

Evaluation of lawn and native grasses under deficit irrigation

Introduction

Increasing water shortage has led to the need for drought tolerant cool-season species in arid climates. Native grasses are believed to conserve more water because they are better adapted for their particular environment. Identifying species with improved tolerance to drought/heat stress is an important approach toward sustainability of turfgrasses in the California landscape amidst declining water resources and increasing water use restrictions on lawns and landscapes.

Objectives

The objectives of this research were to determine: 1) if native cool-season turf species possess higher drought tolerance than commonly used tall fescue; 2) if increased mowing height has a positive effect on quality and performance of 17 cool-season species/cultivar/mixes under deficit irrigation.

Material and Methods

Location: Riverside, California (Plant Hardiness Zone 9b)

Soil: Hanford fine sandy loam

Grass cultivars: See Table 1.

Table 1: Study treatment list

No.	Product/Species/Variety	Company	Seeding Rate g m ⁻²
1	Delta Native Bentgrass ➢ <i>Agrostis pallens</i>	Delta Bluegrass Company	7.5
2	Delta Native Mow Free Mix ➢ <i>Festuca rubra</i> Molate 40% - Red Fescue ➢ <i>Festuca occidentalis</i> 30% - Western Fescue ➢ <i>Festuca idahoensis</i> 30% - Idaho Fescue	Delta Bluegrass Company	15
3	Delta Native Biofiltration Mix ➢ <i>Stipa pulchra</i> - Purple Needlegrass ➢ <i>Festuca rubra</i> Molate - Red Fescue ➢ <i>Hordeum californicum</i> - California barley ➢ <i>Hordeum brachyantherum</i> - Meadow barley	Delta Bluegrass Company	15
4	Delta Bolero Plus Mix 90/10	Delta Bluegrass Company	25
5	Delta 90/10 Fescue/Blue Mix	Delta Bluegrass Company	25
6	MVS Tall Fescue ➢ Spyder LS	Mountain View Seeds	25
7	MVS Tall Fescue ➢ PPG-TF105	Mountain View Seeds	25
8	MVS Tall Fescue ➢ Titanium LS	Mountain View Seeds	25
9	MVS Tall Fescue ➢ PPG-TF142	Mountain View Seeds	15
10	MVS Tall Fescue ➢ PPG-TF156	Mountain View Seeds	15
11	MVS Tall Fescue ➢ PPG-TF145	Mountain View Seeds	15
12	Stover Native All- Purpose Mix ➢ <i>Bromus carinatus</i> 20% ➢ <i>Nassella (Stipa) pulchra</i> 31% ➢ <i>Festuca rubra</i> Molate 31% ➢ <i>Deschampsia cespitosa</i> var <i>Holciformis</i> 8% ➢ <i>Agrostis pallens</i> (Diegosensis) 6% ➢ <i>Koeleria macrantha</i> 4%	STOVER Seed Company	5.5
13	Stover Native Fine Fescue Mix ➢ <i>Festuca rubra</i> Molate 37% ➢ <i>Festuca occidentalis</i> 37% ➢ <i>Koeleria macrantha</i> 11% ➢ <i>Deschampsia cespitosa</i> var <i>Holciformis</i> 15%	STOVER Seed Company	3
14	Stover Native Bentgrass ➢ <i>Agrostis pallens</i> (Diegosensis) Siskiyou thingrass	STOVER Seed Company	3
15	Cutting Edge Sun & Shade Mix ➢ Tall Fescue 19.8% ➢ Chewings Fescue 19.8% ➢ Hard Fescue 19.7% ➢ Kentucky Bluegrass 19.4% ➢ Perennial Ryegrass 19.4%	Cutting Edge	25
16	Pearl's Premium Ultra Low Maintenance Lawn Seed - Sunny Mix ➢ 'Dakota' Tall Fescue 19.75% ➢ 'Frontier' P. Rye 19.75% ➢ 'Deepblue' Kentucky Bluegrass 19.65% ➢ 'Harpoon' Hard Fescue 19.65% ➢ 'Carmen' Chewings Fescue 19.65%	Pearl's Premium	25
17	New Millenia Dwarf Fescue Blend ➢ '2nd Millenium' Tall Fescue ➢ 'Focus' Tall Fescue ➢ 'Avenger' Tall Fescue	STOVER Seed Company	25

Seeding Date: 10 May 2013

Fertilization: 4 g N m⁻² month⁻¹ during the growing season (April to September) for a total of 20 g m⁻² year⁻¹.

