Germination Profiles of Introduced Lovegrasses at Six Constant Temperatures

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Abstract

Seeds of A-68 Lehmann lovegrass (*Eragrostis lehmanniana* Nees), cochise lovegrass (*Eragrostis lehmanniana* Nees × *Eragrostis trichophora* Coss & Dur.) and A-84 and Catalina boer lovegrasses (*Eragrostis curvula* var. *conferta* Nees) accessions were germinated for 14 days at constant temperatures of 15, 18, 21, 24, 27, and 30° C. Light intensity was 216 μ mol $m^{-1}s^{-1}$ and photoperiod was 15 h. Germination of Catalina seeds varied from 87 to 96% between 18 and 30° C after 12 days. Germination of cochise seeds was optimum between 21 and 27° C after 12 days. Germination of A-68 seeds was optimum at 27° C and A-84 seeds at 30° C. This study indicates that Catalina boer lovegrass and cochise lovegrass will germinate at relatively low temperatures. A-68 and A-84 lovegrasses, in contrast, require higher temperatures for optimum germination.

The most commonly recommended grasses for rangeland seeding in the arid Southwestern United States and Northern Mexico were either introduced from Southern Africa or developed from genetic lines collected in Southern Africa. The most easily established and apparently persistent grasses are A-68 Lehmann lovegrass (*Eragrostis lehmanniana* Nees), cochise lovegrass (*Eragrostis lehmanniana* Nees × *Eragrostis trichophora* Coss & Dur.) plus A-84 and Catalina boer lovegrass (*Eragrostis curvula* var. *conferra* Nees). A-68 Lehmann and A-84 boer lovegrasses were introduced in 1930 (Crider 1945). Cochise lovegrass was introduced in 1961 (Holzworth 1980), and Catalina boer lovegrass was selected for seedling drought tolerance (Wright and Jordan 1970) and released in 1969 (Wright 1971).

The amount and distribution of summer precipitation in the arid Southwest is sporadic, and a successful summer seeding may be expected in 1 of 10 years (Cox and Jordan 1983). We have observed Catalina and cochise lovegrass seedling emergence following wet sequences in spring, fall, and winter and when seeds were sown prior to a dry summer; Cox and Martin (1984) have determined that Catalina and cochise seedlings are more drought tolerant than A-68 and A-84 seedlings. If some lovegrasses will germinate at lower soil temperatures, it may be possible to seed in fall and rely on cool-season moisture rather than on warm-season moisture for germination and seedling growth. The purpose of this study was to determine the germination characteristics of four lovegrasses at constant temperatures.

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Methods

Fifty caryopses of either A-68, A-84, Catalina or cochise lovegrasses were placed on filter paper in separate plastic petri dishes. Approximately 9 ml of distilled water was added to each dish at the beginning of the study; and seeds were germinated at either 15, 18, 21, 24, 27, or 30° C on a thermogradient plate (Larsen 1962) under alternating 15 h light and 9 h dark. All experiments were conducted in a light regime of 216 μ mol $m^{-3}s^{-1}$ photosynthetic active solar radiation. Previous laboratory experiments had established that lovegrass germination was not influenced by light intensity or length of photoperiod, as long as photoperiod was greater than 1 h (Unpublished data, USDA-ARS, Tucson Ariz.). Germinated seeds were counted daily for 14 days after water was added. Germination was considered complete when the seed radical was 0.5 cm long.

Dishes were arranged in a stratified randomized block design because temperatures were constant at points across the thermogradient plate. One petri dish was used for each accession at each temperature, and the experiment was repeated 6 times. Total germination was determined by accumulating the number of germinated seed over the 14-day period. Germination values for the respective accessions were compared at the same temperature with analysis of variance at days 6 and 12. When F values were significant, a Duncan's new multiple range test (Steel and Torrie 1960) was used to separate accession means ($P \leq 0.05$).

Results and Discussion

Lovegrasses responded differently to variations in temperature (Fig. 1). Germination of A-84 seeds began 2 days after water was applied and germination of A-68 seeds began 4 days after water was applied at 27 and 30° C. Germination of both A-68 and A-84 seeds were similar in that germination began on day 4 at 24° C, day 6 at 21° C, day 8 at 18° C and between days 11 and 12 at 15° C.

