Fine Fescue Salinity Germination Study

How is the germination of fine fescue cultivars affected by differing levels of saline water used for irrigation.

MATERIALS AND METHODS

Forty-two fine fescue cultivars and experimentals were surveyed for germination under saline conditions. The forty-two entries in this study consisted of thirteen Chewings fescues (Festuca rubra subsp. commutata), eleven hard fescues (Festuca longifolia Thuill), five sheep's fescues (Festuca ovina), three slender creeping red fescues (Festuca rubra L. ssp. litoralis), and ten strong creeping red fescues (Festuca rubra ssp. rubra). This study was conducted to evaluate differences in ability to germinate in high salt environments. Total germination and germination rate were measured under a saline water treatment (14,000 ppm) and a distilled water treatment (0 ppm).

Fifty seeds from each entry were germinated in each treatment. Round germination paper discs were placed in petri dishes and either distilled or saline water (14,000 ppm, ≈40% sea water) was added. Water salinization was achieved by adding Instant Ocean Aquarium Sea Salt Mixture (United Pet Group, Blacksburg, VA 24060) to distilled water until desired concentration was reached. Following saturation of the germination paper, excess water was decanted off. Fifty seeds selected for having adequate seed fill from each variety were placed onto the saturated germination paper. Each dish contained one variety and one treatment for a total of forty-one dishes for each treatment. Following seed placement the lid was placed on the dish and sealed with parafilm. Dishes containing seeds were placed under 24-hour light regiment supplemented with fluorescent lights at night. Germination scoring was conducted daily by counting the number of seeds which had germinated. Germination was considered to have occurred when the coleoptile had extended at least 1mm. Once a variety had no new seeds germinate for three consecutive days that variety was scored as fully germinated and was not counted further.

RESULTS AND DISCUSSION

Saline water slows germination rate when compared to distilled water. Combined analysis of all entries in this study showed that 6 days after seeding over 60% of seeds in the distilled water treatment had germinated. It took 20 days for germination to reach this 60% level in the saline treatment. In addition to slowing germination rate, saline water also affected total germination. As a whole, pooled total germination for all entries in the study was significantly higher in the distilled treatment, at 85%, than in the saline treatment which only reached 67%.

Differences between species in ability to germinate under saline conditions were also observed in this study. Hard fescues as a whole displayed only a 10.4% drop in total germination in the saline treatment compared to the distilled water treatment. Conversely Chewings and sheep's fescues exhibited 24.9% and 19.2% lower total germination rates, respectively, in the saline treatment compared to the distilled treatment. Slender and strong creeping red fescues had intermediate drops in total germination of 12.0% and 15.2%, respectively (Figure 1 and Figure 2).

Within species, varieties and experimentals exhibited differing levels in their ability to, and the rate at which they germinate under saline conditions. These differences can be seen in tables 3-12. These findings further support the presence of improved genetic salinity tolerance in some varieties. Varieties exhibiting very minor differences in germination rate between the two treatments, such as Beacon, Chariot, Blue Ray, and Navigator II should be considered salt tolerant when it comes to germination. Previous research has suggested a correlation between the performance of mature turf under saline conditions and germination performance under saline conditions. Superior entries from this study have been selected and will be used in future breeding projects.

Varietal differences in germination rate and total germination were also present in distilled water treatment. Differences here were likely a result of the age and how the seed lot had been stored. In order to account for these differences, care should be taken to compare germination in the distilled water treatment to germination in the salt treatment.

