Water Conservation Emerges as the Big Issue at National Turfgrass Research Conference.

By Dr. Doug Soldat, *Department of Soil Science, University of Wisconsin-Madison*

Every year, around the time when superintendents begin the ritual of blowing out the irrigation system, turfgrass researchers from all over the country gather to present the results of their most recent research. With over four hundred active members, this group is larger than you might expect. At the conference, the research presentations last only fifteen minutes but run back-to-back for four straight days. The topics are diverse and include breeding and genetics, general turf management, physiology, soils, pathology, weed management and more. Although there is no official theme year-to-year, it was clear to me this year that the number one issue was water conservation.

Water-related issues are no longer relegated to the arid west, a fact made clear by the media coverage of the Atlanta water crisis this fall. Although Atlanta receives over fifty inches of rainfall each year, the growing population in the metro area is using more water than is being replaced. Analogous situations exist in some of Wisconsin's population centers. In my opinion, the largest obstacle facing the green industry today is overcoming the negative public opinion on the impact of turfgrass areas on the environment. Negative perceptions lead to situations like the one in Atlanta where the green industry was the only industry regulated during the water shortage, despite it being nowhere near the number one user of water in the area. Coca-cola is the largest user of water in Atlanta, and they were not regulated. I think pursuing strategies to conserve water on golf courses can work to change public opinion when we communicate our efforts; and secondly, if and when water regulations appear, golf course superintendents will have the tools and know-how to deal with the regulations.

I thought I'd highlight some of the presentations at the confer-

ence related to water conservation that caught my eye. I've broken them down into three categories representing the major strategies for conserving water in turfgrass.

Development and Selection of Improved Species/Cultivars

There was plenty of research on the development of salt-tolerant cultivars, much more than can be adequately summarized here. However, one very interesting presentation made by Christian Baldwin of Clemson University documented the creation of an extremely drought-tolerant creeping bentgrass plant by transferring a gene from a different species into the bentgrass. Due to the concerns of the potential "invasiveness" of turfgrass, it is unlikely that this creeping bentgrass will ever be released — unfortunate due to the tremendous water savings that could result from its use. Dr. Stier's research on the invasive potential of turfgrasses will eventually provide comprehensive science-based information to the governmental agencies which make decisions on whether or not to allow the release of cultivars like the one from Clemson. Rest assured that researchers from across the U.S. are working very hard to improve the salt and drought tolerance of every major turfgrass species and exploring entirely new species as well.

You might be thinking that new cultivars are great, but my course is 80 years old with 80% annual bluegrass and I know my membership will never support a full renovation. Well there is good news for you too. Jing Dai of Penn State studied the salinity tolerance of annual bluegrass ecotypes and found the annual types to be very sensitive to salinity, while the greens-type annual bluegrass was much more tolerant of high salinity levels. She concluded that the salinity tolerance of greens type annual bluegrass was similar to creeping bentgrass, and could be used on golf courses with mild to moderate salinity issues.

Use of Alternative Water Sources

Aside from plant selection, use of alternative water sources is a major water conservation strategy. There is nothing new about using non-potable water for irrigation in the west, but what about in regions of high rainfall? Almost no research on using poor quality irrigation water exists for these areas. However, this is beginning to change. A presentation made by Mark Slavins of Cornell University focused on the use of high salinity irrigation water in the North East. Mark highlighted the fact that nat-

ural rainfall events dilute the salt concentration from the applied irrigation. When rainfall occurs periodically, high salinity water can probably be used for irrigation without making changes to irrigation management. However, irrigating with high salinity water during extended periods of drought (three to five months) will decrease turf quality unless excess irrigation water is applied to leach accumulated salts. Sandy soils were found to be more susceptible to salt accumulation than sandy loam and silt loam soils.

High salinity water, like wastewater, is not the only possible source of alternative irrigation water. In fact, harvested stormwater might become the most prevalent type of alternative water in humid regions of the US. Dr. Kevin Frank of Michigan State University discussed this technique. The concept is simple: capture the runoff from snowmelt and rainfall events that occur in urban areas and use that water for golf course irrigation. This strategy solves two problems at once. First, the nutrient-rich stormwater from the urban areas doesn't ever make it to the surface water bodies where it can cause pollution, and second, the amount of groundwater required for irrigation is drastically reduced. This is another example of how golf courses can potentially provide environmental services in urban areas.

