

Results from the UW-Madison 2010 Golf Course Irrigation Use Survey

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

In 2005, the GCSAA conducted a national survey of golf course water use. The survey found that golf facilities account for 0.5% of all water withdrawn in the US, and only 1.5% of all water used for irrigation. In general, the survey found most golf course superintendents were utilizing technology and scientific information to make decisions about how to irrigate. One of the key conclusions was that golf courses must continue to be proactive in their water conservation practices to achieve environmental and economic sustainability.

While the GCSAA survey (which can be found on the Environmental Institute for Golf web page), was eye-opening, it painted in broad strokes and grouped results from Wisconsin with ten other states, including Nebraska and Missouri which seem pretty different than Wisconsin to me from a climate perspective. So last year, I sent a letter and survey to 491 golf courses in Wisconsin to characterize the typical water use. We received 102 responses for a response rate of 21%, which was slightly disappointing. On the other hand, the GCSAA survey was returned at a rate of only 15%. The primary concern with a low re-

turn rate is the potential for sampling bias – which is the idea that the group returning the survey is fundamentally different (i.e. more conscientious about water use) than the group that did not return the survey. However, a growing body of survey research (e.g. Holbrook et al., 2007) suggests that response rates of 20% often yield statistically similar results to surveys with high response rates (>50%).

The following are some of the highlights from the Wisconsin Water Use Survey.

General Findings

- The average maintenance budget was \$370,000 per 18 holes (which ranged from \$20,000 (believe it or not) to \$1.4 million).
- The average total irrigated acreage was 65 acres. 70% of courses had kept the same irrigated acreage over the last five years, with 15% increasing the acreage, and 15% decreasing it.
- The average amount of irrigation applied was 12.6 inches per year from 2007-2010.
- The average reported cost of annual water use was \$2,656 (range: \$0 to \$28,000)

Water Conservation Practices in Place

- 87% use wetting agents on putting greens, 45% use them on fairways
- 60% handwater portions of the golf course
- 40% have partially upgraded their irrigation
- 39% have raised mowing heights
- 31% say they irrigate fewer acres – this is interesting when you consider that bullet point #2 in the “general” category above indicated that only 15% decreased the area they were irrigating.
- 14% employ a rain shut off switch
- 14% are monitoring soil moisture to schedule irrigation
- 13% are using ET-based irrigation
- 10% have recently completely upgraded their irrigation
- 10% practice root pruning
- 9% use drought tolerant landscape plants
- 7% are harvesting some water for re-use
- 6% have switched to lower water using species or varieties
- 4% conducted an in-house irrigation audit
- 4% use drip irrigation
- 2% reported “other” but did not elaborate
- 1% have had an outside irrigation audit

Irrigation Technology for Water Conservation

- 55% recently installed new irrigation heads
- 39% have recently upgrade nozzles
- 30% recently upgraded irrigation software
- 28% upgraded irrigation controller, with 19% upgrading the master controller
- 22% reported injecting wetting agents into the water
- 21% installed a new pump, with 13% installing a new pump station
- 20% added more heads, while 7% removed heads
- 12% added new lateral or irrigation main lines
- 4% indicated they had a water management plan in place



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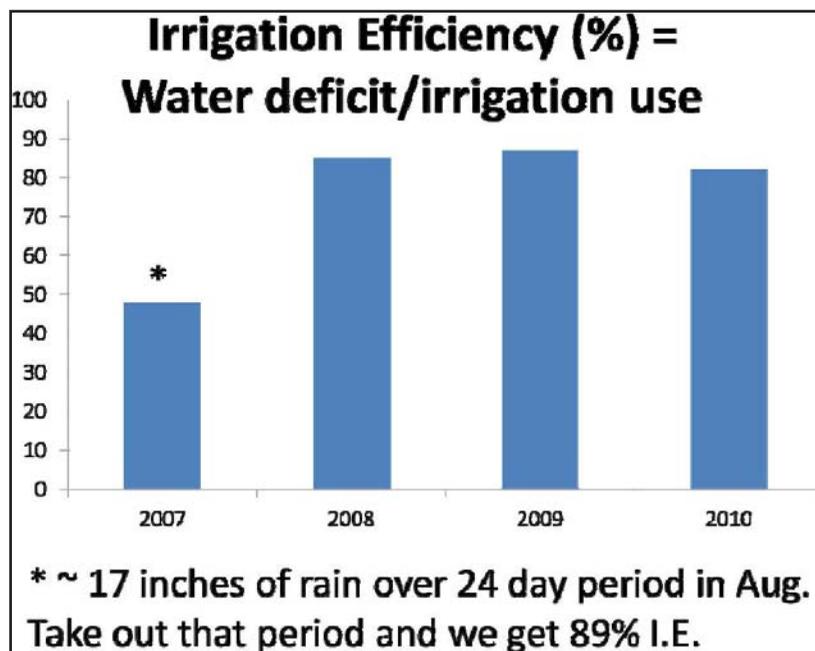
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It seems that there are many water conservation practices already in place on Wisconsin golf courses, including: continual updating of irrigation systems and components, wetting agent use on greens and fairways, use of hand-watering. But, what about the total amount of water used? Is 12.6 inches of water (the average amount of water applied by our golf courses per year) an excessive amount? While it's hard to know for sure, we can do a simple calculation of irrigation efficiency. I will define irrigation efficiency as summer water deficit divided by irrigation applied. The water deficit is the amount of evapotranspiration during that season minus the effective rainfall. Effective rainfall is simply the amount of rain divided by two. This is a pretty gross assumption that accounts for the fact that about half of the rain that falls during the year either drains to the groundwater or runs off before entering the soil. If you get a nice light rain, chances are all of the rain will enter the soil and remain available for plant uptake, but during a five inch rainstorm very little of that rain will be made available to the plants. So the textbooks have concluded that it's dividing the rainfall by two is as good an approximation of effective rainfall as any for this region.

