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COMBINING THE ART WITH THE SCIENCE

Coming off an amazing trip to the US Open, I can't help but think of what would have been had the rains stayed away and the course truly firmed up. The announcers wouldn't have asked Merion's director of grounds, Matt Shaffer, about the possibility of players shooting 17 to 19 under par (which Matt immediately laughed off by saying "That's not going to happen."). Instead they would have probably asked whether the winning score would have been par.

As it turns out, Merion got over six inches of rain during the week and was still able to fend off the best golfers in the world, leaving Justin Rose the winner at an astounding 1 over par. Had it been dry, the winning score may have embarrassed most of the pros, as well as the USGA.

Regardless of the US Open outcome, water management is probably one of the most important aspects of turfgrass management. More importantly, it's not just about how to add water, but how to remove it as well.

At universities across the country, we all share the same mantra of "deep and infrequent" when it comes to the application of water to turfgrass. We sometimes talk about replenishing the system to a set percentage of the ET. We may even go into detail about the current techniques and technology that allows for rapid movement of water through soil profiles.

While overviews and generalities (along with some hard facts) can be offered to students, the practice of adding water as well as removing it is as much of an art as it is a science.

I often hear of students coming back from their internship stating how they "dragged hose all summer." My initial reply is, "Wow! That must have been a great internship." When I say this, I am not being facetious. Most

superintendents I know in the cesspool that is the mid-Atlantic region of the U.S. trust only their best employees to chase wilt on the greens.

As with many agronomic practices, there's no one right way to irrigate. Every golf course is different and in some cases each putting green may react differently to moisture. Some superintendents rely on their overhead irrigation to replenish the system. While not an ideal solution (hand-watering and syringing is generally a better practice), economics and limited staff often make it impossible to micromanage your moisture.

In the past (and currently for many seasoned veterans), the right time to water or syringe is often left to non-scientific methods such as pulling soil cores, watching for "foot-printing", or a variety of other methods learned through years of experience.

The science of water management on a golf course, however, is slowly evolving. In-ground moisture sensors can provide real-time readings of volumetric water content. The use of handheld moisture meters continues to increase and many superintendents are having staff use these to assist in determining water requirements.

While there's no doubt that these tools are improving our ability to limit our water use (remember, overwatering probably kills more grass than anything else), there are still subtleties among greens and even areas on greens that require the operator to make some judgment calls.

One question I often get when I pull out a moisture meter is "What should my percent moisture be?" The answer is "it depends." It depends on the soil type (sand vs. native), the species (creeping bent vs. annual bluegrass), the specific areas on and around the green and other factors. While some putting greens may not

begin to wilt until percent volumetric water content dips into the single digits, others may wilt in the upper teens. There is no universal number everyone can use to determine water requirements at their course.

Water management isn't only about putting supplemental water into a system. In the case of Merion last month, it was about getting the water out. Merion was constructed in the 1800's and has excellent surface drainage. Leading up to the U.S. Open, the club also installed internal drainage to help remove excess water from the greens.

A variety of practices were implemented on the greens leading up to the U.S. Open, including drill and fill, dryjecting, conventional coring and use of the grade. According to Shaffer, "installation of the XGD was the ticket" when it came to moving water through the greens.

In addition to the practices implemented on the greens, fairway programs were critical to keep the course playable during the storms. Beginning in 2005, Shaffer solid tined the fairways twice a year and applied 15 tons of sand per acre after each coring. An additional 20 tons were applied annually in a series of "dustings."

One of the biggest saviors for the fairways during the Championship was the use of the fairway rollers to squeegee water out of the fairways. "I'm not sure if this would be considered a sound agronomic practice, but it helped the fairways dry out faster," said Shaffer. These decisions for the greens and fairways allowed his crew to stay within their planned heights of cut and cut or double cut at least once a day, despite the periodic rains throughout the week.