Improved Irrigation Scheduling and Design

The third strategy for water conservation is to improve irrigation design and scheduling. In terms of irrigation design, there were several excellent presentations on sub-surface drip irrigation at the conference. Subsurface drip irrigation is a series of underground emitters which release water into the soil slowly and efficiently. The main drawback of this technology is the poor results found during turfgrass establishment; however, it has found a market in the golf industry for bunker faces and other difficult to irrigate areas. Subsurface drip irrigation is the most efficient water delivery system, and I expect that future research will continue to improve the utility of this technology.

One of my favorite presentations of the entire conference was made by Larry Stowel (co-author Wendy Gelernter) of the PACE institute. The title of the talk was "Virtual Irrigation Audits in Real-time." Larry noted that there are several ways to check the coverage

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of an irrigation system. One way would be to put catch cans out on a putting green spaced on regular intervals. Turn on the irrigation system for a while and then check the amount of water the fell in each can. This is too labor intensive to be of practical value. What Larry and Wendy found was that one could use a GPS system to map the perimeter of the green and also map the locations of the irrigation heads. Then, using the theoretical throw of each head one could identify areas with different numbers of head throwing to it (Figure 1). They found that the higher the number, the greater the moisture content. This information is quick and easy to obtain, and the manager will have an instant idea of the distribution of soil moisture content following an irrigation event. The manager could use the maps to help employees find "hot spots" for handwatering, or make adjustments to heads in an attempt to improve coverage. Larry stressed that the theoretical maps should be confirmed by taking soil moisture measurements. He gave an example of when the soil moisture probe measurement did not match up with the map. Further investigation found that a surrounds head was hitting the green, making the soil much wetter than expected. The surrounds head was adjusted and irrigation efficiency was instantly improved. With out this type of audit, the problem would have gone undetected.

As you can see, water conservation is an exciting area of turfgrass research and it will become increasingly important to have science-based information when State water regulations become more commonplace. Currently, we are in the process of building a "rain-out" facility at the O.J. Noer Facility that will move out over the plots when rain is detected in order to simulate extended periods of drought so we can accurately conduct studies on water conservation strategies for Wisconsin without a storm coming through and confounding the work. I look forward to using the information we gather to help turfgrass managers improve water conservation.

