Cultivar Development and Extreme Temperature Tolerance of Greens-type Poa annua

David R. Huff
Pennsylvania State University

Objectives:

1. Collect, select, breed, and develop genetically stable and phenotypically uniform cultivars of greens-type *Poa annua* for commercial production.
2. Develop techniques to screen large numbers of germplasm accessions for tolerance to extreme temperatures and coverage by sheets of ice.
3. Identify genetic markers associated with genetic loci (genes) controlling agronomically important traits and specific stress tolerances to aid in the breeding and development of improved cultivars of greens-type *Poa annua.*

Start Date: 2003 (current cycle)
Project Duration: three years
Total Funding: $90,000

In 2005, we began the process of renovating and constructing new research putting greens at the Joseph Valentine Research Facility. Currently, we have the 2002 Landscape Management Research Center (LMRC) putting green trial that remains ongoing, and we transplanted the 2001 trial into our newly acquired greenhouse at the LMRC.

Collaborative studies continue with: Dr. Sowmya Mitra, Cal-Poly - Ponoma (management of *Poa* greens), Dr. Yves Castonguay, AG-Canada, Laval University (winter damage of *Poa* greens), Dr. David Aldous, University of Melbourne, Australia, and Mr. John Neylan, Australian Golf Course Superintendent's Association (salinity tolerance and management of *Poa* greens).

In 2005, the breeding program began supplying necessary germplasm required for the following new collaborative studies: Dr. Trygve Aamlid, The Norwegian Crop Research Institute (pink snow mold, *Microdocium nivale*, tolerance and winter hardiness), the "new" Northeast Regional Project (NE 1025, influence of management practices on the development of anthracnose on *Poa annua* and feeding of annual bluegrass weevil, *Listronotus maculicollis,* on *Poa annua*), and Dr. Scott Warnke, USDA-ARS, Beltsville (genetic analysis of the *Poa annua* genome in relation to potential fitness differences among genotypes on the putting green). Continuing collaborations for turf quality evaluations continue with several other univeristies.

The 2005 seed harvest is still in the process of being cleaned. We also shipped small samples of 2004 seed we believed to be genetically pure to the seed company DLF International in Oregon for evaluating commercial production potential of our best experimental cultivars. In the future, we will begin to rely more heavily on our collaborative seed-producing partner, DLF, to produce the quantity and quality of seed necessary to satisfy the demand of research and evaluation.

We are constantly collecting additional germplasm. A proposal was submitted in 2005 to the National Forage and Turfgrass Crop Germplasm Committee for a European *Poa* germplasm collection trip. This proposal is in collaboration with Dr. R.C. Johnson, USDA-ARS, Washington State University, for the purpose of collecting species of *Poa* closely related to *Poa annua*.

Studying *Poa annua*'s evolutionary history as a species and its evolution of greens-types will greatly enhance our knowledge and ability to manipulate the species through traditional breeding efforts. With a world's collection in place, we have begun to study its genetic variability, higher and lower states of polyploidy, and gene function and regulation of biotic and abiotic stress tolerance.

Mr. Jonathan LaMantia is a graduate student who has been brought on board to investigate and perform in this genetic research arena. Jon is using a combination of molecular techniques (genetic markers and flow cytometry) to further our understanding of the genetics underlying greens-type *P. annua* evolution. Mapping populations, a necessary tool for our genetic analyses, have been constructed for the traits of annual and perennial life histories and for two diseases, anthracnose and dollar spot.

Annual bluegrass is a highly variable species. Most samples were collected from courses located in North America (primarily in the northeast, mid-Atlantic, and Pacific northwest regions), but samples were also collected from Europe, Australia, and New Zealand.

Summary Points

- Collaborative studies continue with several researchers in the US and abroad.
- Research will rely more heavily on a collaborative seed-producing partner, DLF, to produce the quantity and quality of seed necessary to satisfy the demand of research and evaluation.
- Differences among cultivars continue to be observed for resistance to naturally occurring dollar spot disease and anthracnose disease.
- Molecular genetic tools are being used to understand the genetic basis underlying the evolution of biotic and abiotic stress tolerances in greens-type *P. annua*.
- A proposal was submitted in 2005 to the National Forage and Turfgrass Crop Germplasm Committee for a European *Poa* germplasm collection trip.