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Evaluating Large Patch-Tolerant and Cold Hardy Zoysiagrass Germplasm in the Transition Zone

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Evaluating Large Patch-Tolerant and Cold Hardy Zoysiagrass Germplasm in the Transition Zone

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Summary
A *Zoysia japonica* genotype, TAES 5645, that exhibited partial resistance to large patch in preliminary studies conducted by our collaborators at Texas A&M University, was used as a breeding parent at Texas A&M and crossed with 22 cold hardy zoysiagrasses, resulting in 2,858 progeny. These progeny were evaluated for cold hardiness and agronomic traits (establishment rate, overall quality, spring green up, leaf texture, and genetic color) in Manhattan, KS; West Lafayette, IN; and Dallas, TX; from 2012 to 2014. This report focuses on the Manhattan, KS, results. From this work, 60 progeny were identified for further evaluation in larger plots. In fall 2016, 'Meyer' (42% of plot area affected) had more large patch than all zoysiagrass progeny (0 to 23%). In spring 2017, Meyer had 33% large patch, higher than most progeny. Among this group of experimental zoysiagrasses, there appear to be promising progeny that have good winter hardiness, resistance to large patch, and improved turf quality characteristics. Data collection is ongoing.

Rationale
Cold hardiness is the trait that limits the long-term survival of zoysiagrass in the transition zone. Further, large patch disease caused by *Rhizoctonia solani* (AG 2-2 LP) has become the primary pest on zoysiagrass. Large patch disease is currently managed by fungicide applications in fall and/or spring. Improved cultivars with good cold hardiness and large patch resistance are desired in the transition zone, which could reduce fungicide requirements and maintenance costs.

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Objectives

The objectives of this research were to identify high quality experimental zoysiagrass genotypes with cold tolerance equal to or better than Meyer, and some resistance to large patch.

Study Description

In June 2015, 60 experimental progeny, previously screened from 2858 entries for their quality and cold hardiness, were received from our turf breeder collaborators at Texas A&M University and planted in Manhattan, KS. One parent of each of the progeny (TAES 5645) has previously shown partial resistance to large patch infection in the preliminary experiments at Texas A&M. The experimental progeny, plus controls, were laid out in a randomized complete block design with 6- × 6-ft plots in three replications. The plots were maintained under golf course fairway/tee conditions starting in fall 2016. These progeny have also been planted and managed by university cooperators in West Lafayette, IN; Dallas, TX; Blacksburg, VA; Chicago, IL; Columbia, MO; Fayetteville, AR; Knoxville, TN; Raleigh, NC; and Stillwater, OK. This report focuses on the Kansas results. In 2015, vigor was rated on a 1-9 scale with 9 equaling maximum vigor. In May 2016, spring green up was rated on a 1-9 scale with 9 being completely green. In Manhattan on September 12, 2016, after plots were fully established, one-half of each plot was inoculated by inserting the 8–10 gram oats (*Avena sativa* L.) grows with the large patch fungus under the thatch. Large patch severity was determined by visually rating the percentage of each half of the inoculated side that exhibited large patch disease symptoms in November 2016; and May, September, and October 2017. A similar inoculation was done in Fayetteville, AR. At the other sites, disease is assessed via visual rating if it naturally occurs in spring and fall.

Results

The results in Kansas from 2015 to 2018, showed progeny with a wide range of variability in turf quality characteristics including winter injury, spring green up (Figures 1 and 2), establishment rate, genetic color, leaf texture, turfgrass quality, and fall color. Variability in large patch resistance exists among the experimental progeny (Figures 3 and 4). From fall 2016 to fall 2017, Meyer (up to 42% of plot area affected) had more large patch than most zoysiagrass progeny (Table 1 and Figure 5). The top performing zoysiagrass progeny had little large patch present. Among this group of experimental zoysiagrasses, there appear to be promising progeny that have good winter hardiness, resistance to large patch, and improved turf quality characteristics but data collection is ongoing. Kansas data will be combined with data from other sites.

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Table 1. Large patch infestation in top-performing zoysiagrass progeny and standard cultivars in 2016 and 2017 in Manhattan, KS

	Large patch[†]%			
Entry/cultivar	November 2016	May 2017	September 2017	October 2017
6119-179	3.3	10.0	0	0
6102-307	6.7	7.0	0	0
6099-69	7.7	9.3	0	9.0
6100-86	1.0	16.7	0	0
6099-145	4.0	15.7	0	3.3
6126-71	6.3	16.7	0	1.7
6119-168	10.0	18.3	0	25.0
Meyer	41.7	33.3	1.7	8.3
LSD[§§]	13.4[‡]	25.2	19.5	23.0

[†]Large patch was rated as a percentage of the plot area affected on a 0 to 100% scale; n = 3.
[‡]To determine statistical differences among entries, subtract one entry's mean from another entry's mean.
[§§]Statistical differences occur when this value is larger than the corresponding least significant difference (LSD) value ($P < 0.05$).

Figure 1. Progeny showed a wide range of variability in spring green up on April 26, 2017, in Manhattan, KS.

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Figure 2. Progeny showed a wide range of variability in spring green up on April 28, 2018, in Manhattan, KS.

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Figure 3. Large patch symptoms in a less susceptible experimental progeny (top center) compared to a susceptible experimental progeny in October 2017 after inoculating in September 2016 in Manhattan, KS.

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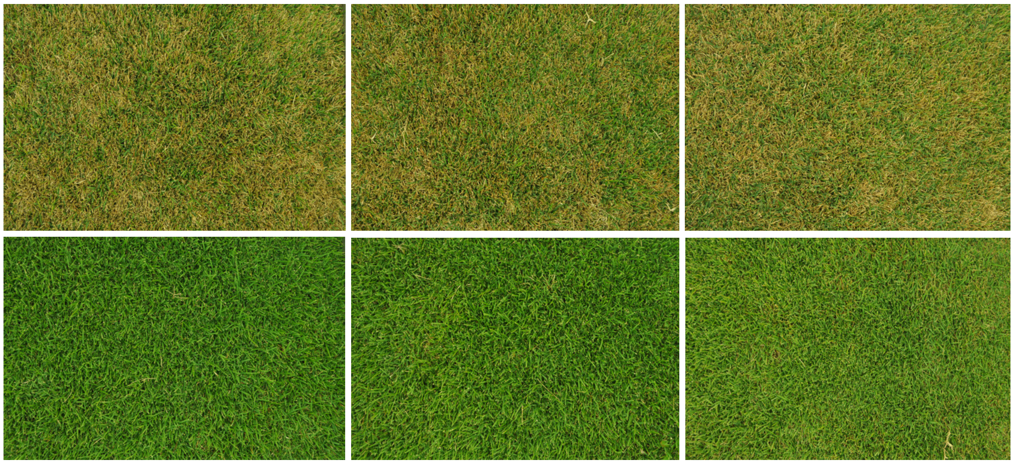

Figure. 4. Overhead photos taken inside a light box of large patch symptoms in a susceptible (6096-81, upper row) and tolerant (6119-179, lower row) zoysiagrass at Manhattan, KS. Photos were taken on October 18, 2017. Each is of a different replicate.

Figure 5. Large patch symptoms in Meyer zoysiagrass (left) compared to an experimental progeny in November 2016 after inoculating in September in Manhattan, KS.

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