Development of Large Patch Resistant and Cold Hardy Zoysiagrass Cultivars for the Transition Zone

2016 Update

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Objective: Phase III (year 3-6) of the evaluation process is focused on field testing in the form of replicated spaced plant nurseries comprised of the newly generated progeny population. The objective of Phase III field test is the selection of experimental lines that have comparable/superior cold tolerance to Meyer, fine texture, and large patch tolerance.

Update on Progress

This was the second year of field evaluation for 60 zoysiagrass experimental lines after they were selected from 2,858 progeny. These progeny were developed at Texas A&M AgriLife Research in Dallas, Texas by crossing 22 cold-hardy zoysiagrasses with TAES 5645 (*Z. japonica*), which has demonstrated reduced susceptibility to large patch in growth chamber studies.

In September 2014, twenty top-performing progeny were selected from space plantings in Manhattan, West Lafayette, IN, and Dallas, TX. These sixty progeny were returned to Dallas for propagation. In June 2015, vegetative plugs of the 60 progeny along with the standard cultivars Meyer, Zorro, El Toro, Zeon, and Chisholm, were shipped from Dallas, TX and planted

in three replicate plots (25 or 36 sq. ft.) in Manhattan, KS, West Lafayette, IN and Dallas, TX. In 2015, the same progeny were also distributed to research cooperators in Blacksburg, VA; Chicago, IL; Columbia, MO; Fayetteville, AR; Knoxville, TN; Raleigh, NC; and Stillwater, OK for evaluation in replicated plots.

Data Collection and Results

In 2016, data were submitted from all locations except Chicago where a personnel change recently took place. For presentation in Tables 1 to 9, the top-performing seven progeny are shown along with the controls (standards). Data summaries below refer to an evaluation of all 60 experimental progeny (and not all are shown in tables). In this progress report, for brevity, comparisons are made to Meyer, which is the standard zoysiagrass cultivar used in the transition zone. Data presented are averages from the locations submitting data for a given parameter, and were analyzed using PROC GLM.

- **Winterkill.** Winterkill was rated at IN in May, 2016 as percent of the plot exhibiting symptoms. Meyer had 12% winterkill; 20 progeny had winter injury levels statistically similar to Meyer, and 40 had more winter injury (Table 1).
- **Green up.** Spring green up was rated visually on a 1-9 scale as 1 = brown and 9 = fully green at AR, MO, NC, OK, TX, and KS. Green-up ratings ranged from 3.1 to 5.7 (Table 2). Twelve progeny had higher green up ratings than Meyer (3.6); all others were statistically similar.
- **Percent Cover.** Percent cover was rated visually (0 to 100 % scale) at MO, NC, OK, TN, VA, TX, KS, and IN between May and November. Average coverage ranged from 17 to 61%. Three progeny had greater coverage than Meyer (34%); all others were not statistically different from Meyer (Table 3).

- **Summer Color.** Color was rated visually on a 1 to 9 scale (9 = darkest green) at AR, MO, NC, OK, TX, and KS. Color ranged from 5.0 to 7.0; none of the progeny had genetic color that was better or worse than Meyer (6.0) (Table 4).
- **Leaf texture.** Leaf texture was rated visually between May and August on a 1 to 9 scale (1 = coarsest and 9 = finest) at AR, MO, NC, OK, TX, and KS. Texture ratings ranged from 4.2 to 7.9; three progeny had a finer leaf texture than Meyer (5.8) (Table 5).
- **Quality.** Turfgrass quality was rated on a 1-9 scale (1 = dead; 6 = minimally acceptable; and 9 = ideal) between May and September at AR, IN, KS, MO, NC, OK, TX, and VA. Average quality ranged from 5.0 to 7.1; four progeny had quality that was better than Meyer (6.0) (Table 6).
- **Fall color.** Fall color was rated visually between October and December on a 1 to 9 scale (1 = brown and 9 = dark green) at MO, NC, OK, TX, VA, and KS. Fall color ranged from 2.9 to 5.5; none of the progeny differed from Meyer (3.9) (Table 7).
- **Large patch.** Large patch was evaluated at KS, where plots were inoculated in September, 2016, and in OK, where a natural infestation occurred. In Kansas, Meyer (42% of plot area affected) had more large patch than all zoysiagrass progeny (0 to 23%) (Table 8). The top performing zoysiagrass progeny had little or no large patch present. In Oklahoma, Meyer had 77% of plot area affected by large patch, which was significantly higher than all but one of the progeny (0 to 58%) (Table 9). Plots were also inoculated in AR and data will be taken in 2017.

Summary highlights:

- Sixty zoysiagrass progeny, each arising from a cross between a parent with reduced susceptibility to large-patch and a cold-hardy parent, are under evaluation after initially screening > 2,800 progeny for quality and cold hardiness.
- Progeny are being evaluated under golf course management conditions at locations throughout the transition zone for turf quality characteristics and reduced susceptibility to large patch
- The fungus causing large patch was inoculated in plots in Manhattan, KS and a natural infestation occurred in Stillwater, OK. Meyer had the largest percentage of plot area affected by the disease at both locations; many of the progeny exhibited no symptoms.
- Progeny showed a wide range of variability in turf quality characteristics including winter injury/hardy, spring green up, establishment rate, genetic color, leaf texture, turfgrass quality, and fall color.
- 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.

Fig. 1. Large patch symptoms in Meyer zoysiagrass (left) compared to an experimental progeny in November, 2016 after inoculating in September at Manhattan, KS.

