Drought Tolerance of Fescues, Ryegrasses, and Their Hybrids

Brent Barnes, Jim Baird, and Adam Lukaszewski
Department of Botany and Plant Sciences
University of California, Riverside

In California and much of the United States, tall fescue (*Festuca arundinacea* Shreb.) is the most widely used lawn grass because of its adaptation to cooler climates, shade, and ability to maintain lush color year-round in warmer climates with supplemental irrigation. Similarly, perennial ryegrass (*Lolium perenne* L.) is widely used on golf courses, athletic fields, and other areas because of its rapid germination and establishment; wear tolerance; and dark green color. However, maintaining a reasonable visual quality of these cool-season turfgrasses requires approximately 80% reference evapotranspiration (Eto) in coastal climates and 90% to 100% ETo in transition climates. The Model Ordinance developed by the California Urban Water Conservation Council and supported by vast majority of water agencies has now reduced landscape irrigation to 70% Eto, and increasing water use restrictions in certain regions of the State mandate even lower water use on landscapes and golf courses in response to drought. Thus, how are homeowners and professional turf managers going to maintain lush cool-season turf in arid conditions or in climates subjected to severe drought? Obviously, a more drought resistant cool-season turfgrass species is needed to maintain desired color with limited water resources.

By intercrossing with meadow fescue (*Festuca pratensis* Huds.) and recurrent selection for drought and heat tolerance, we have developed a population of perennial ryegrass with a marked increase in drought tolerance. This increase was associated with a dramatic increase in the frequency of introgression of *F. pratensis* chromatin on the short arm of chromosome 3. In studies in the United Kingdom on forage-type interspecific hybrids of fescues and ryegrasses or Festulolium, this specific segment of *F. pratensis* chromatin was associated with deep rooting, drought, heat, freezing, and flood tolerance (Humphreys et al., 2003). We believe that extreme selection applied to our materials favored the specific genome regions from *F. pratensis* responsible for drought and heat tolerance under Southern California conditions.

The primary objectives of my M.S. thesis research are to:

1. Quantify the level of drought tolerance in Festulolium versus the parents (*F. pratensis* and „SR4220' perennial ryegrass) and commercially available tall fescue and perennial ryegrass cultivars with demonstrated drought tolerance.
2. Determine rooting characteristics of the aforementioned germplasm as a possible mechanism of drought tolerance.

In this field study, grasses were established to maturity under non-limiting irrigation, and then subjected to deficit irrigation (70% ET_o) for an extended time period. Preliminary results will be discussed and shown at Field Day.

Location:	UCR Turf Facility
Soil:	Hanford fine sandy loam
Experimental Design:	Randomized complete block with 3 replications
Plot Size:	5' by 5'
Seeding Date:	1/14/2010
Fertility:	0.5 lb N/1000 ft^2 approximately monthly
Mowing Height:	2 inches

Irrigation: Maintained at (150% ET_o*K_c)/DU until start of study, then 70% ET_o replacement based on CIMIS data from previous week (divided into three irrigation events/wk by hand watering plots

Deficit irrigation: Initiated on 8/19/2010

Data Collection: Turf quality (1-9, 6 minimally acceptable); color quality (1-9, 6 minimally acceptable); percent cover brown tissue, gravimetric soil water content; clippings taken monthly; Time Domain Reflectometry (TDR) probe for soil water content; and Normalized Difference Vegetation Index (NDVI) for measure of greenness or vigor

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Treatments:

1. „Grande 2' Tall Fescue
2. „Tulsa Time' Tall Fescue
3. „Speedway' Tall Fescue
4. „SR4220' Perennial Ryegrass
5. „Zoom' Perennial Ryegrass
6. VL-001 Festulolium
7. AL-001 Festulolium
8. VL-002 Festulolium
9. „PASJA' Festuca pratensis Huds.
10. VL-003 Festulolium

Plot Map:

North

1	2	3	4	5	6	7	8	9	10
6	1	4	8	7	9	3	5	10	2
3	5	7	1	10	8	2	9	6	4

References:

Humphreys, M.W., P.J. Canter, and H.M. Thomas. 2003. Advances in introgression technologies for precision breeding within the *Lolium-Festuca* complex. Ann. Appl. Biol. 143:1-10.