Perennial Ryegrass Salinity Germination Study

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

MATERIALS AND METHODS

Thirty-Seven perennial ryegrass, two turf annual ryegrass, one turf-intermediate ryegrass, and one forage annual ryegrass cultivars and experimentals were surveyed for germination under saline conditions. This study was conducted to evaluate differences in ability to germinate in high salt environments. Total germination and germination rate were measured under three different treatments: a highly saline treatment (14,000 ppm ≈40% sea water), a moderately saline treatment (8,750 ppm ≈25% sea water) and a distilled water treatment (0 ppm).

Fifty seeds from each entry were germinated in each of three treatments. Round germination paper discs were placed in petri dishes and saturated with one of three solutions; distilled water, moderately saline water, or highly saline water. 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.

Germination paper was saturated in the dishes and excess water was decanted off. Fifty seeds were selected that had 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 of the three treatments. 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. Seeds were examined each day to count the number of seeds which had germinated. Germination was considered to have occurred when the coleoptile had extended at least 1mm. Germination counts were performed every day for each variety. Once a variety had no new seeds germinate for three consecutive days that variety was considered fully germinated and was not counted further. The experiment was conducted in two separate but identical runs.

RESULTS AND DISCUSSION

Saline water slows germination rate when compared to distilled water. Combined analysis of all entries in this study showed that at 4 days after seeding over 67% of seeds in the distilled water treatment had germinated. It took 6 days and 8 days for germination to reach this level in the moderately saline and highly saline treatments, respectively. In addition to slowing germination rate, saline water also affected the total germination at high levels. As a whole, pooled total germination for all entries in the study significantly higher in the distilled treatment, at 94%, than in the highly saline treatment which only reached 72% (Figure 1).

Varietal differences in germination rate as well as total germination under saline conditions were also observed. Stellar 3GL and Apple SGL showed almost no germination inhibition in either of the salinity treatments. Six days after seeding, Stellar 3GL and Apple SGL had 96% and 90% germination, respectively, in the high salinity treatment while the pooled germination at day-6 for all entries in the high salinity treatment was only 55% (Figure 4).

Varietal differences in germination rate and total germination were also present in distilled water treatment. Differences here were likely a result of older seed. 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. Large differences in germination between treatments for a particular variety indicate sensitivity to saline conditions, while small differences indicate increased tolerance to saline environments (Figures 2-5) (Table 1, 2).

This study demonstrated high salinity tolerance in varieties such as Stellar 3GL and Apple SGL.

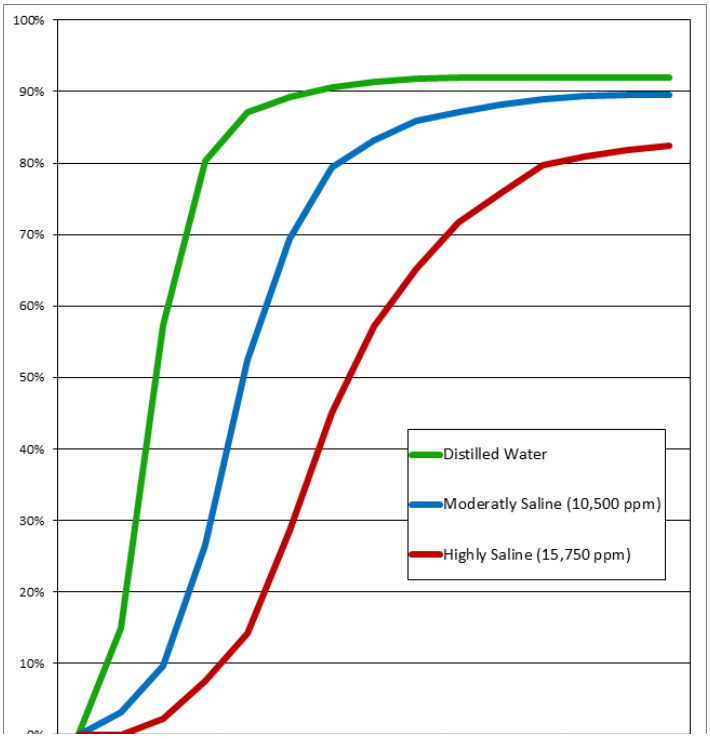


FIGURE 1: Pooled germination over time under three different treatments

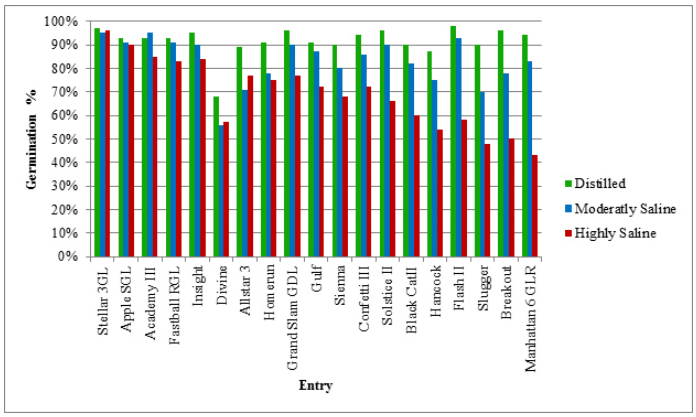


FIGURE 2: Germination of named varieties under three different treatments six days after planting.

