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• **On the cover:** Among the most recognizable symbols in sports, the five Olympic rings mean even more to those in the golf industry this year. They symbolize golf's return to the Olympics for the first time since 1904, and this month's *GCM* previews the golf course and the man behind its construction and maintenance. **Photo by lazyllama/Shutterstock.com**

Irrigation evaluation: An understanding of distribution uniformity is key to having an efficient irrigation system and properly maintained turf.
Photos courtesy of Underhill

(irrigation)

A formula for success

Determining your irrigation system's distribution uniformity and understanding what factors influence it will help you use water more efficiently while also enhancing your course's playing conditions.

With today's high-tech tools, distribution uniformity problems can often be clearly visible.

Regardless of where they manage turfgrass, superintendents know there is no substitute for an irrigation system operating at the peak of its abilities. Unfortunately, other than following guidance gleaned through anecdotal observations, most superintendents struggle with exactly how to quantify whether they're getting the most out of their irrigation system.

An effective method to make such an assessment is to measure distribution uniformity, and if there's an expert on the topic, it's Mike Huck, president of Irrigation and Turfgrass Services and a well-known international turfgrass water management consultant. Based in San Juan Capistrano, Calif., Huck has worked as a golf course superintendent and with the USGA Green Section in his long career. We asked Huck to delve deeper into distribution uniformity and discuss what superintendents need to know about it, as well as how measuring it can benefit a golf facility.

Q: What's "DULQ," and what does it have to do with a golf course?

A: "Distribution uniformity/low quarter" is the most common formula used to measure how uniformly water is distributed across turf. It's considered a barometer of irrigation system performance, and it's expressed as a percentage. A low DULQ value (65 percent or lower) indicates that irrigation coverage is inconsistent, which results in a wide variation in application, with under- or over-watered areas. Higher DULQ rates (80 percent or better) result in irrigation that's more

Metal nozzles deliver high distribution uniformity and optimize coverage, according to tests conducted by the Center for Irrigation Technology at California State University, Fresno.

uniform, with improved turf health, color, density, overall appearance and playability. With higher DULQ values, sprinklers can be programmed for shorter run times, which saves water and energy, and requires less labor for hand watering.

Q: How can a superintendent tell whether a course has distribution uniformity issues?

A: They may not realize their irrigation system is inefficient until obvious signs appear: repetitive, geometrically arranged patterns of wet or dry areas, such as "doughnuts" surrounding each sprinkler.

With today's high-tech tools — such as drone surveys, soil moisture sensors and Google Earth timelines — distribution uniformity problems can often be clearly visible. Drone surveys that employ infrared photography show overly wet or dry areas, and viewing a course on a Google Earth timeline may also reveal repetitive patterns. Or there's the old-fashioned strategy: Stand on an elevated tee and observe discernible wet or dry patterns. If they occur the same distance apart down the entire fairway, the problem is more likely to be a distribution uniformity issue than a soil issue.

Q: Does soil type or location affect distribution uniformity?

A: Yes, soil can influence irrigation issues. Sandy soil allows water to percolate efficiently, but it's most prone to becoming hydrophobic and inhibiting initial wetting. Heavier clay soils result in more lateral movement, but can eventually accumulate water, creating wet, soft areas.

Distribution uniformity problems can show up on any course, but they're more noticeable in the West because of the drier climate and greater reliance on irrigation. In the East, inefficient distribution uniformity can be masked by wet weather — until a dry summer rolls around and it becomes apparent the sprinklers aren't doing their job.

Q: How is inefficient distribution uniformity determined?

A: Catch-can tests. Typically, full-circle sprinklers run a minimum of 15 minutes each. Distribution uniformity is calculated using the DULQ formula, in which DULQ = the average volume of the lowest 25 percent of catchments divided by the average volume of all catchments. The best results can now reach a DULQ of 85 percent or better. By boosting coverage as little as 10 percent, a course can reduce manual spot watering.

Q: So how does a course deal with inefficient distribution uniformity?

A: A crew will typically try to resolve coverage issues by running through the playbook: raising the sprinkler heads, adjusting the heads, changing the irrigation schedule, checking the flow and pressure, looking for insects or disease, checking pump pressure. Then, finally, inspecting the nozzles. Therein often lies the problem.

Q: What about switching nozzles?

A: Many courses have found success by converting to solid metal nozzles, such as Profile from Underhill, constructed from stainless steel and brass. Tests conducted by the Center for Irrigation Technology at California State University, Fresno, have shown metal nozzles consistently produce high distribution uniformity values and optimize coverage.

An economic advantage of switching to metal nozzles is that it can be done by the irrigation staff, directed by the superintendent. Metal nozzles can often extend the life of sprinklers for several years, or until the course can afford to replace all the heads or the entire system.

My suggestion to superintendents is to take the most difficult-to-irrigate hole on the course and try metal nozzles for three weeks or so and see if there's visible improvement in coverage, turf health and uniformity of soil moisture.

I was working at a course near Santa Barbara, Calif., during the recent drought. We viewed the course on Google Earth over a two-year period, before and after the metal nozzle switch-out, and could identify when the nozzles had been changed over to metal because the improvement was so obvious. But then some courses with extremely poor distribution uniformity may have infrastructure problems, such as undersized piping that leads to pressure losses so severe the sprinklers cannot function efficiently. The solution, even if short-term, may again be to try metal nozzles because they perform a bit more effectively at lower pressure than conventional plastic nozzles.

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