that will be maintained more effectively with standard maintenance.

Develop an annual management plan for the naturalized acreage, just as you would for turfgrass areas. Categorize and map the naturalized zones in the plan, based on their location, habitat type, and maintenance needs. Prioritize maintenance based on the categories that are defined in the plan, and try to limit intensive maintenance to smaller areas that receive more play or are located in highly visible locales. Areas further from play are managed in a more sustainable fashion, utilizing selective and rotational maintenance programs whenever possible. This management approach can further reduce management costs and encourage greater plant and habitat diversity.

Acceptance of a sustainable management approach may be difficult at some golf courses. A continuous educational process will be required to convince reluctant golfers that a little plant diversity is beneficial and can help trim management costs. It also will require managers to gain more extensive knowledge of habitat ecology to manage the various habitats in an efficient and effective manner. Conservation organizations such as Audubon International, agencies like the National Resource Conservation Service, and local university specialists or extension agents can provide support and guidance in regard to specific management options and golfer education. Naturalized areas are not maintenance free, but with proper planning and a realistic management approach, they can be a valuable golf course asset that just may put more money in the bank.

JIM SKORULSKI *and* JOHN FOY *are well-seasoned Green Section agronomists who enjoy promoting the creation of naturalized areas on golf courses in the New England and Florida Regions.*

Proper plant material selection is a key consideration in developing naturalized areas and controlling ongoing maintenance costs.



Dollars and Sense: Making It in a Tough Economy

In these hard times, superintendents have to be extra creative.

BY THE USGA GREEN SECTION STAFF

Bunkers are an obvious spot to save money at many golf courses. Realistic expectations must prevail when deciding how they are to be maintained.

The current economic recession has touched all parts of the golf industry. Golf course superintendents have not been immune from the reality and implications that forecasted revenues and rounds of golf are down at most golf facilities. There may be exceptions, but the rule is that most superintendents are studying ways to do more with less.

The agronomists of the USGA Green Section recently collaborated on this article, which is intended to provide golf courses with ideas on how to reduce their course maintenance budgets. Each item may or may not apply to your golf course; this list is not all-inclusive, nor is it intended to be a recommendation for your golf course. At a minimum, the ideas presented will encourage creative thinking among superintendents and their staffs as they manage their golf courses through difficult economic times. When reviewing these ideas, it is up to each individual golf course to determine whether the idea will change the desired standards of the course and whether this is acceptable. Please note — ideas that involve reducing the frequency that something is done only reduce expenses if total payroll hours are reduced as a result.

COST SAVINGS VS. COST CUTTING

Before moving forward, it is important to distinguish between the terms *cost savings* and *cost cutting*. For the purposes of this article, *cost savings* is defined as spending less for a product or service without changing the quality of the course. In golf maintenance, this means the standard remains the same, but a less expensive way has been found to achieve the standard. Cost cutting is defined as spending less for a product or service with a reduction in the standard. In golf maintenance, this means that the standard is lowered and less is spent to achieve the new standard. Always communicate proactively with course officials if the standard is being lowered to cut costs.

USGA TURF ADVISORY SERVICE

The USGA Green Section has been offering Turf Advisory Service consulting visits to golf courses since the early 1950s. Green Section agronomists visit more golf courses each year than any other turfgrass consulting organization. Please contact your regional agronomist for more information about tailoring these ideas to your course and communicating them to those who play the course.

Alternating rolling with mowing has become a popular strategy on putting greens.

PUTTING GREENS

- Change holes less frequently.
- Employee changes the hole and mows the green. If a triplex is used, mount hole changer on the mower.
- Using more plant growth regulators may reduce mowing frequency or allow rolling instead of mowing more often.
- Increase mowing heights to reduce stress, limit fungicide use, and leave a margin for unusual environmental extremes.
- Alternate mowing and rolling.
- Eliminate or reduce double mowing.
- Increase use of triplex mower, but use walk-behind for cleanup pass.
- Use a less-expensive fertility program. For example, use urea plus iron for spoon feeding instead of specialty programs.

