Germination of Three Ryegrass Species and Meadow Fescue Under Saline Conditions

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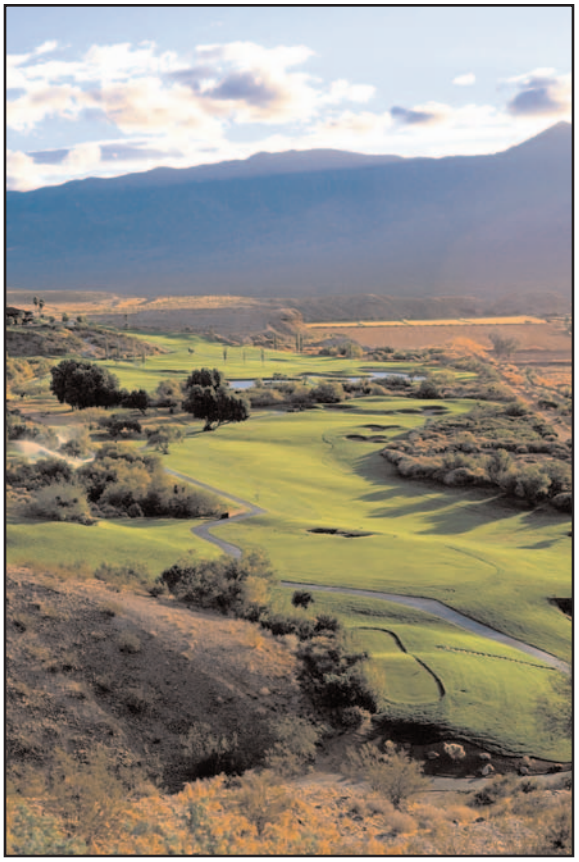

Photo courtesy of Mike Richardson

Overseeded fairways at Palms Hills Golf Club, Mesquite, Nev.
http://www.mesquitecoupleschampionship.com/palmshilltopbest.jpg

Summary. Bermudagrass is often overseeded during the dormant winter months to enhance playability of the turf and extend the growing season. Although diploid perennial ryegrass (2n=2x=14) is the major turfgrass species used for overseeding, recent research indicates the potential use of alternative overseeding species, including tetraploid perennial ryegrass (2n=4x=28), intermediate ryegrass, and meadow fescue. An issue that is becoming increasingly prevalent in overseeding regions is the use of non-potable water sources that may have a high salt content. The objective of this study was to determine the germination potential of four overseeding species in the presence of increasing salt concentrations. The study was conducted in a hydroponic system in the greenhouse. There were no major differences in germination among diploid, tetraploid, or intermediate ryegrass at any of the salinity levels, but germination of all ryegrasses was inhibited at salt concentrations greater than 12500 ppm NaCl. Meadow fescue was more sensitive to salt than the ryegrasses and was severely inhibited at the highest salt concentration (15000 ppm NaCl).

Abbreviations: DAS, days after seeding

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Bermudagrass (*Cynodon* spp.) is often overseeded with a cool-season turfgrass to provide full-year playing conditions. One of the most important decisions in an overseeding program is the selection of an appropriate cool-season species for a specific application. Recent improvements in the turfgrass characteristics of both meadow fescue (*Festuca pratensis*) and tetraploid ryegrass (*Lolium perenne*, 2n=4x=28) suggest that these species have great potential for overseeding dormant bermudagrass (Richardson et al., 2007).

Increased demand for potable water in southern locations where overseeding is practiced has increased the use of lower quality irrigation sources at many golf courses and sports turf facilities. As such, alternative grasses or cultivars with improved tolerance of poor-quality water are of great benefit to turfgrass managers. The objective of this study was to determine the effects of saline water on the germination of four overseeding species, including diploid perennial ryegrass (*L. perenne*, 2n=2x=14), intermediate ryegrass (*L. perenne* x *L. multiflorum*), tetraploid perennial ryegrass, and meadow fescue.

Materials and Methods

A greenhouse study was conducted during the winter of 2006 in which the four overseeding species were germinated in hydroponic solutions adjusted to four irrigation-water salinity levels. The salinity levels included 7500, 10000, 12500, and 15000 ppm NaCl solutions, which correspond to electrical conductivity values of ~12, 16, 20, and 24 dS / m. These levels were chosen based on results from a preliminary study where there was no inhibition of germination of any of these species up to 5000 ppm NaCl. The hydroponic system consisted of tubs (11 by 14 by 5.5 inch) in which a foam insulation board (thickness = 0.56 inch) was cut to fit inside the perimeter of the tub and floated on the hydroponic solution. Twelve holes (1.5 inch diam.) were cut into each board and a nylon screen (18 x 16 mesh) was affixed with silicon glue to the bottom side of the insulation board, which placed the screen in contact with the solution. The base solution for each salinity treatment consisted of a complete nutrient solution that delivered 50 ppm N using a fertilizer formulation (5-11-26, HYDRO-SOL, Peters Professional) specifically designed for hydroponic culture. Air was continuously supplied to each solution via an air stone (Aqua Mist, Penn Plax, Inc., Hauppauge, N.Y.) connected to an aquarium pump (Silent Air, Penn Plax, Inc.). Each solution concentration was replicated four times.

