Irrigation Requirements for Salinity Management on Perennial Ryegrass

James Baird[1], Alea Miehls[1], Donald Suarez[2], and David Crowley[1]
[1]University of California, Riverside
[2]U.S. Salinity Laboratory USDA–ARS, Riverside

Turfgrass and Environmental Research Online
Volume 12, Number 2 | March–April 2013

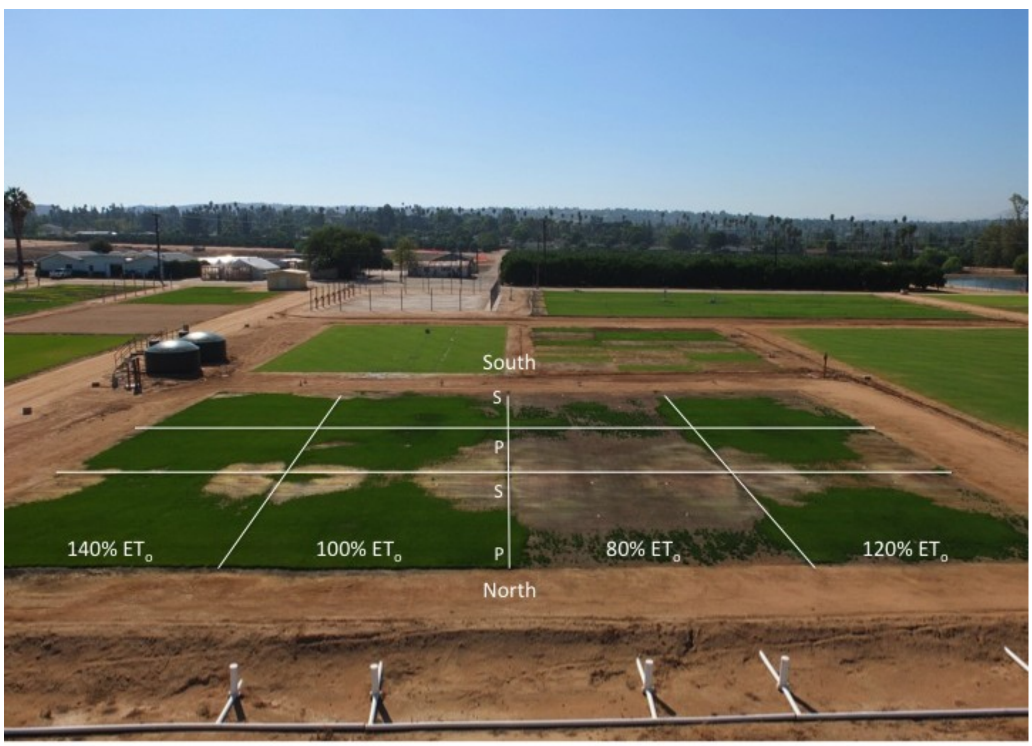
Objectives:

1. *Evaluate the interaction of drought and salinity on perennial ryegrass turf maintained as golf course rough.*
2. *Determine the leaching requirements for salinity management as influenced by several factors including irrigation water quality, soil physical properties, turfgrass species, cultural practices and rapid blight disease incidence.*
3. *Evaluate new and existing technologies and practices for determining soil water and salinity, and ultimately irrigation requirements for salinity management, turf health, and optimal playing conditions.*
4. *Assess the population size and activity of plant growth promoting rhizobacteria (PGPR) in the turf rhizosphere in response to imposed drought and salinity stress.*

The use of reclaimed, low quality water for turfgrass irrigation is an increasingly common and necessary practice in arid regions of the southwestern U.S. However, low quality water for turfgrass irrigation requires that salinity in the root zone must be maintained at a level that does not adversely impact plant quality and growth. Therefore, salinity management practices must be implemented, such as providing adequate drainage, selecting proper turfgrass species, implementing proper cultural practices, and applying adequate water to leach salts through the root zone.

