Development of Stress-tolerant, Turf-type Saltgrass Varieties

Dana Christensen and Yaling Qian
Colorado State University

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

Desert saltgrass is native to the mountain desert regions of the Rocky Mountains in North America. This area ranges from the central valley of California, through the high plains, up into Canada, and south into Mexico. Saltgrass may become a resource-efficient alternative turfgrass for golf courses as golf course managers are challenged with limited water availability, poor water quality, and poor soils in these areas. Saltgrass is a non-domesticated species, however, and little work has been done with it including genetic improvement. The aim of this project is to develop turf lines while improving the species adaptation to drought, salt, and cold tolerance.

A new nursery was established in August of 2003. This nursery consists of old collections that serve as checks, new collections, and about 800 progeny from crosses of turf-type parents. Digital imaging has been used to determine how fast each plant can spread during the season. A digital photograph is taken from a height of eight feet. The green pixels are counted by software, and an estimate of spread is calculated from previous growth. Added with a height measurement, growth can give an indication of plant vigor for breeding purposes.

Additional traits, such as gaps during grow-in and low shoot density, can be calculated from the same image. This removes subjective analysis from difficult to measure traits, in which a person assigns a number for the value of a trait, such as 1=best through 5=poor. Progeny which score high in turf traits will be intercrossed to produce new lines.

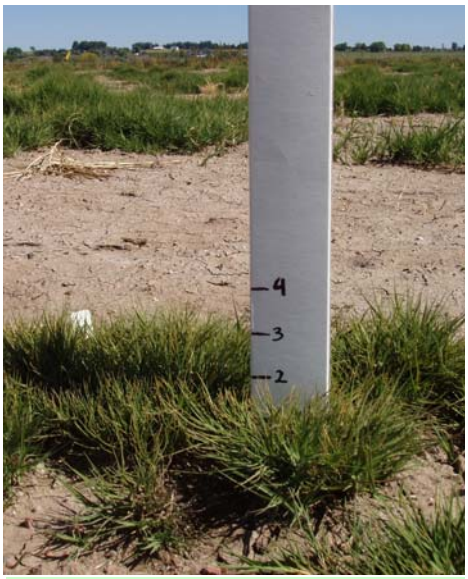
In 2004, we completed two greenhouse studies to screen for salinity tolerance and determine the level of salinity tolerance of elite saltgrass lines. In agreement with the previous experiment, accessions 'A50', 'A49', 'A107', and '72' exhibited the highest turf quality and the least leaf firing at 36-48 dS m^{-1} salinity when compared to other accessions.

Levels of salinity tolerance (indicated by 25% clipping yield reduction) of 12 elite saltgrass lines ranged from 20.3 to 26.2 dS m^{-1}. However, saltgrass germination is dramatically reduced when salinity exceeded 8 to 12 dS m^{-1}. We also found that saltgrass requires approximately a 20° C degree difference between day and night temperatures to produce maximal germination.

Software will determine the amount of ground spread of progeny.

Winter survival of California accessions and Colorado accessions were evaluated in 2004. California accessions suffered 70-95% winter injury in the field, whereas Colorado accessions exhibited less than 2 % winter injury.

Vertical rooting pattern of saltgrass was determined in the field. Saltgrass (mowed to 6.4 cm) exhibited 450% or 2.2 meter deeper root system than the adjacent Kentucky bluegrass, reaching 2.7 meters below soil surface in the field. The extremely deep root system allowed saltgrass to partially utilize water in the deep soil profile and even the saturated water table. These results suggest that saltgrass may be used as a turfgrass that can be irrigated infrequently or without supplemental irrigation if a shallow water table is present.



Transgressive segregation. The parents of this plant were each 4 inches in height. This plant is only two inches.

Summary Points

- Progeny of elite parents are being evaluated for segregation of turf traits, including ground spread through the use of digital imaging.
- Large crossing blocks are being planted to study commercial seed harvesting.
- Saltgrass has an extremely deep root system, reaching 2.7 meters below soil surface in the field when aboveground is mowed to 6.4 cm.
- Saltgrass accessions collected from South California cannot survive Colorado winter.
- Saltgrass requires approximately 20° C day and night temperature difference to produce maximal germination.