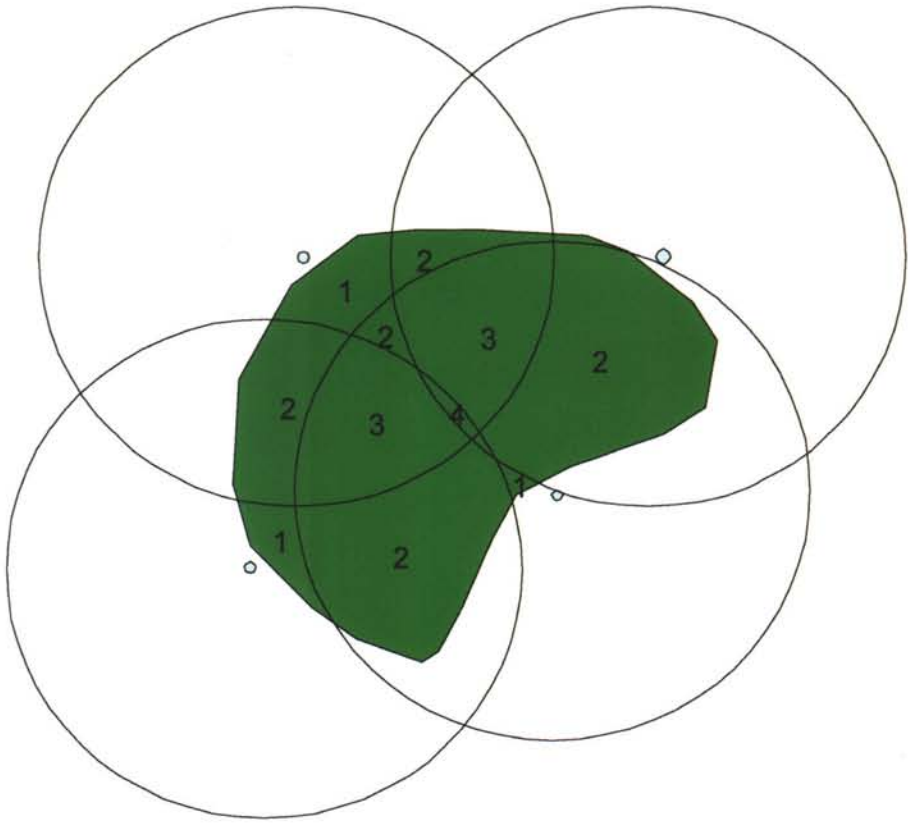


Figure 1. Example of a putting green with imperfect head spacing leading to theoretical differences in soil water content. Areas with one or two heads throwing to them will likely be drier than areas being hit by 3 or 4 heads. A soil moisture probe can be used to validate these predictions. Improved moisture management is possible with this type of information.

As a final note, you might be wondering how the work done at the University of Wisconsin was received at this national conference. Well, I am proud to say that Dr. Stier's graduate student Eric Koeritz took 2nd place in the graduate student competition for his presentation on "Seed Mixtures and Timing for Cool Season Sports Turf Establishment", and Jake Schneider (also with Dr. Stier) took 1st place for his presentation on "Rain Gardens and Urban Water Quality". They were competing against close to one hundred students from dozens of Universities. Congratulations to Eric and Jake and On Wisconsin!

USGA

Mr. Sandman...Is New Technology Lulling Us to Sleep?

By Bob Vavrek, *Senior Agronomist, North Central Region, United States Golf Association Green Section*

The game is played to the greens and on the greens. Needless to say, the quality of the putting surfaces defines a golf course. Superintendents strive to provide smooth, firm, consistent surfaces with enough speed to provide a fair test of putting skill. Really good greens can compensate for poor conditions on the rest of the course. However, when the greens are bad, the course is bad, regardless of the conditioning of fairways, tees, bunkers, and roughs.

Let's put the speed issue aside for this discussion. In fact, speed is a topic discussed less frequently on Turf Advisory Service visits during the past few seasons, perhaps due to the widespread use of rollers and the fact that most mid-to-upper end courses routinely mow at heights of cut at or below 1/8-inch most of the season.

Rollers definitely make the greens faster and smoother. In days gone by, making greens smoother was mostly dependant on how often and how much topdressing was applied to the putting surfaces. After observing hundreds of soil profiles from greens, it is apparent that many courses applied more sand to greens in the past.

This observation should come as no surprise considering the inability of old topdressing equipment to regulate the amount of sand that exits the unit. Old belt/brush type units were generally better suited for the task of applying heavy rates of sand on greens to fill aeration holes than making light applications of sand to greens to smooth and firm up the surface. Substitute or makeshift topdressing equipment, such as a Vicon or Lely fertilizer spreader, could be used to apply sand to greens, though it was still difficult, if not impossible, to apply a small, uniform rate of sand to the turf. As a result, you couldn't topdress all that often, due to the damage to mowers and disruption to play, but that was okay, since plenty of sand was being applied per operation.

Furthermore, it was a more common practice in the past to cultivated greens with 1/2 to 5/8-inch hollow tines every spring and fall. There was no deep-tine, deep-drill, water injection, sand injection, or 1/4-inch Quadratine units to consider as substitutes for standard aeration practices. Heavy applications of sand were made to fill holes and a significant amount of the topdressing filtered into the turf between the holes. The bottom line is that the combination of old topdressing equipment and biannual coring operations resulted in lots of sand being applied to greens each season.

