Genetic Enhancement of Turfgrass Germplasm for Reduced-input Sustainability

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Objectives:

1. The objective of this research, conducted at the USDA, ARS Beltsville Agricultural Research Center in Beltsville, MD, is to use genetic and biotechnology approaches to identify and develop turfgrass germplasm with improved biotic and abiotic stress resistance. Efforts will be made to identify molecular markers associated with desirable traits and to combine useful traits into germplasm able to grow with reduced inputs.

Start Date: 2007
Project Duration: three years
Total Funding: $50,000

In order to improve the stress tolerance of turfgrass, we have undertaken the following five projects:

Development of *Danthonia spicata* as a Low Maintenance, Native Turfgrass Species

A key aspect to the development of *Danthonia spicata* (Poverty grass) as a low maintenance turfgrass species is obtaining a better understanding of the biology of the species. Therefore, we have spent time collecting plant material and observing the growth and reproductive characteristics of the species. Initial observations indicate that there is variation present in the species, and there may be more than one species present in natural stands.

Several new locations for the collection of germplasm were identified. A seeding rate trial was established at the University of Maryland turfgrass center using three different seeding rates. The results of the first year indicate no significant difference in turf quality between the three seeding rates.

Field Screening of Bentgrass Germplasm for Resistance to Important Turfgrass Diseases

A field trial containing clonally propagated plants from a bentgrass mapping population, developed by Dr. Geunhwa Jung at the University of Massachusetts, was established at the University of Maryland turfgrass center. The study involves approximately 300 entries replicated three times, plugged into a ryegrass turf.

The first rating of this material for disease resistance was conducted in the summer of 2008. The artificial inoculation with *Sclerotinia homoeocarpa* was not as effective as we would have liked. Slow fungal growth during inoculum development resulted in a late inoculation of the field trial. However, disease development did occur, and our first rating of the material was conducted with differences clearly present.

Development of *Koeleria macrantha* as a Low-input Turfgrass

The goal of this research is to increase the genetic potential of prairie junegrass (*Koleria macrantha* Ledeb.) for use as a low-input turfgrass. Research on *Koeleria* is all being conducted by the University of Minnesota and has initially been focused on germplasm collection. Future research may involve the establishment of research plots in Maryland to determine the tolerance of *Koeleria* germplasm to the stressful growing conditions often present during Maryland summers.

Identification of Brown Patch Resistant Tall Fescue

The objective of this study was to use digital image analysis (DIA) to evaluate tall fescue plant introductions (PIs) for resistance to both *Rhizoctonia solani* and *R. zeae*. This study included 15 PIs selected from the USDA germplasm database and three commercial cultivars with varying brown patch resistance.

The commercial cultivars had the lowest mean disease severity in each experiment. Mean disease severity ranged from 59-93% for *R. solani* and from 32-64% for *R. zeae*. Current work involves screening the best PIs and using 20 seeds sampled from each PI to evaluate the diversity of resistance to both *R. solani* and *R. zeae* that may be present in each PI.

Bentgrass Breeding Consortium: Molecular Breeding for Dollar Spot and Snow Mold Resistances

The objective of this study was to identify candidate Miniature Inverted-repeat Transposable Elements (MITEs), a class of transposable elements that has not been previously described in turfgrasses, from *Agrostis* and assess their value as a molecular-marker tool.

DNA sequences were screened using the FindMITE program to identify candidate MITE sequences. FindMITE identified 202 MITE-like sequences, or 1.26% of the 16,064 sequences. The MITE display markers had a significantly higher polymorphism rate (0.42) between the mapping population parents than Amplified Fragment Length Polymorphism (AFLP) markers at 0.28. The MITE display protocol would be an effective tool for diversity analyses and mapping in *Agrostis*.

Summary Points

- There is variation present in naturalized stands of the low maintenance species *Danthonia spicata* (Poverty grass), allowing for potential selection of superior plant types.
- A field trial of bentgrass germplasm, planted in Maryland, exhibited differences in response to dollar spot (*Sclerotinia homoeocarpa*) infection.
- Tall fescue plant introductions (PIs) inoculated with *Rhizoctonia solani* and *R. zeae* showed varying degrees of tolerance to both diseases.
- Miniature Inverted-repeat Transposable Elements (MITEs) show promise as an effective tool for diversity analyses and mapping in *Agrostis* species.