2017-01-611

Project Title: Effects of deficit irrigation and rootzone depth on water use and drought resistance of warm-season fairways.
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Objectives:

1. *Quantify water use of key turfgrasses as affected by deficit irrigation practices.*
2. *Evaluate the drought resistance of key turfgrasses as affected by rootzone depth.*
3. *Assess the effects of traffic on turfgrasses under drought stress caused by deficit irrigation programs.*

Start Date: 2017
Number of Years: 3
Total Funding: $90,000

Background and Rationale

Water used for turf irrigation has been considered the number one restriction to advancement of the game of golf in many regions of the United States. In some cases, reduction of total irrigated acreage can be utilized for immediate water savings. A more feasible approach for many superintendents is to reduce the quantity of water applied to the irrigated footprint. Fairways represent on average 38% of irrigated acreage on a golf course and are often irrigated in excess of turf minimum requirements (Lyman, 2012). Research aimed at developing targeted water conservation programs for fairway irrigation could create meaningful water savings in some regions of the country. In mesic climates, irrigation should be applied as a supplement to rainfall and not in place of rainfall.

Modern irrigation practices typically rely on reference ET as calculated from meteorological data to estimate evaporative demand of the atmosphere. Warm-season turfgrass water use is then estimated as the product of reference ET and a crop coefficient of 0.6 to 0.7. Irrigation can then be scheduled to replace soil water lost through ET. Applying irrigation at volumes less than ETc is a common water conservation practice which attempts to maintain a target turf quality while reducing irrigation volumes. Many turfgrasses will demonstrate acceptable turf quality under deficit irrigation, although the severity of the program that sustains acceptable turf performance varies with species, cultivar, and soil/rooting properties (Feldhake et al., 1984; Poudel, 2010; Wherley et al., 2014). Research aimed at measuring the interactions of turf performance, plant water use rates, soil moisture content, rootzone depth, and traffic is warranted.

Methods

Completed: A field experiment is being conducted at the Turfgrass Research Center in Stillwater, OK, to measure turf water use rates as affected by cultivar and deficit irrigation program. Eight fairway-type grasses (U-3, Celebration, Tifway, Latitude 36, TifTuf, Meyer, PremierePro, and OSU 1403) were established from plugs in small plots

as a randomized complete block design with three replications. Grasses were planted in June 2017 and allowed to fully establish under non-limiting irrigation in Year 1.

To Be Completed: During winter 2017-18, access tubes will be installed for measurement of soil moisture using a soil profile sensor (PR2, Delta-T Devices). During year 2, cultivar main plots will be split by irrigation level (25, 40, 55, and 70% reference ET). Irrigation will be hand-applied once or twice per week using a nearby weather station to estimate reference ET. Turfgrass water use will then be calculated as the difference in soil moisture content between measurement dates. To assess how cultivar performance varies under the presence of restrictive rootzones, lysimeters (6-in and 12-in) will be installed within the same plots. Measurements of turf performance will be performed biweekly using turf quality ratings (NTEP methods) and NDVI.

A second experiment is being conducted at the OAES Research Station in Bixby, OK, to study the effects of traffic on irrigation water requirements of common fairway turfgrasses. Small plots will be established from plugs (TifTuf, U-3, Latitude 36, Celebration, Tifway, Meyer, OKC 1403, and OKC 1221) as a randomized complete block design having three replications. During the establishment period, a small–scale center pivot irrigation system will be designed and installed such that it creates an irrigation gradient moving from near the center (wet) to the outer edge (dry). An additional pivoting arm will be installed with golf cart wheels such that traffic can be simulated in a turning manner. NDVI sensors and infrared thermometers (Decagon Devices, Inc.) will be installed on the irrigation arm, while buried soil moisture sensors (Turf Guard, The Toro Co.) will monitor volumetric water content at a 3 to 4-inch depth.

Early Results

No data have been collected related to this project. Field plots at the Stillwater station were established as part of this first year. The Bixby project was delayed for one year due to issues with construction on the station. A preliminary design for the trafficker has been completed.

Future Expectations

Lysimeters and sensor access tubes will continue to be installed at the Stillwater station through winter. Construction of the center pivot / trafficker will begin in March 2018 with planting of plots to occur in April.

