**TITLE**: Effects of Drought on the Performance of Two Hybrid Bluegrasses, Kentucky Bluegrass and Tall Fescue

**OBJECTIVE:** Evaluate the effects of drought on the visual quality and photosynthesis in two hybrid bluegrasses ('Thermal Blue' and 'Reveille'), one Kentucky bluegrass ('Apollo'), and one tall fescue ('Dynasty')

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**INTRODUCTION:**

Drought stress is a major problem in cool-season turfgrasses during summer months in the U.S. transition zone. Kentucky bluegrass is a fine-textured, high quality cool-season turfgrass commonly used in athletic fields and golf courses fairways and roughs. The performance of Kentucky bluegrass is marginal in the transition zone because of its sensitivity to drought. Tall fescue, also a cool-season grass, is sometimes used in golf course roughs and is popular in lawns because of its good drought resistance, but some golf course superintendents do not like its coarser texture. Hybrid bluegrasses, which are genetic crosses between native Texas bluegrass and Kentucky bluegrass, may have similar visual quality as Kentucky bluegrass but greater drought- and heat-resistance than other cool-season grasses. To further complicate the issue, increasing competition for water among industry, agriculture, and the public has resulted in restrictions on turfgrass irrigation.

New cultivars of hybrid bluegrasses are being investigated as potential alternatives that may perform better under drought than current cool-season turfgrasses. Despite the potential for using hybrid bluegrasses in lawns and golf course fairways and roughs, little scientific data are available about the field performances of hybrid bluegrasses in the transition zone, including under well-watered and drought conditions.

**METHODS:**

This study was conducted from 3 August to 8 October, 2004, and from 27 June to 15 September, 2005, under an automated rainout shelter (180 $m^2$) at the Rocky Ford Turfgrass Research Center near Manhattan, KS (Fig. 1). Thirty two plots (1.36 x 1.76 m) of a Kentucky bluegrass ('Apollo'), a tall fescue ('Dynasty'), and two hybrid bluegrasses ('Reveille' and 'Thermal Blue') were arranged in a randomized complete block design with four replications; plots were bordered by metal edging (10 cm depth) to prevent lateral soil-water movement between adjacent plots. One water deficit treatment, which included the replacement of 60% of the water lost from plant and soil surfaces via evapotranspiration (ET), was applied to 16 plots, or 4 plots (reps) of each species/cultivar. The remaining 16 plots were well watered (100% ET replacement) and served as a control. To determine irrigation requirements, evapotranspiration (ET) was calculated by using the Penman-Monteith equation (FAO, 1998) and climatological data obtained at a weather station located at Rocky Ford Turfgrass Research Center. Water was applied twice weekly through a fan spray nozzle attached to a hose; a meter was attached to ensure proper application rate. Plots were mowed at 7.62 cm twice a week with a walk-behind rotary mower.

Turf visual quality was rated on a scale of 1 to 9 (1=poorest quality, 6=minimally acceptable, and 9=highest quality) according to color, texture, density, and uniformity. Quality ratings were recorded weekly by the same individual during the 2-year study. Photosynthesis was measured biweekly on clear days between 1000 and 1400 CST with an LI-6400 portable gas exchange system using a custom surface

chamber. Permanent polyvinyl chloride collars (10-cm diam.) were placed randomly at one location in each plot and were driven approximately 5 cm into the soil. Gross photosynthesis (Pg) was estimated as the sum of photosynthesis measured by sunlit chamber and respiration measured by shaded chamber. In all plots, the volumetric soil water content ($\theta_v$) in the 0- to 50-cm profile was measured weekly using time domain reflectometry and in drought plots at 5 cm using dual-probe heat-pulse sensors.

**RESULTS:**

In well-watered plots, visual quality was highest in tall fescue and lowest in Thermal Blue among species and cultivars. Visual quality was generally higher in Reveille than Thermal Blue during the second month of the study (Fig. 2A).

In the drought treatment, tall fescue also had the highest visual quality among species and cultivars. The visual quality of Reveille was greater than Thermal Blue and Kentucky bluegrass as the plots dried, but then became similar to Thermal Blue and Kentucky bluegrass during the most severe part of drought (Fig. 2B). After termination of the drought treatment and upon re-watering (on 70 DOT), Thermal Blue and Reveille recovered faster than Kentucky bluegrass, and both hybrid bluegrasses had higher visual quality than Kentucky bluegrass late in the study (Fig. 1B).

In well-watered conditions, Pg was generally greatest in TF among species and cultivars (Fig. 3A). In the drought treatment, Pg was greater in TF than in Thermal Blue and KBG during the first two weeks, but Pg thereafter became similar among cultivars and species. There was generally no difference in Pg between TF and Reveille (Fig. 3B).

