Turfgrass Irrigation with Municipal Effluent: Nitrogen Fate, Turf Kc Values and Water Requirements

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Goals:

- *Determine the potential movement of nitrogen contained in municipal secondarily treated wastewater used to irrigate turf.*

- *Determine how effluent irrigation influences the water and nitrogen requirements of turf.*

- *Evaluate five evapotranspiration equations currently used in the United States to predict actual turfgrass water use.*

- *Accumulate an atmospheric database and turfgrass water use database that can be used by the public and private sector to develop and test the accuracy of evapotranspiration equations.*

Cooperators:

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Two large weighing lysimeters located at the University of Arizona Karsten Turfgrass Research Center are being used to evaluate water use and movement of nitrogen (N) fertilizer under turfgrass irrigated with potable and effluent irrigation water.

Each lysimeter is 13 feet deep and 8 feet in diameter and weighs approximately 100,000 pounds. Truck scales are used to measure changes in lysimeter weight, thus allowing measurement of evapotranspiration (evaporation from vegetation). Sampling ports, located at a depth of 3.3 ft. and then every additional 1.6 ft. to a depth of 11.6ft., provide access to the lysimeter soil for extraction of soil water and measurement of soil water status.

Turf water use is determined from daily changes in lysimeter weight and related to reference evapotranspiration (ETo) as computed by automated weather stations. This relationship between actual turf water use and ETo is known as a crop coefficient (Kc) and is required to convert ETo to turf water use for irrigation purposes.

Five popular methods of estimating ETo are presently under evaluation -- the Penman Equations used by the four regional public weather networks (Arizona, California, New Mexico and Southern Nevada) and the Penman Montieth Equation. Results from the first year of study show the five methods of estimating ETo differ by as much as 20%, showing a clear need to match Kc with the method of ETo estimation. Appropriate Kc values for the five methods of estimating ETo varied from 0.74 to 0.91 during the bermudagrass season and from 0.72 to 0.90

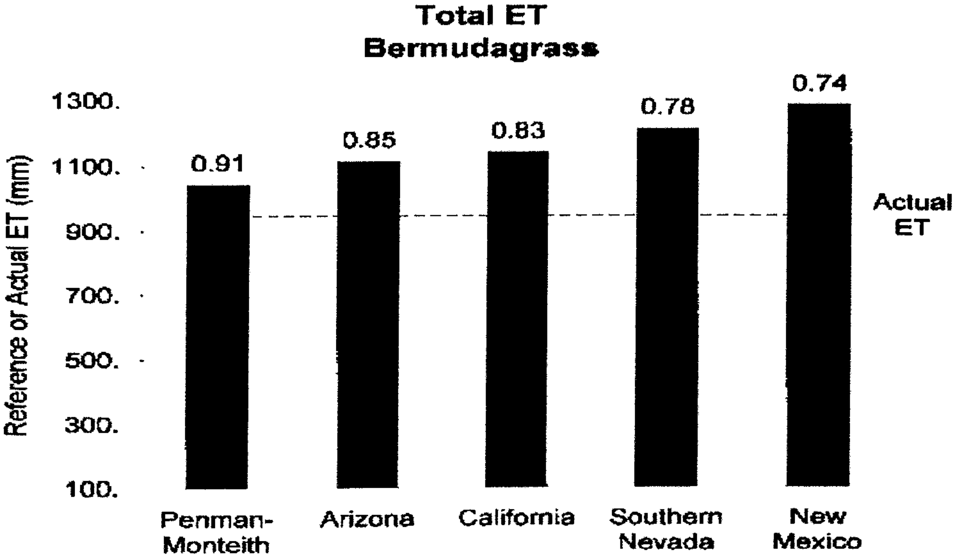
for the winter ryegrass season.

A second portion of this study involves development of a database containing turf water use and meteorological data for use by public and private entities involved in providing turf water management information to the turf industry. Such a database would allow companies providing weather stations and/or irrigation scheduling software to develop Kc values and/or calibrate their procedures for estimating ETo. This database is presently in development and will include turf water use and most meteorological data used to estimate ETo.