Let's take a look at the irrigation efficiency of Wisconsin golf courses in 2008. We will define the irrigation season as May 1 through Sept 30. During that period we had 18.4 inches of rain. We divide that number by two to get 9.2 inches of effective rainfall. The evapotranspiration during that same period was 25.3 inches. We will assume a crop coefficient of 0.8, which brings the total ET down to 20.2 inches. So 20.2 inches of ET (or plant water use) minus the 9.2 inches of effective precipitation equals 11 inches of water deficit (basically the irrigation requirement of the turf). In 2008, Wisconsin golf courses reported using an average of 13 inches of irrigation. So the estimated statewide irrigation efficiency was 11 inches of water required divided by the 13 inches that were applied which equals 85% efficient. I am impressed!

Similarly, the statewide irrigation efficiency in 2009 was 87%, and in 2010 it was 82%. However, in 2007, the irrigation efficiency was only 48%. That year we had 26 inches of rain, but still applied 14 inches of irrigation. What happened? Many may remember that we had (in Madison at least) 17 inches of rainfall over a 24 day period. The majority of those 17 inches did not become plant available, therefore making our assumption that half of all rainfall will be available for use. When we exclude that 24 day period, the irrigation efficiency for the rest of the year jumps up to 89%.



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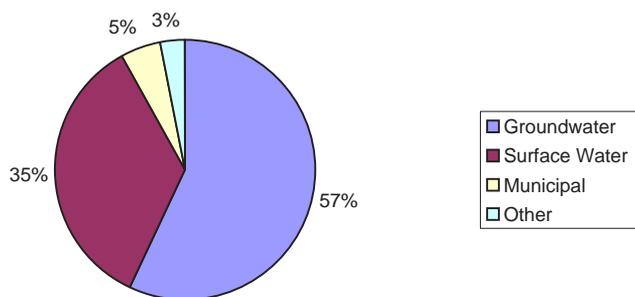
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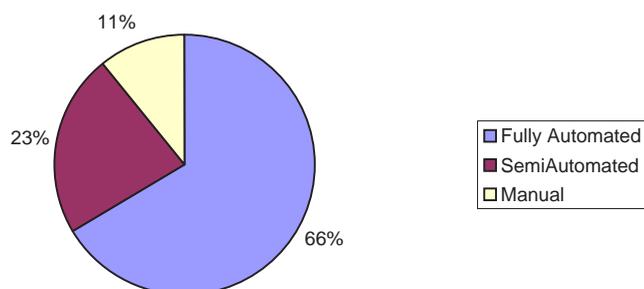
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Golf Course Irrigation Water Sources



Irrigation Systems



So overall, I think an 80 to 90% irrigation statewide efficiency is outstanding! There is not much room for improvement. But it's never a good idea to rest on your laurels, and the survey also revealed many opportunities for improvement. The calculation for irrigation efficiency takes into account the evapotranspiration and the available moisture in the soil (effective rainfall), but less than 15% of the superintendents were using the two outstanding tools to manage their water use. While collectively, superintendents seems to be doing a good job at intuitively getting the irrigation right, using a water budget approach which utilizes soil moisture monitoring and estimates of daily ET can make water management less intuitive and more scientific. It will also be easier to train your assistants to manage the irrigation this way.

Another opportunity for improvement is in irrigation system auditing. Only 5% of you admitted to having conducted an irrigation audit. While I am not necessarily a proponent of traditional catch-can style irrigation auditing, I think using a soil moisture meter to conduct a soil moisture uniformity audit is a very important task for maintaining consistent moisture on the course. For a detailed explanation on this process and its merits, check out my article in the September 2011 issue of the Grass Roots on irrigation distribution uniformity. I am also planning a workshop on soil moisture monitoring and irrigation auditing during the afternoon session at WTA Field Day on July 31st. Hope to see you there! 

References:

Holbrook, A., J. Krosnick, and A. Pfent. 2007. The causes and consequences of response rate in surveys by the news media and government contractor survey research firms. In *Advances in Telephone Survey Methodology*. Eds. J.M. Lepkowski, et al. New York: Wiley.

Coming Events!

Monday June 25th WGCSA Tournament, Oshkosh CC, Oshkosh

Tuesday July 31st Summer Field Day at OJ Noer Center, Verona

August 20th Joint Meeting w/NGLGCSA, Lake Arrowhead Golf Club, Nekoosa

Monday September 17th Wee One Fundraiser, Pine Hills CC, Sheboygan

Fri Oct 5th and Sat Oct 6th Couples Weekend, Edgewood GC, Big Bend

October 1, WTA Fundraiser, Ozaukee Country Club, Mequon

Tuesday & Wednesday December 4th and 5th, Golf Turf Symposium, American Club, Kohler