Elymus Germination in Elevated Salinity

H.B. Pegram, J.I. Morrison, B.S. Baldwin, K.D. Jones, J.B. Rushing
Department of Plant & Soil Sciences, Mississippi State University

Introduction

The Elymus genus is composed of approximately 150 species of grasses with geographic distribution that spans the globe. Most crop species are highly sensitive to elevated levels of salinity. Increased soil salination has become one of the most detrimental environmental factors limiting agricultural productivity. Agricultural commodity losses due to salinity are currently estimated to be 12 billion USD per year and are expected to increase every year as more acreage is affected by salination. It is currently unknown if Southeastern wildrye, Canadian wildrye, Virginia wildrye, and Riverbank wildrye are tolerant of increased salinity. In this study, tolerance to salinity was evaluated in these four species at the seed germination and seedling stage. The test is performed by watering seeds with 100, 200, 300, and 400 mmol NaCl and placing them in a controlled environment chamber. The tolerance level will be determined by germination rate and plant growth. This research is important to determine if these grasses can be grown in salinized soils or be watered with saline water.

Materials and Methods

Four species of wildrye were screened for germination and survival at seedling stage at five salinity levels (0, 100, 200, 300, 400 mmol NaCl). Species included Southeastern, Canada, Virginia, and Riverbank wildrye.

Species were placed on two thicknesses of filter paper in 110mm petri dishes. Salinity treatments were applied to dishes and were the only moisture necessary to complete the study. Dishes were maintained in a controlled environment chamber and germination was counted periodically over 21 days.

- 1g of seed per dish
- 4 replicate dishes per treatment
- 10 mL of solution per dish
- 12hr days – 25:20°C

Seed remaining after 21 days were counted to establish total germination percentage. Data were analyzed using PROC GLM in SAS at $\alpha = 0.05$. Seed source and treatment were treated as main effects and were considered fixed.

Objectives

Soil salinity is a major concern in the agriculture field because it affects approximately 1 billion hectares and increases every year. The goal of this research project was to 1) Screen Virginia, Canada, Riverbank and Southeastern wildrye for tolerance to salinity at the seed germination and seedling growth stage To accomplish this goal the proposed research will assess commercial seedlots of four species of Elymus for saline tolerance using five different levels of salinity applied prior to the seed germination and at the three to four leaf vegetative growth stage.

Figure 2. Germination percentage in experiment 1 of four Elymus species at 0, 100, 200, and 300 mmol NaCl in 110 mm petri dishes in a controlled environment chamber (12-hour daylength, 25°C day/15° night) (CAWR= Canada wildrye, RBWR= riverbank wildrye, SEWR= southeastern wildrye, VAWR= Virginia wildrye).

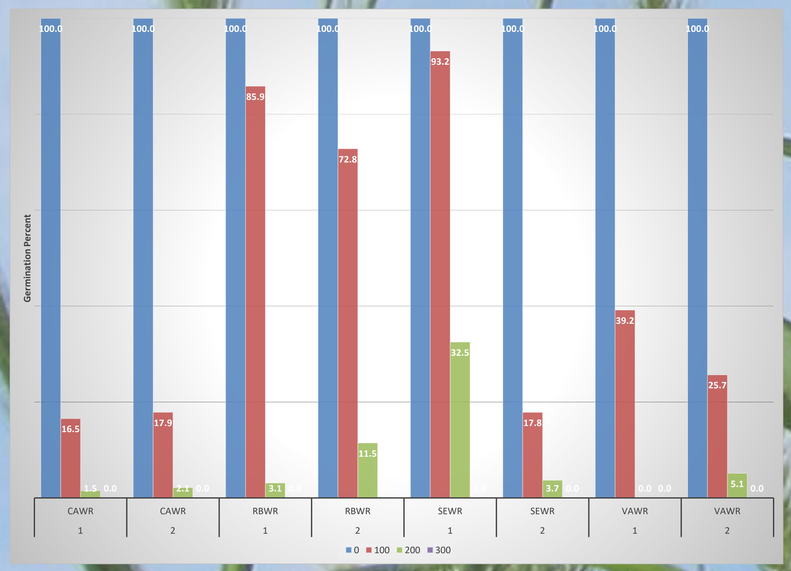

Figure 4. Germination rates as a percentage of untreated control. (CAWR 1= Canada wildrye experiment 1, CAWR 2= Canada wildrye experiment 2, RBWR 1= riverbank wildrye experiment 1, RBWR 2= riverbank wildrye experiment 2, SEWR 1= southeastern wildrye experiment 1, SEWR 2= southeastern wildrye experiment 2, VAWR 1= Virginia wildrye experiment 1, VAWR 2= Virginia wildrye experiment 2)

Experiment 1 results

Canada wildrye

There was significant effect on seed germination due to salinity treatment (P<.0001). Germination percentage decreased significantly as salinity level increased, with the untreated control, 100 mmol and 200 mmol treatments producing germination percentages of 26.7, 4.3, and 0.3, respectively (LSD= 5.8, Figure 4.1).