Twenty-five seeds of each species were placed in each of 3 subsample cells on top of the screen that was in contact with each solution. Germination was monitored frequently (every 1-2 days over the next 14 days) and a seed was considered to have germinated when both the radicle and coleoptile had emerged. Once a seed had germinated, it was counted and removed from the solution.

Results and Discussion

Germination was first observed with intermediate ryegrass in the lowest salt solution at 4 days after seeding (DAS) (Fig. 1). All of the ryegrasses began germinating in the 7000 and 10000 ppm solutions at 5 DAS. In the 12500 and 15000 ppm solutions, ryegrass germination was first observed at 7 DAS. In all solutions except the 15000 ppm, germination of meadow fescue was first observed at 8 DAS, which is consistent with earlier reports comparing these species (Richardson et al., 2007). Minimal germination of meadow fescue was observed at the highest salt concentration (Fig. 1).

All of the ryegrasses obtained similar germination levels in each solution by 14 DAS and exceeded 80% germination in the lowest two salt concentrations (Fig. 1). There was a reduction in final germination of the ryegrasses observed at the 12500 and 15000 ppm, with maximum germination of approximately 60% and 45%, respectively (Fig. 1). Meadow fescue followed a similar trend, except the final germination of this species was reduced to approximately 75% in the 10000 ppm solution, 20% in the 12500 ppm solution, and less than 5% in the highest salt concentration.

The overall conclusion from this study is that tetraploid ryegrass has similar salt tolerance, relative to seed germination, as other commonly used ryegrass species. As these grasses are being applied to many overseeding situations, further research on its salt tolerance as a mature plant would be worthwhile. Germination of meadow fescue appears to be more sensitive to increasing salt levels compared to the ryegrasses and would not be currently recommended in areas where low-quality water is being used. However, it should be noted that the salt concentrations used in this study were quite high. The 10000 ppm solution would approximate a 1:1 mixture of freshwater and seawater and there was minimal germination inhibition observed in any species at that salinity level.

Literature Cited

Richardson, M.D., K.W. Hignight, R.H. Walker, C.A. Rodgers, D. Rush, J.H. McCalla, and D.E. Karcher. 2007. Meadow fescue and tetraploid perennial ryegrass - two new species for overseeding dormant bermudagrass turf. Crop Sci. 47:83-90.

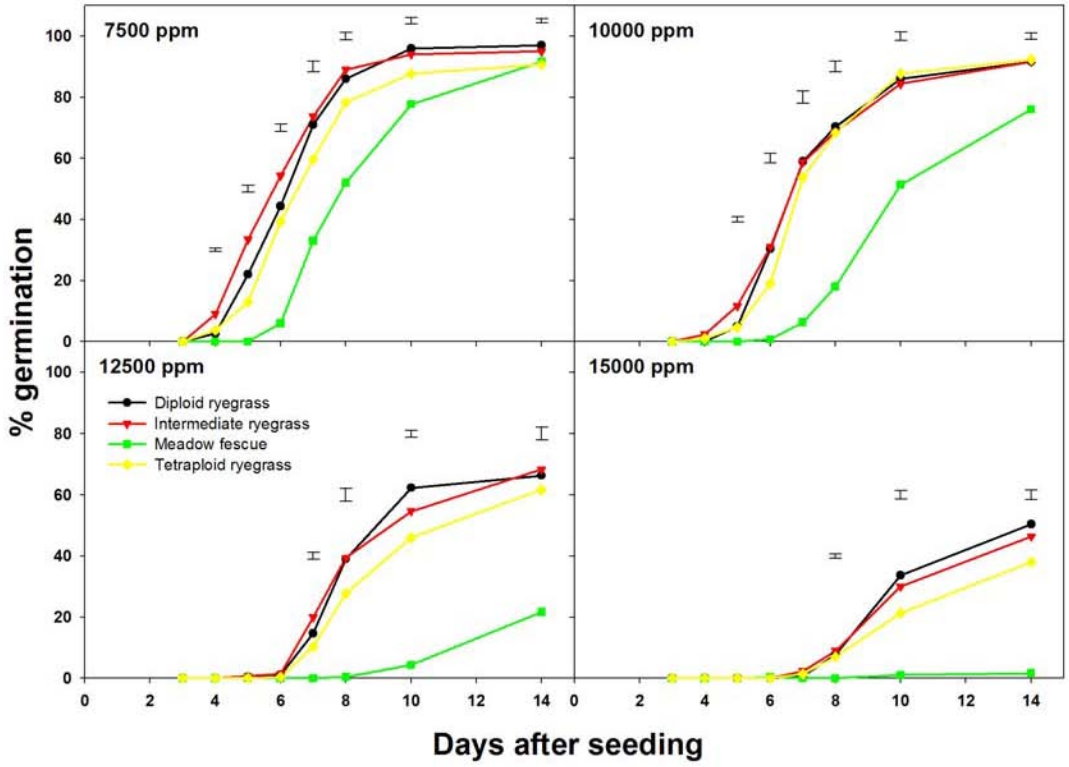

Fig. 1. Germination of four, cool-season turfgrass species in solutions with various NaCl concentrations. Error bars represent the least significant difference (P=0.05) for comparing species within a salinity level.