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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
Duration: four years
Total Funding: $40,000

This project provides matching funds for a five-year USDA-NIFA project funded by the Specialty Crops Research Initiative (grant number 2012-51181-19932). The project involves 10 scientists, along with graduate students and support staff, from three Universities (University of Minnesota, Rutgers University, and the University of Wisconsin). The project has four objectives: Objectives 1 and 2 involve social science research that will determine what consumers desire in new low-input fine fescue varieties; Objective 3 is focusing on identifying breeding material that is tolerant of stresses common to low-input turf environments; Objective 4 is addressing the challenges of educating end-users about the use of fine fescues in parks, lawns, and golf courses.

The fine fescue species have great potential to be functional grasses in sustainable landscapes including lawns, parks, and golf courses. In 2016, much of our research focused on three areas important to golf course superintendents: traffic tolerance, heat stress tolerance, and disease resistance, in particular resistance to snow mold diseases.

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. In a seasonal traffic study, turf uniformity and fullness of cover were reduced by abrasive wear during all seasons (spring, summer, autumn). Turf uniformity was strongly influenced by fine fescue entry but the effect depended on the season during which wear was applied. Greater differences in turf uniformity were observed among fine fescues when wear was applied during summer compared to spring and autumn. This information will be useful for breeders wanting to select traffic tolerant genotypes using traffic simulators. We also evaluated the effect of nitrogen on fiber content on three fine fescues (Fig. 1). Significant differences were observed on fiber contents among three fine fescue cultivars regardless of N level. ‘Beacon’ hard fescue had the highest levels of total cell wall, lignocellulose, and lignin while ‘Garnet’ Chewings fescue exhibited the lowest levels.

Heat Stress (led by Bingru Huang, Rutgers): We screened a large number of fine fescues and identified heat stress tolerant and heat stress susceptible cultivars within each fine fescue species (Fig. 2). We then continued our work on heat stress tolerance by studying proteins associated with leaf senescence during heat stress. Cultivars of fine fescue that had previously shown different heat tolerance were exposed to heat stress temperature at 38/33 ^{o}C (day/night temperatures) and optimal temperature at 22/18 ^{o}C in a controlled environment growth chamber. Membrane and soluble proteins showed altered abundance during heat stress and different responses between cultivars. Comparison of differential protein expression between cultivars differing in the level of heat-induced leaf senescence or heat tolerance will allow for a greater understanding of metabolic pathways regulating heat tolerance which can be used to develop more effective selection protocol for this important trait.

Snow Mold (led by Paul Koch, UW-Madison): We have continued to learn more about snow mold resistance in the fine fescues. Abnormally warm temperatures throughout much of the winter of 2015-2016 resulted in lower than average snow mold development at some sites, however, the Timber Ridge Golf Club site in Minocqua, WI did develop significant snow mold, with most fine fescue plots exhibiting between 5 and 15% disease. Hard fescues had the lowest amount of disease sheep and Chewings fescue had the highest (Fig. 3). Additionally, a growth chamber screening was conducted during the winter of 2015-2016 two cultivars from each the 5 fine fescue species for their resistance to *Microdochium nivale*. We found that cultivars of hard fescue and sheep fescue were the most resistant to pink snow mold, cultivars of Chewings fescue were the most susceptible, and cultivars of slender and strong had intermediate levels of resistance. Turfgrass managers in areas where snow mold 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.

Summary Points

- Turfgrass breeders should screen new germplasm for traffic tolerance in autumn
- Differences in heat stress tolerance have been identified and we are now working on ways to use that information as we develop new fin fescue cultivars
- 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.

