Drought Tolerance of Tall Fescue and Bluegrass Cultivars – 2nd Year Data

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Photo by Doug Karcher

Differences in drought tolerance among bluegrass and tall fescue varieties growing in a rain-out shelter

Additional index words: hybrid bluegrass, Kentucky bluegrass, digital image analysis, lawn, irrigation, rain-out shelter

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Summary. Newer cultivars of tall fescue, Kentucky bluegrass, and hybrid bluegrass may have improved drought tolerance and expanded the range of cool-season turfgrasses for home lawn use in Arkansas. The objective of this research is to compare the drought tolerance of 42 cultivars of these species when maintained as a lawn. Cultivars were established in fall 2006 and dried down during the summers of 2007 and 2008 in a rain-out shelter, which prevented rainfall from reaching the plots. Green turf coverage was evaluated twice weekly as the cultivars were subjected to drought stress. In 2008, the amount of time after irrigation was withheld until green turf coverage dropped to 50% varied by over three weeks among cultivars. On average, the tall fescue cultivars were the most drought tolerant and Kentucky bluegrass the least, while there was no clear trend in drought tolerance among the hybrid bluegrass cultivars. These results are similar to those reported in 2007.

Abbreviations: KBG, Kentucky bluegrass; HBG, hybrid bluegrass; TF, tall fescue

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A desirable trait of cool-season lawn grasses, such as tall fescue (TF, *Festuca arundinacea*) and Kentucky bluegrass (KBG, *Poa pratensis*), is that they stay relatively green throughout most of the year and do not go into complete winter dormancy like bermudagrass (*Cynodon spp.*) or zoysiagrass (*Zoysia spp.*). The use of cool-season grasses for Arkansas lawns has been limited to northern regions of the state due to their poor heat- and drought-tolerance relative to warm-season grasses. In recent years, hybrid bluegrass (HBG) cultivars, which are crosses between Kentucky bluegrass and Texas bluegrass (*P. arachnifera*), have been released as a cool-season lawn turf option with improved heat and drought tolerance (Abraham et al., 2004). In addition, it has recently been de-monstrated that there is variation in drought tolerance among cultivars within tall fescue (Karcher et al., 2008) and Kentucky bluegrass species (Richardson et al., 2008). Identifying cultivars of tall fescue, Kentucky bluegrass, and hybrid bluegrass with excellent drought tolerance may expand the use of cool-season turfgrasses for lawns in Arkansas. Research was initiated recently to compare the relative drought tolerance of various tall fescue, Kentucky bluegrass, and hybrid bluegrass cultivars (Karcher et al., 2008a). The following is a summary of the second year (2008) of drought tolerance data from that study.

Materials and Methods

This research was conducted at the Arkansas Agricultural Research and Extension Center in Fayetteville, Ark. Forty-two cultivars of tall fescue, Kentucky bluegrass, or hybrid bluegrass (Table 1) were seeded into three replicate plots in the fall of 2006 on a native soil experimental area that was constructed under a rain-out shelter. The experimental area was maintained as a home lawn and was mowed weekly at a 2-inch height of cut. On 26 June 2008, the experimental area was saturated with 2 inches of irrigation to ensure uniform soil moisture across the plots. Immediately thereafter, drought stress was initiated by discontinuing irrigation and activating the rain-out shelter so that an automated, sliding roof would cover the plots, keeping them dry during rainfall events. Digital images were collected from each plot regularly during drought stress to evaluate green turf coverage over time and determine the drought-tolerance characteristics of each cultivar. Non-linear regression (using a variable slope, Sigmoid curve) was performed on the digital image analysis data to predict $Days_{50}$ values for each cultivar, which are the estimated number of days after irrigation was withheld until green turf coverage decreased to 50%. A complete description of digital image analysis and statistical methods is presented elsewhere (Karcher et al., 2008b).

