Development of Stress-tolerant, Turf-type Saltgrass Varieties

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Objectives:

1. Evaluate new collections and first cycle of population improvement, select parents from the nursery, and intercross for the second cycle of population improvement.
2. Screen salinity tolerance among saltgrass advanced selections and determine the level of salinity tolerance during germination (seeded type only) and as mature turf for potential new cultivars.
3. Quantify cold hardiness of potential varietal releases, advanced lines, and breeding accessions.

Start Date: 2003
Project Duration: three years
Total Funding: $113,970

In western North America, golf course superintendents are challenged growing turfgrass with limited water amounts, poor water quality, and poor soils. Desert saltgrass, a non-domesticated grass, is native to the arid, alkaline, and salty soils in this area and has potential on golf courses.

After two years of screening, this past fall we have selected 25 parents out of 3000 cycle 1 progeny, in order to mate and form the second-cycle progeny of a turfgrass type line, and also use these for continued breeding. The primary traits selected for are rust resistance, shoot density, clean leaf cut, and seed production, in that order.

A mating design to study inbreeding depression indicates progeny susceptibility to leaf rust when mating closely related plants, even though the parents show apparent rust resistance.

The majority of turf-type plants bear their seed spikes very close to the soil surface. Planting various phenotypes in large plots will allow study for successful commercial seed harvests.

Our salinity tolerance evaluations indicated that many of the elite saltgrass lines had $EC_{25\%}$ (the electrical conductivity of 25% clipping yield reduction) in the range of 20.3 - 29.2 dS m^{-1}. In 2005, experiments were conducted to evaluate the effect of five salinity levels on germination of different saltgrass accessions. All seeds were collected in 2004 and were hand-scarified to break seed coat restriction for germination. Different genotypes differed in their germination percentages and their responses to increasing salinity.

Winter hardiness of California versus Colorado accessions was compared from 2003-2005. Due to the late planting date in 2003, California accessions in the field suffered 85-92% winter injury during 2003-2004 winter season, whereas Colorado accessions exhibited less than 10% winter injury. Plots were planted again early in the 2004 growing season. Consequently, both California and Colorado accessions suffered little winter injury during 2004-2005 winter season, suggesting that early planting dates reduce the degree of winter injury for cold-tender saltgrasses.

During the winter of 2004-2005, laboratory tests showed that most Colorado accessions had LT_{50} (the freezing temperature that result in 50% mortality) ranging from -12ºC to -18ºC, whereas California accessions collected from San Joaquin Valley had LT_{50} ranging from -8º C to -10ºC. Winter dormancy among California accessions was delayed 3-4 weeks compared to Colorado accessions.

In addition, a study is ongoing to test a series of seed pre-treatments for breaking saltgrass seed dormancy and enhancing germination and establishment of inland saltgrass in the growth chamber and in the field. The seed pre-treatments included hot-water soaking, H_2O_2 treatment, H_2SO_4 treatment, KNO_3 treatment, machine scarification, stratification, mycorrhiza inoculation, and treatment combinations.

After several frosts, plants in the background are preparing for winter dormancy. The exotics in front are still green and will show winterkill in spring.

Summary Points

- Second-cycle parents were selected for rust resistance, shoot density, clean leaf cut, seed production, and other turf traits, and will intercross in winter greenhouses.
- Large crossing blocks are being planted to study commercial seed harvesting.
- Salinity level of 25% clipping yield reduction ranged from 20.3 -29.2 dS m^{-1} for 12 elite saltgrass lines.
- Colorado saltgrass accessions were 4º to 10ºC cold hardier than those from California.
- Planting early in the season can reduce winter injury of cold-susceptible saltgrass accessions.