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

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Turfgrass and Environmental Research Online
Volume 13, Number 3 | May—June 2014

Objectives:

1. *Phase I (year 1): Perform pair wise crossing between Large Patch Resistance (LPR) experimental hybrids and germplasm accessions with cold hardy zoysiagrass parental lines (´Meyer´ and Meyer derivatives) in year 1 of the project.*
2. *Phase II (year 2 and 3) of the evaluation process will focus on field testing in the form of non–replicated spaced plant nurseries comprised of the newly generated progeny population that will be conducted concurrently at Manhattan, KS, West Lafayette, IN, and Dallas, TX. The objective of Phase II field testing is the selection of experimental lines that have comparable/superior cold tolerance to Meyer as well as improved turfgrass quality.*
3. *Phase III (year 4–6) of the evaluation process will be in the form of replicated field trials where extensive testing will be performed on the selected entries in the field (Dallas, Manhattan, West Lafayette, and five other locations in the transition zone), as well as a disease nursery in which plots will be inoculated with Rhizoctonia solani (AG 2–2 LP) (Manhattan). This same set of advanced materials will undergo additional testing controlled environment testing to screen for LPR (KSU) and cold tolerance (KSU and Purdue).*

Zoysiagrass is a warm season grass species that provides an excellent playing surface for the sport of golfing with the added benefits of low nutrient and pesticide requirements making it an ideal turfgrass species for use in the transition zone (Fry et al., 2008). ´Meyer´ (Z. japonica) has been the cultivar of choice since its release in 1951 (Grau and Radko, 1951), in part because it has excellent freezing tolerance. However, Meyer is relatively slow to spread and recover from divots, and is more coarse textured and less dense than Z. matrella cultivars (Fry and Dernoeden, 1987; Patton, 2009).

Researchers at Texas AgriLife Research–Dallas and Kansas State University have worked together since 2004 to develop and evaluate zoysiagrasses with better turf quality than Meyer that are adapted to the transition zone. From this work, a number of advanced lines derived from paired crosses between Z. matrella and Z. japonica, have been identified with a level of hardiness equivalent to Meyer and ´Chisholm´ (Okeyo et al., 2011), but with finer texture and better density than Meyer (e.g. – KSUZ 1201 entered in the 2013 NTEP).

Large patch disease, caused by Rhizoctonia solani (AG 2–2 LP), continues to be the #1 pest problem on Meyer zoysiagrass fairways and tees in the transition zone (Kennelly et al, 2009). Most golf course superintendents treat with two applications of fungicide annually to limit damage from large patch. The best fungicides for suppressing this disease cost ~$350/acre. A course with 30 acres would then need to budget $21,000 annually to treat this disease alone. Incorporating large patch tolerance (LPT), along with

Figure 1. 2012 Cold Hardy/Large Patch Tolerant Spaced Plant Nursery growth progress on October 3, 2013.

TERO Vol. 13(3):24–25 | May—June 2014
USGA ID#: 2012–24–458
TGIF Number:241603

Table 1. Summary of Cold Hardy/Large Patch Tolerant families generated at Texas A&M AgriLife–Dallas and their distribution to the three collaborating test locations.

Trait Lineage	Familial Code	Total number of progeny per lineage per location			Total
		Kansas State	Purdue	Texas A&M	
(CH x FT) x LPT	TAES 6096, 6100, 6101, 6109, 6110, 6118	308	305	288	**901**
(LPT x FT) x CH	TAES 6095, 6097 6105, 6106, 6119 6120, 6121	229	216	235	**680**
LPT x CH	TAES 6099, 6102 6104, 6126, 6220	374	373	341	**1088**
CH x LPT	TAES 6221, 6222	40	41	37	**118**
FT/LPT x CH	TAES 6263, 6315 6352	16	36	19	**71**
	Total	**967**	**971**	**920**	**2, 858**

cold hardiness and improved turf quality into new transition zone zoysiagrasses would reduce fungicide requirements and maintenance costs with the added bonus of increased sustainability.

We at Texas AgriLife Research – Dallas are partnering with Drs. Jack Fry, Megan Kennelly from K–State University, and Aaron Patton from Purdue University. These folks have extensive experience with testing turfgrasses adapted to the transition zone for cold hardiness and disease susceptibility.

A total of 2,532 progeny were produced and distributed for planting at three locations in 2012: (1) 863 to Kansas State, (2) 844 Purdue and (3) 825 Dallas Center (Phase I mostly completed). In 2013 another 326 progeny were added to the numbers to broaden the genetic base of the test with another 104 plants planted at Kansas State, 127 at Purdue and 95 at Texas A&M AgriLife Research – Dallas Center. The two year total across all three locations was 2,858 progeny.

Phase II began in 2012 with the planting of three Spaced Plant Nurseries: (1) West Lafayette, IN by Aaron Patton, (2) Manhattan, KS by Jack Fry and (3) Dallas, TX by A.D. Genovesi and Ambika Chandra. 2013 was a grow–in year for these nurseries. The objective of Phase II field testing is the selection of experimental lines that have comparable/superior cold tolerance to that of Meyer as well as improved turf quality. Attention will be paid to the selection of entries that exhibit no visible symptoms of large patch as a result of the natural incidence of the disease. Since Manhattan, KS and West Lafayette, IN have winters that allow for good cold selection pressure, identification of cold hardy lines with turf quality superior to that of Meyer will be the first level of selection. In Dallas winters are mild and we are not able to see separation based on cold hardiness. Because of this we will inoculate our nursery in the fall of 2013 with large patch disease to provide additional selection pressure. The plan of work for 2014 will be to select the top 15 to 20 progeny from the SPNs at each location and propagate the advanced lines for multi–location testing starting in 2015. Advanced lines will be tested over a diverse area in the transition zone at eight locations in 2015, 2016 and 2017.

Summary Points

- Phase I (year 1 and 2) accomplished: Pairwise crosses were made between large patch tolerant germplasm and cold hardy zoysiagrasses adapted to the transition zone with the production of 2,858 progeny by the Texas A&M AgriLife Research––Dallas researchers.
- Phase II (year 2 and 3) in progress: Spaced Plant Nurseries were planted late in 2012 and 2013 at three locations with a two year total of: 967 progeny at Manhattan, KS, 971 progeny at West Lafayette, IN, and 920 progeny at Dallas, TX in 2012. The nurseries were allowed to grow–in during 2013. Selections for the top 15–20 lines from each location will be made in summer of 2014 for advancement and more extensive testing.

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