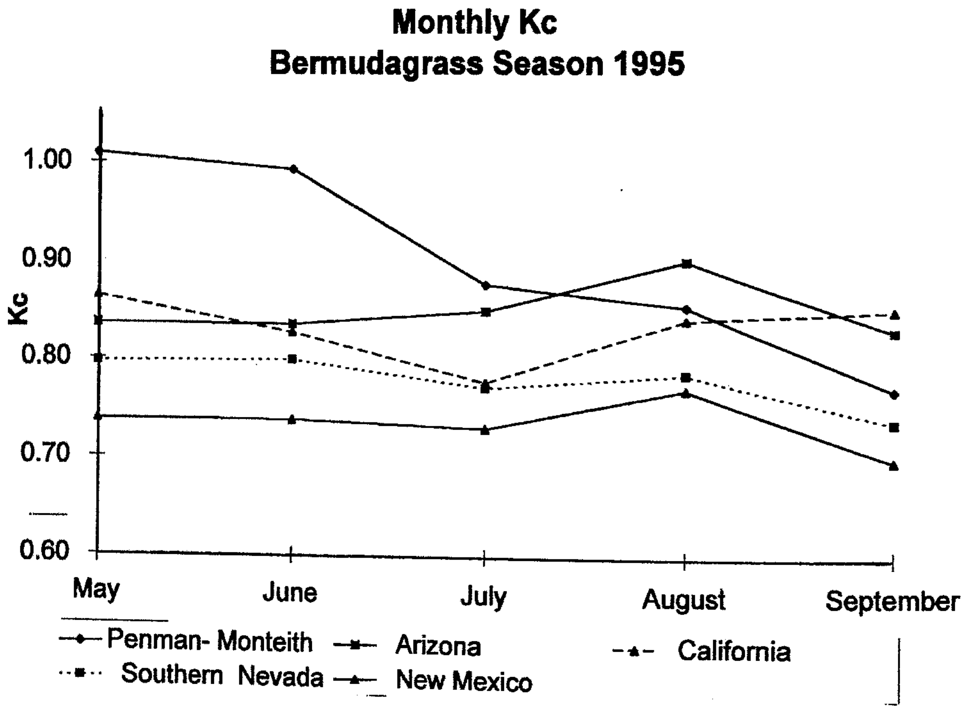
Work on movement of N under the two irrigation regimes began with the bermudagrass season in April. One lysimeter was irrigated with effluent and the other with potable water. Nitrogen, applied as labeled (N^{15}) ammonium sulfate, is applied to both lysimeters every two weeks. The rate of N applied to the lysimeter receiving effluent is adjusted downward to ensure both lysimeters receive similar levels of N.

Results from the first 40 days of evaluation reveal no movement of labeled N below the bermudagrass root zone. Low N concentrations in soil solution extracted from 3.3 ft. suggest very efficient N uptake by the bermudagrass. Higher N concentrations were observed in soil solution samples extracted from 6.6 ft. and likely reflect residual N from the previous winter turf season.

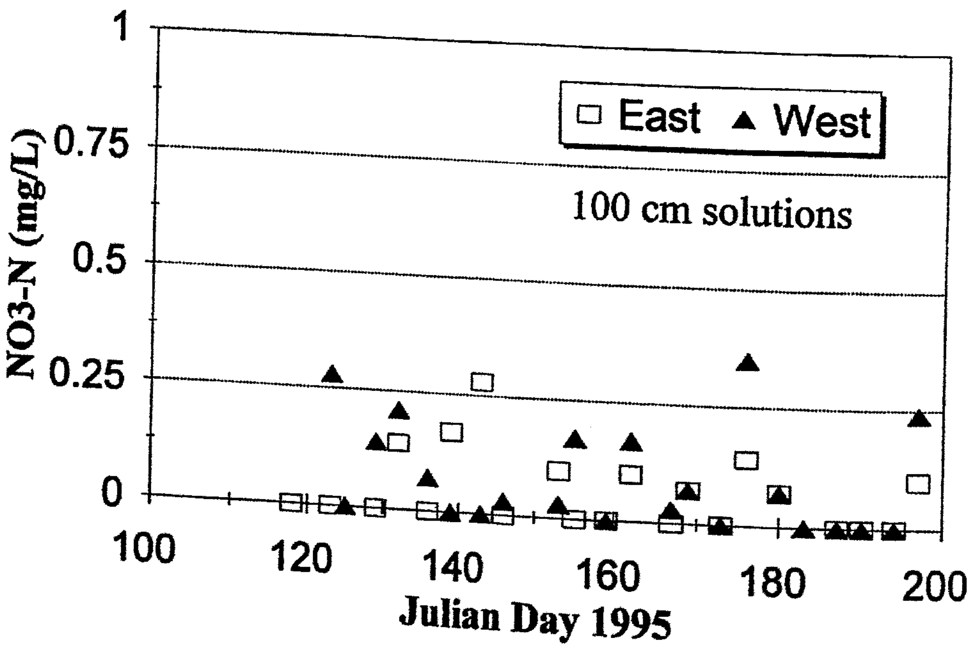
Work on both turfgrass water use and N movement will continue during calendar year 1996.



Summer Eto obtained from the five Penman Equations under investigation (vertical bars). Actual turf ET is presented as the dashed line. The number above each bar represents the appropriate seasonal crop coefficient.



Monthly Kc
Bermudagrass Season 1995
Kc
1.00
0.90
0.80
0.70
0.60
May
June
July
August
September
Penman- Monteith
Arizona
California
Southern Nevada
New Mexico



NO3-N (mg/L)
1
0.75
0.5
0.25
0
East
West
100 cm solutions
100
120
140
160
180
200
Julian Day 1995