2013-02-463

Project Title: Germplasm Improvement of Low-Input Fine Fescues in Response to Consumer Attitudes and Behaviors

Project leader: Eric Watkins

Affiliation: University of Minnesota

Objective:

The long-term goal of this project if the development of improved, low-input fine fescue cultivars that provide economic and environmental benefits for the public.

Start Date: 2012
End Date: 2017
Total Funding: $50,000

This project provided matching funds for a five-year USDA-NIFA project funded by the Specialty Crop Research Initiative (grant number 2012-51181-19932). The project involved 10 scientists, along with graduate students and support staff, from three universities (University of Minnesota, Rutgers University, and the University of Wisconsin). Our group now includes researchers from Purdue University, Oregon State University, and the USDA-ARS in a new project to continue theses efforts. We recently received a $5.4 million grant, Increasing Low-Input Turfgrass Adoption Through Breeding, Innovation, and Public Education, from the U.S. Department of Agriculture's National Institute of Food and Agriculture to continue our work on increasing the availability and use of low-input fine fescues. Below are summaries from some of our research objectives for this just-concluded project.

Barriers to public land managers (led by Kristen Nelson, Minnesota): We investigated how public land managers in urban and suburban areas make decisions about vegetation management; in particular we were interested in their attitudes about the use of low-input turfgrasses such as the fine fescues. Primary challenges we identified were turfgrass maintenance, funding, public awareness, and natural vegetation management. As environmental challenges are increasingly addressed on the local scale, public land managers must be given the support, resources, and flexibility to introduce new practices such as use of lower input turfgrasses.

Industry and homeowner assessment (led by Chengyan Yue, Minnesota): We assessed both industry stakeholders and consumers about turfgrass trait preferences. The most important trait clusters for both breeders and distributors were abiotic stress resistance and growth characteristics. Breeders were more likely than distributors to select traits related to appearance when setting traits priorities. In general, we found that consumer-driven forces (i.e., turfgrass users and marketing companies) had positive impacts on the breeders' likelihood of selecting the studied traits. We also conducted choice experiments to elicit consumer willingness to pay for various consumer traits. We found both US and Canadian participants were willing to pay the highest premium for better ability to withstand foot traffic, followed by low mowing frequency, low fertilizer requirement, and low water usage. This analysis can help turfgrass breeders and industry supply chain members better understand the market potential for low-input turfgrasses.

Traffic (led by Jim Murphy, Rutgers): A major concern for turfgrass managers considering increasing their use of fine fescues is the ability of these grasses to withstand wear and traffic; this is especially of concern to golf course superintendents who might want to use fine fescues on fairways. We have determined better methods for researchers to select traffic and wear tolerant fine fescues. This new information can be utilized in breeding programs so that consumers can be provided with improved cultivars.

Heat Stress (led by Bingru Huang, Rutgers): Heat stress limits the use of fine fescues in some part of the U.S. We completed several experiments studying the heat stress tolerance of fine fescues (Figure 1). In the first, we examined whether heat or drought stress is more detrimental to fine fescues and found that heat stress is more detrimental. In the second study, we examined differential changes in membrane constituents in response to heat stress in hard fescue and identified major membrane constituents associated with stress response. The objective of the third study was to identify amino acids and soluble proteins associated responses to heat stress. Finally, in our fourth study, we assessed genetic variations in the transcript levels of selected genes in fine fescue cultivars differing in heat tolerance, and identified single nucleotide polymorphism (SNP) markers associated with candidate genes related to heat tolerance that can be utilized in turfgrass breeding programs.

Fine Fescue Diseases (led by Paul Koch, Wisconsin and Bruce Clarke, Rutgers): Fine fescue resistance to various snow mold pathogens was investigated in both field (New Jersey and Wisconsin) and controlled environment chamber settings. In general, the hard fescue cultivars exhibited the greatest resistance to both pink snow mold (Figure 2) and gray snow mold while the Chewings fescue cultivars exhibited the greatest susceptibility. Cultivars of slender and strong had intermediate levels of resistance. Turfgrass managers in areas where snow molds are a concern should utilize hard and sheep fescues, while breeders should work to make improvements in diseases resistance in the other fine fescues species.