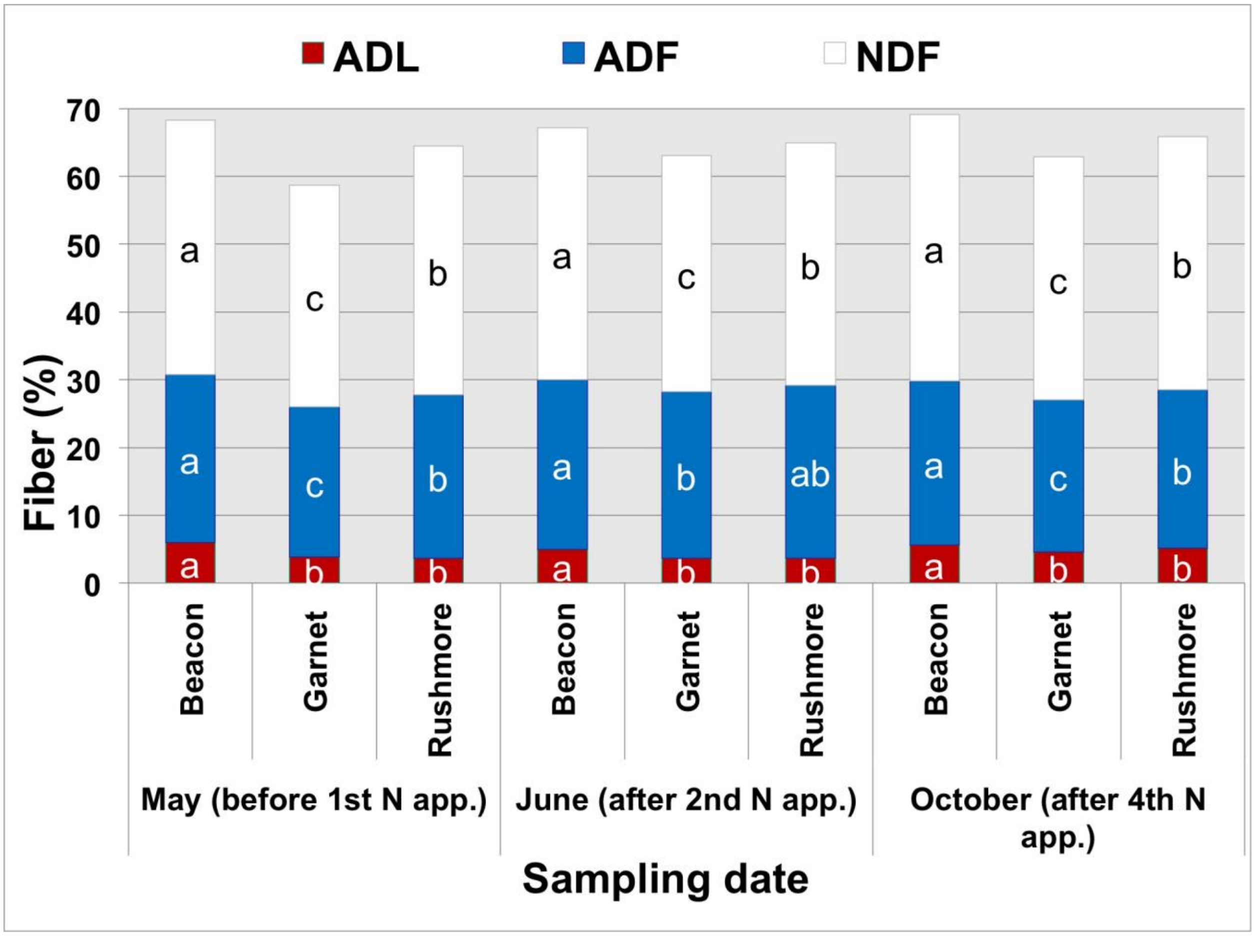

Figure 1. The total cell wall (NDF), lignocellulose (ADF) and lignin (ADL) content of fine fescue cultivars in May (before 1st nitrogen application), June (after 2nd nitrogen application) and October (after 4th nitrogen application) during 2015. Tested cultivars were 'Beacon' hard fescue, 'Garnett' strong creeping red fescue, and 'Rushmore' Chewings fescue.

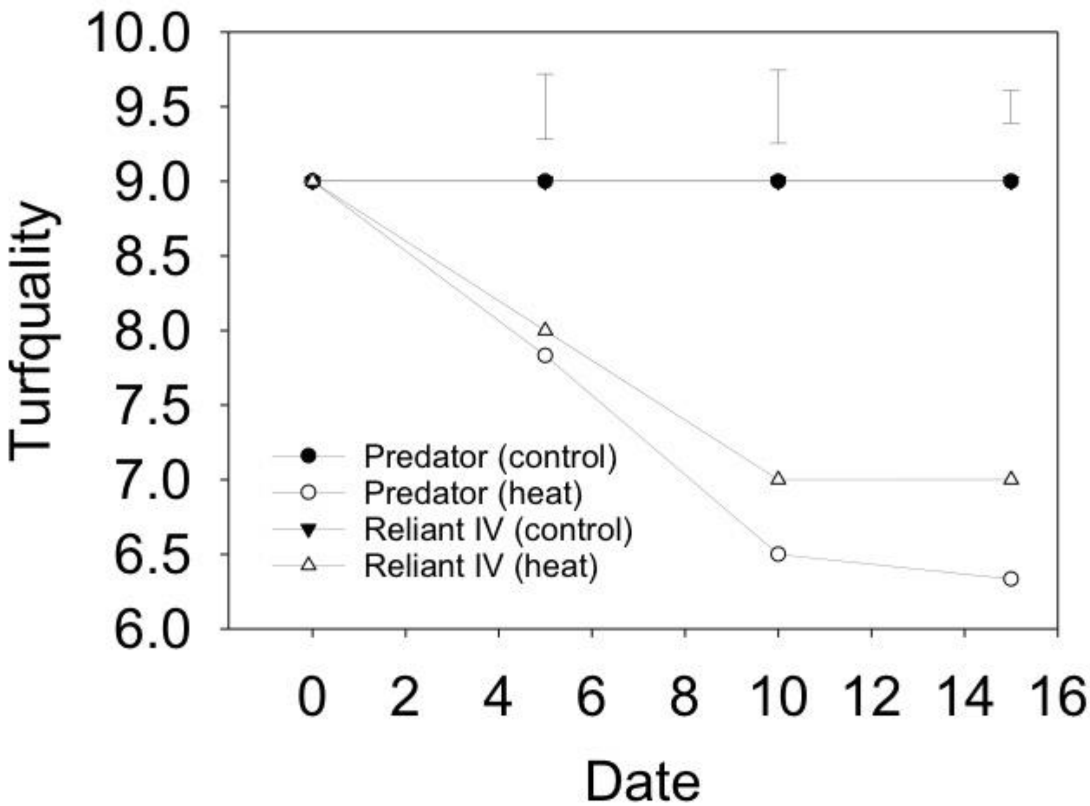

Figure 2. Turf quality for two hard fescue cultivars with or without heat stress. Both cultivars maintained the same turf quality during stress, while Reliant IV was more tolerant of heat stress than Predator.

Figure 3. Differences in T. ishikariensis severity on Bridgeport II (Chewings) and Beacon (Hard) fine fescue on March 30th, 2016 at Timber Ridge GC in Minocqua, WI.