

ET Rates of *Distichlis* (Inland Saltgrass) Clones A119, A48, Sea Isle 1 Sea Shore *Paspalum* and Tifway Bermudagrass

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Abstract

The ET rate of bermudagrass is relatively well known. The ET rate of Seashore paspalum in an arid environment is not, nor is there any information on the ET of Distichlis as a mowed turf. A greenhouse test using gravimetric lysimeters was conducted in the late summer of 2004 to measure and compare the ET of two Distichlis clones and Sea Isle 1 seashore paspalum to that of Tifway 419 bermudagrass. This test showed that under glass house conditions when soil moisture was not limiting: (1) Seashore paspalum had a higher ET rate than A119 saltgrass in terms of mm/day, and total consumptive water use for the 19 day test period, (2) A48 saltgrass and Tifway bermudagrass had similar daily ET rates and similar total water use, (3) total water use between two select saltgrass clones was not significantly different. Saltgrass A48 and A119 had a total consumptive water use of 84.2 and 76.5 mm, respectively over the 19 day test period. Tifway Bermuda totaled 82.2 mm, and Sea Isle 1 used 92.1 mm over 19 days.

Introduction

Alternative grass species which have greater salinity tolerance than bermudagrass may have an important use in turfgrass settings in areas which have (1) limited rainfall, (2) high salinity irrigation water, (3) saline and/or sodic soils, or combination of thereof.

Although new Sea Shore paspalum cultivars have been released in 2000, no data exist on the water use rates of this species in a semi-arid or arid environment. Likewise, several experimental accessions (vegetative clones) of Inland Saltgrass have been identified as having a turf-type habit that warrants further testing for potential development for commercialization. While clones of saltgrass have been screened for salinity tolerance, only empirical observations of this species maintaining green leaves without wilting (between 20-30 days without irrigation during the summer in Tucson, AZ) have been made. No data are available as to its ET rate (consumptive water use) under well-watered conditions. Therefore, a test was devised to measure the ET of two selected saltgrass clones, one Seashore paspalum, along with Tifway bermudagrass (standard). Therefore, the direct objectives were to (1) measure ET (CWU) rates of saltgrass clones A48 and A119, (2) measure the ET (CWU) of Sea Isle 2000 Seashore paspalum, and (3) compare the well watered ET of those grasses to Tifway 419 bermudagrass as the standard warm season turfgrass.

Materials and Methods

Lysimeters were constructed of 6.0" diameter x 12" deep schedule 40 PVC. Lysimeters contained a recessed 1/4" drain plug threaded into the underside bottom (disk), which was plugged with a stopper to prevent any possible drainage during the ET measurement phase. Each lysimeter was filled with 1/16" mesh screen, a thin geotextile porous sheet and then filled with calcined clay. The bulk density of the rootzone was 0.8 gm/cc. The advantages of

calcinced include (1) high infiltration rates, (2) good moisture holding capacity (3) good plant available water and (4) rapid drainage.

Twelve lysimeters of A119 and A48 inland saltgrass were established in May 2003, while twelve lysimeters each of both Sea Isle I Seashore paspalum and Tifway bermudagrass were established in May 2004. Lysimeters were established and maintained outside on an elevated greenhouse bench at the Karsten Turf Research Center. The turfs were watered daily, with three applications of ½ strength Hoglands #2 nutrient solution applied as a complete fertilizer. Plots were mowed with an electric shears using either a 1 ¼ or 1 ½ snap-on collar adapter which allowed consistent and uniform mowing heights. In September of 2004, a greenhouse stand was constructed (7' x 14') which allowed the tops of the lysimeters to be at "bench level" with all other surrounding benches. In addition, tall-unmowed flats of pasture type bermudagrasses were placed on an adjacent bench on the leeward side of the greenhouse exhaust fans. Both of these were done in effort to minimize vortex air movement during greenhouse cooling cycles.

The greenhouse was constructed with Lexon plastic (one year old). Light transmission in the photosynthetic range (PAR micro einstein/meter²/second) averaged 70-85% transmission of outside solar conditions during the period of 8:00 AM to 6:00 PM. Percent transmission was higher near solar noon 10:00 – 2:00 pm. Day night temperatures were controlled at 85⁰ F range/day, and 65⁰ F night temperatures.

