Water and Turfgrass in the Arid Southwest

Water use rates of Tifway 419 bermudagrass, SeaIsle1, seashore paspalum, and inland saltgrass.

BY D. M. KOPEC, STEPHEN NOLAN, P. W. BROWN, AND M. PESSARAKLI

The arid Southwest is the fastest-growing area of the United States. With low annual rainfall and a dependency on well and river-fed water, golf courses and turfs in general are under close public scrutiny regarding water use. Advancements in irrigation systems and the use of weather stations to closely determine irrigation amounts based on grass type and local weather have been big improvements in reducing the amount of water applied to turfs. Other advancements that can help save water or provide acceptable turfs at less than optimal amounts of applied water include the development of heat-, drought-, and salt-tolerant turfgrasses. The advantage of the commercial acceptance of salt-tolerant turfgrasses is that they can use existing saline water supplies, which saves potable water from being used on turf.

Usually, but not always, salt-tolerant grasses also are drought tolerant. Seashore paspalum and inland saltgrass are two warm-season grasses that have very good to excellent salt tolerance. But what is the water use rate of these two grasses compared to the standard bermudagrass Tifway 419 in a semi-arid environment?

This is the logical place to start when answering questions about the water use rate of "new" grasses. This information will help in applied irrigation trials later on — which tell a golf course manager how much water the grass needs when the turf is expected to look good without struggling to absorb water from the soil as the rootzone moisture becomes depleted through evapotranspiration.

A field study is being conducted by the University of Arizona to determine the relative water use rates (ET) of two turf-type saltgrass single-plant selections (A-48, A-119), SeaIsle1 seashore paspalum, and Tifway bermudagrass. This information will show if either seashore paspalum or inland saltgrass uses less water than Tifway 419 bermudagrass under non-drought soil moisture conditions. Each of the four grasses are single-clone genotypes derived from one original plant each. The test is being conducted for two years. Results from the first summer (2005) are reported below. The second-year testing is in progress.

TESTING METHODS

A field test area surrounded by Tifway bermudagrass was planted to eight plots each of Tifway 419 bermudagrass, SeaIsle1 seashore paspalum, A-48 saltgrass, and A-119 saltgrass in late June of 2004. The paspalum and bermudagrass were plugged while the two saltgrass clones were sprigged with washed rhizomes in rows 10"-12" on center. Each grass appears in eight different plots in the test (32 plots total). At the center of each plot, a lysimeter is installed for measuring turfgrass water use. The lysimeter is made from 6" round PVC and has 12" of rootzone depth.

The terms *ET* and *consumptive water use* are interchangeable and represent the amount of water lost from grass leaves (transpiration) and that from the soil surface (evaporation). Thus the term ET. When ET is summed over a defined time period (days, weeks, or months), it is called *consumptive use*. ET is often expressed in millimeters per day. There are about 25mm in 1".

Grass water use was determined by weighing the 32 lysimeters at pre-dawn conditions each day for three consecutive days. The change in weight in a lysimeter is the result of water loss through ET.

After the lysimeters were weighed on the morning of the third day, they were removed and taken into the greenhouse, where they were mowed by hand while the field plots were mowed at the same height of 1.25". Then the field plots were fertilized as needed and irrigated overnight. At the same time, the lysimeter pots in the greenhouse were hand mowed and fertilized as necessary and then filled with water and drained. The next morning, at dawn, the lysimeters were weighed and placed in the field. This is the starting point for determining the ET. Each lysimeter was weighed again the following two mornings, and then the whole process was repeated.

The testing period for 2005 started on June 1 and ended on September 15, 2005. During this period, 56 individual ET measurement days (28 ET cycles) were measured. There were eight days on which rain negated functional measurements of ET, and ET is not measured on the day of field plot irrigation and mowing.

RESULTS AND DISCUSSION: ET ON A DAILY BASIS

Of the 56 measurement days, the main effect of the grass treatment was statistically significant on 50 ET measurement days. This means that there were true differences in water use among these three grass species. There were only three days in July, two days in August, and one day in September when this was not the case.

Seashore paspalum had the highest ET rate (used the most water) in mm/day, ranging from a high value of 11.8mm/day in June to 5.7mm/day in September, and during cloudy days in late July and August (humid monsoon). Seashore paspalum ranked first for ET on all 36 measurement days in June and July, and on 12 of 20 days in August and mid-September.

During June, A-48 saltgrass used the least amount of water in mm/day, followed by saltgrass A-119. Saltgrass A-119 was often similar in water use to Tifway bermudagrass, which was almost always lower in daily water use than seashore paspalum.

Observing daily ET values in July showed that paspalum used the most water, while either one of the two saltgrass accessions used significantly less than the paspalum. Tifway 419 bermudagrass had statistically similar water use rates to paspalum on 9 of 19 measurement days in August 2005.

For daily ET values in August and September, seashore paspalum ranked highest in ET on 12 of 20 ET measurement days, with no statistical differences for ET occurring between Tifway bermudagrass and paspalum on 4 of 20 ET determination days.

