EFFECTS OF VARIOUS SALTS AND TEMPERATURES ON GERMINATION IN GUAR

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Guar, Cyamopsis tetragonoloba(L.) Taub, is a summer annual, drought-tolerant legume introduced from India into the United States. In the United States, guar is grown mainly for the galactomannin gum in the endosperm of the seed. Guar is adapted to dry, tropical, or sub-tropical regions with predominantly summer rains. Consequently, commercial production of the crop in the United States is centered in Texas and Oklahoma, with smaller cultivated areas in southern Arizona.

Salinity and temperature stresses are major environmental factors that limit germination. Cultivation in semi-arid and arid regions is frequently prevented by high temperatures and saline soils. Therefore, a need exists to expand our knowledge of the effects of temperature and salinity and their interactions on germination in guar.

The experiment was designed to study the interaction among the different salts and temperatures and its effect on germination. Three guar cultivars, Kinman, Santa Cruz and Lewis, and three salts, sodium chloride (NaCl), potassium chloride (KCl), and disodium sulfate (Na_2SO_4), were used in the study. The different osmotic potentials were 0, -0.3, -0.7, -1.1, and -1.5MPa, and all the experiments were conducted in dark conditions in four different growth chambers each set at a constant temperature of either 25°C, 30°C, 34°C or 37°C. All seeds were placed in the appropriate salt solution and growth chamber and after seven days, the percent germination was determined.

The results (Table 1) show that germination decreased with increasing salt concentrations, but there were no significant differences in germination with increased temperature. A temperature-salinity interaction was observed with the greatest suppression of germination at the higher temperatures (34°C and 37°C) and salt concentrations (-1.1 and -1.5 MPa). The response varied according to the type of salt (data not shown), with the lowest germination rate for all three cultivars in Na_2SO_4 at -0.7 to -1.5 MPa osmotic potentials. The three cultivars showed a highly significant difference in their germination response to salt stress; Kinman performed better than either of the two other cultivars in low salt concentration, but at higher concentrations and temperatures the differences were not significant.

Table 1. Mean separations of percent germination in three guar cultivars at four temperatures and five osmotic potentials for the combined salts.

Cultivar	Osmotic potential (MPa)	Temperature (C) 25	30	34	37	Mean
Kinman	0	90.8a*	93.4a	89.9a	90.5a	91.2
Lewis	0	75.3b	81.2b	77.2b	80.1b	78.4
Santa Cruz	0	77.2b	75.7b	73.7b	78.4b	76.2
Mean		81.1	83.4	80.3	83.0	81.9
Kinman	-0.3	89.5a*	91.8a	79.2a	70.9a	82.8
Lewis	-0.3	71.2b	76.8b	69.7ab	65.7ab	70.8
Santa Cruz	-0.3	75.3b	72.1b	66.0b	60.2b	68.4
Mean		78.6	80.2	71.6	65.6	74.0
Kinman	-0.7	85.2a*	84.1a	37.7a	40.0a	71.7
Lewis	-0.7	65.8b	73.9ab	45.8a	32.7a	54.6
Santa Cruz	-0.7	70.1b	66.0b	38.8a	37.0a	53.0
Mean	-0.7	73.7	74.7	40.8	36.6	56.4
Kinman	-1.1	68.3a*	38.6a	20.3a	10.3a	34.4
Lewis	-1.1	50.3b	52.2b	23.2a	13.9a	34.9
Santa Cruz	-1.1	51.3b	49.0b	17.5a	10.0a	31.9
Mean		56.6	46.6	20.3	11.4	33.7
Kinman	-1.5	21.4a*	11.1a	5.6a	1.2a	9.8
Lewis	-1.5	23.8a	16.9a	10.9a	1.3a	13.2
Santa Cruz	-1.5	20.3a	16.2a	8.6a	1.1a	11.5
Mean		21.8	14.7	8.4	1.2	11.5

* Means within a column for each osmotic potential followed by different letters are significantly different at .05 and .01 probability levels, respectively.