Effect of Irrigation Type and Rootzone Material on Irrigation Efficiency, Turfgrass Quality, and Water Use on Putting Greens in the Southwest

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Objectives:

1. To study the effects of different irrigation systems on turf quality, drought resistance, and irrigation efficiency in greens with a sloping design.
2. To study the effects of rootzone materials (sand, sand-peat mix, and sand- urea-formaldehyde polymer mix) on creeping bentgrass establishment, turf quality, and soil moisture retention in a sloped putting green.

Start Date: 2002
Project Duration: three years
Total Funding: $90,000

Two sets of guidelines are currently followed for the construction of golf greens and tees in the US. California style greens have a 30-cm (12-inch) deep straight sand rootzone layer with no gravel blanket underneath. United States Golf Association's (USGA) specifications include a stratified coarse-textured sandy rootzone with a 30-cm (12-inches) deep rootzone overlaying a 10-cm (4-inches) deep gravel blanket. Because of the coarse nature of both rootzones, they resist compaction, provide high air-filled porosity, but lack adequate water retention.

Greens and tees built according to either California or USGA specifications are usually irrigated with a pop-up sprinkler system installed in the perimeter of the turf areas. Sprinkler irrigation has been the accepted practice for irrigating lawns since Joseph Smith patented the first swiveling lawn sprinkler in 1894. Sprinkler overlap, wind drift, and evaporation losses during the irrigation process all contribute to water losses that increase overall water consumption and/or decrease plant stand quality.

Subirrigation systems apply water laterally to the rootzone from perforated tiles or emitters buried either close to the surface or just below the normal root penetration from beneath the surface (subsurface drip irrigation or subirrigation). Although the benefits of subsurface irrigation have been extensively studied in agriculture, it has received very little acceptance or attention in the field of turf irrigation. Other advantages of subirrigation systems include the improved distribution uniformity (no wind drift or runoff), uninterrupted use of the turf area during irrigation, and energy savings due to a lower operating pressure.

A research area was built at the Fabian Garcia Research Center at New Mexico State University to study the impact of irrigation type (sprinkler vs. subsurface drip irrigation vs. subirrigation) and greens type (USGA with sand/peat rootzone verus California with a straight sand rootzone) on irrigation efficiency and turfgrass performance.

A 4000 m^2 (43,000 ft^2) research area was built at the Fabian Garcia Research Center at New Mexico State University to study the impact of irrigation type (sprinkler vs. subsurface drip irrigation vs. subirrigation) and greens type (USGA with sand/peat rootzone verus California with a straight sand rootzone) on irrigation efficiency and turfgrass performance of 'Bengal' creeping bentgrass.

Evaporative Control System™ (ECS), the subirrigation system used, consists of a system of 1.5 m x 1.5 m (5 ft x 5 ft) trays connected with a 5-cm (2-inch) diameter PVC pipe. The trays are placed 30 cm (12 inches) below the surface and filled with straight sand. The USGA type subsurface drip irrigated greens include a Toro DL 2000™ drip irrigation system placed at 18 cm (7 inches) depth with the drip emitters 30 cm (12 inches) apart between emitters and between drip lines.

Each of the 12 research greens is 17 m x 17 m (55 ft x 55 ft) in size and includes a 5% south facing slope. The greens were established in 2003. Data collected in 2005 included turf quality, occurrence of localized dry spot, and irrigation water consumption.

Statistical analysis of the data revealed significant differences in turfgrass quality and localized dry spot occurrence. Subirrigated creeping bentgrass was of significantly higher quality and had significantly fewer localized dry spots than either subsurface drip irrigated plots, sprinkler irrigated USGA or California plots.

USGA greens irrigated with subsurface drip irrigation had the highest occurrence of localized dry spots. Irrigation water consumption was lowest on subirrigated greens. A total of 102 cm (40 inches) of irrigation were needed between January 1 and August 31 to maintain creeping bentgrass on sprinkler irrigated California and USGA greens. Plots irrigated with Evaporative Control System™ (ECS) subirrigation system and Toro DL 2000™ subsurface drip irrigation system were watered with 86 cm (33.8 inches) and 106 cm (41.7 inches) respectively.

Summary Points

- A research area was built at the Fabian Garcia Research Center at New Mexico State University to study the impact of irrigation type (sprinkler vs. subsurface drip irrigation vs. subirrigation) and greens type (USGA with sand/peat rootzone verus California with a straight sand rootzone) on irrigation efficiency and turfgrass performance of 'Bengal' creeping bentgrass.
- Subirrigated creeping bentgrass had significantly higher quality and significantly fewer localized dry spots than either subsurface drip irrigated plots, sprinkler irrigated USGA or California plots.
- Irrigation water consumption was lowest on subirrigated greens.