Effect of Greens Type, 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: 3 years
Total Funding: $90,000

Two sets of guidelines are currently applied 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 underlying gravel blanket. Trenches containing drain tiles and filled with gravel achieve drainage. United States Golf Association's (USGA) specifications include a stratified coarse-textured sandy rootzone with a 30-cm (12-inch) deep rootzone overlaying a 10-cm (4 -inch) 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, despite its low efficiency in distributing water. 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 quality.

Irrigation research plots were built to study the impact of irrigation type (sprinkler vs. subsurface drip irrigation vs. subirrigation) and type of rootzone mix (straight sand vs. sand mixed with peat vs. sand mixed with urea-formaldehyde polymer) on irrigation efficiency and turfgrass performance of 'Bengal' creeping bentgrass.

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, subsurface irrigation has received very little acceptance or attention in the field of turf irrigation, despite strong evidence of its potential water savings. 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 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 vs. California with straight sand rootzone) on irrigation efficiency and turfgrass performance of 'Bengal'creeping bentgrass. Each of the 12 research greens is 17 m x 17 m (55' x 55') in size and includes a 5% south facing slope.

Greens were established in 2003. Data collected in 2004 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.

Aerial view of the irrigation research plots at the Fabian Garcia Research Center at New Mexico State University.

Summary Points

- Studies are underway at New Mexico State University to compare sprinkler versus subsurface drip versus subground irrigation for putting greens.
- Subirrigated creeping bentgrass was of significantly higher quality and had significantly fewer localized dry spots than either subsurface drip irrigated plots, or sprinkler irrigated USGA or California plots.
- Greens built according to California specifications with straight sand had the highest occurrence of localized dry spots.
- Irrigation water consumption was highest on sprinkler irrigated California and USGA greens. A total of 345 mm (13.6 inches) of irrigation was needed between May and August to maintain creeping bentgrass on sprinkler irrigated California and USGA greens adequately.
- Plots irrigated with Evaporative Control System (ECS) subirrigation system and Toro Geoflow subsurface drip irrigation system were watered with 345 mm (13.6") and 470 mm (18.5"), respectively.