All About Discovery!

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Water conservation potential of subsurface drip-irrigation on warm-season grasses

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Introduction

- In light of drought conditions and resulting water shortages, and water conservation strategies have been implemented in the arid southwestern part of the US.
- Turf areas play an important role in our society and we should do everything to maintain it in a sustainable manner.
- Subsurface drip irrigation can maintain adequate turf quality even applied at 50% ETos compared to traditional overhead sprinkler irrigation (Schiavon et al, 2014).

Objectives

A study was conducted at New Mexico State University

- to investigate the effects of low ET-replacement turfgrass irrigation from a subsurface drip system on warm-season turf.
- to determine the minimum irrigation level needed to maintain an acceptable turf quality, and therefore quantify the amount of water conservation potential when using subsurface drip irrigation

Materials and Methods

- Las Cruces, New Mexico State University, arid 1265 m; USDA Plant Hardiness Zone 8.
- June 1st 2015 to November 15th 2015 and June 1st 2016 to November 15th 2016
- Turfgrasses: Bermudagrass (*Cynodon dactylon* L.) var. Princess 77 and Seashore paspalum (Paspalum vaginatum O. Swartz) var. Sea Spray (originally established in 2009).
- Irrigation: 1) Subsurface drip irrigation Toro DL2000 (The Toro Company, Riverside, CA), installed according to specifications (10 cm below ground and 30 cm emitter spacing).
- Four irrigation treatments based on ETos (Snyder and Eching 2007):
  10%, 25%, 40%, 55%, with irrigation applied every other day.
- Plots were mowed twice per week at a height of 2 cm and clippings were collected.
- Data:
  1. Turfgrass quality [on a scale from 1 to 9, (1 = dead turf and 9 = dark green, uniform turf)];
  2. Green cover (%) and color (DGCI) determined bi-weekly from digital image analysis (SigmaScan® Pro 5; Systat Software Inc., San Jose, CA).
  3. Normalized difference vegetation Index (NDVI) by mean of a Greenseeker® (Trimble Navigation Limited, Sunnyvale, CA)
- The experimental design was a randomized complete block with irrigation level as the main block treatment and grass species (plot size 7 m by 7 m) and sampling date as the subplot treatments. All treatment factors were replicated 3 times.
- Data were subjected to an analysis of variance (ANOVA) using SAS Proc Mixed followed by multiple comparisons of means using Fisher's LSD test at the 0.05 probability level.

Table 1. Climate data for the study period at the turfgrass salinity research center, Las Cruces, NM

Month	Temp Max		Temp Min		Temp Avg.		Precipitation		ET_{OS}	
	C	F	C	F	C	F	mm	in	mm	in
May	28.8	83.8	12.3	54.1	21.2	70.2	31.0	1.2	215.2	8.1
June	35.2	95.4	20.5	68.9	28.3	82.9	22.4	0.9	237.5	8.6
July	34.9	94.8	21.1	70.1	27.7	81.8	42.9	1.7	183.1	7.0
August	35.0	95.0	22.0	71.6	28.3	83.0	19.1	0.8	191.7	7.0
September	32.4	90.3	19.2	66.5	25.7	78.2	6.4	0.3	155.4	5.6
October	25.6	78.2	12.9	55.2	18.9	66.0	46.0	1.8	111.5	4.0
November	19.0	66.2	4.1	39.3	11.2	52.1	20.8	0.8	77.0	2.7

