Three University Cooperative Effort to Develop Cold Hardy Zoysiagrass Cultivars with Large Patch Tolerance for the Transition Zone

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Objectives:

1. *Phase I (Year 1 and 2): Pairwise crossing between Large Patch Tolerant (LPT) and cold hardy zoysiagrass parental lines ('Meyer' and Meyer derivatives).*
2. *Phase II (Year 2 and 3): Field evaluation of the newly generated progeny populations (Phase I) in non-replicated spaced plant nurseries (SPNs) at Manhattan, KS, West Lafayette, IN, and Dallas, TX. The purpose of SPN is the selection of experimental hybrids that have comparable/superior cold tolerance to that of Meyer as well as improved turfgrass quality. Attention will be paid to the selection of entries asymptomatic for large patch disease as a result of the natural incidence of the pathogen. Progeny selections will be made based on the performance of experimental hybrids at three university test locations and the selected progeny will be propagated in 2014 for Phase III.*
3. *Phase III (Year 4 - 6): Extensive testing will be conducted with the advanced lines in the form of a replicated field trial (RFT) at Dallas, Manhattan, West Lafayette, and seven other locations in the transition zone. This same set of advanced materials will be evaluated in a disease nursery with larger plot size inoculated with Rhizoctonia solani (AG 2-2 LP) isolates reared in the lab (KSU). Additional testing using standard laboratory bioassays will allow for measured comparative levels of LPT (KSU) and cold tolerance (KSU and Purdue) under controlled conditions.*

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 cold hardiness and improved turf quality into new transition zone

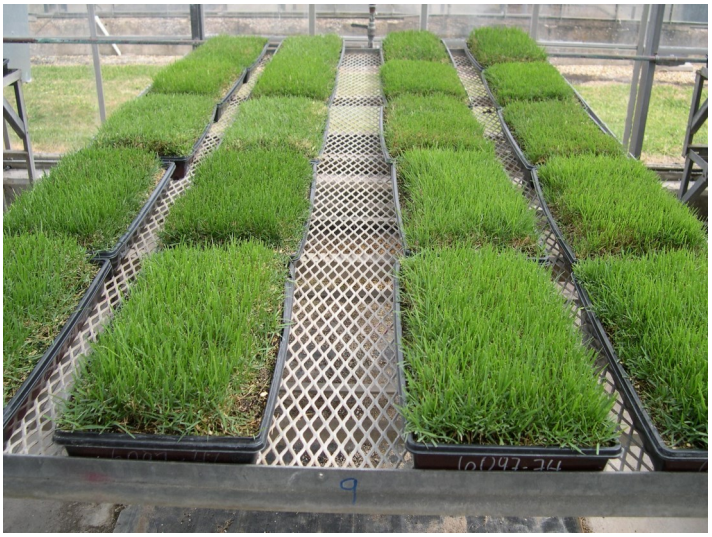

Figure 1. 2014 Cold Hardy/Large Patch Tolerant advanced lines shipped from Purdue for propagation in Dallas.

Table 1. Summary of (60) *Zoysia* progeny advanced from three test sites for a three year evaluation at ten test locations.

Lineage	Pedigree	Number of progeny advanced per lineage per location			Number advanced/ Family
		K-State U.	Purdue U.	Texas A&M AgriLife	
(CH x FT) x LPR	TAES 6096, 6100, 6101, 6109, 6110, 6118	9/308	11/305	4/288	**24/901**
(LPR x FT) x CH	TAES 6095, 6097 6105, 6106, 6119 6120, 6121	2/229	7/216	6/235	**15/680**
LPR x CH	TAES 6099, 6102 6104, 6126, 6220	9/374	2/373	9/341	**20/1088**
CH x LPR	TAES 6221, 6222	0/40	0/41	1/37	**1/118**
FT/LPR x CH	TAES 6263, 6315 6352	0/16	0/36	0/19	**0/71**
Advanced/Total No. Progeny		**20/967**	**20/971**	**20/920**	**60/2, 858**

CH: Cold Hardy parental lines; LPT: Large Patch Tolerant parental lines; FT: Fine-textured parental lines
Pedigree: Pairwise combination of different parental lines within each lineage.

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.

Phase I completed. A total of 2,532 progeny were produced and distributed for planting at three locations in 2012: (1) 863 to Manhattan, KS, (2) 844 West Lafayette, IN and (3) 825 Dallas, TX . In 2013 another 326 progeny were added to the numbers to broaden the genetic base of the test with another 104 plants planted at Manhattan, KS, 127 at West Lafayette, IN and 95 at Dallas, TX. The two year total across all three locations was 2,858 progeny.

Phase II completed. This phase 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 Dennis Genovesi and Ambika Chandra. 2013 was a grow-in year for these nurseries. The objective of Phase II field testing was the selection of experimental lines that have comparable/superior cold tolerance to that of Meyer as well as improved turf quality. 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 the SPN was inoculated in December of 2013 with isolates of *Rhizoctonia solani* (courtesy Dr. Young-Ki Jo, College Station, TX) to provide additional disease selection pressure. In late summer and fall of 2014 the PI's picked the 20 best entries from each of the three locations for evaluation starting in 2015. A high selection pressure resulted in only 2%, i.e. 60 out of a total of 2,858, to be advanced for a multi-location testing. Table 1 shows the summary of number of progeny per lineage advanced from each of the three locations.

Phase III initiated. PI's at Purdue and Kansas State shipped their selections to the Dallas Center in late August and early September, 2014 for propagation. Plant materials are being groomed for propagation with 10 – 18 cell trays needed for each entry or 660 trays total for all entries across all locations. The plan of work for 2015 is to establish replicated field trials with the 60 advanced lines and 6 standards/parental lines at seven diverse locations in the transition zone in addition to Manhattan, West Lafayette and Dallas, making it a total of 10 locations tested. The replicated field trial will span a three year period (2015 to 2017). There will be 66 x 3 reps = 198 plots (approx.. 5' x 5') at each location. This same set of advanced materials will be evaluated in disease nurseries at both K-State and Purdue inoculated with *Rhizoctonia solani* (AG 2-2 LP) isolates reared in the lab. Additional testing using standard laboratory bioassays will allow for measured comparative levels of LPT (KSU) and cold tolerance (KSU and Purdue) under controlled conditions.

Summary

- 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) accomplished: 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 and 2014. Selection of the top 20 lines from each location was made late in the growing season in 2014. Advanced lines were shipped to Dallas Center for propagation.
- Phase III (years 4, 5 and 6) initiated. Experimental lines and checks will be planted in replicated field trials and evaluated at 10 locations across the transition zone over a 3 year period.

References:

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