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Evaluating the Performance of Four Subsurface Drip Irrigation Systems Used on Creeping Bentgrass Tee Boxes at the Las Campanas Golf Course (Santa Fe, NM)

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PROJECT DESCRIPTION

An irrigation trial was conducted at the Las Campanas Golf Course (Santa Fe, NM) to evaluate the effect of different subsurface drip irrigation systems (SDI) on turf quality, stress and water usage of creeping bentgrass tee boxes.

Objectives:

To evaluate the performance of four SDIs on visual turf quality, Normalized Difference Vegetation Index (NDVI), and water consumption of creeping bentgrass tee boxes.

MATERIALS AND METHODS

The study was conducted at the Club at Las Campanas, located in Santa Fe, NM [arid, 2133 m (7,000 ft) elevation] from April to November 2017. The championship tee boxes used for the study were constructed according to USGA specifications (sand based profile). The grass established was creeping bentgrass (*Agrostis stolonifera* L.) and the tee boxes were between 25 (Sunrise Course) and 18 (Sunset Course) years old.

The subsurface drip systems were installed in May of 2016 and consisted initially of two brands. One of them was the Toro Rootguard® DL2000™ (The Toro Co., Riverside, CA) delivering 2.0 l hr⁻¹ (0.48 gal h⁻¹) and operating at 241 kPa (35psi). The other system was the Rainbird XSF with copper shield Technology (Rainbird®, Azusa, CA), delivering 2.0 l hr⁻¹ (0.6 gal h⁻¹) and operating at 241 kPa (35psi). Both systems were installed at a depth of 10 cm (4 inches). Each system was installed in three tee boxes, one set at 23 cm (9 inches) of spacing between lines, and two tee boxes with 30 cm (12 inches) spacing. This decision was based on the lack of information on installation and performance of SDI on sand based profiles, and the team suspected that 30 cm spacing might be too far apart. Both systems were installed according to manufacture specifications. A filter and a pressure regulator were installed on each tee box before the main valve, in addition to an air release valve and an automatic flush valve. The team choose two approaches to install the SDI systems under pre-existing turfgrass. The first strategy was to remove the sod, and using a disk trencher, cut into the sand profile. After the system was installed, the sod was laid back into place, followed by topdressing and irrigation using the overhead sprinkler system. The second approach was to trench directly into the existing

turfgrass. After the system was installed, the lines were re-compacted, the turfgrass was then topdressed, followed by irrigation with the overhead sprinkler system.

Due to the publicity and success of the first year of the study, two additional subsurface drip systems brands were installed during the summer of 2017. One of them was the Netafim™ Techline CVXR (Netafim Irrigation Inc., Fresno, CA) delivering 2.0 l hr^{-1} (0.53 gal h^{-1}) and operating at 344 kPa (50 psi). The second system was the Hunter® Eco-Mat® (Hunter Industries Inc., San Marcos, CA) delivering 2.0 l hr^{-1} (0.5 gal h^{-1}) and operating at 241 kPa (35psi). Both systems were installed at the depth of 10 cm (4 inches). Each system was installed with 30 cm (12 inches) spacing between lines. Three tee boxes were converted to the Netafim system and one was converted to the Hunter system.

Two tee boxes irrigated with overhead sprinkler systems were designated as the controls. Irrigation audits were conducted twice during the course of the study. Each SDI system and the controls were equipped with water meters installed after the valves. Each tee box was measured, and the surface area was calculated. The amount of water delivered to each tee box was reported relative to the irrigated area.

Turfgrass maintenance was conducted by the maintenance crew at the Las Campanas golf course. This included irrigation at approximately 100% ETos, daily mowing, fertilization, topdressing and verticutting as needed. Due to concerns about potential damage to the irrigation systems, SDI tee boxes were not aerified.

List of tee boxes with corresponding irrigation systems:

1. Control on #14 Sunrise
2. Control on # 15 Sunset
3. Toro @ 9" on #5 Sunrise
4. Toro @ 12" on #13 Sunrise
5. Toro @ 12" on #18 Sunset
6. Rainbird @ 9" on #6 Sunset
7. Rainbird @ 12" on #11 Sunrise
8. Rainbird @ 12" on # 14 Sunrise
9. Netafim on #6 Sunrise
10. Netafim on #12 Sunrise
11. Netafim on #17 Sunrise
12. Hunter on #15 Sunrise

Data Collection

Visual turf quality, NDVI, and water meter readings were recorded monthly starting at the beginning of the growing period on March 8th, 2017. In addition to the readings, ground and aerial photographs using a drone were taken on each occasion.

