

Breeding Turf-type Annual Ryegrass for Salinity Tolerance

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Objectives:

1. To identify improved salt-tolerant genotypes and introgress the tolerance into adapted turf-type genotypes of annual ryegrass and increase seed of these populations for experimental testing.
2. To select plants of turf-type annual ryegrass which are infected with a fungal endophyte and determine if presence of the endophyte provides this population with increased tolerance to high salt concentrations.
3. To test the experimental lines of annual ryegrass under high salinity growing conditions in hydroponic and field conditions and release the line as a salt-tolerant variety.

Start Date: 2008

Project Duration: three years

Total Funding: \$88,276

Annual and perennial ryegrass are considered to be susceptible to high salinity. Genetic selection for tolerance to high salinity will be carried out by two methods. First, a salt tank greenhouse screening method will be conducted to select salt tolerant plants at Overton. Secondly, a screening procedure will be utilized under high-salt field conditions at Pecos, Texas.

Selection of genotypes with improved salt tolerance were planted in the field in a high-salinity soil and irrigating with high-salinity water at Pecos, Texas. Seed (300 g) was broadcast over a 30 x 30 ft area. Sprinkler irrigation was used to germinate and establish a stand. During the 2008-09 season almost no rainfall occurred at Pecos. Irrigation was the only source of moisture for the growing season. Selection of seed heads of best plants took place in May of 2009.

In the greenhouse, seed were planted into an organic mix in flats. When plants were in the 2-3 leaf stage, entire flats were immersed in water with a salt concentration of 3,100 ppm (4.9 dS m⁻¹). Thereafter, flats were immersed every 3 to 4 days. Salt concentration was increased gradually over 60 days until a water salt concentration of 15,900 ppm (25.4 dS m⁻¹) was accomplished. At that time, 80% of plants were dead. Remaining plants (300 plants) cross-pollinated and produce seed in the spring of 2009. This seed, as well as the seed from Pecos, is being tested for salt tolerance in 2010.

In addition, 27 genotypes were tested in a field trial at Pecos, Texas and in two experiments in a greenhouse at Overton. At Pecos, ratings were made at



When plants were in the 2-3 leaf stage, entire flats were immersed in water containing increasing concentration of salt.

three dates. On the first date, February 4, all genotypes were quite small, and we were comparing genotypes with similar plant stature. Most of the perennial ryegrass entries were also rated high for susceptibility to salt damage. By comparing salt damage ratings at all three dates, it is apparent some entries demonstrated tolerance to salt damage. PSB (Pecos BLK) and Pecos BLK 07-08 were selected from space plants for two or more generations at Pecos. They appear to be somewhat salt tolerant; however, it may be that they are becoming adapted to that soil type and environment and not just high salinity.

In the greenhouse trials, the salt concentration was at 5,000 ppm at first immersion. Salt concentrations were gradually increased until near the end of the screening period, when salt concentrations were 9,800 ppm. The actual rating for each entry should increase from one date to the next date. This is useful to judge how severe the "salt damage" was. Late in the rating period of both trials, many ratings

were at or near 8, meaning many plants were dead.

A sixth replication of all entries was grown in flats with identical conditions, except it was immersed in well water and not in saline water. Ratings were also made on entries from this treatment. We had a significant amount of senescence in the untreated (salt) plants. This could have been due to poor light quality, poor water quality, or some other factor. The entry TF -152 appears to be tolerant to high salt.

Summary Points

- Differences for salt tolerance between annual and perennial genotypes were obtained in both greenhouse and field experiments.
- Early generation salt-tolerant germplasm seed was increased at Overton in 2009.
- This salt-tolerant germplasm will be tested in 2010 to determine if it truly is improved for salt tolerance.