**CONCLUSIONS:**

In well-watered and drought treatments, tall fescue had highest the visual quality and greatest Pg among species and cultivars. In the drought treatment, Reveille performed better than Thermal Blue, and both hybrids (i.e., Thermal Blue and Reveille) recovered from drought more quickly than Kentucky bluegrass. In general, the performances ranked: tall fescue > Reveille >= Thermal Blue=Kentucky bluegrass.

**Figure 1**. Rainout shelter (180 m2) at Rocky Ford Turfgrass Research Center near Manhattan, KS. The rainout shelter automatically moved over plots (on tracks) when rainfall began, then retracted one hour after rainfall ended.

**Figure 2.** Visual quality of Thermal Blue (HBG1), Reveille (HBG2), Kentucky bluegrass (KBG), and tall fescue (TF) rated on a scale of 1 to 9 (1=poorest and 9=highest) under well-watered (A) and drought (B) conditions in 2005. Means followed with the same letter on a given day after treatment initiation (days of treatment) are not significantly different (P<0.05).

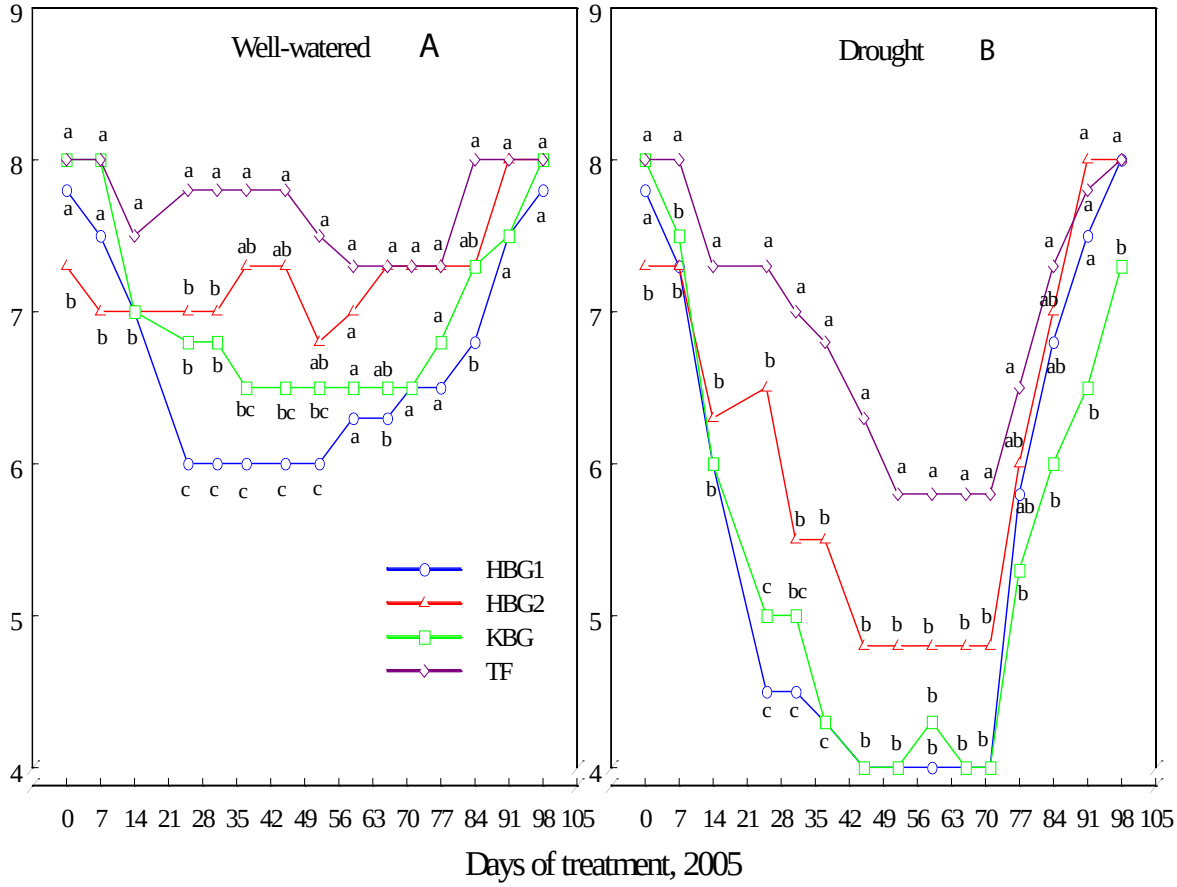

**Figure 3**. Gross photosynthesis (Pg; sum of photosynthesis and respiration) in Thermal Blue (HBG1), Reveille (HBG2), Kentucky bluegrass (KBG), and tall fescue (TF) in well-watered (A) and drought (B) plots in 2005. Means followed with the same letter on a given day after treatment initiation (days of treatment) were not significantly different (P<0.05).