Deficit Irrigation of Seashore Paspalum and Bermudagrass

Jaime B. Bañuelos, James L. Walworth,* Paul W. Brown, and David M. Kopec

ABSTRACT

We compared the responses of 16 mm tall 'Tifsport', 'Tifway 419', 'Tifgreen 328', and 'MidIron' bermudagrass [*Cynodon dactylon* (L.) Pers. × *Cynodon transvaalensis* Davy], and 'SeaSpray', 'SeaDwarf', and 'Sea Isle 1' seashore paspalum (*Paspalum vaginatum* Swartz) to variable rates of irrigation applied using a linear gradient irrigation system in the semiarid Southwest. Target irrigation levels were 100, 80, 60, and 40% (2009) and 100, 80, 70, 60, and 40% (2010) of standardized reference evapotranspiration (ETos). Actual water applied (including rainfall) was 100, 83, 66, and 49% of ETos in 2009 and 100, 83, 75, 66, and 49% in 2010. Canopy temperatures increased as much as 15°C, quality (rated on a scale of 1–9) decreased from values of 6 or greater in turf irrigated with 100% ETos to 1.25 to 4.35 in turf irrigated with 40% ETos in July and August 2010, while dry matter production declined between 1.3 and 15.8 g m^{-2} d^{-1}. Water application rates required to maximize turfgrass quality ratings across all turfgrasses ranged from 75 to 83% of ETos. Lower application rates were required for acceptable quality turfgrass (with quality ratings ≥6.0) and ranged from 66 to 75% of ETos for bermudagrass, and 75 to 80% of ETos for seashore paspalum. Spring green-up was delayed by deficit irrigation, approximately 2 wk with 80% ETos, 4 wk with 70% ETos, and 6 wk with 60% ETos. Bermudagrass, particularly MidIron, maintained higher quality ratings than seashore paspalum under accumulated water stress conditions.

WATER SHORTAGE IS an issue of considerable concern in Arizona where water supplies are limited, precipitation is low, and population growth is high. The water requirements of turfgrasses grown in the Desert Southwest are quite high due to the warm, semiarid climate which generates high rates of evaporative demand, limited precipitation, and mild winter temperatures that allow year round culture of turfgrass (Brown et al., 2001). A number of studies have addressed the water requirements of bermudagrass, the prominent warm season turfgrass in the desert southwest, when grown under well-watered conditions. Erie et al. (1982) reported that the water use of bermudagrass lawns was 1105 mm in Phoenix during the active growing season (mid-April to mid-October). Kneebone and Pepper (1982) evaluated the water use of bermudagrass subjected to several management regimes in Tucson, AZ. Annual water use of bermudagrass was 1654 mm under a "high" management regime that included overseeding with annual ryegrass (*Lolium multiflorum* Lam.), increased soil water availability, and high rates of N fertilizer. Water use decreased to 1235 mm when bermudagrass was grown with a "low" management regime that included less N fertilizer, no overseeding, and slightly lower levels of available soil moisture.

Devitt et al. (1992) used drainage lysimeters on two golf courses and one park in Las Vegas, NV to determine the crop coefficients (Kcs) of common bermudagrass overseeded in the fall with perennial ryegrass (*L. perenne* L.). Monthly Kcs based on the modified Penman procedure ranged from 0.43 in February to 0.89 in June and July for fairway turf. Qian et al. (1996) evaluated the precision of black Bellani plates, a class A evaporation pan, and the Penman–Monteith empirical model (ETo) for estimating turfgrass evapotranspiration (ET). Results from their study revealed a regression line slope equivalent to a Kc of 0.80 for 'Midlawn' bermudagrass based on the Penman–Monteith equation ETo.

Brown et al. (2001) used weighing lysimeters to develop monthly and seasonal Kcs for use with 'Tifway' bermudagrass overseeded in winter with 'Froghair' intermediate ryegrass (*L. perenne* × *L. multiflorum*). They concluded that a constant Kc of 0.80 was adequate for bermudagrass in the summer when ETos was computed using the FAO Penman–Monteith equation (Allen et al., 1998).

Fewer studies have been conducted on bermudagrass in the Desert Southwest under suboptimal irrigation. Meyer and Gibeault (1987) reported that annual Kcs ranged from 0.54 to 0.79 for warm season grasses, and that acceptable quality was maintained with a Kc of 0.60. Garrot and Mancino (1994) evaluated water use of 'Texturf-10', 'Tifgreen', and MidIron bermudagrasses. Grasses were irrigated deeply and infrequently (when visible wilt was observed). Water use was presented as a fraction of ETo and ranged from 0.57 for MidIron to 0.64 for Texturf-10 during the growing season. High water use fractions

J.B. Bañuelos, J.L.Walworth and P.W. Brown, Dep. of Soil Water and Environmental Science, and D.M. Kopec, Dep. of Plant Sciences, Univ. of Arizona, Tucson, AZ 85721. Received 26 Apr. 2011. *Corresponding author (walworth@ag.arizona.edu).

Published in Agron. J. 103:1567–1577 (2011)
Posted online 18 Aug 2011
doi:10.2134/agronj2011.0127

Abbreviations: θ_v, volumetric soil water content; ADWR, Arizona Department of Water Resources; AZMET, Arizona Meteorological Network; C, cultivar; CATD, canopy-air temperature differentials; CIMIS, California Irrigation Management Information System; CU, consumptive water use; EC, electrical conductivity; ET, evapotranspiration; ETos, standardized reference evapotranspiration; IL, irrigation level; Kc, crop coefficient; LGIS, Linear Gradient Irrigation System; NTEP, National Turfgrass Evaluation Program; R, replication; TDR, time domain reflectometry.