Whereas traditional leaching practices for managing turfgrass salinity have relied upon either mathematical models that may over predict leaching fractions or simply leaving the irrigation system on during the night to ensure adequate leaching, the objective of our research is to provide more precise estimates of leaching fractions based upon water quality, turfgrass species,

Figure 1. Turfgrass salinity research area in October 2012 in Riverside, CA. Alternating irrigation lines are fed by potable (P) or saline (S) water. Two 5,000–gallon tanks are used to store and deliver saline irrigation water. In the perpendicular direction, the area is divided into four irrigation zones, ranging from replacement of 80 to 140% ET_o. Two subsurface drain lines bisect each of the irrigation zones with outlets for collection of leachate. Twelve 30–ft x 30–ft plots represent a continuous distribution of saline and potable water at a given irrigation regime.



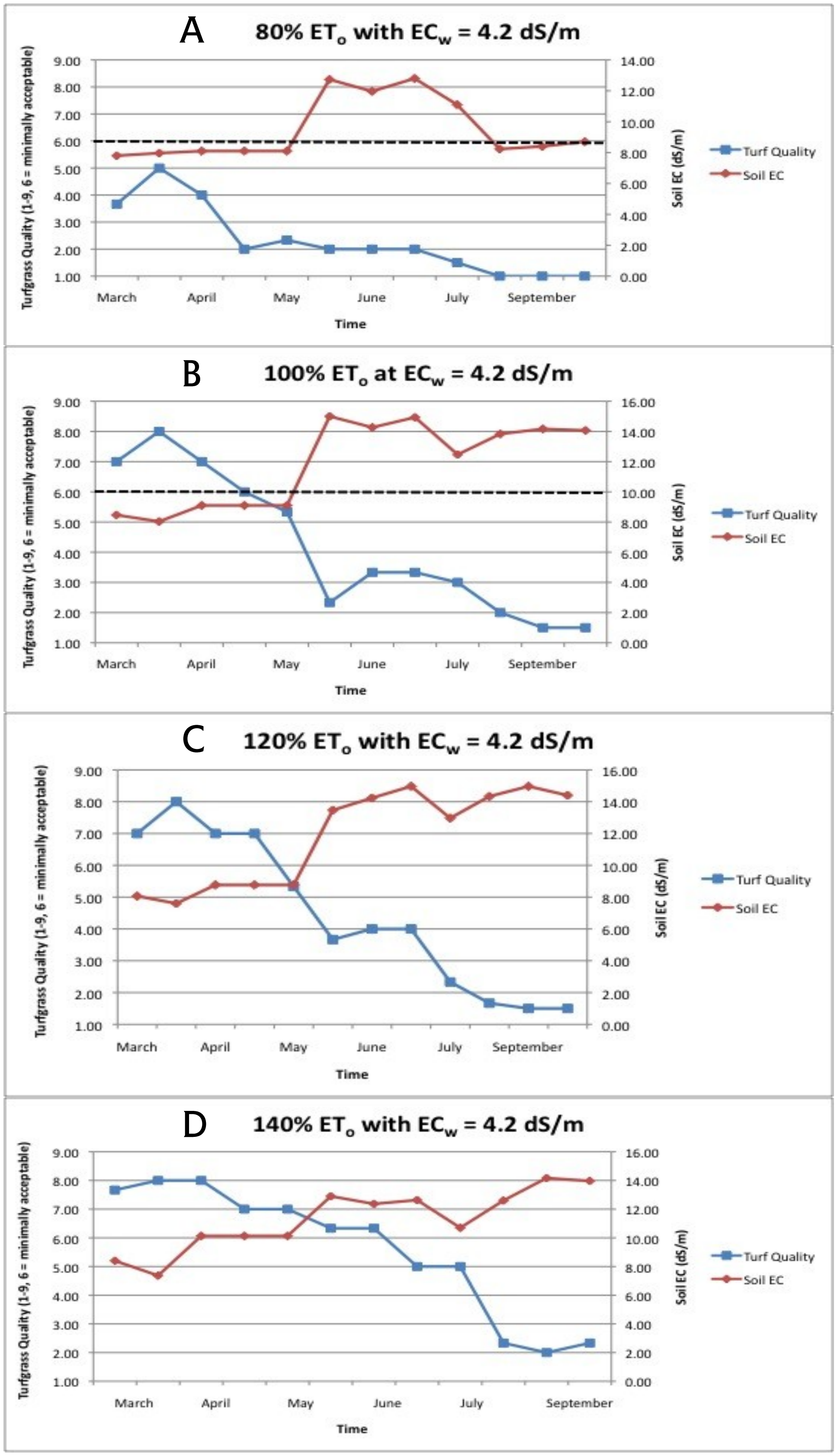
TERO Vol. 12(2):11–13 | March–April 2013
USGA ID#: 2012–05–439
TGIF Number: 219643

soil type, and other factors. The end results are expected to conserve water, regardless of quality, in addition to providing healthier turf that is dry and firm enough for functional use.