BUNKERS

- Reduce raking frequency and increase the use of touch-up or spot raking.
- Increase use of motorized rakes and reduce hand raking at clubs that usually rely on hand raking.
- Eliminate excessive or unnecessary bunkers. Install mounding or depressions instead. Initially requires investment in time and resources.
- Treat perimeters and banks with growth regulators to reduce edging/mowing frequency.
- Extend the life of fiberglass-handled bunker rakes with the installation of plastic sleeves from vinylguardgolf.com.

FAIRWAYS

- Reduce fairway mowings per week.
- Increase use of growth regulators to reduce clippings and support reduced mowing frequency.
- Rely more often on fertigation. Nitrogen applied frequently in small amounts is more efficient than granular applications. A pound of nitrogen can be stretched further with fertigation.
- Eliminate all nutrients except nitrogen for one season or so.
- Reduce total nitrogen applied.
- Use more iron and less nitrogen.
- Increase use of large pull-behind gang mowers.
- Implement the most efficient mowing patterns to save on fuel and time.
- Don't collect clippings.
- Use generic herbicides.
- Decrease herbicide applications.
- Take advantage of early order programs for fairway and rough products.

ROUGH

- Mow roughs less frequently.
- Decrease total fertility in rough, or fertilize only high-traffic zones.
- Apply herbicides less frequently.
- Skip preemergence application if weed seed bank is minimal and weeds have been controlled successfully for years.
- Eliminate the intermediate cut.
- Lower the primary rough cut and mow less frequently.
- Maintain a wide band of low-cut primary rough around each fairway. Maintain a higher cut (4-6") and mow less frequently farther away.
- Create no-mow areas if they are out of play.
- Reduce herbicide applications and labor in natural areas.

The expense of maintaining water coolers on the golf course should be compared to alternative means of providing water to golfers. Substantial annual savings exist.

- Mow with gang mowers instead of self-contained rotaries.
- Remove mulch and install a more shade-tolerant grass.

TEES

- Eliminate topdressing for a season or two (if applicable).
- Eliminate use of walk-behind mowers.
- Don't overseed.
- Abandon square tee configuration and round off edges with a triplex.
- Move tee markers less frequently.
- Reduce fertility (if applicable).
- Mow less frequently.
- Eliminate overseeding bermudagrass tees in winter.

COURSE AMENITIES

- Eliminate on-course water coolers. Inform golfers of the need to buy water or fill their own water bottles prior to play.
- Eliminate landscape plantings and flowers on the golf course.
- Shrink landscape plantings around the clubhouse.

BUDGETING AND PLANNING

- Conduct time and motion studies to determine what it costs to do everything on the golf course. Be sure to include materials. This information is invaluable for planning.
- Consider gap maintenance to avoid golfers and increase productivity.
- Begin the workweek on Saturday. Better able to manage hours and avoid overtime.

TREES

- Remove trees that are a hindrance to turfgrass health.
- Do not just trim trees if what they need to be is removed.
- When removing trees, hire a land clearing company. They are often one-third the price.
- Root prune trees to decrease water use in rough.

Rounding off square tees with a triplex mower can reduce mowing time by 50%.

MAINTENANCE OF WATER HAZARDS

- Maintain to the margin of a hazard. Eliminate string trimming inside the hazard or reduce it to once per season.

MAINTENANCE DOWN THE MIDDLE

- Keep the focus on the middle of the course. Commit to having fantastic tees, fairways, and greens, even if it means lowering standards in the roughs, woods, and bunkers.

LABOR

- Hire fewer summer employees.
- Eliminate or reduce special projects.
- Borrow or share equipment in appropriate situations.
- Study the zone maintenance concept. Employees are all cross-trained. Each zone leader can mow greens, change holes, rake bunkers, change tee markers, empty trash, and replace water jugs. This is more efficient and consumes less fuel.

- Implement the buddy system, where two workers ride in one cart to reduce fuel consumption.
- Eliminate overtime.

GOLFER CONTROL ISSUES

- Control golf carts more strictly to reduce wear and the need for nitrogen and water.

time it takes to get the crew out on the course. When the facility is poorly designed, bring one or two staff in 30 minutes early to stage all the equipment needed for morning jobs outside the building. This avoids the crew from wasting five to ten minutes every day waiting to get equipment out of the building.