We have also identified summer patch, caused by *Magnaporthiopsis meyeri-festucae*, as a major disease of hard fescue; in fact, this disease may severely limit use of this species in certain parts of the US. Through single plant field evaluations (Figure 3), we identified sources of resistance to this pathogen and these materials are now being used in additional studies.

Summary Points

- Primary challenges to public land managers in using fine fescues include turfgrass maintenance, funding, public awareness, and natural vegetation management.
- Consumers were willing to pay the highest premium for better ability to withstand foot traffic, followed by low mowing frequency, low fertilizer requirement, and low water usage.
- Heat stress is more detrimental than drought stress to fine fescues and there is great variation for heat tolerance.
- Hard and sheep fescue have superior snow mold resistance compared to other fine fescues and should be utilized in northern climates where snow mold is a concern.
- Summer patch may severely limit the use of hard fescue in some areas.

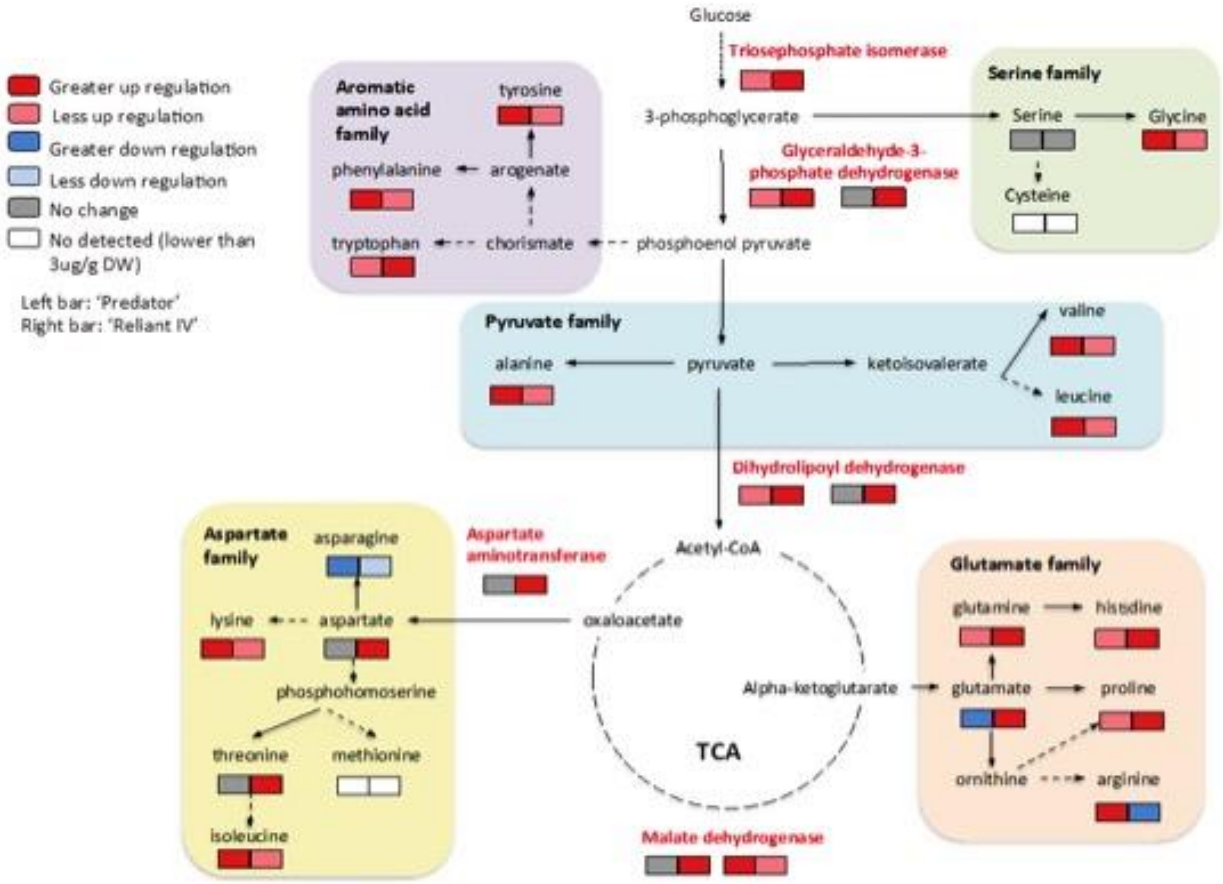

Figure 1: Heat-tolerant 'Reliant IV' and heat-sensitive 'Predator' hard fescue exhibit differential accumulation of metabolites in different metabolic pathways in response to heat stress.

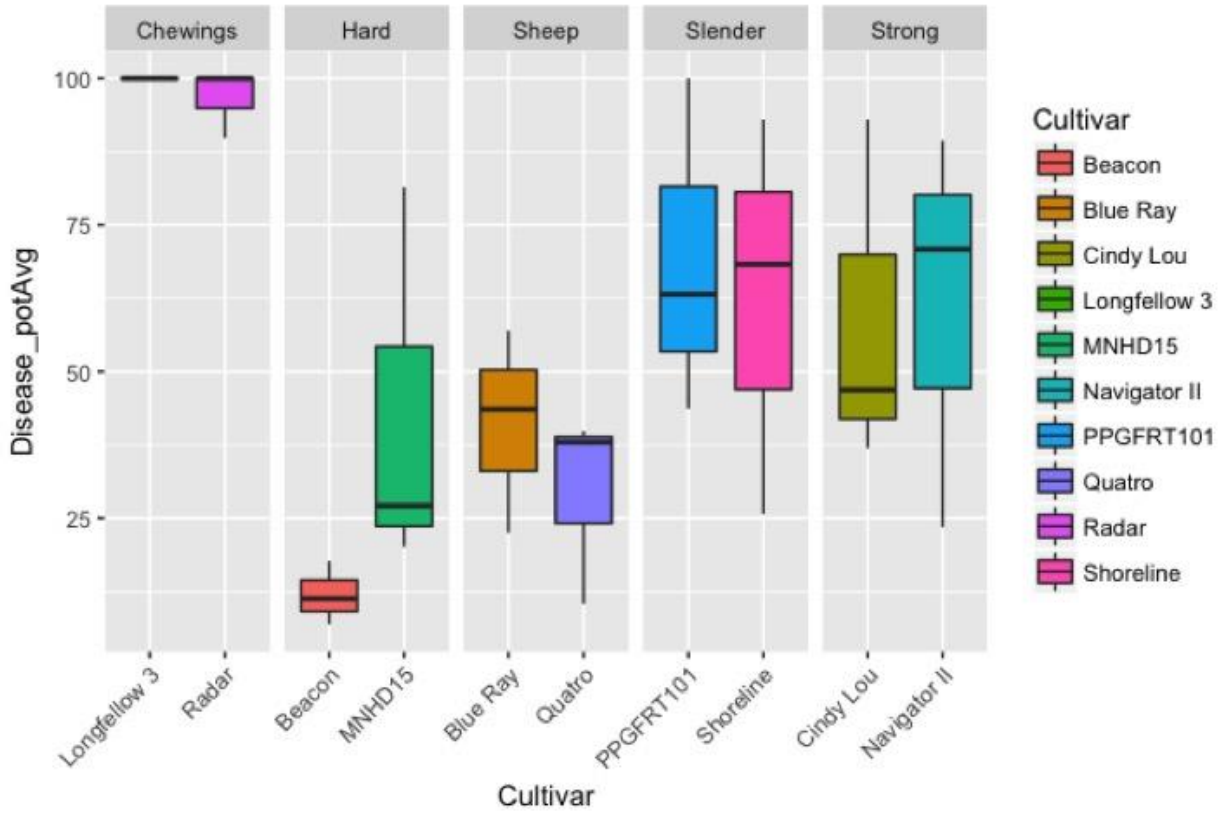

Figure 2: Microdochium patch severity as assessed on inoculated fine fescue cultivars in a controlled environment chamber.