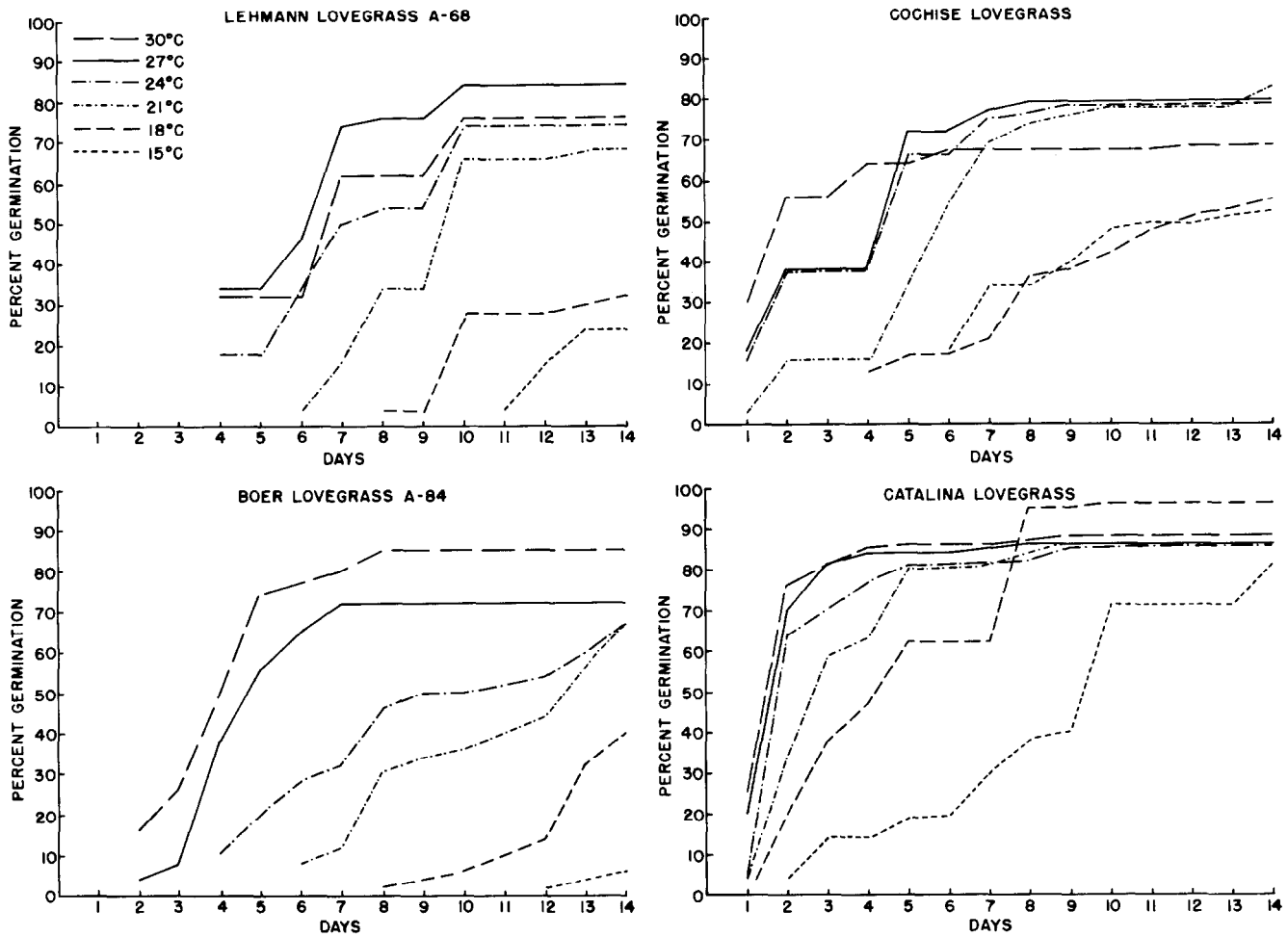

Fig. 1. *Germination (%) of 4 lovegrasses over 14 days at 6 constant temperatures.*

Germination of Catalina seeds began within 1 day at 18 to 30° C but was delayed 1 day at 15° C. Germination of cochise seeds began within 1 day at 21 to 30° C, but was delayed 3 days at 18° C and 5 days at 15° C.

Germination of the lovegrasses generally increased as temperature increased from 15 to 27° C after 6 days (Table 1). Germination of Catalina and cochise seeds occurred at 15° C, but germination of Catalina seeds increased 300% at 18° C while the germination of cochise seeds was unchanged. Germination of Catalina seeds was relatively uniform from 18 to 30° C. Germination of A-68 and A-84 seeds did not occur below 21° C within 6 days. Optimum germination of A-68 and cochise seeds occurred at 27° C and optimum germination of A-84 seeds occurred at 30° C within 12 days.

Germination of Catalina seeds was significantly ($P \leq 0.05$) greater than the remaining accessions from 15 to 24° C after 12 days (Table 1). Optimum Catalina germination occurred at 18° C and this occurred in all petri dishes. Germination of cochise seeds was intermediate and unchanged from 21 to 27° C, but A-68 germination peaked at 27° C while A-84 germination peaked at 30° C.

The rapid and consistently high germination of Catalina seeds across all temperatures suggests this accession is adapted over a

Table 1. Mean[1] germination (%) of four lovegrasses accessions at six constant temperatures after six and twelve days.

Accession	Day	Temperature (° C) 15	18	21	24	27	30
				%			
A-68	6			3[c]	34[c]	45[c]	33[c]
Cochise		18[a]	17[b]	55[b]	67[b]	72[b]	64[b]
A-84				8[c]	28[c]	65[b]	77[b]
Catalina		19[a]	63[a]	81[a]	81[a]	84[a]	87[a]
A-68	12	15[c]	28[c]	66[c]	74[b]	84[a]	77[b]
Cochise		50[b]	51[b]	79[b]	79[b]	79[ab]	68[c]
A-84		2[d]	13[d]	44[d]	54[c]	72[b]	85[a]
Catalina		72[a]	96[a]	87[a]	87[a]	87[a]	88[a]

[1]Each mean is the average of six replications of 50 seed.
[2]Means within columns at 6 and 12 days are not significantly different ($P \leq 0.05$) when followed by the same superscript.

greater elevation gradient and can be expected to germinate following both warm- and cool-season moisture in the Sonoran Desert. Germination of cochise and A-68 seeds was inhibited at both higher and lower temperatures and this might suggest that cochise and A-68 seeds should be planted in either fall or spring. This might also explain why A-68 has persisted in the Sonoran Desert when the probability of fall-spring precipitation is greater than in the Chihuahuan Desert. Seeds of A-84 seed should probably be planted only in summer, and seeding limited to areas where summer precipitation exceeds 20 cm (Cox et al. 1982).

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