Anything that can be done to reduce irrigation will lessen the electric bill.

- Reduce shotgun starts unless an outing is generating revenue for the club.
- Delay opening the course in the spring by a week.

EQUIPMENT

- Keep blades sharp.
- Know the clip rate and optimum speed of every mower to produce the best cut.
- Ensure accurate spray or granular calibration to prevent unintentional over- or under-application.
- Determine the fleet management option (lease vs. purchase) that provides best cash flow.
- Keep equipment stored in the maintenance facility to minimize the

IRRIGATION

- Reduce the total amount of water applied. There is a partial kilowatt-hour behind every drop of water applied.
- Reduce irrigated areas.
- Fine tune the system via leveling heads, replacing worn nozzles, etc.
- Understand how the electric utility charges for power and then operate the pumps in the most efficient way.

MISCELLANEOUS

- Contact the local electricity provider and schedule a commercial audit for the maintenance facility and clubhouse.
- Evaluate the golf cart charging protocol and be sure it is the most cost-effective way to charge the golf carts.
- Be sure to apply to the IRS to claim the Off Road Fuel Tax Credit for unleaded gasoline used in golf course equipment.
- Install motion-activated light switches in restrooms and the break room.
- Keep the maintenance facility two degrees warmer in summer and two degrees cooler in winter.
- Evaluate the number of phone lines entering the clubhouse and maintenance facility. Reduce if possible.
- Modify uniform service. Consider purchasing two pairs of pants and shorts each year for employees. Install a washing machine and dryer in the maintenance facility.
- Do not provide Styrofoam cups in the break room. Buy each employee a thermal mug — one time only.
- Study the most effective way to store equipment to minimize time spent in the morning getting equipment ready to go.
- Use perennial plant materials at the clubhouse.

CONCLUSION

Recessions are difficult, but not permanent. They give rise to new ways of operating and take all of us out of our comfort zone. Being forced to consider ways of keeping the bar at the same level instead of raising the bar requires a different mindset. As we move from tough times to more prosperous ones, golf course superintendents and course officials will be better off for the experience. Now and in the future, the USGA Green Section remains committed to staying up to date and providing cutting-edge information to all who seek it.

This article was compiled by Chris Hartwiger *and* Patrick O'Brien, *with contributions from the other regional Green Section agronomists.*

IKE GRAINGER AWARD PRESENTED TO DR. JAMES R. WATSON AND DR. PAUL E. RIEKE

The USGA is pleased to honor Dr. James R. Watson and Dr. Paul E. Rieke with the USGA's Ike Grainger Award for 25 years of dedicated service as USGA committee volunteers.

The award was named in honor of a remarkable gentleman named Isaac B. Grainger, who served as USGA president and as a Rules authority for many decades until his death on October 18, 1999, just short of his 105th birthday! So legendary was Grainger's knowledge of the Rules of Golf and his lifetime devotion to the game, that in 1995 the USGA established the Ike Grainger Award to recognize persons who have volunteered on behalf of the USGA for 25 years.

The USGA volunteers we honor are well known to practically everyone who is involved in turfgrass management, and golf turf management in particular. Dr. Watson and Dr. Rieke (a.k.a. Dr. Jim and Dr. Paul) are icons in the industry, and their contributions to the USGA and to golf have involved participation in the USGA Turfgrass and Environmental Research Committee for 25 years. Interestingly, they have many characteristics in common.

- Each was raised on a farm and took a circuitous path to the turfgrass industry — Dr. Jim was born in 1920 in Leesville, Louisiana, and Dr. Paul was born in 1934 in Kankakee, Illinois.
- Both are soft spoken, but both are strong leaders and have contributed profoundly to the great successes of the USGA's Turfgrass and Environmental Research Program.
- Both have received the USGA Green Section Award for "contributions to the game of golf through work with turfgrass." This annual award was established in 1961, and the list of recipients is a who's who of turfgrass in academia, industry, and superintendence.
- Both have received the Green Section's Piper and Oakley Award, established in 1998 to recognize volunteers who have contributed exceptional service for the benefit of the programs and activities of the USGA Green Section. Drs. Piper and Oakley were men of great character, keen vision, and remarkable achievement, characteristics that pertain equally well to Dr. Jim and Dr. Paul.
- The presentation of the Ike Grainger Awards to Dr. Jim Watson and Dr. Paul Rieke completes the final leg of their "Triple Crown" as it pertains to recognition from the USGA. No one else has ever achieved all three honors.

