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Techniques for Enhancing Saltgrass Seed Germination and Establishment

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ABSTRACT

Because of its exceptional salinity tolerance, inland saltgrass [*Distichlis spicata* var. *stricta (L.)* Greene] has great potential for use as a turfgrass and revegetation species of saline sites. However, saltgrass seeds have a low germination rate due to seed dormancy. Three experiments were conducted to evaluate different seed treatments to enhance germination and establishment of inland saltgrass. In Experiment I, seven different seed treatments were tested for their ability to enhance germination percentage in the growth chamber and compared with a control of no treatment. These treatments included treatments with hot water, hydrogen peroxide (H_2O_2), sulfuric acid ($H2_sO4$), potassium nitrate (KNO_3), bleach, machine scarification, stratification, and hand nicking. Results indicated that germination percentage was increased only by stratification, hand nicking, and machine scarification treatments as compareil with the control. In Experiment II, machine scarification, stratification, hand nicking, and the control were tested in the growth chamber. Eland nicking, scarification, and stratification increased percentage germination from 13.0% to 54.0 to 61.7%. Stratification resulted in the fastest germination, followed by hand nicking and scarification. Experiment III was conducted in the field, and seed treatments included machine scarification, stratification, and the control. Two months after seeding, pints seeded with stratified and scarified saltgrass seeds established adequate plot coverage as a turf, whereas the coverage fur the control was inadequate, exhibiting inferior turf quality. In summary, stratification and machine scarification improve germination and establishment of seeded saltgrass.

INLAND SALTGRASS, native to Western America, is a dioecious, rhizomatous, perennial, salt tolerant, warm-season grass. Inland saltgrass is commonly found in saline environments, including saline/alkali salt flats, and along the sides of highways that are frequently subjected to winter deicing with salts (Nielson, 1956; Gould, 1968; Hansen et al., 1976). Mature inland saltgrass stands have been reported to tolerate full strength seawater soil salinity (approximately 36 000 to 43 000 mg L^{-1}, i.e., 56 to 67 dS m^{-1}) under dry salt playa conditions (Kemp and Cunningham, 1981; Dahlgren et al., 1997). Alshammary et al. (2004) found that saltgrass shoot growth was not reduced as salinity increased from control to 23 dS m^{-1} and root growth was stimulated at salinity levels ranging from 5 to 20 dS m^{-1}. In laboratory experiments, Hansen et al. (1976) found that maximum growth of saltgrass was obtained at 15 000 ppm (about 23 dS m^{-1}) of soluble salts in nutrient solution cultures.

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Due to its salinity tolerance, saltgrass is a species with potential for use as a turfgrass or revegetation of saline sites, it is reported that in nature inland saltgrass produces few seeds and reproduction is mostly from rhizomes (U.S. Forest Service, 2004). Establishment and revegetation using saltgrass rhizomes is labor intensive with specialized requirements. Establishment by direct seeding could be more efficient than planting rhizomes. Researchers at Colorado State University have found that under cultivation, several saltgrass accessions produce adequate seed yield. However, the seeds typically have a low germination rate due to seed dormancy. Nielson (1956) reported that simple after-ripening, low temperature treatment at 0 and —5°C, treatments with sulfuric acid, sodium hydroxide, potassium nitrate, sodium chloride, and red light treatment did not greatly increase saltgrass germination. The author further suggested that saltgrass seeds in the wild would germinate only after the seed coat decayed or was broken by freezing and thawing conditions. Harrington (2000), using 4- to 5-yr-old seeds, found that hand nicking that broke the seed coat without injuring the emhryo could induce germination to over 90% when temperature was maintained between 25 and 35°C. Amen et al. (1970) indicated that a month of after-ripening at low temperature (4°C) and a month of cold stratification improved germination of coastal saltgrass *[Distichlis spicata* var. *spicata (L.)* Greene]. Generally, coastal saltgrass is referred to as a different subspecies from inland saltgrass (Gould, 1968).

To define successful techniques for breaking dormancy of inland saltgrass for commercial seed production, the objective of this study was to evaluate different seed treatments to break dormancy and to enhance germination and establishment of inland saltgrass.

MATERIALS AND METHODS

Seed Sample Collection and Pregermination Treatments

Saltgrass seedheads were collected in October 2004 from an Arkansas River riparian area (for Experiment I). For Experiments II and III seedheads were collected in August 2001 and