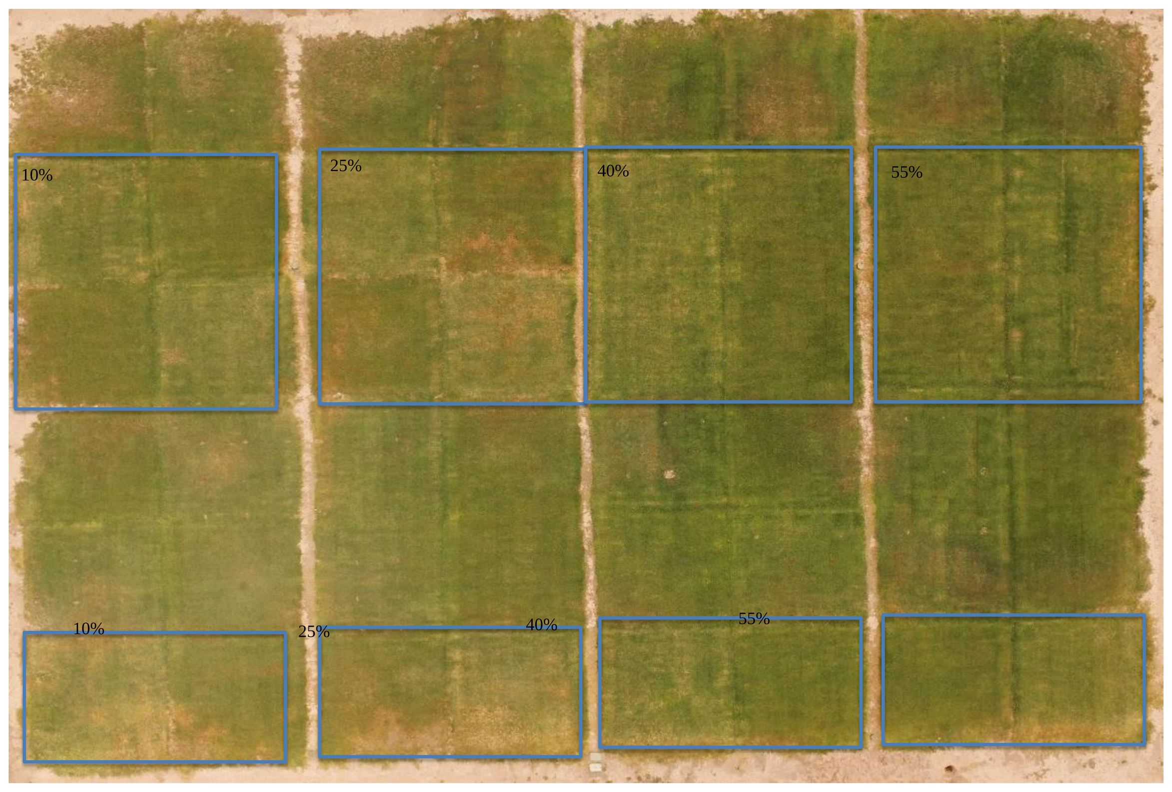

Figure 1. Aerial view of the study area, September 2nd 2015.

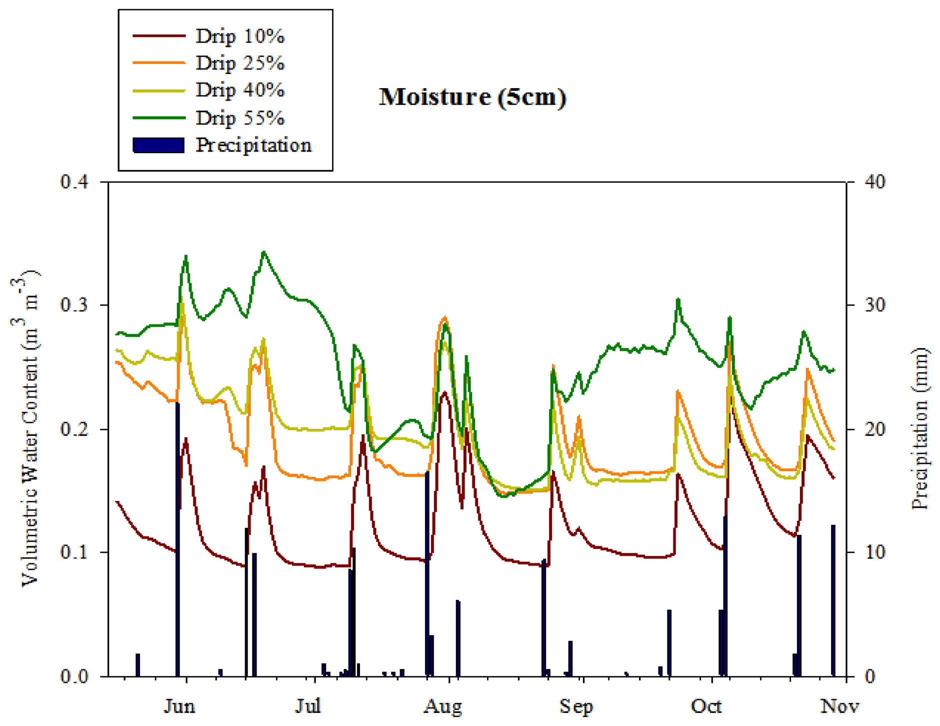

Figure 2. Soil moisture (m^3 m^{-3}) at 5cm depth for subsurface drip irrigation at 4 level of irrigations irrigation. Vertical bars indicate precipitation (mm) events June 1st to November 15th 2015.

Data and Results

- Our study did not include a corresponding overhead irrigation treatment, however in previous studies we were unable to sustain turfgrass below 55% ETos replacement if irrigation was applied from a pop-up sprinkler system (Schiavon et al., 2014).
- With the help of limited summer precipitation (Table 1), all irrigation treatments resulted in acceptable turfgrass quality (≥6) in June, July and August.
- During September and October the 10% and 25% ETos irrigation treatments resulted in quality ratings of 5.8, which were lower than for 45% (7.9) and 55% (8.3) (Figure 1).
- Grass species differed in quality only in October and November, during which seashore paspalum exhibited higher turfgrass quality and DGCI compared to bermudagrass.
- No difference in fall color retention between irrigation treatments was found for each of the 2 turfgrass species.
- Soil moisture differed between irrigation treatments, but several rain events during the research period helped in providing adequate moisture even for the lowest ET replacement levels.(Figure 2).

Conclusions

Subsurface drip-irrigation offers the potential to apply irrigation at very low ET-replacement levels. We estimate water savings as high as 40% on warm season grasses when irrigation is applied from a subsurface drip-irrigation system.

References

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