

2017-14-624

Project Title: Development of a shade-tolerant bermudagrass cultivar(s) suitable for fine turf use.

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Objectives:

1. *Screen for fine turf qualities and shade resistance in newly developed common and hybrid bermudagrass germplasm,*
2. *Further develop an existing bermudagrass breeding population for superior fine turf characteristics, shade resistance and seed yield, and*
3. *Develop and validate a high throughput method for screening plants for shade resistance.*

Start Date: 2017

Number of Years: 3

Total Funding: \$90,000

Background and Rationale

Bermudagrass is a desirable turfgrass for use in the transition zone due to its relatively good drought, heat, disease, and insect resistance, and reasonably good cold hardiness. The main factor that prevents more widespread use of bermudagrass is its poor shade tolerance. Beginning in 2007, 45 common bermudagrasses [*Cynodon dactylon* (L.) Pers. var. *dactylon*] collected from China, Africa, and Australia that exhibited good seed production were tested along with four bermudagrass varieties for shade tolerance and overall turf quality. Of those 45 bermudagrasses, the 10 best-performing selections were chosen for further development. Polycrossing combinations of those 10 selections in 2011 produced three synthetic populations. Two of these experimental cultivars, OKS 2011-1 and OKS 2011-4, were tested for shade tolerance and the third OKS 2011-3 was retained for further selection. OKS 2011-1 and OKS 2011-4 did not outperform existing seeded-type cultivars in severe shaded conditions. From the OKS 2011-3 breeding population, the best performing 90 plants were selected after two years of shade pressure. These plants were tested in the field for turf quality and major seed yield related traits. This project seeks to build on previous work to continue selecting for shade tolerance among common bermudagrasses and interspecific hybrids.

Methods

A rapid throughput screening method was developed to identify genotypes showing enhanced shade tolerance under greenhouse conditions. This was done to reduce cost and time associated with multi-year field trials. In June 2017, 75 bermudagrass genotypes were established from sprigs within 2.5-in diameter deep pots under three light environments (0, 51, and 63% shade) within a research greenhouse. Once uniformly established (~8-weeks), plants were subjected to shade treatments using neutral density black fabric for 4 months and clipped biweekly at 1.5-in to promote rapid stress. Fertilizer was applied using a commercial soluble fertilizer (Peter's 20-20-20)

biweekly at carefully metered amounts ($0.125 \text{ lb N M}^{-1}$) to ensure uniform application. Turf quality, leaf elongation rate, and above-ground biomass (verdure) were assessed at the conclusion of the 4-month shade treatment.

Early Results

After 4 months of heavy shade treatment, visual turf quality of 7 experimental bermudagrass cultivars exceeded the minimally acceptable threshold of 6 (Fig 1). Industry standard 'TifGrand' demonstrated a mean turf quality score of 4.7, while 18 of OSU's experimental cultivars exceeded this value. Similar to our previous field trial, 'Patriot' was one of the worst performing cultivars under the greenhouse screening method. The top-performing cultivar ('2014-4x2') showed minimal shade avoidance response (etiolation), while the worst-performing cultivar ('2014-29x19') developed a 'stemmy' and etiolated growth habit under heavy shade (Fig. 2 and 3). Results suggest the greenhouse method can be used to quickly identify shade tolerant genotypes from large numbers of experimental units, and that the OSU germplasm collection shows promise for development of a new interspecific hybrid bermudagrass cultivar having enhanced shade tolerance.

Future Expectations

The greenhouse screening trial will be repeated in spring 2018 to verify results from the first run. Findings from the greenhouse trials will be compared to those from a field trial in order to validate the method and further work towards development of a new cultivar. Field plots dedicated for this project have laid fallow for a full year and will be prepared for planting of 75 genotypes, including industry standards, in spring 2018. The plots will be established under ambient conditions. Plots will be subjected to shade conditions as early as mid-summer in order to start the selection pressure. The cultivars will be planted in a nearby non-shaded plot in order to verify performance is related to shade treatment and not general poor adaptation.

Summary Points:

- 75 bermudagrass genotypes have been screened for shade tolerance under greenhouse conditions.
- Several of these genotypes expressed similar or better shade tolerance to the current industry standard TifGrand bermudagrass.
- All 75 genotypes will be planted in the field in spring 2018 for validation of greenhouse screening methods.