From left: Dr. James R. Watson and Dr. Paul E. Rieke.

Now, you might wonder how important the Ike Grainger Award is, given that "*all* you have to do" is show up for 25 years! Well, you can be assured that Dr. Watson and Dr. Rieke have spent countless hours, days, weeks, months, and years on behalf of the USGA, and they were instrumental in helping direct the largest turfgrass and environmental research program ever undertaken. Since 1983, this USGA program has supported more than 400 research projects at 39 universities, at a cost of more than $34 million in actual grants.

On top of that, each year several USGA staff, along with committee volunteers, took turns visiting the 35+ universities and the principal investigators at every one. This involved a lot of travel and dedication on the part of our volunteers, and I'll bet you can guess who were the two most consistent volunteers — yes, Dr. Jim and Dr. Paul. Their knowledge, experience, and loyalty have been invaluable, and without their guidance, the program would have been lesser for it.

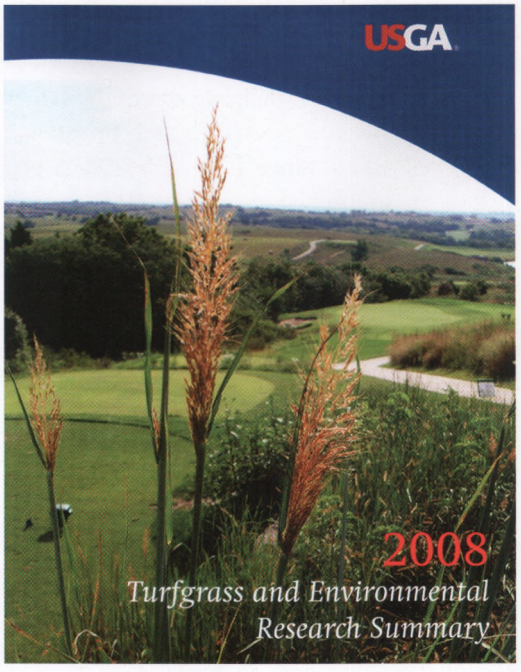
GREEN SECTION INTERNSHIPS AWARDED FOR 2009

For the 12th year, the USGA Green Section has awarded internships to outstanding turfgrass management students. During 2009, the Green Section will provide the opportunity for 15 students to travel with the Green Section staff on Turf Advisory Service visits. Each intern will travel for one week with an agronomist in his or her region between the months of May and August. The goal of the internship program is to provide students with a broader view of the golf course industry and the opportunity to learn about golf course maintenance through the perspective of the Green Section agronomists. More information about the internship program can be found on the USGA Green Section Web site at http://www.usga.org/turf/internship/2009_internship.html.

Intern Name	Year	University	Advisor
Richard Bache	Junior	North Carolina State University	Dr. Richard Cooper
Patrick Bastron	Senior	University of Wisconsin	Dr. John Stier
Caleb Bristow	Senior	Auburn University	Dr. Beth Guertal
Phillip Cahoon	Junior	California Polytechnic	Prof. Kelly Parkins
Sheldon Champion	Junior	Delaware Valley College	Dr. Doug Linde
John Daniels	Junior	University of Missouri	Prof. Brad Fresenburg
Bryce Fischer	Junior	University of Montana	Dr. Tracy A. O. Dougher
Michael Ford	Senior	State University of New York	Prof. Dominic Morales
Marcus Harness	Senior	Washington State University	Prof. Matt Williams
John Kauffman	Ph.D. Program	University of Tennessee	Dr. John Sorochan
Nicholas Menchyk	Ph.D. Program	Clemson University	Dr. Halbo Liu
James Popko, Jr.	M.S. Program	University of Massachusetts	Dr. Geunhwa Jung
Aneta Studzinska	Ph.D. Program	Ohio State University	Dr. Karl Danneberger
Jon Trappe	M.S. Program	University of Arkansas	Dr. Aaron Patton
Bradley Williams	M.S. Program	University of Florida	Dr. Jason Dettman-Kruse

