How well do cool season turfgrasses survive extended summer dormancy?

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Introduction

- Extended droughts in the western US have resulted in water restrictions and watering bans on landscape irrigation.
- Turfgrasses enter summer dormancy and can survive without irrigation. However, the extremely dry and very warm conditions in the West often exceed the drought tolerance of the grasses even when dormant.

Purpose

- Study summer dormancy and survival of cool-season turfgrasses.
- How do cool-season grasses differ in their response to drought?
- How long can selected turfgrasses survive without irrigation?
- Can small amounts of irrigation keep the grasses alive but maintain dormancy?

Visual Responses to Extended Drought and Recovery

Fig. 1. (left) Tall fescue retained some green color to mid-August. (right) Recovery of dormant plugs.

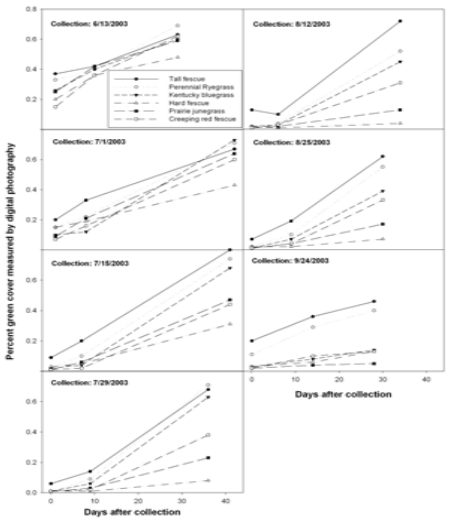

Fig. 2. Recovery of plugs collected between June and Sept. 2003. Species differences began to appear by early to mid-July in 2003 and were pronounced by mid-August.Tall fescue showed best recovery with Kentucky bluegrass and perennial ryegrass statistically equal. All entries had less recovery after 2 ½ months of dormancy..

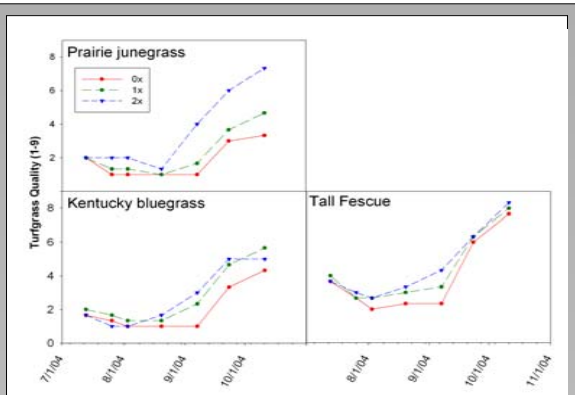

Fig. 3. Turfgrass quality of plots during recovery period in 2004. Like in 2003, Kentucky bluegrass and tall fescue recovered best where not irrigated. Supplemental irrigation treatments enhanced survival of prairie junegrass in 2004. This was not observed in 2003.

2003 Study Methods

- **Species:** Kentucky bluegrass, tall fescue, perennial ryegrass, crested hairgrass, hard fescue, creeping red fescue.
- **Irrigation treatments:** No irrigation, 0.6cm (¼") of water every month, and 0.6cm (¼") of water every two weeks beginning mid May, 2003.
- **Data:** Plugs were cut every two weeks, beginning June 4th, plugs were taken from each plot and watered for re-growth. Visual ratings and percent green cover from digital photographs [Karcher & Richardson (2003)].

2004 Study Methods

- **Species:** Kentucky bluegrass, tall fescue, prairie junegrass, tufted hairgrass, and buffalograss.
- **Irrigation treatments:** No irrigation treatment, 1.2cm (½") of water every month, and twice each month.
- **Data:** Similar to 2003. Each plot also contained an access tube allowing frequent measurement of soil moisture to 100 cm using a Sentek Diviner 2000 probe. Readings were made twice each week from June 1st to mid- September.

2007 Study Methods

- **Species:** Four Kentucky bluegrass varieties (Newport, Midnight, Rugby II, Baron), one tall fescue (Gazelle) and one perennial ryegrass (variety unknown).
- **Irrigation treatments**: No irrigation, 1.2 cm (½") of water every month, and well-watered (80% ETo) beginning June 15, 2007.
- **Data:** visual quality, surface temperature with infrared thermometer, percent green using digital image analysis, stomatal conductance using a leaf porometer (Decagon Devices), and plant water potential using a pressure chamber.

Fig. 4. Overall plot appearance in 2007 showing dormancy of no-water plots and active growth in well-watered plots. Like in 2003 and 2004, tall fescue maintained some active growth even when not irrigated.

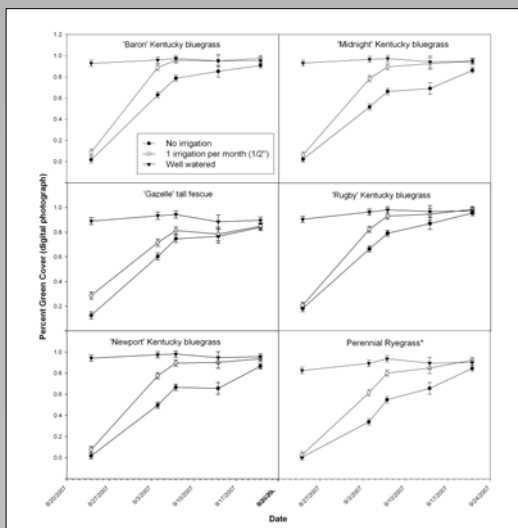

Fig. 5. Recovery of plots as measured by percent green cover in late summer 2007 in no irrigation or supplemental irrigation treatments.