Results and Discussion

The 42 cultivars tested in this trial were ranked from most to least drought tolerant (Table 1). The number of days after irrigation was withheld until green turf coverage dropped to 50% ranged from 60 d for Tulsa tall fescue to 37 d for Mallard Kentucky bluegrass. This range of greater than three weeks (23 d) is significant when considering that a rainfall event would be probable during this period on a non-irrigated lawn in Arkansas. In such a case, cultivars in this trial that were most drought tolerant would be much more likely to retain acceptable green turf coverage between rainfall events compared to the more drought-sensitive cultivars and not need supplemental irrigation. There were eight other tall fescue cultivars that had statistically similar drought tolerance as Tulsa (Fig. 1), including 2nd Millennium, which was the top-performing variety in 2007. There were two cultivars with drought tolerance as poor as Mallard: P707 and Champlain Kentucky bluegrass (Fig. 1).

In general, the tall fescue cultivars were more drought tolerant (higher $Days_{50}$ values) than the bluegrasses. Twenty-seven of the 29 most drought-tolerant cultivars were tall fescue whereas only one of the six least drought-tolerant cultivars was tall fescue. All of the Kentucky bluegrass cultivars were among the bottom half of those tested with regard to drought tolerance.

There was not a clear trend in drought tolerance among hybrid bluegrass cultivars with one of the four (TB 390) having a $Days_{50}$ value among the top-performing half of the cultivars tested. These results are similar to those reported from the 2007 growing season (Karcher et al. 2007).

Conclusions

These results demonstrate that there are differences in drought tolerance among cool-season grasses used in Arkansas lawns. Therefore, drought-tolerance screening should be performed routinely on these species so that cultivars may be selected that are best adapted for lawns where irrigation in not available or is limited.

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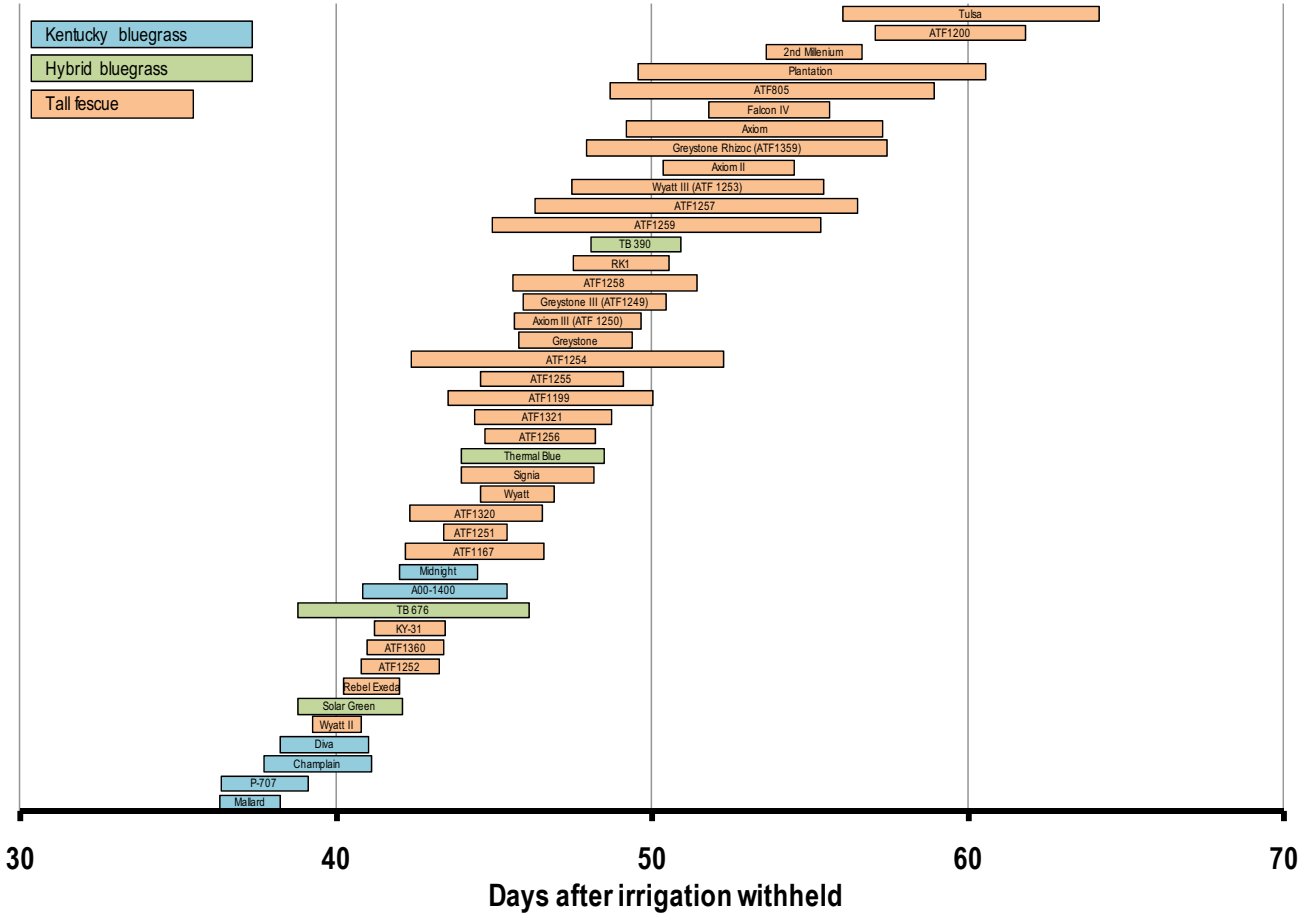