NEW PUBLICATION AVAILABLE

The *2008 Turfgrass and Environmental Research Summary* is now available free of charge through the USGA Order Department (800-336-4446). The research summary provides a one-page summary of each research project currently being funded by the USGA's Turfgrass and Environmental Research Program. This publication is appropriate for researchers, university extension personnel, and golf course superintendents who are interested in learning about the latest results from the program. Request publication NS 1647.



PHYSICAL SOIL TESTING LABORATORIES

The following laboratories are accredited by the American Association for Laboratory Accreditation (A2LA), having demonstrated ongoing competency in testing materials specified in the USGA's Recommendations for Putting Green Construction. The USGA recommends that only A2LA-accredited laboratories be used for testing and analyzing materials for building greens according to our guidelines.

Brookside Laboratories, Inc.
308 Main Street, New Knoxville, OH 45871
Attn: Mark Flock
Voice phone: (419) 753-2448
FAX: (419) 753-2949
E-Mail: mflock@BLINC.COM

Dakota Analytical, Inc.
1503 11th Ave. NE, E. Grand Forks, MN 56721
Attn: Diane Rindt, Laboratory Manager
Voice phone: (701) 746-4300 or (800) 424-3443
FAX: (218) 773-3151
E-Mail: lab@dakotapeat.com

European Turfgrass Laboratories Ltd.
Unit 58, Stirling Enterprise Park
Stirling FK7 7RP Scotland
Attn: Sharon Bruce
Voice phone: (44) 1786-449195
FAX: (44) 1786-449688

Hummel & Co.
35 King Street, P.O. Box 606
Trumansburg, NY 14886
Attn: Norm Hummel
Voice phone: (607) 387-5694
FAX: (607) 387-9499
E-Mail: soildr1@zoom-dsl.com

Hutcheson Technical & Soil Services
8 West Street, South
Huntsville, ON, Canada, P1H 1P2
Attn: Chelsea Stroud-Gammage
Voice phone: (705) 788-0407
Fax: (705) 789-4457

ISTRC New Mix Lab LLC
11372 Strang Line Road
Lenexa, KS 66215
Voice phone: (800) 362-8873
FAX: (913) 829-8873
E-Mail: istrcnewmixlab@worldnet.att.net

Sports Turf Research Institute
hyperlink to www.stri.co.uk
St. Ives Estate, Bingley
West Yorkshire BD16 1AU
England
Attn: Michael Baines
Voice phone: +44 (0) 1274-565131
FAX: +44 (0) 1274-561891
E-Mail: stephen.baker@stri.org.uk

Thomas Turf Services, Inc.
11183 State Highway 30
College Station, TX 77845
Attn: Bob Yzaguirre, Lab Manager
Voice phone: (979) 774-1600
FAX: (979) 774-1604
E-Mail: soiltest@thomasturf.com

Tifton Physical Soil Testing Laboratory, Inc.
1412 Murray Avenue, Tifton, GA 31794
Attn: Powell Gaines
Voice phone: (229) 382-7292
FAX: (229) 382-7992
E-Mail: pgaines@friendlycity.net