Summary Points:

- Field plots for a warm-season fairway deficit irrigation study have been established using seven commonly used cultivars and an OSU experimental bermudagrass.
- Research plots are being instrumented for soil moisture sensors and lysimeters during winter with irrigation treatments scheduled to be initiated in summer 2018.
- A preliminary design for an automated golf cart trafficker has been developed and initial construction is scheduled to begin in February 2018.

Fig. 1. An overview of the established fairway deficit irrigation plots in Nov 2017.

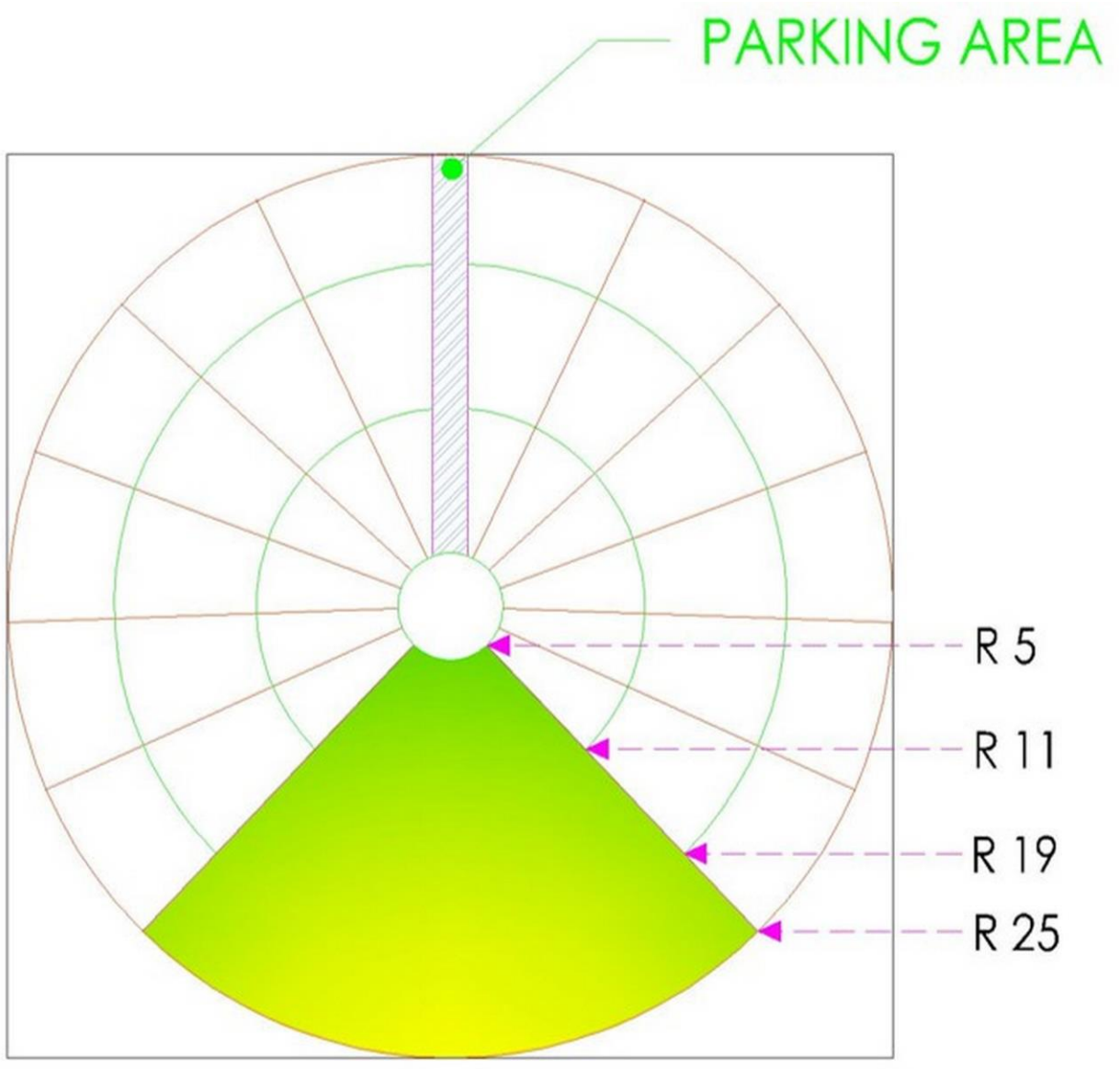

Fig. 2. Schematic of the proposed radial gradient irrigation system and trafficker.