

COMMERCIAL GRAIN AND FORAGE SORGHUM GERMINATION IN SODIUM CHLORIDE

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Summary

Laboratory germination of 49 high yielding grain sorghum hybrids and forage types in -14 and -16 bar NaCl solutions showed a wide difference in days to 50% germination. Data from this study should assist growers in selecting sorghum varieties for improved germination and seedling emergence in saline soils.

Introduction: Many areas in Arizona have experienced salinity problems due to salt originally in the soil or added by irrigation water. This salt reaches highest concentrations directly where seed germination occurs. Although sorghum is classified as moderately tolerant (a 50% yield reduction occurs at an E_{Ce} of 12 mmhos/cm compared to maize at 8 mmhos/cm, cotton at 16 mmhos/cm and barley at 18 mmhos/cm) stand establishment on saline soil can be very difficult. In addition, varieties more able to germinate in saline soil may contend with salt throughout the life cycle resulting in less yield reduction. This laboratory experiment was conducted to determine if some grain sorghum hybrids germinate better in NaCl than others.

Materials and Methods: The commercial hybrids used in this study were the highest yielding entries from grain yield tests under optimal and sub-optimal moisture regimens grown at the Marana Agricultural Center in 1984. Sodium chloride was used to salinize the media as this is usually the predominant salt. No other salts were added so results would not be confounded nor the response alleviated. The solutions of NaCl were -14 and -16 bars or atmospheres of pressure. This equals in other units of measurement; 16,540 and 18,903 ppm, 38.9 and 44.4 mmhos/cm of E_{Ce} or 3.9 and 4.4 siemens per meter (S/m), respectively. Plastic trays measuring 25 by 19 by 1.5 cm containing one eight-ply paper towel were wetted with 55 ml (1.86 oz) of the salt solution bringing the towel to "field capacity". Each tray unit received 100 seeds between the fourth and fifth ply, were replicated twice and stacked by blocks in a dark, air-tight plastic bag and held between 27 to 30°C (81-86° F). Daily germination counts started at day three and continued until day 14. Germination was considered complete when both radicle and plumule reached 1.5 cm (.6 in) in length whereupon the seedling was removed.

Results and Discussion: The 49 hybrids and varieties tested showed a wide difference in days to 50% germination. The data are shown in Figure 1 for ten entries representing the range of response. These germination values have been corrected for each hybrid's percent germination in distilled water. An analysis of variance was conducted on number of days to 50% germination without arcsin transformation because variances in this range are larger than in the tail ends where a binomial distribution prevails. Letters along the 50% germination line separate the significantly different means using LSD's at the .05 level. Two of the plotted lines in the first group (a) represent long term

checks (9 and 10) and along with entry six this group includes Asgrow Topaz, Funks G-522DR, Paymaster DR 1125, DeKalb DK 59e and George Warner W-839DR.

