

Evapotranspiration Rates of Bermudagrasses Under Non-Limiting Soil Moisture Conditions



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Introduction

Use of turfgrasses with lower evapotranspiration (ET) rates may be one method of reducing overall landscape water use. In using such a strategy one should first insure that the grasses selected have overall superior adaptation to the various abiotic and biotic stresses that are present and that the cultivars selected can otherwise meet the needs of the end user. The purpose of this preliminary study was to employ the use of mini-lysimeters to assess the daily ET rate of a small number of turf bermudagrasses growing under simulated lawn conditions at Stillwater, OK. If the method proves feasible, it could be utilized in future studies to evaluate larger numbers of cultivars for ET under non-limiting soil moisture conditions.

Objectives

- Evaluate bermudagrasses for their evapotranspiration (ET) rates under non-limiting soil moisture conditions at Stillwater OK during August through September 2010.
- Work out logistics of method to allow for effective comparative work on 20 bermudagrass cultivars in 2011 and 2012

Materials and Methods

- The field experiment was designed as a randomized complete block with 3 replications. Mini-lysimeters constructed from 15.3 cm dia PVC pipe and measuring 30.5 cm deep were used for assessing ET.
- Fritted clay was used as the root zone medium in the lysimeter. The soil type of the field plots was an .
- Lysimeters were placed in 2.4 x 2.4 m turf field plots for measurement. A single lysimeter was located with each turfgrass plot.
- Lysimeters were fit into PVC plastic pot sheaths in the ground and leveled with pea gravel to assure appropriate lysimeter height.
- Turfgrass plots and lysimeters were mowed regularly at 5.1 cm.
- Lysimeters were saturated and allowed to drain to field capacity before being weighed pre-dawn and placed into the ground on the first day. The next water event for the lysimeter would be on day 4, just after determining the ET for day 3. The method is very similar to that which has been used by Kopec et al. (2006). In Arizona, three consecutive days of full potential ET could occur under desert conditions before a reduction in ET occurred using similar mini-lysimeters.
- Lysimeters were subsequently weighed to the nearest 1 gm, pre-dawn, once per day, each day, if rain did not occur. 1 gm change in lysimeter weight was equal to 0.0548 mm of water evapotranspired.
- Daily ET was determined by the loss in weight of water every 24 hours.
- ET measurements were analyzed using Statistical Analysis Systems SAS 9.1 software for the PC. The Proc Mixed procedure was used to test the Date, Cultivar and Date x Cultivar interaction. Cultivar mean ET values were separated by T test at $p = 0.05$.



Figure 1. Mini-lysimeter precision fit to its respective field plot.

Results

- Highly significant date effects ($p < 0.001$) as well as significant cultivar effects ($p = 0.02$) were found (ANOVA not shown). Interestingly, the cultivar x date interaction was not found significant ($p = 0.98$). The significant date effect was expected as weather can be highly variable from day to day leading to variation in mean bermudagrass ET amongst days. The date effect will not otherwise be discussed in this poster.
- The cultivar overall mean ET was separated by T test (Table 1).
- Riviera had a slight but significantly higher mean daily water use rate than TifSport, Patriot, Tifway and Tulsa Grass and Sod U-3.

Cultivar	Mean Evapotranspiration ¹ -----mm d ⁻¹ -----
Riviera	4.727a
TifSport	4.403b
Patriot	4.380b
Tifway	4.361b
TGS_U3	4.347bc

¹Mean of 16 evaluation dates and three replications per measurement event.



Figure 2. Mini-lysimeter shown removed from its respective turfgrass plot.

Conclusions

- The lysimeter work discussed in this poster should be considered preliminary as the 16 sampling dates were conducted during a very brief two month period, August – September 2010.
- Riviera had a slight but significantly higher mean daily water use rate than TifSport, Patriot, Tifway and Tulsa Grass & Sod U-3.
- Cultivars did not vary in their water use rate within the 16 sampling dates.
- The use of mini-lysimeters in the field at Stillwater appears to be a useful method for evaluation of ET.
- Assembling a work crew to make pre-dawn measurements at very early hours of the summer months is not convenient but is required to utilize this method of ET estimation.
- With a crew size of 3 people, ET measurements, watering and lysimeter clipping could be completed in under 2 hours time with a trained crew working with 15 experimental units (5 cultivars x 3 replications). If clipping of lysimeters is not required on a particular day, a crew size of 3 people can easily complete the ET measurements and watering in 1 hour pre-dawn.
- Speculatively speaking, if additional cultivar entries are added in 2011 and 2012 we are hopeful that increased error degrees of freedom may be expected to increase testing power to pick up significant differences amongst cultivars within testing dates.
- Fifteen additional bermudagrass cultivars are present in the field trial and have lysimeters present. These cultivars may be evaluated for ET in 2011 and 2012.

Literature Cited

Kopec, D.M., S. Nolan, P.Brown, and M. Pessarakli. 2006. Water and Turfgrass in the Arid Southwest. USGA Greens Section Record. 2006:6:12-14.

Acknowledgements

We gratefully acknowledge support from the Oklahoma Agricultural Experiment Station and the Oklahoma Water Resource Research Institute for their financial support of this on-going research effort.