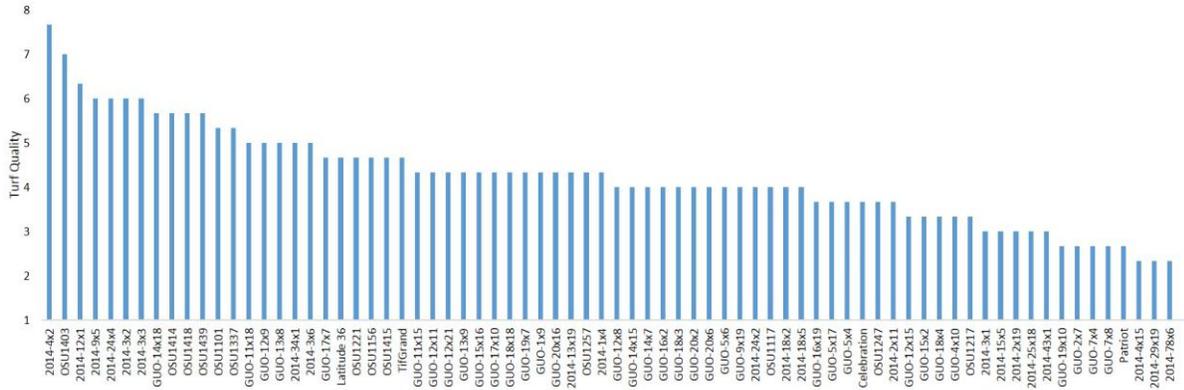


Fig. 1. Turf quality of experimental bermudagrasses under 4-months of heavy shade in a greenhouse.

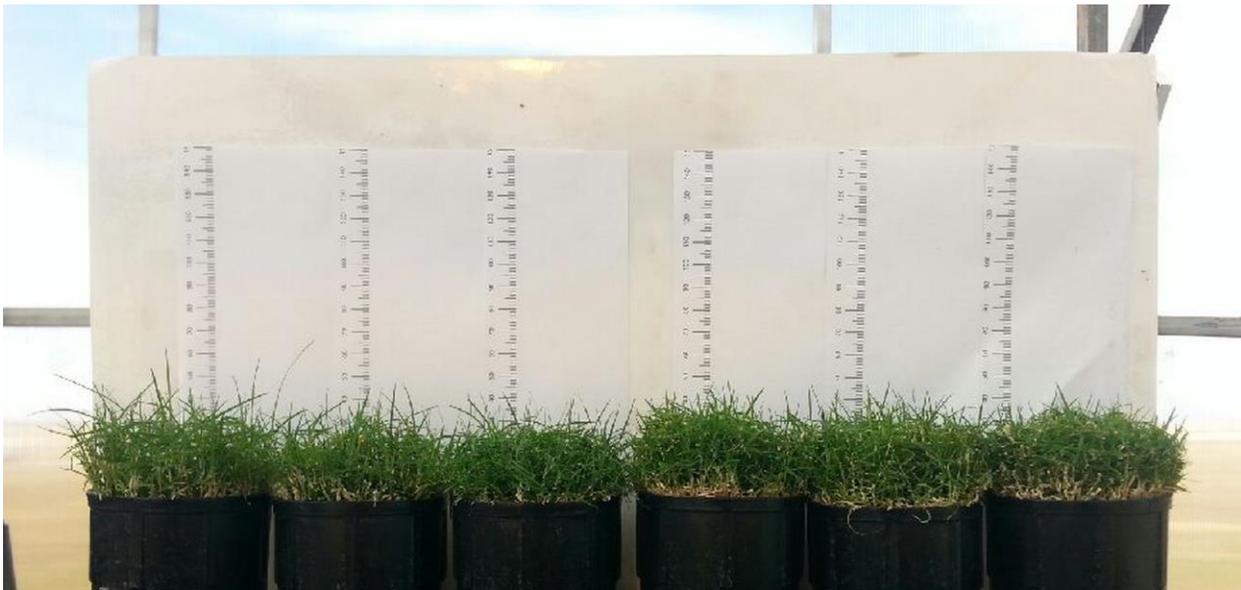


Fig. 2. Top performing entry '2014-4x2' under heavy shade (left) and full sun (right).



Fig. 3. Poor performing etry '2014-29x19' under heavy shade (left) and full sun (right).