Germination of Two Native Wheatgrass (*Agropyron*) Species under Different Temperature and Water Potential Regimes

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Abstract

Native wheatgrass species are important for land reclamation or rangeland re-seeding. The objective of this study was to evaluate seed germination of slender wheatgrass (*Agropyron trachycaulum* Link Malte) and northern wheatgrass (*Agropyron dasystachyum* (Hook.) Scribn.) under different temperatures and water potentials. Over a 10 d period, germination was studied in four growth chambers with constant temperatures of 5, 10, 20 and 25°C and water potentials of –1.0, –0.8, –0.6, –0.4, –0.2 and 0.0 Mpa at each temperature. Two wheatgrass species showed a good germination at or higher than –0.4 Mpa water potentials when temperature was 20-25°C, but the percentage was reduced at or lower than –0.6 Mpa. Compared to northern wheatgrass, higher percent of seed germinated for slender wheatgrass at lower water potential, but slender wheatgrass required higher germination temperature.

Introduction

Over the past few years, non-native plant species were preferred for land reclamation due to their aggressive growth characteristics (Naeth et al., 1999). This greater use of non-native species negatively impacted ecosystem development and function (Lyster et al., 2001). Recently, a number of native plant species have been used for land reclamation. There is also a great interest in seeding native plant mixture for forage production in the drier region of western Canada.

Slender wheatgrass (*Agropyron trachycaulum* Link Malte) and northern wheatgrass (*Agropyron dasystachyum* (Hook.) Scribn.) are two native wheatgrass species commonly used in western Canada for erosion control and re-vegetation of overgrazed pasture. However, there is limited information available on germination of these two species under different temperatures and water availability. The objective of the present study was to assess germination of slender wheatgrass and northern wheatgrass under different temperatures and water potentials over 10-day period.

Materials & methods

Germination test

Polyethylene glycol (PEG8000) was dissolved in distilled water to make solutions that had the osmotic potentials of –0.2, –0.4, –0.6, –0.8, –1.0 Mpa, using the method described by Michel (1983). Distilled water was used as the control (0.0 Mpa). Germination tests were conducted in darkness at constant temperatures of 5, 10, 20, 25°C. Experimental design was a randomized complete block design with four replicates. For each replicate, treatments of temperature and water potential were randomly applied to the experimental unit of 50-seed samples. Fifty seeds were imbibed in 9 cm sterilized plastic Petri dishes on top of two layers of filter paper (Whatman 597) that were moistened by adding 6 ml of distilled water or PEG solutions. The Petri dishes were enclosed and sealed in polyethylene bags to prevent desiccation. Germination counts were made daily for 10 days and germinated seeds were removed. Seeds with a radical greater than 2 mm were considered germinated. Data were analyzed using the PROC MIXED procedure of SAS with temperature, water potential, and their interaction as fixed effects, and replicate as a random effect. When ANOVA indicated significant differences among treatment ($P \leq 0.05$), the means were separated using the least square means comparison.

Results

There was an interaction effect of temperature and water potential on seed germination of both species ($P<0.01$). Final germination of two wheatgrass species increased with the increase of temperature. No germination occurred for both species at 5°C after 10 days. Slender wheatgrass didn't germinate at 10°C, while the final germination for northern wheatgrass was 32% at this temperature (Table 1). Compared to germination at distilled water, final germination of northern wheatgass decreased at or lower than water potential of -0.4 Mpa. The germination of slender wheatgrass decreased at or lower than water potential of -0.6 Mpa. No seeds germinated for both species at water potential of -1.0 Mpa (Table 1). At 20 and 25°C, germination started for both species after 3 days at or higher than water potential of -0.4 Mpa. However, northern wheatgrass reached relatively higher percent of germination than slender wheatgrass after 3-4 days (Figure 1a,b,d,e). Germination of northern wheatgrass started after 6 days at 10 °C (Figure 1c).

Table 1. Final germination percentage (%) of two wheatgrass species at different temperature and water potential regimes over 10 days.