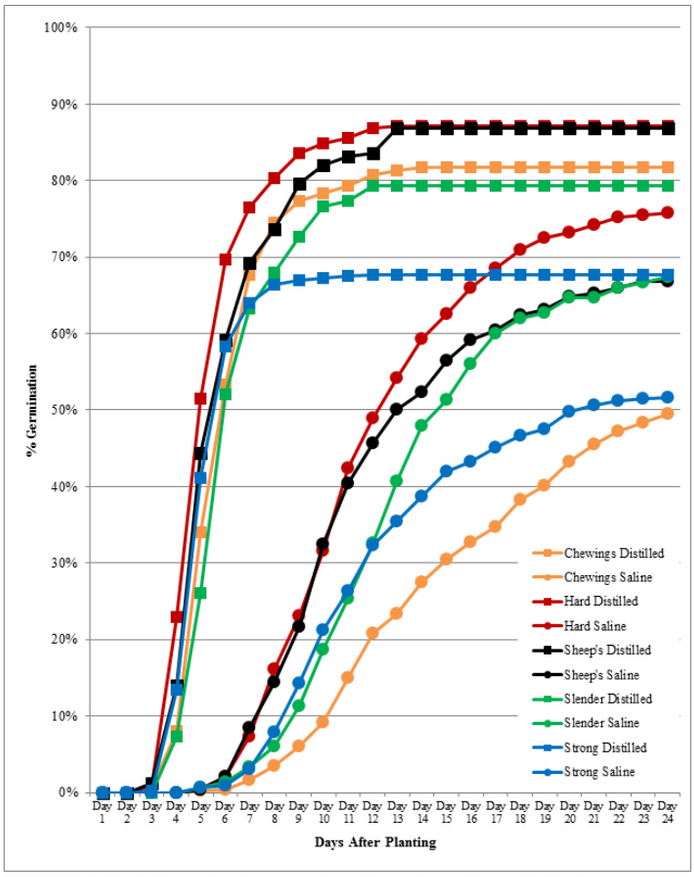


FIGURE 1: Pooled germination over time for each species under both treatments

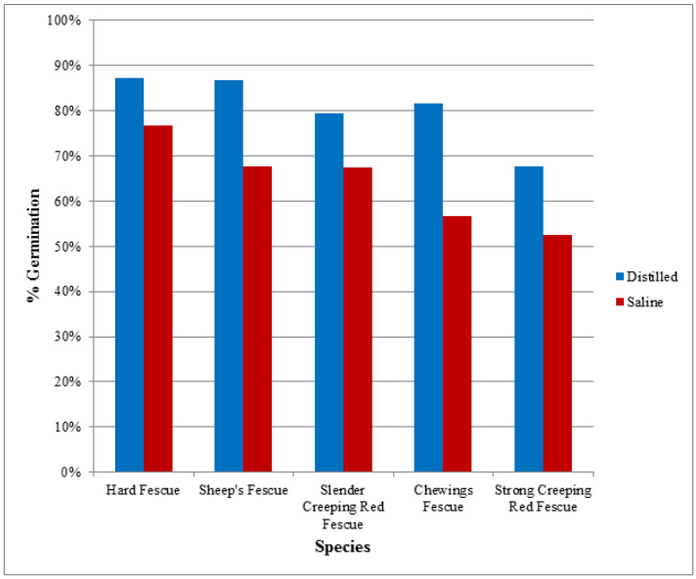


FIGURE 2: Total germination of fine fescue species under two treatments.

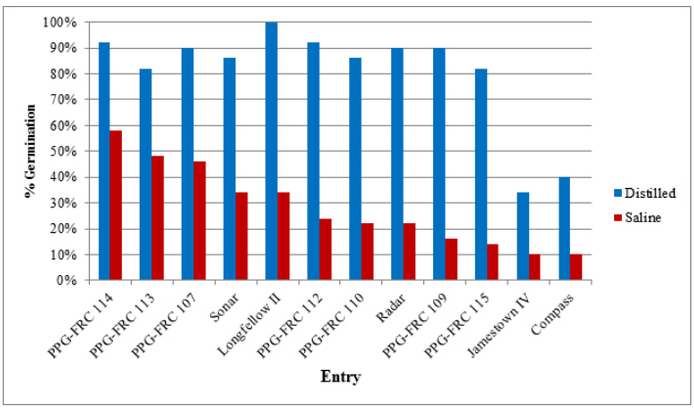


FIGURE 3: Germination of Chewings fescues fifteen days after planting.