KEY FINDINGS

Installation:

- SDI systems installed using the sod removal approach resulted in a faster recovery, and overall better turfgrass quality during the first months of the study. Therefore, the Netafim and Hunter tee boxes added in 2017 were installed with the sod removed.
- There was no visible difference between the 9” and 12” spacing in terms of water consumption, recovery and performance. Thus it appears that 12” spacing is sufficient to provide acceptable turfgrass quality even on a sandy rootzone.
- On a couple of occasions drip lines were inadvertently installed at the incorrect depth and spacing, resulting in unsuccessful establishment and ultimately led to the system being re-installed.
- With the help of the in-ground sprinkler system, turf stands recovered within a few months from post installation injury.

Performance:

- All the SDI systems installed performed equally well in terms of turfgrass quality, with little to non-visible signs of difference between systems.
- The NDVI values recorded did not show any differences in stress between the controls and the SDI-irrigated tee boxes
- The irrigation amounts used by SDI-irrigated tee boxes were remarkably lower from those used by the control tee boxes. Sprinkler-irrigated tee boxes received 3 to 5 times more water compared to the SDI-irrigated tee boxes. It appears that the higher irrigation amounts used by sprinkler systems were due in part to overspray. Pop-up heads irrigated beyond the tee box area and ended up irrigating the surrounding native vegetation. In contrast, the SDI systems delivered the water only to the designated area.
- The growth of the native vegetation surrounding tee boxes was significantly reduced in SDI-irrigated tee boxes (by not giving additional water), thereby reducing or eliminating the need for maintenance of those areas.

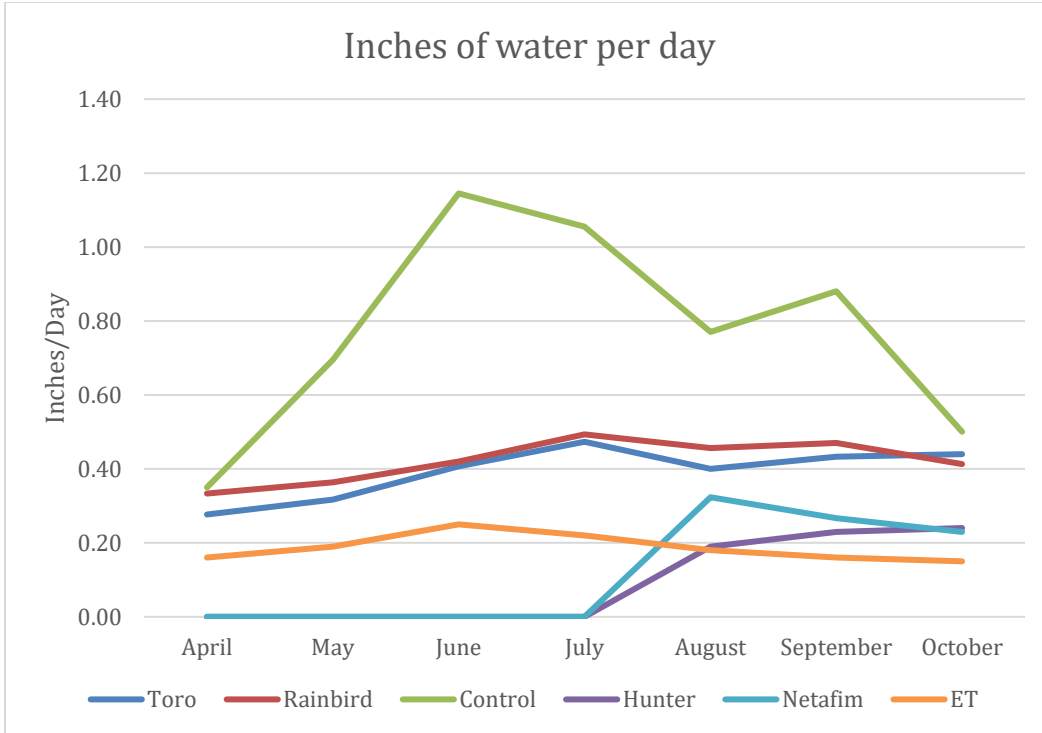


Figure 1. Amount of water distributed by each irrigation system.



Figure 2. Watering pattern typical of sprinkler irrigation, with water being distributed outside the tee area.



Figure 3. Process of installation with the existing turfgrass removed.



Figure 4. Recovery of turfgrass 4 months after sod removal installation.



Figure 5. Recovery of turfgrass 4 months after trenching into existing turfgrass.



Figure 6. Incorrectly installed subsurface drip irrigation.



Figure 7. Overall, all tee boxes look great by the end of 2017.