Evaluating Methods for Vegetative Propagation and Enhancement of Seed Production of Greens-Type Poa annua *Cultivars*

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Objectives:

1. Establish efficient vegetative propagation methods of greens-type *Poa annua* for sod production and for establish ing/renovating golf course putting greens.
2. Scale-up our results for greens-type cultivar production to a larger commercial level by collaborating with sod producers.
3. Release a genetically stable, vegetative greens-type cultivar exhibiting superior putting green quality and stress tolerance.

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Project Duration: 3 years
Total Funding: $20,000

Poa annua is widely recognized for providing a large portion of high-quality putting surfaces in many regions of North America, Europe, and Australasia. However, despite repeated attempts in the U.S. to develop improved cultivars of greens-type *P. annua* for the golf course industry, there currently are no commercially available sources suitable for use in new construction or renovation of putting green surfaces.

Our previous genetic research suggests that the dwarf, perennial greens-type phenotypes result from the action of mowing which causes a repression of the plant growth hormone gibberellic acid signaling pathway through a non-Mendelian epigenetic mechanism involving the auxin biosynthesis pathway. Greens-type *P. annua* is an unstable phenotype which, in the absence of mowing pressure, will relatively quickly revert back to its wild annual form. The purpose of this research is to determine if the genetic stability of perennial greens-type *P. annua* is capable of being maintained through vegetative propagation during sod production of cultivars.

Poa annua is an allotetraploid species which means it originated from a whole genome duplication of an F_1 hybrid between two diploid parents. The parental species of *P. annua* have long been believed to be *P. supina*, a perennial, stoloniferous species that is native to the mountainous regions of central Europe and *P. infirma*, a bunch-type annual that inhabits the Mediterranean regions of Western Europe. Typically, an allotetraploid has the complete complement of chromosomes that each of the diploid parents contains.

Poa annua's set of chromosomes has a vastly different structure than either of its two parental species. The mechanism that has rearranged the chromosomal structure of *P. annua* most likely involves the action of class II transposable genetic elements, or "jumping genes." It is well known that once such jumping genes have been mobilized, often the resulting genomic reshuffling is accompanied by a wide variety of non-Mendelian epigenetic factors that differentially regulate gene expression.

Dr. Dave Huff and his colleagues have successfully propagated phenotypically stable greens-type Poa annua *across several replicated trials in various regions of the U.S.*

The ability of *P. annua* to become so widely distributed and to inhabit such a wide range of environments is likely the result of the same mechanism that has enabled it to evolve an ability to tolerate the close mowing heights of golf green putting surfaces. Gaining additional information and knowledge of exactly how these transposable elements have restructured the chromosomes of *P. annua* and how these elements affect genetic stability will help us in the future to potentially manipulate the breeding and genomics of *P. annua*.

We have demonstrated that genetic integrity and resulting phenotypic stability is achievable through vegetative propagation in combination with the action of mowing as the most critical factor to maintaining the greens-type phenotype. Using these methods, we have successfully propagated phenotypically stable greens-type *P. annua* across several replicated trials in various regions of the U.S. In order to rapidly establish these sod production fields, we have carefully produced 5 lb of phenotypically stable seed to provide the necessary planting stock for an evaluation of scaled-up production.

After the initial establishment, cores will be harvested from these sod fields to expand production and supply of our greens-type *P. annua* cultivar. The cultivar chosen for this sod production has repeatedly demonstrated high turf quality and excellent field resistance to anthracnose and dollar spot.

Summary Points

- Our research has successfully demonstrated the potential to maintain the phenotypic stability of greens-type *Poa annua* cultivars through vegetative propagation in combination with mowing.
- We have successfully produced enough stock material to initiate testing of large-scale sod production of one our top-performing cultivars.
- We have begun collaborating with commercial sod producers in Pennsylvania and Illinios to begin scaling up our vegetative propagation techniques of greens-type *P. annua*.