Adaptation and Physiological Responses to Dormancy and Drought

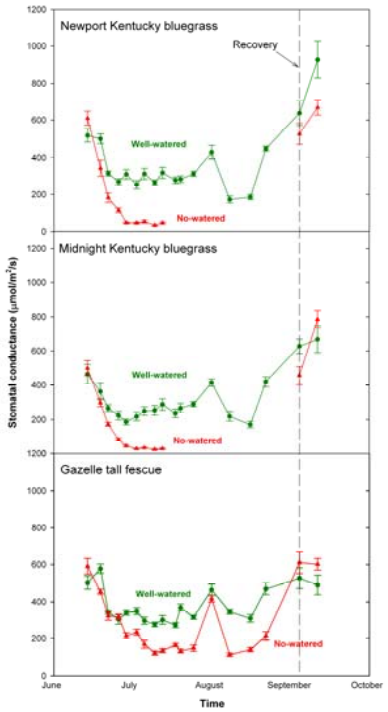

Fig. 6. Stomatal conductance in well-watered and no water treatments in 2007.

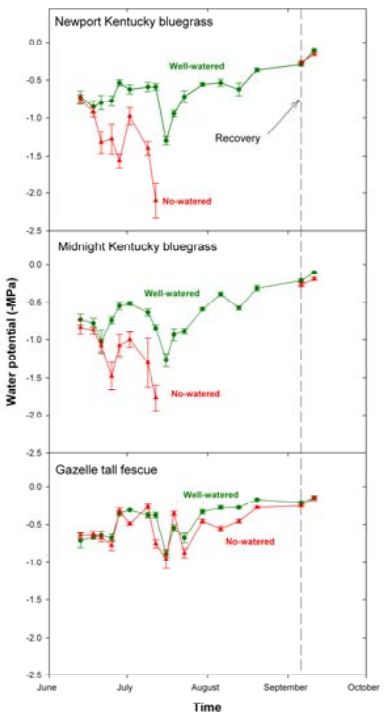

Fig. 7. Plant water potential in well-watered and no water treatments in 2007.

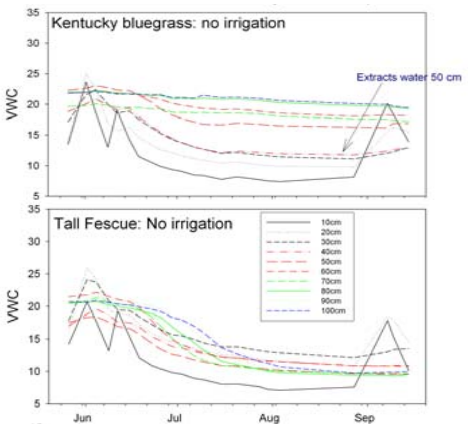

Fig. 8. Soil profile water extraction by Kentucky bluegrass and tall fescue (2004 data). Kentucky bluegrass water extraction occurs down to 50cm compared to at least 100cm for tall fescue.

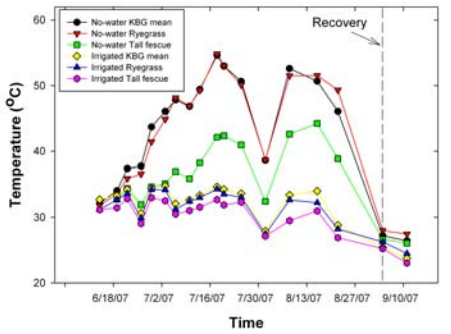

Fig. 9. Surface temperature of well-watered and no-water treatments in 2007. Kentucky bluegrass temperatures were very similar and averaged in this graph.

2007 Results:

- Kentucky bluegrass quickly entered summer dormancy in the no-water plots as indicated by visual appearance (Fig. 4), stomatal conductance (Fig. 6), and plant water potential (Fig. 7).
- Tall fescue maintained a high water potential (Fig. 7) and slightly reduced stomatal conductance (Fig. 6).
- Maintenance of water potential is possible because of the deep rooting characteristics of tall fescue (Fig. 8).
- All Kentucky bluegrass varieties and perennial ryegrass responded similarly in the drydown period as indicated by surface temperature (Fig. 9).

Conclusions and Future Work

- Tall fescue remains actively growing longer than other species during extended drought common to the Intermountain West, likely due to its deep root system.
- In drought, tall fescue stomatal conductance decreases, but water potential is maintained.
- Kentucky bluegrass and perennial ryegrass quickly enter summer dormancy, but recover in late summer and early fall.
- Prairie junegrass and fine fescues do not reliably survive extended dormancy. Poor recovery may be due to high temperatures rather than being solely water related.
- Supplemental irrigation during dormancy may be beneficial to survival but results are mixed.
- Future work will study varietal differences in response to extended summer dormancy and influence of restricted rootzones to limit root depth on drought survival.

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