Mowing: Plots were mowed at either 5 or 10 cm.

Irrigation: Turf was watered by hand three times per week (Monday-Wednesday-Friday) to replace 60% ETo. Irrigation was withheld every time a precipitation event occurred.

Data: Plots rated every two weeks for drought stress (1-9 scale, 9 = best) and Digital Image Analysis (DIA) from June 1 2014 and 2015, and until October 31 2014 and 2015. Data were subjected to analysis of variance (ANOVA). When necessary, multiple comparisons of means were assessed using Fisher's protected least significant difference test at the 0.05 probability level.



Figure 1. Cool-season species irrigated at 60% ET_o on 9/5/2014, 96 days after the beginning of the study with no additional rainfall events.



Figure 2. Cool-season species irrigated at 60% ET_o on 10/17/2014, 138 days after the beginning of the study and after 7.5 cm of precipitation.

Results

- 1) During both years, all grasses dropped below acceptable quality of 6 one month after the beginning of the study.
- 2) Quality of cool-season species raised above acceptable quality only when substantial rain events occurred (Fig. 2).
- 3) Mowing height had no positive effect on turf quality.
- 4) Tall fescue 'PPG-TF105' showed the highest quality and cover throughout the study (Table 2). Conversely, native bentgrasses tolerated deficit irrigation the least.

Table 2. Turf quality and percent green cover (%) assessed by DIA of cool-season species and mixes in Riverside, CA. Data were averaged over 2 mowing heights, 5 collection months, 2 years, and 3 replications and represent an average of 60 data points.

Grass	Quality	Turf cover (%)
Delta Native Bentgrass	3.8 E	58 D
Delta Native Mow Free Mix	4.9 BCD	64 BCD
Delta Native Biofiltration Mix	4.4 DE	65 ABCD
Delta Bolero Plus Mix 90/10	5.4 AB	70 ABC
Delta 90/10 Fescue/Blue Mix	5.2 ABC	66 ABCD
Spyder LS	5.3 ABC	69 ABC
PPG-TF105	5.9 A	74 A
Titanium LS	5.1 BCD	64 ABCD
PPG-TF142	5.1 ABCD	68 ABC
PPG-TF156	4.5 BCD	63 BCD
PPG-TF145	4.5 BCD	68 ABC
Stover Native All- Purpose Mix	4.8 BCD	68 ABC
Stover Native Fine Fescue Mix	4.6 CDE	64 BCD
Stover Native Bentgrass	3.9 E	61 CD
Cutting Edge Sun & Shade Mix	4.8 BCD	68 ABC
Pearl's Premium Ultra Low Maintenance Lawn Seed - Sunny Mix	5.1 BCD	71 AB
New Millenia Dwarf Fescue Blend	5.1 ABCD	63 ABCD

Conclusions

- When data were averaged over mowing height and collection dates, no variety/species/mix could achieve an acceptable rating of 6, demonstrating that cool-season species are not adapted to be grown in Southern California while deficit irrigated.
- Mowing height had no effect on alleviation of drought stress symptoms on any species; results indicate that reducing irrigation to 60% ET_o causes stress to cool-season grasses that may not be overcome with other management practices.
- Tall fescue, by itself or in mixes, performed the best in the trial. Conversely, native bentgrass had the poorest quality and cover, revealing poor adaptability to inland hot, desert environments such as Riverside.

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