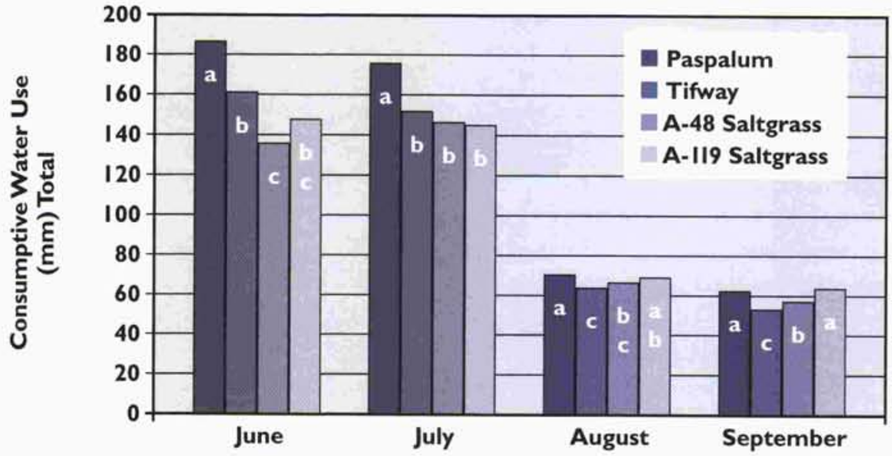
The relative ET rates of saltgrass increased as the summer season progressed into the monsoon. Saltgrass A-119 had rates similar to paspalum on 19 of 20 ET evaluation events, and A-119 saltgrass had the highest ET rate on 6 of these 20 measurement days. In August and September, Tifway bermudagrass used significantly less water than paspalum on 15 of 20 evaluation dates, and significantly less water than A-119 saltgrass on 8 of 20 evaluation dates.

MONTHLY CONSUMPTIVE WATER USE

This analysis was done to see what the water use was for each calendar month. Remember that it takes three days of measurements to get two days of ET, and that rain events negated water use calculations. This analysis was based on the consumptive water use for June, July, August, and midway into September. Results showed that paspalum had statistically higher ET values than all other grasses in June and July, and was

With low annual rainfall, water use is an important characteristic to consider when selecting grasses in the arid Southwest. After several weeks of drought, saltgrass (background) was able to maintain its green color longer when compared to the buffalograss (foreground) plots.

Figure 1
Total Consumptive Water Use by Month, 2005, University of Arizona
Grasses with the same letter in common are similar in water use



equal to saltgrass A-119 in August and September (Figure 1). Note that August is a humid month in the desert, and there were eight rainout events when ET measurements were not possible. Tifway bermudagrass always had statistically lower water use values than paspalum in each month. Saltgrass A-48 had statistically lower water use totals than A-119 saltgrass for the two-week measurement period in September. Otherwise, monthly ET (consumptive water use) values showed no statistical difference between the two saltgrass clones.

CONSUMPTIVE WATER USE FOR THE SEASON

Total consumptive water use (mm water) summed over the 56 measurement days ranged from 495.4mm for paspalum to 405.8mm for A-48 saltgrass (Figure 2). Both saltgrass clones and Tifway bermudagrass used less water over the measurement days than did seashore paspalum. Compared to SeaIsle1 seashore paspalum, Tifway bermudagrass, A-48 and A-119 saltgrass used 87%, 81%, and 86% of the water that seashore paspalum used over all 56 measurement dates when soil moisture was not limited.

A summation analysis showed that for season water use totals: (1) SeaIsle1 paspalum used more water than Tifway bermudagrass, (2) SeaIsle1 seashore paspalum used more water than the other three grasses collectively, and (3) both saltgrass clones collectively used less water than paspalum and bermudagrass together. This test demonstrates that at a 1.25" mowing height, the consumptive water use rates differ between saltgrass, bermudagrass, and seashore paspalum in a semi-arid environment, when soil moisture is not limiting.

RESEARCH CONCLUSIONS

- Bermudagrass always had a statistically lower ET rate (and consumptive water use values) than seashore paspalum.
- Summation analysis showed that the combined water use of A-48 and A-119 saltgrass was statistically significantly less than that of the combined water use of SeaIsle1 seashore paspalum and Tifway bermudagrass for the sum of 56 daily ET measurements in 2005.
- Based on the measurement period of June 1 to September 15 (56 days), seashore paspalum used 495mm of water, while Tifway bermudagrass used 429mm, A-48 saltgrass used 405mm, and A-119 saltgrass used 425mm of water.
- For the total water use of 56 ET measurements, Tifway bermudagrass, A-48 and A-119 saltgrass used 87%, 81%, and 86% of the water that seashore paspalum used, respectively, when soil moisture was not limiting.

D. M. KOPEC, PH.D., *is a professor in the Plant Science Dept. at the University of Arizona. His colleagues* STEPHEN NOLAN, P. W. BROWN, *and* M. PESSARAKLI *also are associated with the University of Arizona.*

Figure 2
Total Consumptive Water Use (mm) of Four Grasses for 56 Days, Summer 2005, University of Arizona