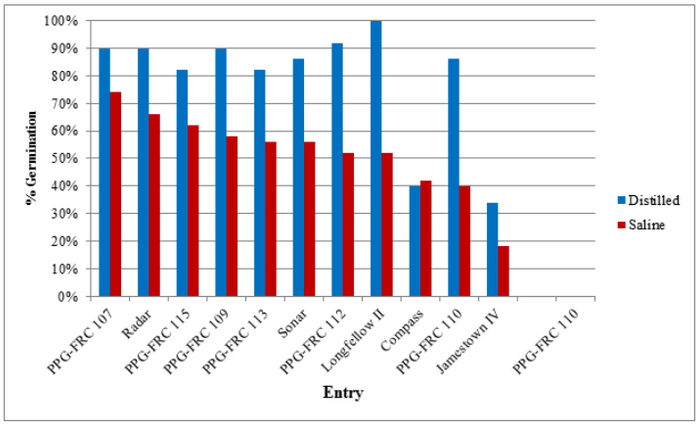


FIGURE 4: Total germination of Chewings fescues.

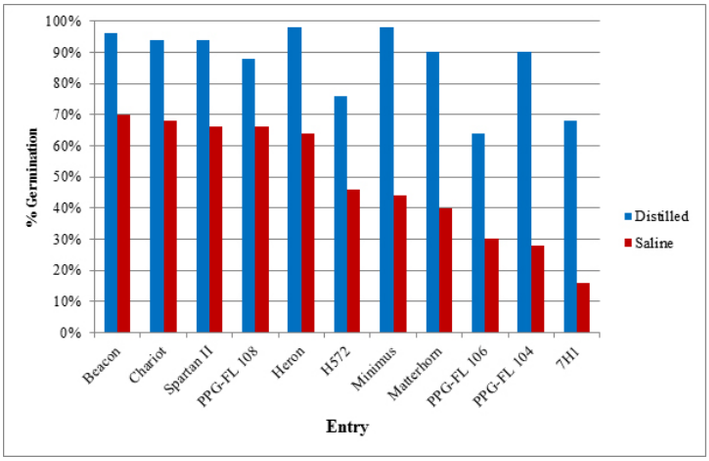


FIGURE 5: Germination of hard fescues fifteen days after planting.

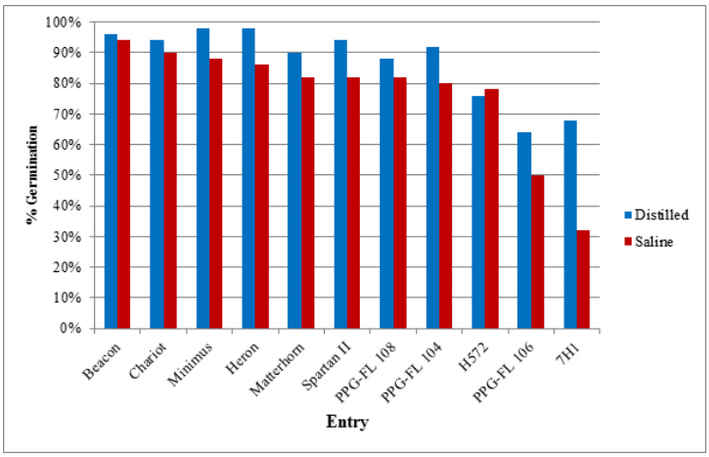


FIGURE 6: Total germination of hard fescues.

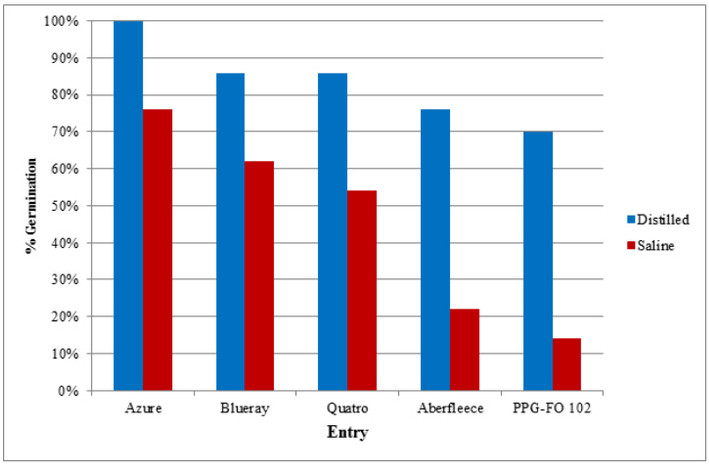


FIGURE 7: Germination of sheep's fescues twelve days after planting.