Fig. 1. Confidence intervals (95%) for the number of days after irrigation is withheld before cultivars reach 50% green cover. Cultivars with overlapping bars are not significantly different.

Table 1. Drought tolerance ranking of tall fescue, Kentucky bluegrass, and hybrid bluegrass selections based on the $Days_{50}$ values, the predicted number of days after irrigation is withheld when 50% green turf cover is reached.

Rank	Selection	Species[z]	$Days_{50}$
1.	Tulsa	TF	60.1
2.	ATF1200	TF	59.5
3.	2nd Millenium	TF	55.1
4.	Plantation	TF	55.1
5.	ATF805	TF	53.8
6.	Falcon IV	TF	53.7
7.	Axiom	TF	53.2
8.	Greystone Rhizoc (ATF1359)	TF	52.7
9.	Axiom II	TF	52.4
10.	Wyatt III (ATF 1253)	TF	51.4
11.	ATF1257	TF	51.4
12.	ATF1259	TF	50.1
13.	TB 390	HBG	49.5
14.	RK1	TF	49.0
15.	ATF1258	TF	48.5
16.	Greystone III (ATF1249)	TF	48.2
17.	Axiom III (ATF 1250)	TF	47.6
18.	Greystone	TF	47.6
19.	ATF1254	TF	47.3
20.	ATF1255	TF	46.8
21.	ATF1199	TF	46.8
22.	ATF1321	TF	46.6
23.	ATF1256	TF	46.5
24.	Thermal Blue	HBG	46.2
25.	Signia	TF	46.1
26.	Wyatt	TF	45.7
27.	ATF1320	TF	44.4
28.	ATF1251	TF	44.4
29.	ATF1167	TF	44.4
30.	Midnight	KBG	43.2
31.	A00-1400	KBG	43.1
32.	TB 676	HBG	42.5
33.	KY-31	TF	42.3
34.	ATF1360	TF	42.2
35.	ATF1252	TF	42.0
36.	Rebel Exeda	TF	41.1
37.	Solar Green	HBG	40.4
38.	Wyatt II	TF	40.0
39.	Diva	KBG	39.6
40.	Champlain	KBG	39.4
41.	P-707	KBG	37.7
42.	Mallard	KBG	37.3

[z] HBG = hybrid bluegrass, KBG = Kentucky bluegrass, and TF = tall fescue.