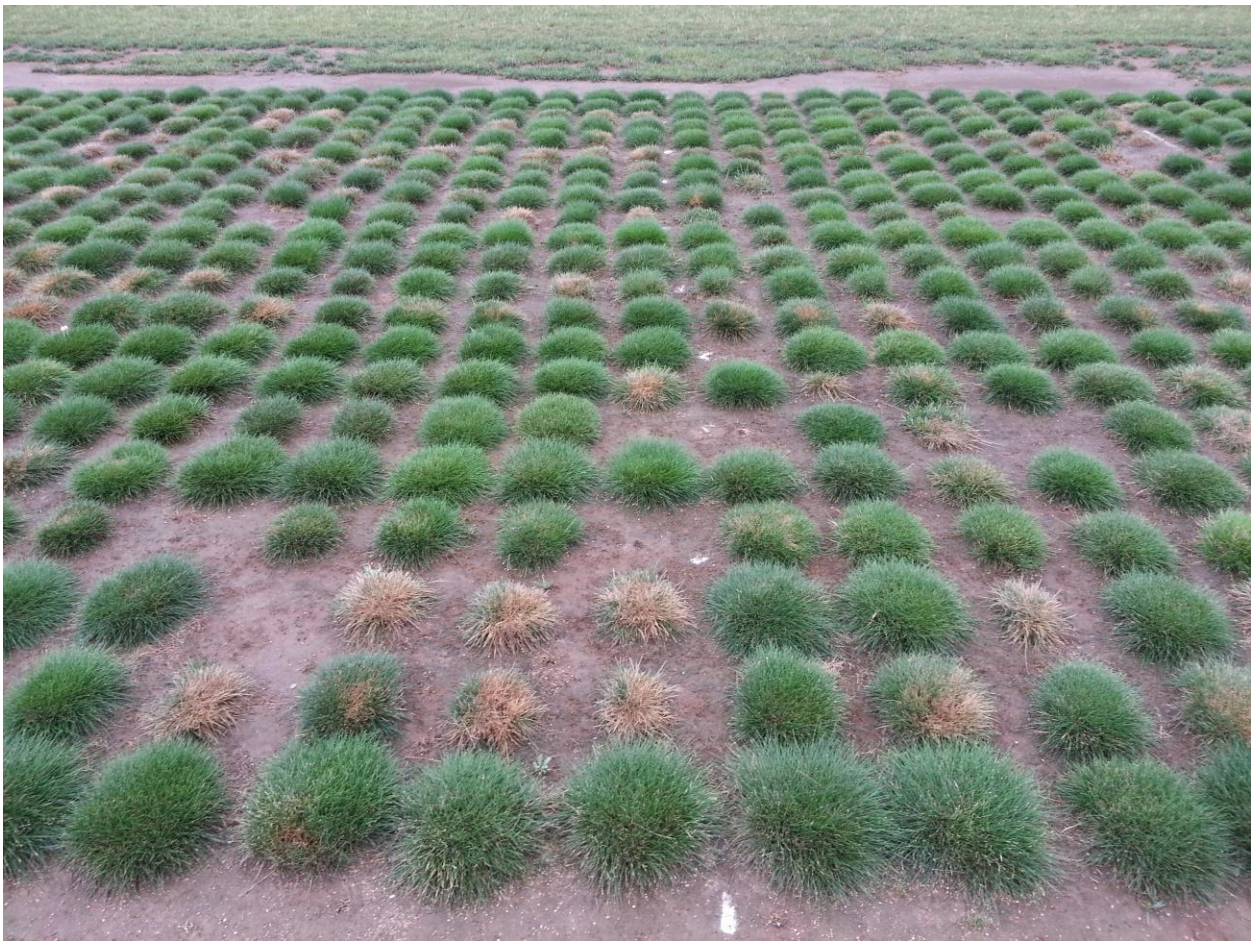

Figure 3: Hard fescue genotypes being screened for resistance to summer patch disease in New Jersey.