Eight lysimeters were included in a RCBD with blocks established in rows perpendicular to the direction of airflow. The test bench was 25 feet from cooling pads, and 14 feet from a temperature set ambient exhaust fan. Each test lysimeter was surrounded by a border lysimeter to minimize edge affects and to normalize any nearest neighbor affects in relation to water vapor loss and mass air flow.

On the day of each ET measurement period (cycle), plants were clipped, filled slowly three times with water, allowed to drain for 10-15 minutes, capped at the drain port, and weighed to the nearest 0.5 g. Changes in weight from day to day were used to calculate ET rates in mm/day. ET values were analyzed both on a daily basis and when summed as consecutive daily ET values (ET cycles) before the procedures were repeated for the next measurement period (cycle). Cycles 1 and 2 were comprised of two consecutive daily ET measurements. All other cycles were three days (daily ET) in length. Data were analyzed as a RCBD with eight replications using the ANOVA technique using GNP software.

Response values were daily ET values (mm/day) and cumulative ET cycle totals (ET mm/cycle). The grand total of ET summed over all 19-measurement days was calculated and analyzed as well. Tukeys H.S.D. values were used to generate treatment mean separation values at the P = 0.05 level.

Results and Discussion

The F ratio for the grass main effect was statistically significant on 13 of 19 daily ET measurement events that began on August 27, 2004, and ended on October 27, 2004. There was no effect of the "day number" in terms of the actual day in the sequence of all days within a given measurement period (cycle span). The first "day" ET was significant on 5 of 7 cycles, while second or third day ET's were significant on 8 of 12 measurement events. Therefore, "day number" had no relevance to ET, or potential ET bias relative to re-irrigation events.

On each day that the grass main effect was significant for ET mm/ day (ET day 2,4,5,8,11,12,13,14,16,18 and 19), 'Sea Isle 1' Seashore paspalum had the highest ET rate. The test mean values of ET mm/day ranged from 2.63 mm/day1 (cloudy day weather), to 5.34 mm/day (otherwise). ET periods ranged from 20-24 hours in length, depending on operations previously described.

The lowest ET was generally that of the saltgrass clone A119, which is somewhat finer in texture than A48 saltgrass. The differences between Seashore paspalum and A119 were generally 0.75-1.25 mm/day. A 48 saltgrass and 'Tifway' bermudagrass had near almost identical ET values throughout the 19-day test period. Significance was therefore imparted by the water loss responses of A119 and paspalum. Empirical observations were noted that both Tifway 419 and Sea Isle 1 Seashore paspalum had 100% turf cover, while the saltgrass clones probably provided

95% cover. Still the water use differences between grasses differing by mean water use separation statistics were greater than 5% of actual ET values. At no time did plants show signs of wilting.

When ET values were summed for cycle analysis (successive daily ET values per day which were summed before re-wetting) the F ratio for the grass main effect was significant on 4 of 7 cycle totals and also for the total ET sum of 19 measurement days. Consumptive water use (when the grass main effect was significant) showed that Seashore paspalum had the greatest ET values, and that A119 saltgrass had the least. These were the same grass trends that occurred when ET's were analyzed on the daily ET basis.

The grand total ET was also greatest for Seashore paspalum, least for A119 and intermediate for both A 48 and Tifway bermudagrass. The 19 day final total cumulative ET for paspalum was 92.1mm and 76.5 for A119 saltgrass. This represents a 13% difference in ET. If extrapolated over a 6 month (180 day) period, the difference in estimated consumptive water use could be as much as 148mm (almost 6 inches).

This test showed that under glass house conditions when soil moisture was not limiting:

1. Seashore paspalum had a higher ET rate than A119 saltgrass in terms of mm/day, which was reflected in the greatest ET water loss (consumptive water use) throughout the test.
2. A48 saltgrass and Tifway bermudagrass had similar daily ET rates and similar total water use.
3. Total water use between two select saltgrass clones was not significantly different . Saltgrass A48 and A119 had a total consumptive water use of 84.2 and 76.5 mm, respectively over the 19 day test period.

Further testing under field (non-controlled conditions) using the same varieties and accessions should be done to measure grass response in both greenhouse and field turf conditions.