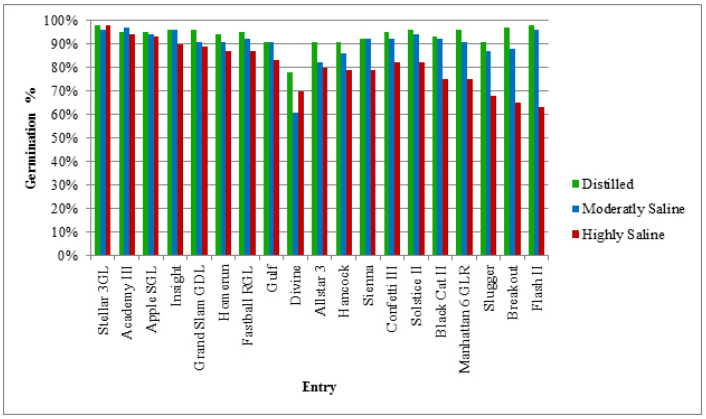


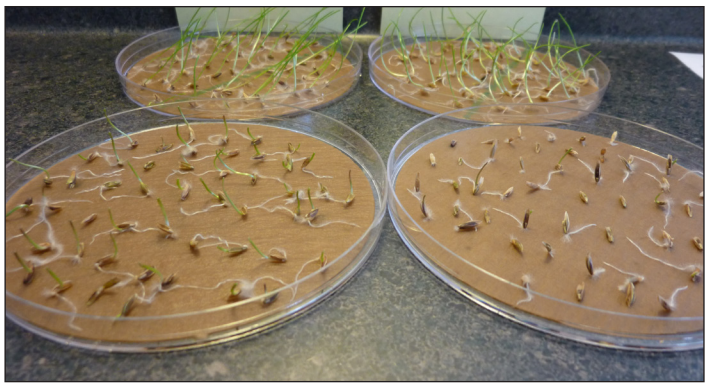
FIGURE 3: Total germination of named varieties under three different treatments

Variety	Distilled	Moderately Saline	Highly Saline
Stellar 3GL	97%	95%	96%
Apple SGL	93%	91%	90%
Academy III	93%	95%	85%
Insight	95%	90%	84%
Fastball RGL	93%	91%	83%
Allstar 3	89%	71%	77%
Grand Slam GLD	96%	90%	77%
Homerun	91%	78%	75%
Confetti III	94%	86%	72%
Gulf	91%	87%	72%
Sienna	90%	80%	68%
Solstice II	96%	90%	66%
Black Cat II	90%	82%	60%
Flash II	98%	93%	58%
Divine	68%	56%	57%
Hancock	87%	75%	54%
Breakout	96%	78%	50%
Slugger	90%	70%	48%
Manhattan 6 GLR	94%	83%	43%
PPG-TAR 104	98%	72%	29%
PPG-TAR 106	89%	54%	21%
LSD @ 0.05	**14%**	**16%**	**28%**

TABLE 1: Percent germination under three different treatments.

Variety	Distilled	Moderately Saline	Highly Saline
Stellar 3GL	98%	96%	98%
Academy III	95%	97%	94%
Apple SGL	95%	94%	93%
Insight	96%	96%	90%
Grand Slam GLD	96%	91%	89%
Fastball RGL	95%	92%	87%
Homerun	94%	91%	87%
Gulf	91%	91%	83%
Solstice II	96%	94%	82%
Confetti III	95%	92%	82%
Allstar 3	91%	82%	80%
Sienna	92%	92%	79%
Hancock	91%	86%	79%
Black Cat II	93%	92%	75%
Manhattan 6 GLR	96%	91%	75%
Divine	78%	61%	70%
Slugger	91%	87%	68%
Breakout	97%	88%	65%
Flash II	98%	96%	63%
PPG-TAR 104	98%	94%	43%
PPG-TAR 106	92%	69%	31%
LSD @ 0.05	**12%**	**12%**	**28%**

TABLE 2: Total germination under three different treatments.



Stellar 3GL (left) and Manhattan 6 GLR (right) 5 days after seeding. High saline treatment seedlings shown in front with distilled water treatment seedlings in back.

Three different perennial ryegrass varieties showing the different affects of saline water used to irrigate mature plants.

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