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

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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 in order to aid in the breeding and development of improved cultivars of greens-type *Poa annua.*

Start Date: 1998
Project Duration: 5 years
Total Funding: $175,000

The purpose of this research is not to replace creeping bentgrass as a putting surface, but to offer an alternative grass to those golf courses where *Poa annua* is simply a better choice. The main focus of this project is to develop commercial seed sources of uniform and stable cultivars of greens-type *P. annua*. Such products would allow superintendents and architects an opportunity to utilize *P. annua* putting surfaces rather than having to wait out the natural evolution of greens-types from the wild and weedy invasive annuals.

Currently, we have a total of three putting green quality evaluation trials at Penn State. These trials demonstrate that most cultivars in the breeding program are capable of being successfully established and maintained on sand-based rootzones and that several cultivars have superior turf quality.

Differences among cultivars continue to be observed for resistance to naturally occurring dollar spot and anthracnose diseases. However, four selections were relatively unaffected by the disease while the turf quality of the remaining 57 selections were impacted to varying degrees. During the 2003 growing season, most of these 57 selections demonstrated an interesting variability in their recovery from the devastating 2002 season with most selections achieving full recovery by the end of 2003.

Annual bluegrass nursery at Pennsylvania State University

A susceptible and several resistant cultivars have been identified for a strain of anthracnose. Isolates of this strain of *Colletotrichum graminicola* (Cesati) Wilson were collected and will provide a basis for investigating the underlying genetic mechanism of resistance in *Poa annua*.

We are currently utilizing the molecular genetic tools of genetic markers, flow cytometry, and micro-array analysis to further our understanding of the genetics underlying greens-type *P. annua* evolution and stress tolerance. A significant effort was made this year to maintain genetic purity of the greens-type *Poa annua* lines that are cultivated in the project. Additional germplasm collections were obtained from various golf courses having predominately *Poa* greens from Arizona, New Jersey, and Sweden.

The total seed harvest of 2003 yielded only approximately 15 lbs of seed from all cultivars. Most of the 2003 seed harvest was used for either the on-site trial at Bandon Dunes, Oregon, establishing new collaborative evaluation trials across the country, or for establishing a seed production field in Oregon.

The establishment of this seed production field in Oregon has been delayed due to interference via the Minnesota *Poa* patent and efforts are underway to come to a resolution with University of Minnesota.

Studying *Poa annua*'s evolutionary history as a species and it's evolutionary history 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 are beginning to research genetic variation, variability in DNA content, maintenance and changes in polyploidy, and gene function and regulation as it relates to biotic and abiotic stress tolerance. We are currently utilizing the molecular genetic tools of genetic markers, flow cytometry and micro-array analysis to further our understanding of the genetics underlying greens-type *P. annua* evolution.

Results this year suggest that although DNA content of leaf nuclei are highly variable within the species, there does not seem to be a significant negative correlation between DNA content and perenniality as previously suspected.

Summary Points

- A susceptible and several resistant cultivars have been identified for a strain of anthracnose.
- Additional germplasm collections were obtained from various golf courses having predominately *Poa* greens from Arizona, New Jersey, and Sweden.
- The total seed harvest of 2003 yielded only approximately 15 lbs of seed from all cultivars.
- The establishment of a seed production field in Oregon has been delayed due to interference via the Minnesota *Poa* patent and efforts are underway to come to a resolution with University of Minnesota.
- There does not seem to be a significant negative correlation between DNA content and perenniality as previously suspected.