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ABOUT THE COVER

Historic King Hall on the University of Wisconsin - Madison campus has a close connection to the golf course industry of Wisconsin. Its namesake, F.H. King, established the first soil science department in the U.S. here on the Wisconsin campus. In its over one hundred year history, King Hall has been the office and lab for turf scienctists like O.J. Noer, James R. Love, Wayne R. Kussow and Doug Soldat. At one time the great wildlife ecologist Also Leopold had his office in King Hall. Located on Observatory Drive, the building overlooks Lake Mendota and is one of the oldest on the CALS area of the campus. The character and architecture of King Hall are captured by Beverly Bergemann, our talented cover artist.

"I had never been to Wisconsin, but all my life I had heard about it ... When I saw it for the first and only time in early October, the air was rich with butter-colored sunlight, not fuzzy but crisp and clear so that every frost-gay tree was set off, the rising hills were not compounded, but alone and separate. I remembered now that I had been told Wisconsin is a lovely state, but the telling had not prepared me. It was a magic day. The land dripped with richness, the fat cows and pigs gleaming against the green, and, in smaller holdings, corn standing in little tents as corn should, and pumpkins all about."

– John Steinbeck
Travels with Charley
1962

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THE GRASS ROOTS

THE GRASS ROOTS is a bi-monthly publication of the Wisconsin Golf Course Superintendents Association, printed in Waunakee, Wisconsin by Kramer Printing. No part of THE GRASS ROOTS may be reprinted without expressed written permission by the editor.

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Be Careful What You Wish For

By Mike Lyons, *Golf Course Superintendent, Old Hickory Country Club*

Well, I asked for rain and unfortunately some of us really got it. Here we received around 12" in that stretch. It would begin to dry up and then it would rain another inch and we would be right back to putting signs, rope and anything else we could do so the course could stay open. I wish everyone a better fall than the late summer some of us received. As I am writing this we have our first frost delay; first sign of the light at the end of the tunnel? Not to complain, but why does it seem to always happen on the weekend?

As many of you know NR-151 is going into affect on March 10, 2008.

Dr. Soldat has put together various workshops for us to attend. I hope everyone takes advantage of this opportunity. We will all need to comply with the new regulations. These workshops will help us understand what is required and how to go about developing a nutrient management plan for our golf courses.

There are many things going on this fall. The Wee-One was once again a great success. If you have not become a member, please consider doing so. It is a very worthy cause. The Dinner Dance was hosted at Minocqua Country Club and with fall here the colors, it was beautiful. It is truly unfortunate we don't get more couples involved. It is a great weekend to just relax and have some fun. The WTA Golf Outing is very important to all of us. It was held at Black Wolf Run and I know many of you were able to attend. Keep your eyes open for the Symposium mailing. This year it is being held on the 28th and 29th of November at The American Club in Kohler. This has always been one of the best education opportunities you can attend. Finally, the GCSAA Seminars are coming back to the month of December. The dates, location and topics have not yet been determined. Keep your eyes open for this one as well.

Reading last issue I noticed that the Superintendent Tournament low gross winner was not mentioned. The year's winner was Scott Anthes from Northern Bay Golf and Marina with a great round of 74. Congratulations, Scott.

As I mentioned earlier I hope everyone has a great fall and an even better winter. Before we know it the GIS will be here and we will all be discussing the new products and great educational opportunities they had to offer.

Take care.

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Techno-Turf Management

By Dr. John Stier, *University of Wisconsin-Madison, Department of Horticulture*

This July I was invited along with several other researchers to give presentations on the latest methods for measuring turfgrass stress responses at the American Society for Horticultural Science annual conference. The stresses of interest were water, compaction, herbicide, and low temperatures. While the presentations were intended for researchers, I thought several items might have practical interest for golf course superintendents.