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Table 1: Mean ET (evapotranspiration)¹ rates per day of four grasses grown in greenhouse lysimeters. 2004. University of Arizona.

	1		2		3		4		5		6		7		8		9		10	
Grass²																				
A119	5.3	a	5.0	b	4.5	a	4.8	b	4.7	ab	4.5	a	4.7	a	4.5	b	3.8	a	2.9	b
A48	6.2	a	5.4	ab	4.8	a	5.3	ab	5.4	a	4.9	a	5.3	a	4.8	ab	4.1	a	3.3	ab
Bermuda	5.5	a	5.1	b	5.0	a	5.0	ab	4.3	b	4.5	a	5.3	a	4.6	b	3.9	a	3.2	b
Pasp	6.0	a	5.8	a	5.2	a	5.6	a	5.4	a	5.2	a	5.6	a	5.6	a	4.0	a	3.8	a
Significance³	NS		*		NS		*		*		NS		NS		*		NS		*	
Test Mean⁴	5.8		5.3		4.9		5.2		5.0		4.8		5.2		4.9		3.9		3.3	
	11		12		13		14		15		16		17		18		19			
A119	4.0	c	3.5	b	2.2	b	4.0	c	3.1	a	3.9	c	4.0	c	3.9	b	3.9	b		
A48	4.4	bc	3.9	b	2.6	ab	4.4	bc	3.5	a	4.2	bc	4.4	bc	4.1	ab	4.1	ab		
Bermuda	4.6	b	3.8	b	2.8	ab	4.6	b	3.4	a	4.4	b	4.7	b	4.2	ab	4.4	ab		
Pasp	5.4	a	4.5	a	2.9	a	5.4	a	3.6	a	4.9	a	5.2	a	4.5	a	4.7	a		
Significance³	***		***		*		***		NS		***		***		**		**			
Test Mean⁴	4.6		3.9		2.6		4.6		3.4		4.4		4.6		4.2		4.3			

¹ ET mm d⁻¹. Values are the means of eight replications. Mean Separation by Tukey HSD at $P=0.05$.

² Grasses are A119 and A48 Inland Saltgrass Clones (*Distichlis* Spp.), Tifway Hybrid Bermudagrass Sea Isle 1 and Seashore Paspalum. Day 1-4 Mow height = 3.2 cm. Days 5-19, mow height = 3.8 cm.

³ NS is non significant; *, ** and *** significant at $P \leq 0.05, 0.01$ and 0.001 respectively.

⁴ Average of all grasses on each day. Values are the means of 32 observations.

Table 2. Mean ET (evapotranspiration) values (mm)⁵ of four grasses over seven consecutive measurement cycles. University of Arizona. 2004.

	1		2		3		4		5		6		7		Sum ⁶	
Grass ⁷																
A119	10.4	a	14.0	a	13.8	a	10.7	b	9.7	c	6.6	a	11.3	a	76.5	b
A48	11.7	a	15.4	a	14.9	a	11.7	ab	10.9	bc	7.3	a	12.2	a	84.2	ab
Bermuda	10.6	a	14.4	a	14.4	a	11.7	ab	11.2	b	8.1	a	11.9	a	82.2	ab
Pasp	11.8	a	16.2	a	16.4	a	13.2	a	12.9	a	8.4	a	13.2	a	92.1	a
Significance⁸	NS		NS		NS		*		***		NS		NS		***	
Test Mean⁹	11.1		15.0		14.9		11.8		11.2		7.6		12.2		87.6	

⁵ ET mm d⁻¹. Values summed for 2 days ET on cycle 1 and 2. Cycles values summed for 3 days ET on cycle 3-7. Mean Separation by Tukey HSD at $P=0.05$.

⁶ Total ET summed over cycles 1-7 (19 days of observation).

⁷ Grasses are A119 and A48 Inland Saltgrass Clones (*Distichlis* Spp.), Tifway Hybrid Bermudagrass Sea Isle 1 and Seashore Paspalum. Cycles 1-2 Mow height = 3.2 cm. Cycle 3-7, mow height = 3.8 cm.

⁸ NS is non significant; *,** and *** significant at $P \leq 0.05$, 0.01 and 0.001 respectively.

⁹ Average of all grasses on each day. Values are the means of 32 observations.