The effectiveness of genetically-engineered herbicide resistance in creeping bentgrass has been demonstrated in multiple field tests. This trait is now ready to be incorporated into a commercial cultivar.

We currently have fifty independent transgenic lines of creeping bentgrass expressing one of five potential disease-resistance genes. We have established randomized replicated field trials of these plants that will be evaluated in the summer of 1999.

We also have transgenic plants from bombardments with HVA1, a potential drought and salinity tolerance gene. Plants found to be expressing HVA1 will be screened for effectiveness of the gene.

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

Pennsylvania State University

David R. Huff

Start Date: 1998
Number of Years: 5
Total Funding: $175,000

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 cultivar of greens-type Poa annua.*

Annual bluegrass *(Poa annua* L.) makes up a large portion of the putting surfaces in many regions of the United States and Canada. Given its wide-spread occurrence in the golf industry, there is currently a need for high quality, commercially available sources of greens-type *P. annua* for use in constructing, renovating, or maintaining *P. annua* golf greens. Greens-type P. *annua* actually has many characteristics that make them enviable as a putting surface. They typically have high shoot densities (9,000 shoots dm^{-2} or 7 to 24 times higher than that of bentgrass), an upright growth habit, and aggressively inhabit golf greens maintained at extremely close ($\leq$ 0.125 inches) mowing heights. The purpose of this research is not to replace creeping bentgrass as a putting surface, but simply offer an alternative for those golf courses where *P. annua* is simply a better choice.

Germplasm Collection and Evaluation: To date, this project has collected over 2,500 samples of greens-type *Poa annua* from regions including the northeast United States (Pennsylvania, New Jersey, Long Island NY) the mid-Atlantic (Delaware, Maryland, Virginia), and the Pacific northwest (Oregon, Washington). The performance and morphological features of field plot accessions are beginning to demonstrate that there is a tremendous amount of naturally occurring variation between regions, among golf courses within regions, and even among samples within a golf green.

Field resistance to dollar spot disease was observed during summer and fall of 1998 in one particular accession collected from Long Island, NY. This particular accession was completely free of dollar spot disease while all other surrounding plots were moderately to heavily diseased. This disease occurred naturally and was not treated with fungicides.

Currently, our collections of greens-type *Poa annua* exist as a collection of naturally occurring ecotypes and, as such, display a wide range of variation in many, many agronomically important traits. This variation is partitioned among individual plants due to its self-pollinated breeding system and thus, is readily accessible through selection as distinct, uniform, and stable inbred lines. Initially, ecotypic and mass selection of elite germplasm will be used for the development of cultivars. As regional testing and evaluation begins to identify genetically superior strains, these elite strains will begin to serve as parental sources for the cross-hybridization and subsequent single line selection that will eventually result in improved commercial cultivars.

Regional Testing: Based on the 1998-season plot evaluations, a renewed emphasis must be placed on extensive regional testing. In order to enhance and expand regional testing efforts, we have begun to identify cooperators willing to evaluate our experimental strains in golf green plots.

Seed Production and Increase: Seed of the selected accessions were sown into seed production plots (approximately 5 ft. x 20 ft.), in September 1998, for further seed yield evaluation and for generating seed increase for further regional testing. We are expecting a reasonable, though limited, seed harvest for the summer of 1999.

Genetic Identification and Manipulation of Polyhaploids. The evolutionary history of *Poa annua* (allopolyploidy) suggests that observed sexual sterility of particular strains is likely. This may be due to the genetic state of these accessions being sterile polyhaploids (plants derived from an unfertilized, reduced egg). We have begun a set of experiments in an attempt to restore fertility to several sexually sterile accessions.