Enter new technology, such as sophisticated, high capacity topdressing units with infinitely adjustable spinner spreaders and a myriad of cultivation options that do not require removing cores or filling holes. It became very easy to substitute one deep-tine operation and one 1/4-inch Quadratine aeration per season for the time consuming, labor intensive practice of coring greens with 1/2-inch tines spring and fall. It became very easy to substitute a quick pass across greens with the high capacity spinner unit every two weeks (sanding 6 or more greens per load) or, better yet, a pass every week using a walk behind fertilizer spinner spreader for the old practice of dumping a load of sand on greens every three to four weeks and then brushing, brushing, brushing in the sand. Progress is good and after all, topdressing greens 20 to 25 times a year just has to be better than topdressing three or four times per season. Or is it?

There are plenty of ways to rationalize why modern topdressing and aeration operations are better than the old ways. In the long run, more sophisticated equipment is less costly than labor. Golfers have one less thing to complain about when standard coring operations are suspended and when the sand is applied so lightly that they can't see it, it doesn't need to be brushed into the turf and it doesn't affect a putt. Greens are commonly mowed at or below 1/8-inch and any more than a dusting of sand will only end up in the clipping basket. The list goes on and on.

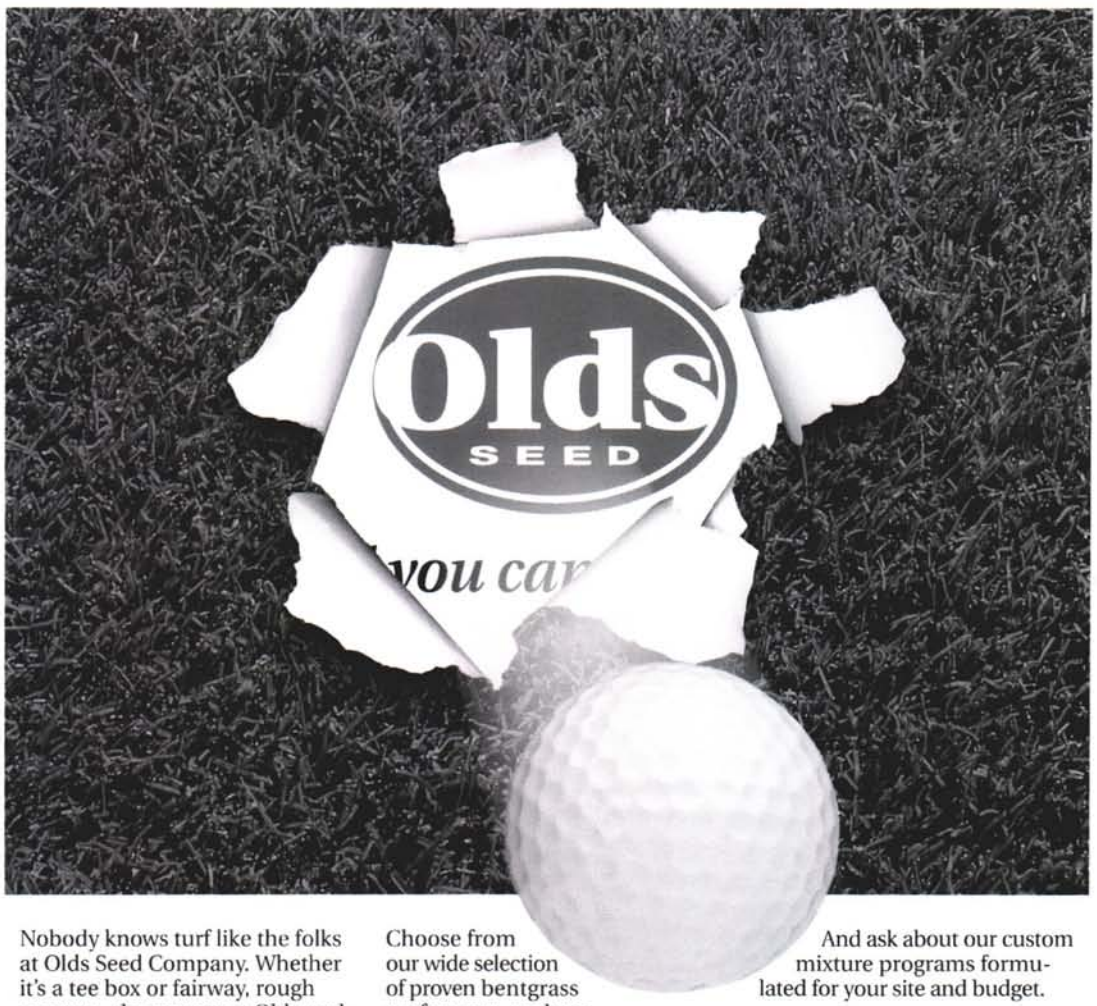
So what's the fuss? Well, if you were only topdressing to make greens smoother, then very light, frequent applications of sand would not be an issue. Then again, if you are topdressing to make greens smooth, why not just roll the greens and eliminate topdressing altogether? The fact is that topdressing and standard coring operations are necessary to manage organic matter (OM) accumulation in greens and rolling won't keep greens free from excess thatch accumulation.