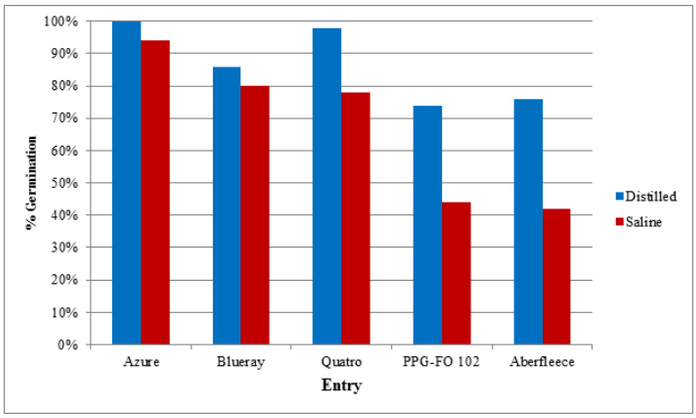


FIGURE 8: Total germination of sheep's fescues.

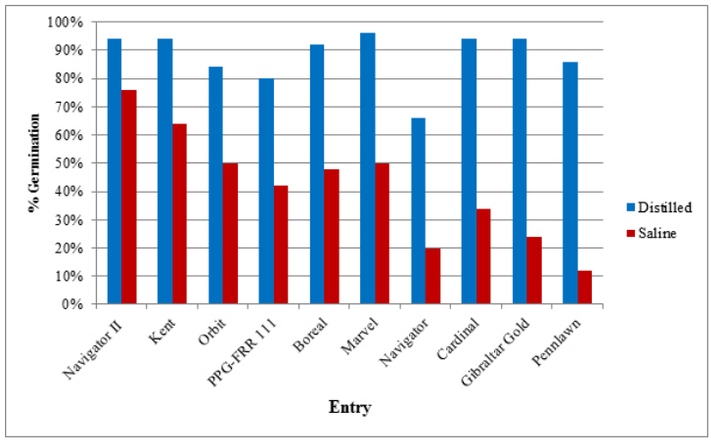


FIGURE 11: Germination of strong creeping red fescues twelve days after planting.

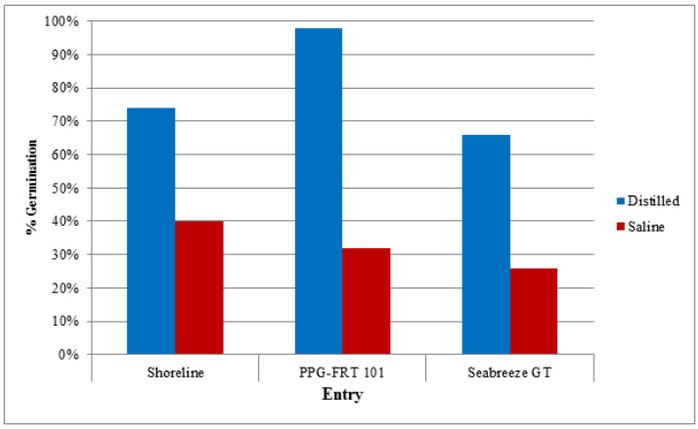


FIGURE 9: Germination of slender creeping red fescues twelve days after planting.

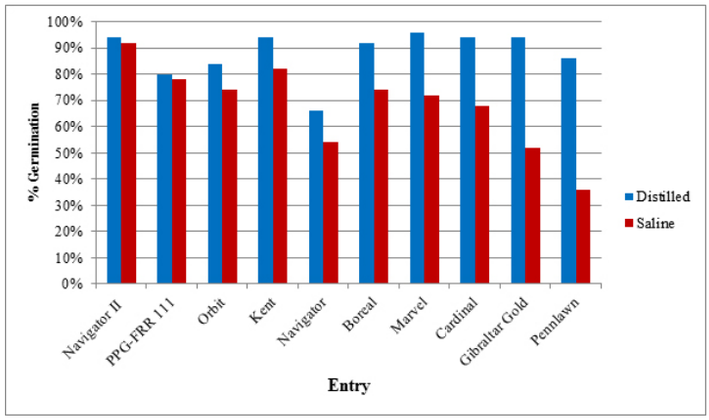


FIGURE 12: Total germination of strong creeping red fescues.