Dr. Bernd Leinauer (New Mexico State University) gave a presentation on water conservation. Since much of the area in the Western states exists in a perpetual drought, water supply and quality have been an issue for as long as the area has been inhabited. This year Phoenix, AZ became the country's fifth largest city, and claims to have the country's largest per capita number of golf courses, yet the area is one of the driest in the country. The day I left for the conference, July 16, USA Today ran an article on the benefits of replacing turf in lawns with rocks, cacti and other water-thrifty plants.

The two main issues of water for turf irrigation in the West are quantity and salinity. Superintendents know irrigation is needed to ensure a sufficient water supply to the turf in order to keep the grass green and growing. In the past most superintendents have been able to irrigate with as much water they deemed necessary, whenever the time seemed appropriate. As an expanding population increases demand for potable water supplies, the turf industry will have to become smarter water users. Temporary irrigation bans are already common throughout the West and southeastern regions of the U.S. Wisconsin is likely to begin seeing at least localized restrictions on golf course irrigation in the future as public water supplies diminish and state and federal water laws regulate access. Both ground and surface sources will be affected. One of the ways superintendents will deal with reduced water

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supplies will be monitoring of the soil moisture content to justify irrigation events and to accurately determine the correct amount of water for each area of the golf course at each irrigation event.

Historically superintendents have watched for changes in leaf color from green to a bluish-green and/or "footprinting" to know when the turf was in need of water. Many superintendents even have a good idea of the irrigation time needed to supply a given amount of water to the turf, e.g., one-half inch. However, such an approach is costly in terms of labor, and since usually only the superintendent and/or an assistant can judge and decide on irrigation needs, some areas may not get the appropriate amount of irrigation. Differences in soil type between areas of the golf course, compaction, and changes in nozzles or even wind effects on irrigation can reduce the likelihood of maintaining sufficient soil moisture.

Researchers have long used a variety of techniques to monitor soil moisture in various experiments. Pulling a soil core with a probe and feeling the soil is undoubtedly the simplest method of monitoring soil moisture, but for most people this technique provides no more information than simply "This soil is dry" or "This soil is moist". A more labor-intensive but accurate method is the use of monolith lysimeters. A monolith lysimeter is nothing more than a tube, usually PVC, pushed into the ground. The tube is then pulled from the ground, complete with turf and its intact root and soil structure, then saturated and weighed. The lysimeter is pulled each day and reweighed. The lysimeter becomes lighter each day as water is transpired or evaporated from the system, providing an accurate measure of the amount of water needed to be replaced by irrigation (or rainfall). Since this method could easily occupy a person's time every day on a golf course, more advanced technologies have to be considered.

One of the tried and true methods for measuring soil moisture without removing samples is to install a tensiometer in the soil. Anyone who completed an introductory soils course in college will remember these gauges-they consist of a cylindrical or oval-shaped water-filled rod with a porous ceramic cup at one end and a gauge at the other end which displays a soil moisture reading. A sufficiently deep hole is made in the ground, sized to ensure a snug

fit between the ceramic cup and the soil. After about 10 minutes, sufficient water has exited from the ceramic cup to establish an equilibrium with the soil moisture. At this point the gauge displays the soil moisture within some percentage range depending on the quality of the tensiometer. Unfortunately these don't provide a quick measurement, and depending on the size, the hole left may be an inch or more in diameter which means they aren't conducive to monitoring moisture on several places on each green on a daily basis. Neutron probes have been used by some researchers in the past to accurately measure soil moisture. Probes are placed into the ground, and radioactivity is used to measure soil moisture but these are expensive and one needs a license to operate them!

