

# Influence of Temperature on the Germination of Some Range Grasses

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## Highlight

Boer lovegrass, galleta, and blue grama germinate relatively well within a temperature range of 60 to 100 F, but the temperature range required for good germination of alkali sacaton and Lehmann lovegrass is limited to 80 to 90 and 60 to 70 F, respectively. Alternating temperatures were not superior to constant temperatures for promoting germination.

Alkali sacaton (*Sporobolus airoides* Torr.), galleta (*Hilaria jamesii* Torr.), and blue grama

(*Bouteloua gracilis* [H.B.K.] Lag.) are the principal perennial grass species found on the Rio Puerco watershed in west-central New Mexico. These species, together with Lehmann and Boer lovegrass, are of interest for erosion control purposes, and are being studied to determine ways of establishing them on deteriorated sites. The purpose of this study was to determine the effect of alternating and constant temperatures on germination.

Some information is available regarding the germination requirements of the above-mentioned species, but apparently none of them has previously been germinated over as wide a range of temperatures as were tested in this study.

Toole (1938) germinated Lehmann lovegrass at constant temperatures of 50, 59, 68, 77, and 86 F, and at alternating temperatures of 59-77, 68-86, and room to 95 F (the seeds were held 18 hr at the lower temperature and 6 hr at the higher temperature). The highest germination percentage was obtained with a constant temperature of 59 F, and each 9 F rise in temperature from 59 to

86 F lowered germination percentages. The best alternating temperature was 68-86 F with light. For blue grama, the highest germination percentages were obtained with alternating temperatures of 68-86 and 59-77 F.

Toole (1941) obtained 87 to 94% germination of fully after-ripened alkali sacaton seeds and 30 to 87% germination of comparatively fresh seeds at various alternating temperatures. Jackson (1928) reported 80 to 100% germination of alkali sacaton seeds at a constant temperature of 77 F.

Wilson (1931) reported the results of germination tests of galleta and blue grama conducted yearly over a period of several years by the New Mexico Agricultural Experiment Station. All of these tests were conducted at an alternating temperature program consisting of 16 hr at 68 F and 8 hr at 86 F. Germination percentages ranged from 6.5 to 21.5 for galleta and 0 to 76.5 for blue grama.

## Methods and Materials

Seeds (caryopses free from all attached parts) of Lehmann and Boer lovegrass, galleta, blue grama, and alkali sacaton were germinated in

<sup>1</sup> Forest Service, U.S. Department of Agriculture, with central headquarters maintained at Fort Collins in cooperation with Colorado State University; research reported here was conducted at Albuquerque in cooperation with the University of New Mexico and the Bureau of Land Management, Santa Fe, New Mexico.

100% relative humidity chambers at constant temperatures of 50, 60, 70, 80, 90, 100, and 110 F, and at alternating temperatures of 58-76, 68-86, 75-95, 75-105, 79-101, and 88-106 F. There were four 100-seed replications of each species. Alternating temperatures were programmed for 16 hr at the low temperature and 8 hr at the high temperature daily. All temperatures were programmed for 16 hr darkness and 8 hr light daily; in the case of alternating temperatures, the light hours coincided with the high temperature hours.

All seeds were from 3-year-old lots. The seeds used were selected at random without regard to size or color, but only fully developed, undamaged seeds were used. The germination substrata were two thicknesses of standard blue germination blotter paper saturated with distilled water at the outset of the study; additional waterings were not necessary. The duration of all tests was 32 days. Germination counts were made daily during the first 10 days, and at 4-day intervals thereafter. A seed was considered germinated when both radicle and plumule had attained a length of 3 mm. Germinated and molded seeds were removed from the dishes at the time of each count. Germination percentages were transformed by means of the arc sine transformation for analysis of variance to compare alternating and constant temperatures. The weighted means of the alternating temperatures were calculated on the basis of length of time at each temperature.

### Results and Discussion

Lehmann lovegrass had the most specific temperature requirements for germination (Table 1). It germinated best at a constant temperature of 60 F, which agrees with the findings of Toole (1938). Successive 10 F increases or decreases from 60 F resulted in progressively, though not always significantly, less germination. The alternating temperature regimen whose weighted mean was nearest 60 F (58-76 F; weighted mean of 64 F) resulted in significantly better germination of the species than all other alternating temperatures.

**Table 1. Percent germination<sup>1</sup> of Lehmann and Boer lovegrass, galleta, blue grama, and alkali sacaton after 32 days at each of 13 temperatures.<sup>2</sup>**

Temperature (F)		Species				
		Lehmann love-grass	Boer love-grass	Galleta	Blue grama	Alkali sacaton
Constant	50	22.00a	0a	0	26.25	0a
	60	82.50	76.25c	85.75a	96.25a	14.50
	70	74.25	75.50bc	90.25b	99.00bc	22.25
	80	31.00bcd	82.00c	95.75cd	99.75bc	71.75
	90	28.75ac	73.75bc	98.00d	94.50a	87.50d
	100	23.75ab	68.50b	85.00a	99.75c	52.00b
	110	3.25	0a	14.00	18.25	0a
Alternating	58- 76(64)	58.00	73.00bc	93.25bc	96.50a	53.00b
	68- 86(79)	43.50e	74.00bc	94.50bc	100.00c	86.50d
	75- 95(81)	29.75ad	79.75c	95.50cd	99.75c	83.00cd
	79-101(82)	36.25bcde	76.00bc	93.00bc	97.25ab	79.75c
	75-105(90)	41.40e	72.75bc	90.25ab	100.00c	83.75cd
	88-106(94)	33.00bcd	75.50bc	68.50	71.75	64.75

<sup>1</sup> Each value is the mean of four 100-seed replications. Any two means within species followed by the same letter are not significantly different (.05 level; Duncan multiple range procedure, Steel and Torrie, 1960).

<sup>2</sup> Numbers in parentheses following alternate temperatures are their weighted means in degrees F.

Boer lovegrass germinated above 70% with constant temperatures of 60 to 90 F and at all alternating temperatures. Germination was maximum at a constant 80 F (82%) and at an alternating temperature of 75-95 F (80%). Seeds did not germinate at constant temperatures of 50 and 110 F.

Galleta germinated 85% and higher with constant temperatures of 60-90 F and with alternating temperatures whose weighted means were 64 to 90 F. A constant temperature of 90 F and an alternating temperature regimen of 75-95 F gave maximum germination of 98 and 96% respectively. Seeds did not germinate at a constant temperature of 50 F, and germinated only 14% at 110 F.

Blue grama germinated in excess of 94% at constant temperatures ranging from 60 to 100 F and at alternating temperatures whose weighted means ranged from 64 to 90 F. Constant temperatures of 50 and 110 F and an alternating temperature of 88-106 F (weighted mean of 94 F) significantly reduced the germination of blue grama.

Alkali sacaton germinated best at a constant temperature of 90 F and at alternating temperatures whose weighted means ranged from 79 to 90 F. Successive 10 F increases or decreases in constant temperature from 90 F and alternating temperatures with weighted means of 64 F (58-76 F) and 94 F (88-106 F) significantly reduced germination. No germination occurred at constant temperatures of 50 and 110 F.

### LITERATURE CITED

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