OM accumulation is easy to ignore because you don't see it and it is difficult to measure. The many problems associated with excessive OM in the upper soil profile of greens are a topic for an entire separate article. Suffice it to say that the Green Section staff considers inadequate OM management to be the most common reason why new sand based greens fail. Allowing the pore space at the surface of greens to become clogged with OM may not cause many concerns during a mild, dry season. However, it will make greens very difficult to manage during a hot, wet summer.

OM management is so easy, yet so difficult. Thatch accumulates when the rate of OM production exceeds the rate of decomposition. OM decomposition is a microbial process and microbial activity is inhibited by cool/cold temperatures, oxygen (aerobic microbes), and too little or too much moisture. A cool climate and excessive moisture due to poor drainage, overwatering, or frequent heavy rainfall can tip the scales in favor of OM accumulation. Likewise, turf that naturally has high shoot density or turf that is over-fertilized can be prone to excessive OM accumulation.

Why are hollow tine coring and topdressing important? Coring greens, removing the cores and filling the holes with sand will physically remove some of the OM from the upper soil profile. Frequent topdressing with sand constantly dilutes OM as it is pro-

TURF PROS



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duced. Now that many courses are substituting other forms of cultivation for hollow tine aeration, the importance of managing greens with adequate amounts of topdressing increases.

Unfortunately, while the frequency of topdressing at many courses has increased due to new equipment, the actual amount of sand applied to greens per season has decreased significantly. It's not about how many times the greens are topdressed; it's all about how much sand is being applied to greens per season. Don't blame the companies that developed spinner spreaders for the problem, because every unit has a dial somewhere that regulates the amount of sand that exits the unit.

How much topdressing is enough and how can I quantify progress? As mentioned above, OM is difficult, but not impossible, to measure. However, analytical procedures can vary from lab to lab as well as the interpretation of results. Do not compare OM values between labs. Still, valuable information can be gleaned from sampling greens and developing a baseline to document the effects of modifying management practices. Keep in mind that OM accumulation can vary from green to green. For example, a green with poor surface and subsurface drainage will have more potential for OM accumulation than a green that drains properly. Consequently, sample greens separately.

Contact the lab regarding sampling procedures. It makes little sense to pull an 8 inch core from the greens to measure the average OM of the entire profile when the problem clearly exists in the top inch of the root zone. It would be far better to remove multiple samples from the green and provide the lab a composite sample from the top inch of the turf when a well defined layer of excessive OM is visible.

It's never easy to make changes in course management that require more time and labor or changes that may inconvenience golfers. In the long run, providing firmer, smoother, more consistent greens capable of tolerating the extremes in weather patterns that have become common these past several seasons cannot help but benefit the golfers and the course. Strive to communicate the benefits of more aggressive coring and topdressing to the players. It can be surprising what some golfers will tolerate when given an opportunity to understand the concern.

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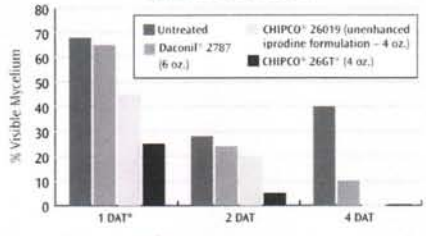

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