Breeding and Evaluation of Kentucky Bluegrass, Tall Fescue, Perennial Ryegrass, and Bentgrass for Turf

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Objectives:

1. Collect and evaluate potentially useful turfgrass germplasm.
2. Collect and evaluate endophytes associated with cool-season turfgrass species.
3. Continue the breeding and development of new cool-season turfgrasses.
4. Develop and apply several new tools designed to improve the ability to discriminate among endophyte isolates from nature and to synthesize new grass-endophyte combinations for experimental testing and possible commercial use.

Start Date: 1982
Project Duration: Continuous
Total Funding: $10,000 per year

Efficient technologies for obtaining large numbers of plantlets from tissue cultures of elite Kentucky bluegrasses were developed. This enables exciting new opportunities for the genetic improvement of this apomictic species by means of transformation and somoclonal selection. Tolerance of salt and drought was enhanced by transformation with the BADH gene and by regeneration of somoclonal mutants on medium supplemented with NaCl.

Continued progress is being made in the genetic improvement of our major cool-season turfgrasses. Increases have been made in stress tolerance, disease and insect resistance, durability, persistence, a lower growth profile, attractiveness, and seed yield. They all contribute to reductions in pesticide, fertilizer and mowing requirements and a marked improvement in turfgrass performance.

This genetic improvement program was initially based on a very extensive program of germplasm collection from old turfs primarily in the USA. Seeds originating in western Europe and the British Isles had been introduced to establish pastures, hay fields, and turfs. These were subjected to the diseases, insects, and environmental stresses of the hot, humid summers and relatively cold winters of the eastern USA. Plants best adapted to these conditions survived and spread to produce patches exceeding one meter in diameter under stressful, low-maintenance conditions.

Major improvements have been made in gray leaf spot resistance as shown above with one of the experimental selctions (plot on right) compared to a standard cultivar (plot on left).

Thousands of plants were selected from old turfs after collection efforts were expanded starting in 1962. Outstanding apomictic selections of Kentucky bluegrass were released as cultivars and/or used as parents in intraspecific and interspecific hybridization programs. The best selections of perennial ryegrass, tall fescue, Chewings fescue, strong creeping red fescue, hard fescue, rough bluegrass, colonial bentgrass, and creeping bentgrass were evaluated in clonal evaluation trials, greenhouse disease screens, and spaced-plant nurseries.

The best were intercrossed and progeny tested to release as synthetic cultivars. Others were used as parents of breeding composites to initiate many cycles of population improvement. Over the next 41 years, this involved evaluation of over three million plants in spaced-plant nurseries and mowed clonal tests, hundreds of thousands of single-plant progenies in closely mowed turf trials, and hundreds of thousands of seedlings or selections in greenhouse disease screening tests at Rutgers University.

Cycles of population improvement involved phenotypic and genotypic selection conduced over 40 years. It included modified population backcrossing to incorporate valuable genes and useful fungal endophytes. Many cycles of phenotypic assortive mating were used to uncover desirable recessive genes in vigorous, non-inbred populations. Selection of plants able to survive severe, interplant competition in closely mowed turfs growing in highly stressful evaluation also contributed to substantial genetic improvement.

The cultivar on the left is KY-31 with brown patch versus a selection called ATN (on the right), selected from tiller plots with improved quality and brown patch resistance.

A substantial expansion of efforts to collect, evaluate, enhance, and utilize new sources of turfgrass and endophyte germplasm initiated in 1996 is contributing greatly to improving resistance to many diseases and insect pests including gray leaf spot caused by *Pyricularia grisea* and dollar spot caused by *Sclerotinia homoeocarpa*.

Summary Points

- Continued progress is being made in the genetic improvement of our major cool-season turfgrasses. Increases have been made in stress tolerance, disease and insect resistance, durability, persistence, a lower growth profile, attractiveness, and seed yield
- A substantial expansion of efforts to collect, evaluate, enhance and utilize new sources of turfgrass and endophyte germplasm initiated in 1996 is contributing greatly to improving resistance to many diseases and insect pests including gray leaf spot caused by *Pyricularia grisea* and dollar spot caused by *Sclerotinia homoeocarpa*.