Riverbank wildrye

There was significant effect on seed germination due to salinity treatment (P<.0001). Germination percentage decreased significantly as salinity level increased, with the untreated control, 100 mmol and 200 mmol treatments producing germination percentages of 83.3, 71.7 and 2.7, respectively (LSD= 6.7, Figure 4.1).

Southeastern wildrye

There was significant effect on seed germination due to salinity treatment (P<.0001). Germination percentage decreased significantly as salinity level increased, with the untreated control, 100 mmol, 200 mmol and 300 mmol treatments producing germination percentages of 88.0, 82.0, 28.7, and 0.3, respectively (LSD= 5.6, Figure 4.1).

Virginia wildrye

There was significant effect on seed germination due to salinity treatment (P<.0001). Germination percentage decreased significantly as salinity level increased, with the untreated control and 100 mmol treatments producing germination percentages of 96.0 and 37.7, respectively (LSD= 5.9, Figure 4.1).

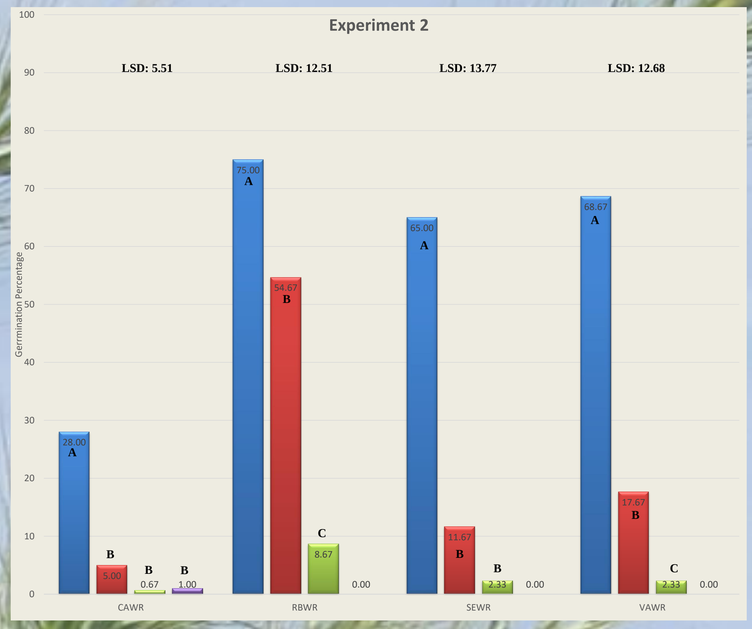

Figure 3. Germination percentage in experiment 2 of four *Elymus* species at 0, 100, 200, and 300 mmol NaCl in 110 mm petri dishes in a controlled environment chamber (12-hour daylength, 25°C day/15° night) (CAWR= Canada wildrye, RBWR= riverbank wildrye, SEWR= southeastern wildrye, VAWR= Virginia wildrye).

Canada wildrye

There was significant effect on seed germination due to salinity treatment (P<.0001). Generally, germination percentage decreased as salinity level increased from untreated control to 200 mmol. Germination percentage decreased significantly from 100 mmol to 200 mmol and remained unchanged from 200 mmol to 300 mmol. Overall, the untreated control, 100 mmol, 200 mmol and 30 0mmol treatments producing germination percentages of 28.0, 5.0, 0.7 and 1.0, respectively (LSD= 5.5, Figure 4.2).

Riverbank wildrye

There was significant effect on seed germination due to salinity treatment (P<.0001). Germination percentage decreased significantly as salinity level increased, with the untreated control, 100 mmol and 200 mmol treatments producing germination percentages of 75.0, 54.7, and 8.7, respectively (LSD= 12.5, Figure 4.2).

Southeastern wildrye

There was significant effect on seed germination due to salinity treatment (P<.0001). Generally, germination percentage decreased significantly as salinity level increased. There was a significant decrease in germination at 100mmol salinity and germination remained unchanged at 200 mmol. Overall, the untreated control, 100mmol and 200mmol treatments producing germination percentages of 65.0, 11.7, and 2.3, respectively (LSD= 13.7, Figure 4.2).

Virginia wildrye

There was significant effect on seed germination due to salinity treatment (P<.0001). Germination percentage decreased significantly as salinity level increased, with the untreated control, 100 mmol and 200 mmol treatments producing germination percentages of 68.7, 17.7, and 2.3, respectively (LSD= 12.6, Figure 4.2)

Conclusions

Differences in seedlot quality were evident, however all seedlots showed some tolerance to salinity at every treatment level. Data shows that this species has relatively high inherent tolerance to saline conditions at the seed germination stage. Further saline tolerance studies are necessary to fully investigate the potential for tolerance in *Elymus*.