Species	Treatments						P value	SEM
	Temperature ^{0}C							
	5	10	20	25				
NWG	0 d	32 c	76 b	94 a			<0.01	2.2
SWG	0 c	0 c	49 b	61 a			<0.01	1.6
	Water potential (Mpa)							
	0.0	-0.2	-0.4	-0.6	-0.8	-1.0		
NWG	78 a	83 a	65 b	42 c	7 d	0 e	<0.01	2.4
SWG	75b	87 a	87 a	68 c	14 d	0e	<0.01	2.4

Means within a row at each treatment with the same letter are not significantly different ($P>0.05$). NWG, northern wheatgrass; SWG, slender wheatgrass

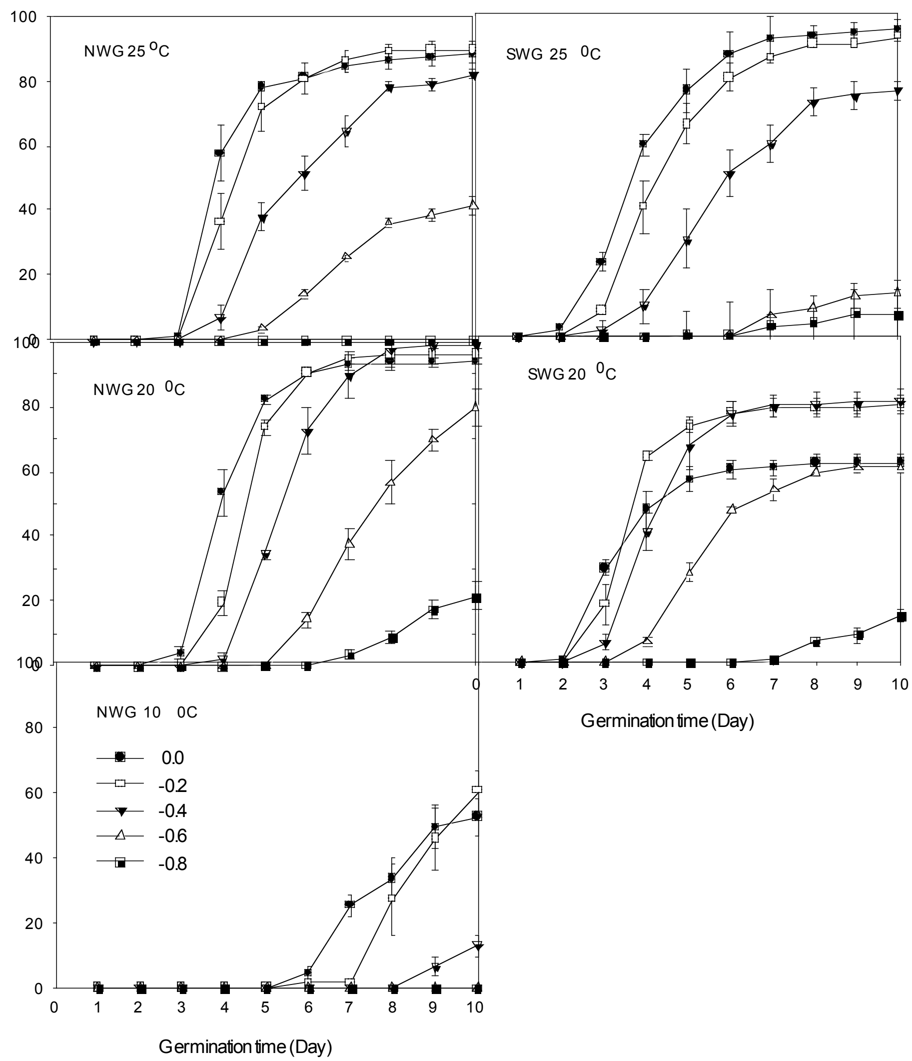

Figure 1. Cumulative germination (%) of northern wheatgrass (NWG) and slender wheatgrass (SWG) over 10-day period under a range of temperature and water potential regimes. Values are mean±SE.

Conclusions

Two wheatgrass species showed good germination at temperature of 20 and 25 °C and water potential of higher than -0.4 Mpa. Seeds of slender wheatgrass can germinate under lower water potential than northern wheatgrass. However, seeds of slender wheatgrass required higher germination temperature than northern wheatgrass. According to the present study, recommended germination temperature for slender wheatgrass is 25°C, and for northern wheatgrass is 20 or 25°C.

References

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