Stop #11: UCR Turfgrass Breeding Project

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Introduction:

A new turfgrass breeding program has been launched at the 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. In 2014 another 26 accessions were added. There were several criteria for selection of collection accessions: 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) conditions hoping to 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 intermated with established turf accessions, and the process of selection will start. The goal is to widen the genetic base of turf tall fescues, primarily by making use of more drought/heat tolerant/resistant exotic accessions. Our biggest problem at the moment is poor vernalization and hence, poor and uneven flowering which makes making crosses almost impossible.

Bermudagrass:

In the past we have established a collection of 68 accessions representing all distinct species of bermudagrass. These were obtained from USDA and other sources. In the past year we added another 45 accessions, mostly from the USDA collection of Bermuda grass; two were provided by Mr. Tremmel and several were collected locally from abandoned sites. There is clear variation essentially every identifiable characteristic among the accessions, including the onset of winter dormancy. In 2013 we made a range of individual crosses between selected 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). We also harvested seed from open pollination among all collection accessions in the field. Since all these accessions represent single plants, and bermudagrasses 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* and we ended up with ca. 350 viable hybrids. To determine the male cross parent in hybrids from open pollination of the collection accessions we run two plates (188 entries) of DArT DNA markers. The mass of data is still being processed but we assume that the parentage of most hybrids will be established and in the process, the hybrids themselves will become fingerprinted. From among the hybrids we selected a total of 30 with interesting characteristics, planted them on larger plots in several locations to test their performance including: Arizona Country Club, Scottsdale; Coachella Valley Agricultural Research Station, Thermal; and Preserve Golf Club, Carmel. Some will be tested under extreme drought; all will be scored for the onset of winter dormancy. Crosses were repeated again in 2014 but as of August 2015 we do not see any germination, with a single exception of a hybrid of *C. transvaalensis*. We repeated controlled crosses in 2015 but at this point we do not know how successful they were.

Festuca-Lolium Hybrids:

We continue working with populations of perennial ryegrass (*Lolium perenne*) with introgressions of chromatin from meadow fescue (*Festuca pratensis*). Most work is done in the greenhouse on individually karyotyped plants. As with tall fescue, in the field we have serious problems with inadequate vernalization over the last two winters, hence we were unable to produce sufficient seed for dry-down experiments. For the time being we keep adding to the pollination block all plants with introgressions of *F. pratensis* chromosome 3, known to be involved in stress tolerance in Festulolium. We assume the first winter with a typical temperature will solve our vernalization problems and adequate amount of seed will be produced to start another round of selection under extreme drought. In the meantime, new sets of lines are generated under controlled conditions in the greenhouse.

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).