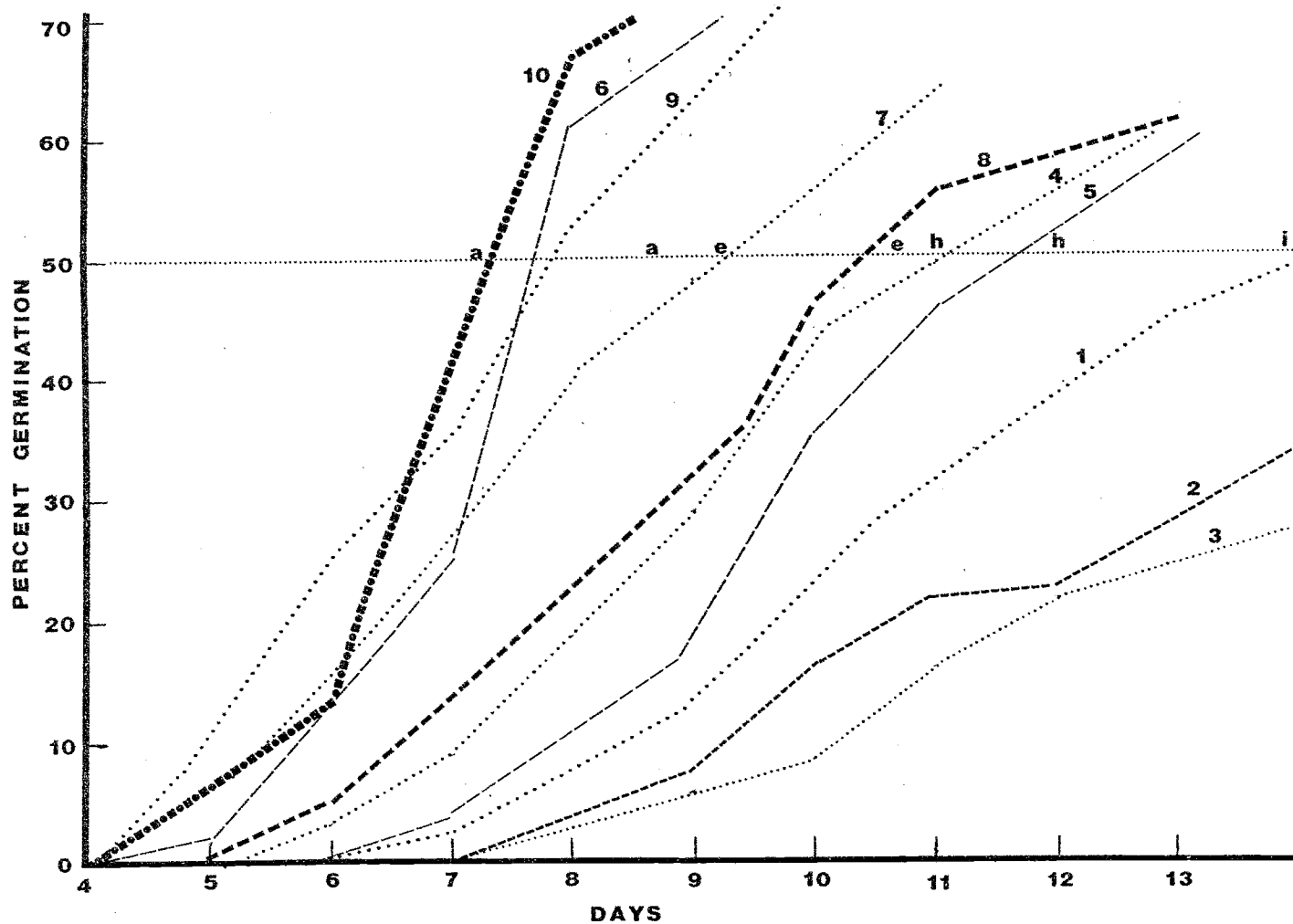


Figure 1. Cumulative percent germination of grain sorghum hybrids and one check variety in -14 bar NaCl media.

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|---------|------------------|---------|-------------------|
| Entry 1 | Asgrow Double Tx | Entry 6 | Stauffer S9750 |
| 2 | Asgrow H8108 | 7 | Triumph TWO 70-D |
| 3 | DeKalb DK 69 | 8 | Triumph TWO 80-D |
| 4 | NC+ 174 | 9 | Brawley (variety) |
| 5 | Richardson 5483 | 10 | A NE 34 X Brawley |

The 16 best cultivars under -14 bars were tested in -16 bars along with checks and ten commercial forage varieties, however, the temperature of the second test was 3 to 5° C above the first rendering the two tests uncomparable. Emergence was accelerated by this temperature rise to a point where entries 6,7,9 and 10 reached 50% germination between 5.3 and 6.0 days vs 7.3 to 8.7 at -14 bars. Not all lines decreased time to 50% germination showing an interaction between temperature and entry. For example, Richardson 5530 reached only 40% germination after 14 days in -16 compared to 10.3 days for 50% in -14 (e group). The forage hybrids were included in the -16 test for comparison against the better grain hybrids but the 10 forages chosen were poorer than all but two of the grain types. DeKalb FS 25a+ required 8.2 days for 50% germination, Seedtec WAC Sic-um (SXS) 8.7 days and DeKalb SX 7+ 9.7 days. Five forage entries did not reach 50% within the 14 days.

This study shows that a large variation exists among the available commercial grain sorghum hybrids similar to the variation for water-use-efficiency, yield potential and insect and disease resistance. Although more laboratory work remains, future progress requires field research to determine actual emergence and collect yield data.