Dr. Leinauer has conducted extensive research on methods to monitor soil moisture and salinity for over 15 years. In fact, for the past few years one of his Ph.D. students has been Casey Johnson, a graduate of the UW-Madison turf program and a Wisconsin native. Most of their work has relied on instrumentation that measures the dielectric constant of the soil. As most people know, water is a fairly good conductor of electricity. Since the early 1990s researchers have used technology called time domain reflectometry (TDR) to very accurately measure soil moisture very quickly and with a minimum of surface disturbance. The first TDR systems were bulky and expensive-Dr. Kussow had one. One I used in the mid-1990s was similar to Dr. Kussow's and cost over $10,000. It was so large and heavy we pulled the system in a child's wagon across the turf plots while using the device. However, the ease of use and accuracy were outstanding. Two or more steel rods called "waveguides" are embedded in a resin block which is wired to a device which generates and measures electrical pulses. The waveguides, usually less than one-quarter inch diameter, are inserted into the turf either vertically or diagonally depending on the soil profile of interest. The push of a button sends an electrical pulse down the waveguides, and the speed of the pulse is used by the TDR to calculate the amount of soil moisture. A measurement can literally be collected in less than 10 seconds.

As with most technology, advancements have occurred rapidly since initial development while costs have decreased. The expensive, bulky devices have given way to hand-held units selling for $1,000 and less. Bernd has tested a number of these devices for accuracy, ease of use, etc. He showed this information

in his presentation and two items stood out for me: First, all types provided good to excellent accuracy and second, longer waveguides were a bit more reliable than shorter waveguides. Trime and Turf-Tech manufacture some of the more user-friendly units and both have waveguide lengths suitable for turf measurements (e.g., three to six inches). Dr. Soldat at UW-Madison has been using one of the devices at the OJ Noer Facility this summer for some of his experiments. The long handle allows measurements to be collected from a standing position, and multiple measurements can be taken from a putting green in just a few minutes. It's so easy one of the cavemen from the Geico commercial could do it!

Dr. John Sorochan (University of Tennessee) spoke about compaction. Some of you heard him speak at the Wisconsin Turfgrass Association winter conference this year. He has been using what's called ground-penetrating radar to measure soil compaction. This technology involves a radar unit mounted to or behind a vehicle. As the vehicle is driven across the ground, radar data are collected in a computer and used to generate a 3-dimensional map of the soil underground. The depth of interest can be set by the user. Colors are used in addition to peaks and valleys to denote different levels of compaction on the map. One map he showed was from the University of Tennessee football field at the end of last year's season. In this map, green indicated little compaction while orange showed areas of high compaction. As one would expect, green color dominated the sides and end zones with only minor peaks randomly occurring, and the center of the field showing some moderate-sized orange peaks. At first the audience was puzzled when the largest orange peaks were shown in a small area near the 50 yd line of the sideline, until John explained that last year was a losing season for the usually stellar football team and the orange area was where the coach paced and stomped during the games!

Dr. Brian Horgan at the University of Minnesota has been working with the Toro Co. to develop similar technology for golf courses, while UW-Madison engineers have recently tried their own design on the putting greens at the OJ Noer Turfgrass Facility. John has also used the technology to compare compaction from conventional golf carts to the Segway transporter. Although the wheels on the two-wheeled Segway are narrower than those on golf carts, the enormous difference in weight generates dramatically less compaction than golf carts. In addition to measuring compaction, ground-penetrating radar can be used to locate pipes and other buried objects. Such information is helpful when renovating an older golf course in order to find buried items such as irrigation lines.

A third speaker, Dr. Doug Karcher (University of Arkansas) has gained a national reputation for his development of digital image analysis for turf. Some of

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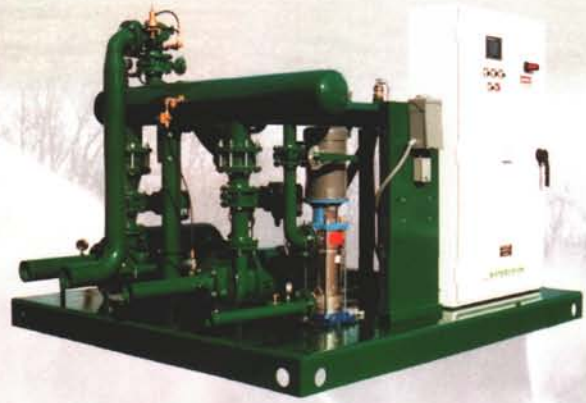

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