Stop #9: UCR Turfgrass Breeding Project

Adam Lukaszewski, Priti Saxena, and Jim Baird

Introduction

A new turfgrass breeding program has been launched at University of California, Riverside. Due to increased concerns about drought and diminishing potable water supplies, it's important to develop drought tolerant turfgrass cultivars for semi-arid regions, and more specifically California climates. The objective of this program is to develop cultivars with improved drought, heat, and salt tolerance as well as winter color retention. Currently, the major efforts are being employed in selecting superior germplasm and early cycles of hybridizations in tall fescue, bermudagrass, perennial ryegrass and Fescue-*Lolium* (Festulolium). Irrigation has been installed on 10,000 ft^2 of new land designated for breeding and germplasm collections; and additional irrigated land will be made available as the program expands.

Tall fescue

In fall 2013, 36 tall fescue accessions selected from the USDA collection (25 individual plants of each accession) were planted into the field. There were several criteria for this selection: location of the original population (mostly Mediterranean but also as far as Afghanistan, Japan, and South Africa), harsh climate conditions and, if noted, salt stress. We are evaluating individual plants under normal (non-stress) condition this spring, select superior types, clone them and establish a new nursery where plants will be stressed, originally for drought, later also for salinity. Selected plants will be inter-mated with established turf accessions, and the process of selection will start. The goal is to select more drought/heat tolerant/resistant accessions locally and internationally and broaden the genetic pool of turf type tall fescue. Selected genotypes will be incorporated in the hybridization and selection cycles to develop elite tall fescue lines through recurrent selection, which could be further utilized in synthetic cultivar(s) development. Currently, more selections have been made from local uncultivated areas and from the USDA repository to enhance the genetic variation. The selected plants will be planted in field in November 2014 for inter-mating in the spring, 2015. The progenies will be evaluated for drought, heat, and salt stresses.

Bermudagrass

We have established a collection of 68 accessions representing all distinct species of bermudagrass. These were obtained from USDA and other sources. It is clear that there is clear variation for the onset of dormancy among the accessions. So far we identified six variants that maintained green color after frost in late November and early December, well past the onset of dormancy for a majority of the accessions and most commercial varieties. These will be the focus of future mating and selection efforts.

Individual crosses were set up in 2013 (the detached tiller approach) between individual accessions of *Cynodon transvaalensis, C. dactylon*, *C. barberi* and *C. plectostachus*. Viable seed was obtained and germinated from a cross involving *C. dactylon x C. incompletus* and reciprocal crosses involving different accessions of *C. dactylon, C. transvaalensis* and *C. barberi* (a total of six hybrids). In addition, we

harvested seed from open pollination among all collection accessions in the field. Since all these accessions represent single plants, and bermudas are known for self-incompatibility, all seed was assumed to be from cross-pollination. Viable (germinating) seed was obtained from 12 accessions, including *C. dactylon, C. transvaalensis, C. radiatus, C. incompletus* and *C. barberii*. The total number of seedlings obtained was ca. 420 but seedling mortality reduced it to ca. 350. Viable plants were transplanted to the field where they showed enormous variation for every observable characteristic. Based on visual evaluation under normal growing conditions, 35 hybrids were selected for further observation on 4ft x 4ft plots, established in mid-August. Based on the observed characteristics of the collection accessions, another 15 accessions were selected in spring 2014 for controlled interspecific crosses in the greenhouse. These included individual accessions of *C. transvaalensis*, *C. dactylon*, *C. radiatus* and C. *plectostachus* (a total of 30 cross combinations). The harvested seeds are sown in Petri plates and seedlings will be planted in the field. Once again, seed were harvested from open pollination of the collection accessions for another round of selection.

Festuca-Lolium Hybrids

Populations of perennial ryegrass (*Lolium perenne*) with introgressions of chromosome 3S from meadow fescue (*Festuca pratensis*) were intermated in the field in 2013 and collected seed were sown in fall 2013. These plants would be part of the large scale commercial perennial ryegrass dry-down experiment. Larger seed samples that were generated in 2012 from populations of *L. perenne* with *F. pratensis* introgression 3S were sown in dense seeding in the field in April 2013 for another round of screening for survival under the ultimate drought stress. Irrigation was turned off in August and surviving plants were selected in October 2013 and transplanted with the populations described above to the new breeding area for intermating in 2014. Perhaps because of a very mild winter, heading and flowering of the transplants were poor and uneven, and we did not manage to harvest the expected amount of seed.

A total of 138 *Festuca-Lolium* hybrids from a new round of hybridization were transplanted to the field in March 2014 and are under evaluation for drought and heat tolerance. Thirty-six *Lolium perenne* plants from accession ‘SR4550’ were selected in February 2014 from a field under saline irrigation based on their performance under water deficit and high salinity conditions. These plants are maintained in the green house and will soon be planted in the field for further screening of drought tolerance along with other collected germplasm.

Summary

Persistent efforts are continuing to enhance genetic variation and adaptability of turfgrasses in southern California. With the onset of initial cycles of breeding and expanding germplasm collections the future of the breeding program at UCR focuses on the development of germplasm with improved drought and heat tolerance characteristics while maintaining aesthetic value (e.g., year round green color).