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Effect of Different Salt Concentration and Temperatures on the Germination of Cool - Season Forage Crops

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[Introduction]

Forage legumes benefit pastures and hay crops by fixing N, improving the seasonal distribution of growth, and enhancing animal performance. Growth processes within the seed are chemical reactions activated by moisture, oxygen, and temperature. Some major factors that affect seed germination which is water and temperature and salinity. This study was carried out to investigate the effects of temperature, and salinity at seed germination which is the stage of plant life most sensitive to abiotic stresses.

[Material and Methods]

Germination experiments were conducted in the chamber set at 15°C, 20°C, 25°C, 30°C and photoperiod (16h light/8h dark). Seeds were germinated in distilled water (0mM), and in 25mM, 50mM, 100mM of NaCl solutions under these temperatures and photoperiod. All the seeds from the previous germination tests which did not germinate after 20 days at different NaCl treatments, were placed in new Petri dishes with filter paper and distilled water and incubated under the same temperatures for 10 days to investigate the recovery of germination. Data analysis included three-way ANOVA to test the effect of main factors (salinity and temperature) and species. For two-way ANOVA was carried out to detect the salinity and temperature in SASS and Duncan's test was used to estimate the least significant range between means ($P < 0.01$).

[Results and Discussion]

Forages can be a simple answer to soil erosion and decline in organic matter and fertility, a problem caused by modern cultivation and fallowing practices on much of the farmland the world over. Salinity stress had a strong inhibitory effect on germination, perhaps by preventing the uptake of inorganic ions that are required to trigger the germination process. Moreover, high temperatures bring about irreversible damage to the seeds. Our results suggest that salinity and temperature stress had great effects on germination. Germination percentage and rate were high at 20°C in all species which were indicating that are cool-season forages. As expected, germination percentage was decreased when NaCl concentration was increased and the highest percentage has occurred at 20°C and the lowest percentage was at 30°C. The mean of final germination of *Medicago sativa* was 59%, *Trifolium pratense* was 84%, *Festuca arundinacea* was 76% and *Phleum pratense* was 26%, respectively. Furthermore, no significant difference was found between 0mM and 25mM, and the highest percentage was obtained in 0mM in all four species and 50mM treatment had a slight difference and 100mM NaCl concentration treatment had a great effect on germination percentage. Seeds incubated under high temperatures with high NaCl concentrations seemed to be subjected to heavy stress, as indicated by delayed germination. Many seeds that remained inert in a high saline environment were able to recover and germinate as normal when the salinity conditions were removed but the highest recovery occurred in 100mM NaCl treatments at the 20°C. Therefore, high temperature affects salinity in the germination recovery. This is because evaporation under full sunlight and higher temperatures causes an increase in the salt content by capillary movement.

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