The combination of internal and surface drainage, the many years of

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To understand the sort of issues we'll be dealing with, check out this study of subsidence in California's Coachella Valley (Enter on.doi.gov/145fYKX into your browser to read this study). The end result was a \$50 million pipeline that brings additional surface water from the Colorado River to Coachella Valley, the region that includes Palm Springs. The water comes into a reclamation plant where it's blended with recycled water to meet the summer demands of up to 50 golf courses that draw on the aquifer.

Another term splashed about at water conferences is "direct potable reuse." The availability of recycled water for irrigation may decline as new methods of treatment allow for more recycled water to go safely back into the water system for drinking. Here's an example from Texas (Enter nyti.ms/WTx8IF into your browser) and a demonstration project in San Diego (Enter bit.ly/bHkurf into your browser).

A leading irrigation consultant told me that such projects are, "a double-edged sword because yes, they increase supply, but advanced treatment means higher water rates for the membrane (reverse osmosis) operation and brine disposal infrastructure and operating costs. This process is just starting to gain traction in the industry."

All of which means that while you also might not like water, you need to know about it. Down to the last drop.

Okay. So what do I like about water?

I like that it comes in three forms: frozen, liquid, or gas.

That three-quarters of the earth's surface is covered in water, and that we are trying to find safe ways to harness its power.

In frozen form, it's ideal for skating, a key element of my second favorite sport – hockey, and the perfect complement to my post-round Grey Goose and tonic.

I like showering after a long day on the golf course, and especially at great clubs like Riviera, Merion, and Pine Valley where the showerheads are big and fully pressured.

One more thing to like about water: It keeps us healthy. Remember to stay hydrated, and to make sure your staff drinks enough water, too. Unlike golf courses, for us there is almost no such thing as too much water. **GCI**

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sand topdressing, and the unorthodox use of the fairway rollers as a squeegee allowed the native soil golf course to bounce back from several inches of rain in just a day or two. It's important to point out these results didn't happen overnight. Many years of modified cultural practices were used in advance of the championship to ensure the course was playable if and when a major storm hit.

The bottom line? Many things can impact the playability and health of your golf course, and irrigation/moisture management is high on that list. While some of these practices can have a quick impact on moisture management, others require long-term planning and implementation before the practices pay off.

While we continue to increase our use of scientific instruments to help determine irrigation inputs, the overall process will continue to remain more of an art than an exact science. The turfgrass managers that fine tune irrigation and moisture management are usually the ones that make it through the most difficult of conditions. The superintendents who figure out how to combine the art with the science will likely continue to have the most success. **GCI**

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At the same time, irrigation and water management issues were taking 80 percent of Eric's time. With the new system, irrigation materials and labor repair costs dropped to \$2,500 annually and hand-watering hours dipped to 500 hours (50 percent less). The greens are now hand watered, which they were not previously, and accounts for the majority of the hand watering. This decrease in labor has allowed the staff to concentrate on other course improvements.

The new irrigation system has greatly improved the consistency of the course playability, not only on a hole-to-hole basis, but from a month-to-month basis throughout the golf season. It has also been a major factor in the aesthetics of this link-style course allowing it to be dry where and when it is supposed to be, which has brought out the original design intent. **GCI**

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have a tremendous influence on irrigation decisions – we water smarter.

We tend to focus on applying water to golf courses to even out precipitation. But in a year like this, drainage systems can be important to good golf turf. During this year's Memorial Tournament, Jack Nicklaus was discussing a drainage project and concluded with, "Drier golf courses are more fun to play." He's right.

Water is obviously the most important factor in manag-

ing a golf course. Turf cannot live with either too little or too much. And water has become a national concern in the most recent decades. When I look back to watching my grandfather use a forked stick to dowse for spring water on his farm, to contemporary golf course irrigation considerations, I really do feel my age. That perspective, however, leads me to have a lot of confidence that our golf turf industry will continue the innovation needed to carefully use this precious national resource. **GCI**