

Development of Shade-Tolerant Bermudagrass Cultivars for Fine Turf Use

Yanqi Wu, Kyungjoon Koh, and Greg Bell
Oklahoma State University



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Objectives:

1. Develop a breeding population for fine turf characteristics, shade resistance and seed yield.
2. Test turf qualities and shade resistance of two experimental cultivars in comparison with commercially available vegetatively and seed propagated cultivars.

Bermudagrass (*Cynodon* spp.) is a warm-season turfgrass that is widely used on golf courses in the US. However, most currently available bermudagrass cultivars don't have sufficient shade tolerance. Since 2007, with financial support from the USGA, 45 common bermudagrass [*C. dactylon* (L.) Pers.] germplasm accessions assembled by the Oklahoma State University turfgrass breeding program with seed-producing potential

were tested and selected for shade tolerance. Using the best germplasm accessions, two synthetics, OKS2011-1 and OKS2011-4, were created and entered into the 2013 National Turfgrass Evaluation Program bermudagrass trial at multiple locations. In addition, one breeding population was formed in a polycross nursery using selected accessions for shade tolerance in 2012. Approximately 350 progeny plants from the breeding population were

Figure 1. A field nursery used to quantify selfing and outcrossing rates of common bermudagrass plants.

Bermudagrass	Shade			Sun			Shade/sun Decline***
	TQ	Rank [†]	NDVI**	TQ	Rank	NDVI	
	1-9=best	-- LSD --		1-9=best	-- LSD --		--- % ---
Latitude36	6.2	A	0.7910	7.8	A	0.8508	-7.0
Yukon	5.8	AB	0.7817	7.1	B	0.8361	-6.5
NorthBridge	5.8	AB	0.7846	7.8	A	0.8446	-7.1
Celebration	5.6	BC	0.7976	6.6	D	0.8318	-4.1
2011-1	5.3	BCD	0.7953	6.6	CD	0.8480	-6.2
Riviera	5.3	CD	0.7790	7.0	BC	0.8389	-7.1
TifGrand	5.1	CD	0.7617	6.9	BCD	0.8273	-7.9
2011-4	4.9	D	0.7667	6.6	D	0.8218	-6.7
Princess77	4.1	E	0.7805	6.5	D	0.8281	-5.7
Patriot	3.6	E	0.6732	6.5	D	0.8293	-18.8
LSD	0.55		0.0348	0.41		0.0126	

[†] Based on Fisher's protected least significant difference ($P=0.05$); means followed by the same letter do not differ significantly

^{**} Normalized difference vegetation index (near infrared reflectance - red reflectance) / (near infrared reflectance + red reflectance)

^{***} NDVI in shade compared with NDVI in full sun reported in %; (severe shade - full sun)/full sun*100





Figure 1. A severe shade site of conifer trees to the west of and deciduous trees to the east of bermudagrass plots (image on the left) and a full sun site of bermudagrass plots of OKS2011-1, OKS2011-4, and eight commercial cultivars, including five clonal cultivars Celebration, Latitude 36, NorthBridge, Patriot, and TifGrand, and three seeded cultivars, Princess 77, Riviera, and Yukon.

established in a field nursery with severe shade in 2013. Best progeny plants under shade will be selected in the spring of 2015. The selected progeny will be further studied for their seed yield potential and turf quality in a space planted nursery.

In the summer of 2013, OKS2011-1, OKS2011-4, along with 'Celebration', 'Latitude 36', 'NorthBridge', 'Patriot', 'Princess 77', 'Riviera', 'TifGrand', and 'Yukon' were planted in plots of 3 ft. x 5 ft. with four replications on one severe shade site, one partial shade site, and one full sun site (Figure 1). The three sites are adjacent each other and located on the OSU Turf Research Center. The plots were fully established and evaluated in 2014. In 2014, photosynthetic photon flux (PPF) in the severe shade plots was 41% of that on the full sun site. The shade plots received full sun-light only between approximately 12 to 3pm, which also is a common shade condition on the golf courses. Visual quality ratings were made every two weeks and NDVI ratings were collected monthly in the trials.

Shade stress caused an average 26% decline in turf quality (TQ) and a 7.7% decline in normalized difference vegetation index (NDVI) in 2014 (Table 1). Latitude36 and NorthBridge were the top ranked bermudagrasses in both

the severe shade and full sun plots. OKS2011-1 was visually ranked in the top five including Yukon in the severe shade plots. Among seeded type bermudagrasses, OKS2011-1 was visually ranked higher than Princess77 and OKS2011-4, equal to Riviera, but lower than Yukon in full sun. OKS2011-4 was visually ranked higher than Princess77 in shade, but equal to Princess77 in full sun. The visual quality of Yukon, Riviera, and OKS2011-1 were superior to OKS2011-4 in shade.

Summary

- Approximately 350 progeny of a breeding population were space planted and tested for shade tolerance.
- Two experimental synthetics created from shade tolerant selections along with five clonal and three seed-producing cultivars were fully established and tested for turf performance under severe shade, partial shade and full sun in 2014.
- OKS2011-1 bermudagrass was visually ranked in the top five entries for turf quality in the severe shade plots.