In this study, we combined the line source irrigation method of generating a continuous distribution of saline and potable irrigation water with the application of different quantities of water to provide detailed information on the interaction of water application and salinity on plant response. The study area is composed of 12 main plots of seed–established perennial ryegrass ´SR 4550´, each irrigated with saline (EC = ~4.2 dS/m or 2600 ppm) and potable water (EC = ~0.2 dS/m). In the perpendicular direction, three main plots are irrigated with different amounts of water, ranging from 80 (deficit), 100, 120, or 140% ET_o (reference evapotranspiration). To more precisely determine the effects of salinity on turfgrass health and underlying soil, the 12 main plots are subdivided into 9 sub–plots ranging from low to high irrigation salinity (Figure 1). Clippings were collected from each sub–plot biweekly beginning with a baseline measurement shortly before the saline irrigation was initiated on 21 July 2011. Turf quality was also assessed bi–weekly on a 1–9 rating scale, where 1 = dead turf, 6 = minimally acceptable, and 9 = ideal. Toro Turf Guard TDR (time–domain reflectometry) sensors continuously report soil salinity, temperature, and moisture in select plots representing low, medium, and high irrigation salinity. Irrometer suction lysimeters were placed at a 10–inch depth to extract leachate at periodic intervals. As saline and drought conditions progressed, extensive soil samples were collected and will be analyzed for saturation paste extract EC (electrical conductivity).

During the first six months under the study parameters, perennial ryegrass quality was maintained with minimal turf loss in the higher

Figure 2. Perennial ryegrass quality and soil EC (dS/m) in 2012 on plots receiving high saline water (4.2 dS/m) at: A) 80% ET_o; B) 100% ET_o.; C) 120% ET_o; and D)140% ET_o. The experiment is located in Riverside,



TERO Vol. 12(2):11–13 | March–April 2013
USGA ID#: 2012–05–439
TGIF Number: 219643

irrigation regimes (120 and 140% ET_o). However, after one year of irrigation with high saline water (4.2 dS/m), turfgrass quality has declined substantially with 50% cover remaining on turf irrigated at 140% ET_o, 10 to 20% cover at 120% and 100% ET_o, and no living turf at 80% ET_o (data not shown). Over time, soil EC (reported by TDR sensors) has increased substantially in plots receiving high saline water (Figure 2). As a result, turfgrass quality has declined significantly across all irrigation regimes. Thus far, this study has substantiated the need for maintaining adequate water infiltration, drainage, and distribution uniformity when using low quality water for irrigation to help manage salts in the root zone by leaching, and for maintaining turfgrass that is dry and firm enough for functional use.

As saline and drought conditions continue over the next couple months, we expect further losses of turf, ultimately leading to the conclusion of data collection. Comprehensive statistical analyses of 2011 and 2012 data are planned to more accurately identify critical irrigation and salinity levels for turfgrass management and water conservation.

Summary Points

- Using low quality, high saline (4.2 dS/m) water for irrigation of perennial ryegrass turf continuously for one year resulted in increased soil salinity, ultimately leading to a severe loss of turf regardless of irrigation amount.
- Irrigation at 80% ET_o in Riverside, CA is not enough water to maintain perennial ryegrass quality and cover for an extended period of time, regardless of water quality.
- When soil EC levels approach 9–10 dS/m, irrigation with high saline water at 100, 120, and 140% ET_o was not sufficient to maintain perennial ryegrass quality.
- Irrigation with poor quality water (up to 2.1 dS/m) at 140% ET_o appears to be suitable for maintaining healthy perennial ryegrass in Riverside, CA.