# Irrigation Requirements for Salinity Management on Perennial Ryegrass Turf (*Lolium perenne* L.)

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**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 and biological 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.*

**Field test area to evaluate perennial ryegrass to varying qualities and quantities of irrigation water.**

Shortages of fresh water in the southwestern U.S. are expected to increase, as are the demands that water be used as efficiently as possible. The turfgrass industry is already under pressure to reduce its use of fresh water supplies. However, the potential to use saline waters for irrigation, especially under conditions of efficient irrigation, have been mostly overlooked and leaching requirements for saline waters overestimated.

Increasing use of recycled water that is often high in salinity warrants further examination of irrigation practices for turfgrass health and salinity management. A study was conducted during 2011-2012 in Riverside, Calif., to evaluate the response of SR 4550 perennial ryegrass turf to varying qualities and quantities of irrigation water. Irrigation water ranged from potable ($EC_w$ ~ 0.6) to saline ($EC_w$ 4.2 ~ decisiemens/meter), and four separate irrigation zones received irrigation at 80%, 100%, 120% and 140% ETo.

Perennial ryegrass response (quality, cover and weight) over the 2-yr study was dependent upon irrigation amount, water quality, and time that the turf was irrigated under saline and deficit conditions. Soil salinity ($EC_e$) was also a significant predictor of turfgrass quality and cover during the 442-d study period. Changes in turf quality cover and clipping yield were primarily driven by the number of days that the area had been irrigated with saline water. When data were separated by irrigation amount, both time and water quality accounted for 54% of the variability in quality and 46% of the variability in cover at 80% $ET_o$. Soil salinity ($EC_e$) and sodium absorption ratio (SAR) were highly correlated with irrigation water quality, but not irrigation amount. $EC_e$ at 4-8 inches and SAR at 4-8 inches accounted for 41% of the variability in quality and cover in September 2012.

Our results suggest that perennial ryegrass requires irrigation scheduling above 120% $ET_o$, irrigation water quality below $EC_w$ ~ 1.7 decisiemens/meter and $EC_e$ below 3.8 decisiemens/meter to maintain acceptable quality and cover for 442 days in Riverside, Calif. Perennial ryegrass response (quality, cover and weight) over the two-year study was dependent on irrigation amount, water quality, and time that the turf was irrigated under saline and deficit conditions. Soil salinity ($EC_e$) was also a significant predictor of turfgrass quality and cover during the 442-day study period.

Irrigation water salinity, rather than irrigation amount, was significantly correlated with soil salinity and SAR at all depths during the course of the study. These results corroborate findings of Devitt et al. (2007) who reported that irrigation water salinity accounted for variability in soil salinity (0-15 cm). These results also confirm that using irrigation water with high soluble salts can increase overall salinity of the soil profile over time.

Irrigation at 80 and 100% $ET_o$ could not sustain turf quality and cover at an acceptable level for one year regardless of water quality. These results differ from Gibeault et al. (1985) who reported that perennial ryegrass quality was optimal at 100% $ET_o$ with low saline water under sprinkler irrigation in Irvine, CA (cooler climate with lower temperature and $ET_o$). Cool-season grasses in general, and particularly perennial ryegrass, are not well adapted to high temperatures, drought, and heat stress that are characteristic to inland Mediterranean climates and desert conditions.

For these reasons, perennial ryegrass use is restricted mainly to overseeding warm-season turf during winter months when temperatures are cooler and water is less limited. In our study, turf quality and cover was maintained at an acceptable level during the late fall, winter, and late spring in Riverside, CA, with less water (100% $ET_o$) and with a higher irrigation water salinity ($EC_w$ ~ 3.0 dS m-1).

These results suggest that growing and maintaining perennial ryegrass at an acceptable quality during the overseeding period in the Coachella Valley can be accomplished using much less water, and water of poorer quality if proper management practices are implemented. Overall, the performance of perennial ryegrass 'SR 4550' in this experiment suggests that a sufficient amount of irrigation water (120 – 140% $ET_o$) above reference evapotranspiration ($ET_o$) must be applied to maintain acceptable quality and cover in Riverside, CA, especially when using recycled water for irrigation.

## References

Devitt, D.A., Lockett, M., Morris, R.L., Bird, B.M. 2007. Spatial and temporal distribution of salts on fairways and greens irrigated with reuse water. Agron. J. 99:692-700.

Gibeault, V.A., J.L. Meyer, V.B. Youngner, and S.T. Cockerham. 1985. Irrigation of turfgrass below replacement of evapotranspiration as a means of water conservation: performance of commonly used turfgrasses. Int. Turfgrass

**Table 1. Time (d) for perennial ryegrass quality to fall below a minimally acceptable quality rating of 6 (1 to 9 scale, 9 = best) and turf cover to drop below 90% during the 442-d line-source gradient study in Riverside, CA. Values were generated by regression equations and are presented for each water quality (ECw) treatment.**

| | $EC_w$ | % $ET_o$* | | | |
|---|---|---|---|---|---|
| | dS $m^{-1}$ | 80 | 100 | 120 | 140 |
| | | Time (days) | | | |
| Turf Quality (Rating=6) | 0.6 | 207 | 318 | 332 | 441 |
| | 1.7 | 164 | 259 | 305 | 395 |
| | 3.0 | 115 | 191 | 275 | 343 |
| | 3.5 | 96 | 165 | 263 | 323 |
| | 4.2 | 67 | 126 | 245 | 292 |
| Turf Cover (Rating=90%) | 0.6 | 207 | 323 | 328 | 442 |
| | 1.7 | 180 | 258 | 307 | 423 |
| | 3.0 | 150 | 186 | 283 | 358 |
| | 3.5 | 138 | 158 | 274 | 333 |
| | 4.2 | 121 | 115 | 259 | 294 |

* % $ET_o$, irrigation amount.