Multiple Stress Tolerance, Seed Dormancy Breaking, and Establishment of Seeded Saltgrass

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Objectives:

1. Quantify cold hardiness of potential varietal releases and advanced seeded lines.
2. Continue to determine the level of salinity tolerance during germination (seeded type only) and as mature turf for potential new cultivars.
3. Evaluate different seed treatments to break seed dormancy.
4. Evaluate saltgrass seeding establishment in the field with high and moderate levels of soil salinity.
5. Determine saltgrass rooting characteristics and soil moisture extraction patterns under two irrigation regimes.

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Project Duration: three years
Total Funding: $72,036

The May seeding date is best for saltgrass establishment in Colorado, with seeding rates as low as 74 kg ha^{-1} achieving optimal establishment of saltgrass in one season.

Saltgrass seeds have a low germination rate due to their seed dormancy. We evaluated different seed treatments and found that stratification and machine scarification improve germination and establishment of seeded saltgrass. However, information is lacking concerning the effects of seeding date and seeding rate on establishment of saltgrass.

Growing degree days (GDD) or heat accumulation units are useful in predicting suitable seeding time for warm-season grasses. We have completed a study to 1) determine the effect of seeding rate, seeding date, and two different seed treatments on saltgrass germination and establishment, and 2) determine the required accumulative GDD for saltgrass to establish adequate coverage (80%) after seeding. Seeding dates tested were May 15, June 15, and July 15 at two locations (Horticulture Research Center and a golf course in Denver).

This field study showed that machine scarification and stratification broke saltgrass seed dormancy equally well. Saltgrass seeded in May established adequate coverage (80%) in September even using the lowest seeding rate (74 kg ha^{-1}). For plots seeded in June, only the higher seeding rates (123 and 170 kg ha^{-1}) established adequate coverage by the end of growing season. For plots seeded in July, however, even the highest seeding rate failed to establish adequate coverage in September.

The accumulated GDD to achieve adequate coverage was 1,748, 1,663, and 1,435 for 74, 123, and 172 kg ha^{-1} seeding rates, respectively. When seeded on July 15, total accumulated GDD toward the first frost was 889 and 1,220 at our two experimental sites. Therefore, it was unlikely to achieve adequate coverage when saltgrass was seeded in July in Northern Colorado. However, a higher seeding rate may be used to compensate for the June seeding date to achieve adequate coverage by the end of the growing season.

The accumulated GDD assessment provided in our study suggests that saltgrass has higher establishment GDD requirements than bermudagras and buffalograss, but lower or similar GDD requirements as zoysiagrass. Our results will aid in selecting appropriate seeding dates for different climates for successful establishment of saltgrass.

Saltgrass has been classified as a halophyte, however, saltgrass is less salinity tolerant during germination than established turf stands. Our lab and growth chamber tests showed that Proxy solution (at 5-10 mM a.i.) and thiourea (30 mM) increased saltgrass germination under a range of salinity treatments (0-30 dS/m). Experiments have been conducted in 2008 to scale up growth chamber studies to field conditions in order to confirm the effectiveness of seed pretreatments with Proxy and thiourea in enhancing saltgrass seed germination under saline conditions. Water (control), Proxy (5-10 mM a.i.), and thiourea (30 mM) were used as pretreatment agents to soak scarified saltgrass seeds for 24 to 48 hours.

After pre-treatment, saltgrass was seeded under four different salinity conditions in the field. Data were collected weekly on soil salinity, the number of seeds germinated, and plot coverage. Saltgrass germination percentage was 51% under non-saline condition, which was reduced to 14% when soil salinity increased to 18 dS m^{-1}. Soaking saltgrass seeds in Proxy solution (5-10 mM a.i.) increased saltgrass germination percentage under all salinity levels. However, thiourea pre-treatment did not increase saltgrass germination in the field conditions.

Summary Points

- The May seeding date is best for saltgrass establishment in Colorado, with seeding rates as low as 74 kg ha^{-1} achieving optimal establishment of saltgrass in one season.
- Saltgrass has higher establishment GDD requirements than bermudagras and buffalograss but lower or similar GDD requirements as zoysiagrass.
- Soaking scarified saltgrass seeds with 5-10 mM Proxy solution increased the subsequent germination of saltgrass at 5 - 20 dS m^{-1}soil salinity.
- Thiourea pre-treatment did not increase saltgrass germination in the field conditions.