Turf Diagnostics & Design, Inc.
613 E. First Street, Linwood, KS 66052
Attn: Sam Ferro
Voice phone: (913) 723-3700
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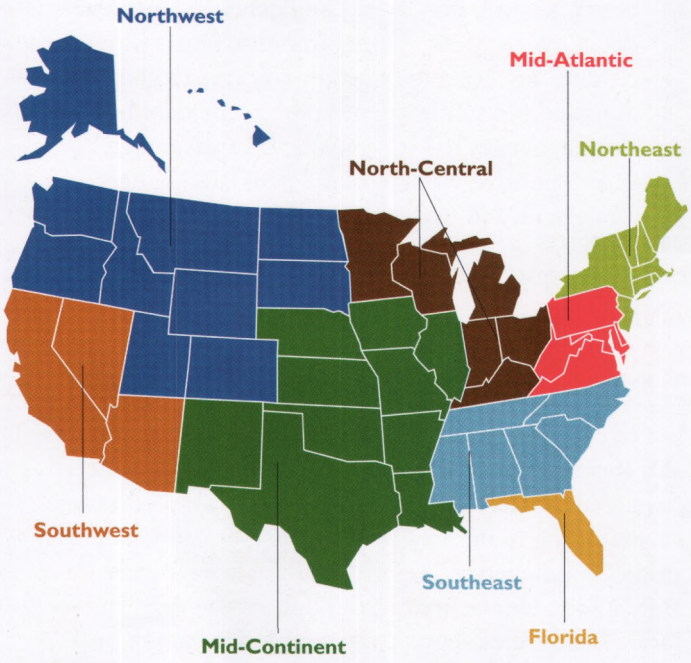

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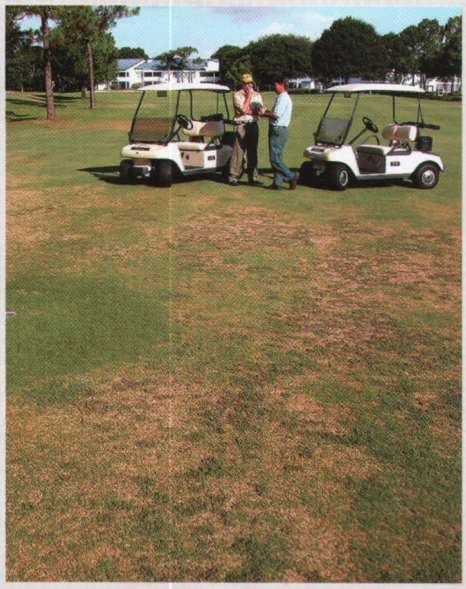
Turf *Twisters*

Q: Will we gain anything from returning the clippings to the turf rather than collecting them from our fairways every time we mow? (New Jersey)

A: Yes, a nutrient effect can be gained. Grass clippings contain a significant amount of nutrients. As the clippings decay, nutrients are returned to the soil for uptake again. Research indicates that approximately 50% of applied nitrogen is removed when clippings are harvested. Other studies show that 100 to 150 lbs. of nitrogen is removed per acre per year via clipping collection.

Q: I've been asked to cut back the operating budget and specifically to reduce bunker maintenance. I like the idea of reducing the maintenance cost of hazards, but I don't want to apply a change that will draw complaints. Any suggestions? (Kentucky)

A: Start by reducing the raking frequency. One or two complete rakings each week can be supplemented by hand raking disturbed areas on mornings when complete machine raking is withheld. Then, be sure that bunker drainage is functioning properly and that design features do not allow constant erosion. Investing in drainage and subtle design changes to ensure positive water movement will pay dividends in the form of reduced maintenance costs. Microenvironment limitations also should be considered. As an example, if tree roots are moving into a bunker, or if overhanging growth is adding debris, adjustments are in order. Don't allow the temporary tree to compromise the permanent bunker. Finally, take advantage of the mandated budget reduction to remind players that bunkers are to be avoided and the amount of resources they consume should be limited.



Q: With the loss of Nemacur (fenamiphos), what hope do we have for managing plant parasitic nematodes? (Florida)

A: Soil-borne plant parasitic nematodes are among the worst pests Florida golf courses face, especially with the loss of Nemacur. Curfew (1,3-D) is currently the only effective commercial alternative, according to numerous studies conducted by Dr. Billy Crow, University of Florida Landscape Nematologist, but it can only be applied once yearly and does not have a year-long residual. In regard to nematode damage, managing the symptoms is just as important as controlling the pest. Since nematodes feed on turfgrass roots, it is important to apply supplemental water and nutrients to infected areas on a light/frequent basis during times of intense pressure. Nematode populations fluctuate greatly throughout the year, and it is important to target peak times to mitigate stress. Other alternatives are currently being evaluated, and we may finally have several effective products within the next couple of years.

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