Table 1. Winterkill of top-performing zoysiagrass progeny and standard cultivars in late spring 2016 in IN.

Entry	**Winter kill (%)**[†]
6101-9	16.7
6121-5	18.3
6099-8	18.3
6100-13	23.3
6099-151	23.3
6096-36	23.3
6101-52	25.0
Zorro	73.3
El Toro	65.0
Zeon	66.7
Chisholm	20.0
Meyer	11.7
LSD	24.5*

[†]Winter injury was rated 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 LSD value ($P < 0.05$).

Table 2. Spring green up of top-performing zoysiagrass progeny and standard cultivars in spring 2016 in AR, MO, NC, OK, TX, and KS.

Entry	**Spring green up**[†]
6119-179	5.7
6095-73	5.5
6099-447	5.4
6099-145	5.4
6097-74	5.2
6126-71	5.1
6119-14	5.1
Zorro	4.4
El Toro	5.3
Zeon	4.3
Chisholm	4.7
Meyer	3.6
LSD	1.6*

[†]Spring green up was rated on a 1-9 scale (1 = brown; 9 = fully green); n = 18.

*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 LSD value ($P < 0.05$).

Table 3. Percent cover of top-performing zoysiagrass progeny and standard cultivars in summer 2016 in IN, MO, NC, OK, TN, TX, VA, and KS.

Entry	**Cover (%)**[†]
6099-69	57.1
6119-179	55.6
6099-359	55.2
6095-73	50.9
6096-36	50.7
6101-52	50.5
6121-5	50.3
Zorro	34.6
El Toro	60.1
Zeon	43.0
Chisholm	60.0
Meyer	34.2
LSD	22.0*

[†] Percentage cover was rated on 0 to 100 % scale; n = 24. Grasses were planted in the previous summer (2015) as vegetative plugs (2 inch diam., 12 inches apart).

*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 LSD value ($P < 0.05$).

Table 4. Summer color of top-performing zoysiagrass progeny and standard cultivars in mid summer 2016 in AR, MO, NC, OK, TX, and KS.

Entry	**Genetic color**[†]
6102-289	7.0
6096-117	6.8
6095-83	6.8
6119-14	6.7
6126-71	6.7
6101-71	6.7
6100-86	6.7
Zorro	6.9
El Toro	5.2
Zeon	6.9
Chisholm	5.0
Meyer	6.1
LSD	1.1*

[†]Genetic color was rated on a 1-9 scale (1 = brown/straw/dead; 9 = dark green); n = 18.

*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 LSD value ($P < 0.05$).

Table 5. Leaf texture of top-performing zoysiagrass progeny and standard cultivars in mid summer 2016 in AR, MO, NC, OK, TX, and KS.

Entry	**Leaf texture**[†]
6096-137	7.8
6119-155	7.3
6102-289	7.1
6101-154	6.9
6101-32	6.8
6101-52	6.8
6100-26	6.8
Zorro	7.8
El Toro	4.4
Zeon	7.9
Chisholm	4.2
Meyer	5.8
LSD	1.2*

[†]Leaf texture was rated on a 1-9 scale (1 = coarsest; 9 = finest); n = 18.

*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 LSD value ($P < 0.05$).

Table 6. Turfgrass quality of top-performing zoysiagrass progeny and standard cultivars in summer 2016 in AR, IN, KS, MO, NC, OK, TX, and VA.

Entry	**Turfgrass quality**[†]
6095-73	7.1
6099-69	7.0
6101-26	7.0
6101-52	7.0
6101-154	7.0
6101-32	6.9
6119-179	6.9
Zorro	6.7
El Toro	7.0
Zeon	6.5
Chisholm	6.7
Meyer	6.1
LSD	0.9*

[†]Turfgrass quality was rated on a scale of 1-9 (1 =dead; 6 = minimally acceptable; 9 = ideal); n = 24.

*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 LSD value ($P < 0.05$).

Table 7. Fall color of top-performing zoysiagrass progeny and standard cultivars in late fall 2016 in MO, NC, OK, TX, VA, and KS.

Entry	**Fall color**[†]
6126-71	5.5
6095-83	5.2
6102-289	5.2
6119-87	4.9
6095-101	4.9
6095-117	4.9
6119-155	4.9
Zorro	4.3
El Toro	4.2
Zeon	4.1
Chisholm	4.1
Meyer	3.9
LSD	1.5*

[†]Fall color was rated on a 1-9 scale (1 = brown; 9 = dark green); n = 18.

*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 LSD value ($P < 0.05$).

Table 8. Large patch infestation in top-performing zoysiagrass progeny and standard cultivars in Nov. 2016 in KS.

Entry	**Large patch (%)**[†]
6099-447	0.0
6095-101	0.0
6101-26	0.0
6104-150	0.0
6099-359	0.0
6100-146	0.0
6102-62	0.3
Zorro	6.7
El Toro	1.7
Zeon	7.3
Chisholm	1.3
Meyer	41.7
LSD	15.8*

[†]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 LSD value ($P < 0.05$).

Table 9. Large patch infestation in top-performing zoysiagrass progeny and standard cultivars in Nov. 2016 in OK.

Entry	**Large patch (%)**[†]
6102-47	0.0
6095-101	0.0
6101-26	0.0
6104-150	0.0
6097-74	0.0
6096-137	0.0
6102-196	0.0
Zorro	26.7
El Toro	48.3
Zeon	36.7
Chisholm	0.0
Meyer	76.7
LSD	15.8*

[†]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 LSD value ($P < 0.05$).