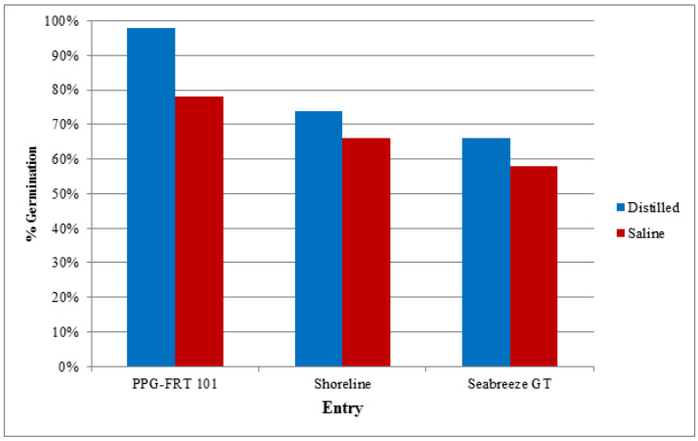
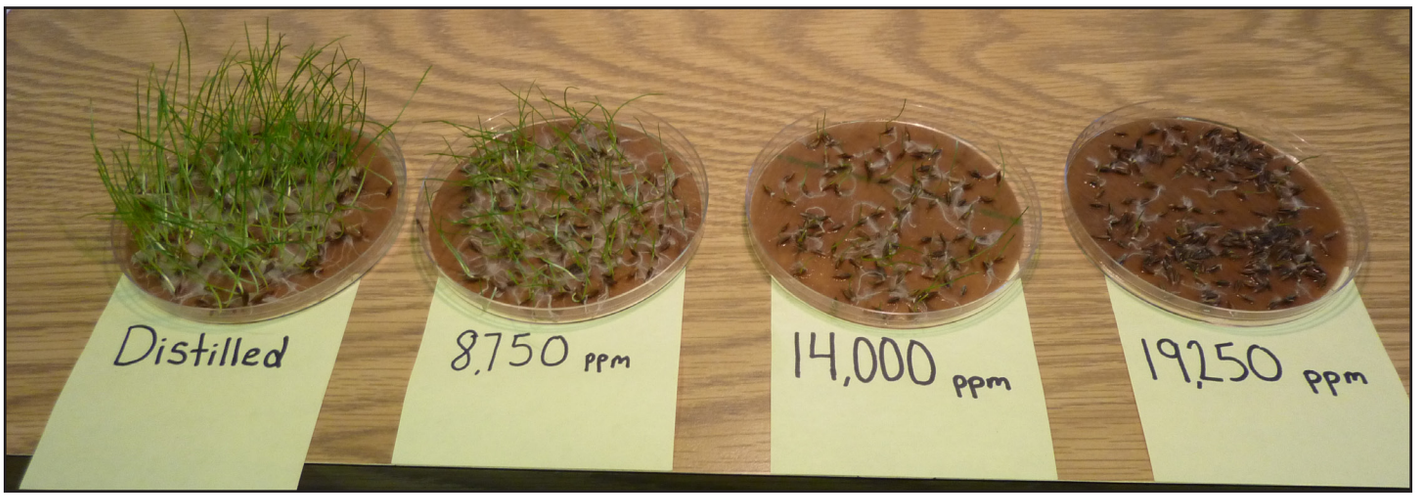


FIGURE 10: Total germination of slender creeping red fescues.

(Above) The salination table at PEAK Plant Genetics is capable of irrigating selected varieties with a controlled amount of saline added to water. (Below) Germination results of a single variety at different salinity levels 14 days after seeding.



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