Comparative Germination of 4 Western Wheat Grass (*Agropyron smithii*) Cultivars under Constant and Alternating Temperatures

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Objective

The objective of this project was to investigate seed germination requirements of 4 cultivars of western wheat grass (*Agropyron smithii*) under constant and alternating temperatures, similar to those temperatures found in a prairie environment. Results of this research will provide a better understanding of the requirements for successful species regeneration on the prairies.

Introduction

Future climate change will affect the germination response of native plant species. A number of native species have a large distribution range and thus may have differing germination. Temperature is an important variable affecting seed germination. To further understand the germination requirements of native prairie seed, SPARC utilizes the Thermal Gradient Plate (TGP), which features 96 cells with individual cell temperature control. Each cell is monitored with an accuracy of ±0.2°C. The TGP allows for simulation of prairie temperatures, as well as climate change.

Materials and Methods

Four WWG cultivars were selected for testing: Arriba (A), Barton (B), Recovery (R), and WR Poole (WRP). A full factorial randomized complete block statistical design with four replicates was utilized into the TGP. Germination tests were conducted with designated temperature treatments of 1) constant 20°C, 2) 10°C day/5°C night, 3) 15°C day/10°C night, 4) 20°C day/15°C night and 5) 25°C day/20°C night. Temperatures were monitored using the TGP management computer readings and a thermocouple.

Fifty scarified seeds were placed in a petri dish lined with two pieces of filter paper (Whatman 597), moistened with distilled water, but with no pooling of water. A single piece of filter paper was placed on top of the seeds. Each plate was placed in its own individual cell in the TGP, with the assigned temperature treatment. The test ran for 30 days in darkness; germination counts were performed daily, recorded and germinated seeds removed. A seed showing a radicle of greater than 2 mm was considered to have germinated.

Results and Discussion

WWG cultivars showed a better germination response to the oscillating temperature than to the constant temperature of 20°C (Table 1). Overall, the best temperature for percent germination was 15°C day/10°C night but a significant difference between the cultivars was noted (Table 2). Arriba and WR Poole showed good percent germination at 15°C day/10°C night. Barton and Recovery showed good germination at the higher temperature treatments, indicating that they may be better suited for warmer climatic conditions.

Table 1: Measured parameters for germination of Western Wheat Grass cultivars: Arriba (A), Barton (B) Recovery (R) and WR Poole (WRP) germinated at a constant and alternating day/night temperatures. Means followed by different letters are significantly different (P<0.05).

Factor	% Germination	Days to 1st Germination	Days to Maximum Germination	Day of Highest Germination
Cultivar				
(A)	36.0a	7.6b	8.7b	9.7b
(B)	26.0b	8.0b	10.0b	11.0b
(R)	9.6c	6.6b	8.5b	9.4b
(WRP)	7.6c	13.5a	16.6a	17.6a
Prob>F	<.0001	0.0006	0.0002	0.0002
Temperature				
20°C	12.5c	6.5b	6.8b	7.8b
10°C/5°C	16.0bc	14.3a	16.2a	17.0a
15°C/10°C	27.6a	7.6b	10.4ab	11.4ab
20°C/15°C	23.3ab	9.0ab	11.6ab	12.6ab
25°C/20°C	19.6abc	7.3b	9.7b	10.7b
Prob>F	<.0001	0.0009	0.0014	0.0019

Table 2: Temperature effects (a constant and alternating day/night temperatures) on the Western Wheat Grass cultivars: Arriba (A), Barton (B), Recovery (R) and WR Poole (WRP). Means followed by different letters are significantly different (P<0.05).

Cultivar	% Germination	Days to 1st Germination	Days to Maximum Germination	Day of Highest Germination
(A)				
Temperature				
20°C	21.5b	5.25b	5.5b	6.5b
10°C/5°C	38.5ab	13a	17a	18a
15°C/10°C	51.5a	7.5b	8.25ab	9.25ab
20°C/15°C	41.5ab	6.25b	6.75b	7.75b
25°C/20°C	27b	5.75b	6b	7b
Prob>F	0.0063	0.0002	0.0095	0.0095
(B)				
Temperature				
20°C	18a	5.75b	6.25b	7.25b
10°C/5°C	16.5a	15a	16.25a	17.25a
15°C/10°C	30a	7b	11.25ab	12.25ab
20°C/15°C	33a	7b	9.75b	10.75b
25°C/20°C	32.5a	5.25b	6.25b	7.25b
Prob>F	0.0149	<.0001	0.0014	0.0014
(R)				
Temperature				
20°C	7.5ab	4.75	5.5	6.5
10°C/5°C	3.5b	10	12.25	12.75
15°C/10°C	12.5ab	7.5	8.5	9.5
20°C/15°C	10.5ab	6	6	7
25°C/20°C	14a	4.75	10.25	11.25
Prob>F	0.0240	0.6967	0.7477	0.8044
(WRP)				
Temperature				
20°C	3b	10	10	10.75
10°C/5°C	5.5b	19.25	19.25	20.25
15°C/10°C	16.5a	8.25	13.5	14.5
20°C/15°C	8ab	16.25	24	25
25°C/20°C	5b	13.25	16.25	12.25
Prob>F	0.0022	0.4562	0.2209	0.2185

Conclusions

The results show that temperature strongly influences seed germination. The cultivars tested appear to respond to an alternating temperature than to a constant one. Some cultivars also showed a germination preference for higher temperatures, indicating they might do well in a warmer climate.

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