

Variability in Salt Tolerance within a Population of Alfalfa

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ABSTRACT

Genetic variability must exist for a selection program to be successful. Alfalfa seedlings were selected for salt tolerance after six weeks growth at 7500 ppm NaCl. The selection criteria considered plant height and survival. Variability for each factor within a population of alfalfa was shown. Both criteria were important and facilitated selection from those parents which contributed most to the salt tolerance of the population.

INTRODUCTION

Salinity tolerance in crops is becoming an important issue in irrigated areas such as Arizona. Selection and breeding for salt tolerance has become increasingly important to plant scientists in recent years (Norlyn, 1980; Noble, 1983). Before selection for a trait such as salt tolerance is possible, genetic variation must exist (Shannon, 1985). Alfalfa is the primary feed crop in Arizona and its variability in response to salt stress is discussed here.

MATERIALS AND METHODS

As part of a program to develop a salt tolerant population of alfalfa at the University of Arizona, a "salt box" was developed for propagation of seedlings under saline conditions (McKimmie and Dobrenz, 1987). Approximately 6400 seed were sown in the salt box at 7500 ppm NaCl salinity; the most vigorous (tallest, and with no salt-damaged leaves) plants were selected for crossing in the field. They were transplanted to an isolated crossing block in Marana, AZ and intercrossing was facilitated with honeybees. When seed was mature, it was harvested from individual parent plants and reseeded into plots in the salt box to produce the next cycle of plants. Parents were scored on the basis of the percent survival and height of their progeny (Table 1). The scoring system was designed as follows: parents whose progeny had greater than 58% survival after 6 weeks growth at 7500 ppm NaCl scored 9 points, 50-57% scored 7 points, 44-49% 5 points, 37-43% 3 points, 31-36% 2 points, and 0-30% 1 point. Scoring for height was 10 points for 14 or more plants (out of 100 seed planted) greater than 6 cm, 8 points for 10-13 plants, 6 points for 8-9 plants, 4 points for 5-7 plants, 2 points for 3-4 plants, and 1 point for the fewer than three plants which were taller than 6 cm. The two scores were added; this total score was assigned to the respective parent clone. The highest ranking clones were used to select from one to three of their tallest progeny. The progeny of the lowest scoring one-third of the clones were not used. Selected plants were again transplanted into the field to produce the next cycle of seed.

RESULTS AND DISCUSSION

The ranking system (Table 1) provided a good way to distinguish between clones to selection for salt tolerance. The variability which existed between seed from different parents of cycle II (and thus within the population) was evident. Percent survival ranged from 23-63 percent (Figure 1). Number of plants taller than 6 cm ranged from 0-15 (Figure 2). There was a positive correlation ($r = .69$) between survival and height. Despite the high r value for correlation, a perusal of Figures 1 and 2, where each clone occupies the same place on both figures, reveals that some clones' survival value did not parallel their height value. For this reason the authors feel justified in

using both values as criteria for selection purposes. In this way, a clone with a mediocre score in one variable, such as survival, would still have progeny selected if its score in the other variable was high. For a crop such as alfalfa where yield is related to both stand and vigor, the most favorable results would come from acknowledging both factors in a selection program. Thus it was possible to select from those parents from the previous cycle which contributed most to the salt tolerance of the population. See accompanying article "Progress in the development of salt tolerance in alfalfa."

Table 1. Scoring system used to rank individual alfalfa clones based on the survival and height of their progeny in the salt box. *

<u>Parameter Scored</u>	<u>Points</u>
<u>% Survival</u>	
58+	9
50-57	7
44-49	5
37-43	3
31-36	2
0-30	1
<u>No. Plants Taller Than 6 cm</u>	
14+	10
10-13	8
8-9	6
5-7	4
3-4	2
<2	1

* Progeny were selected from clones with highest combined scores.

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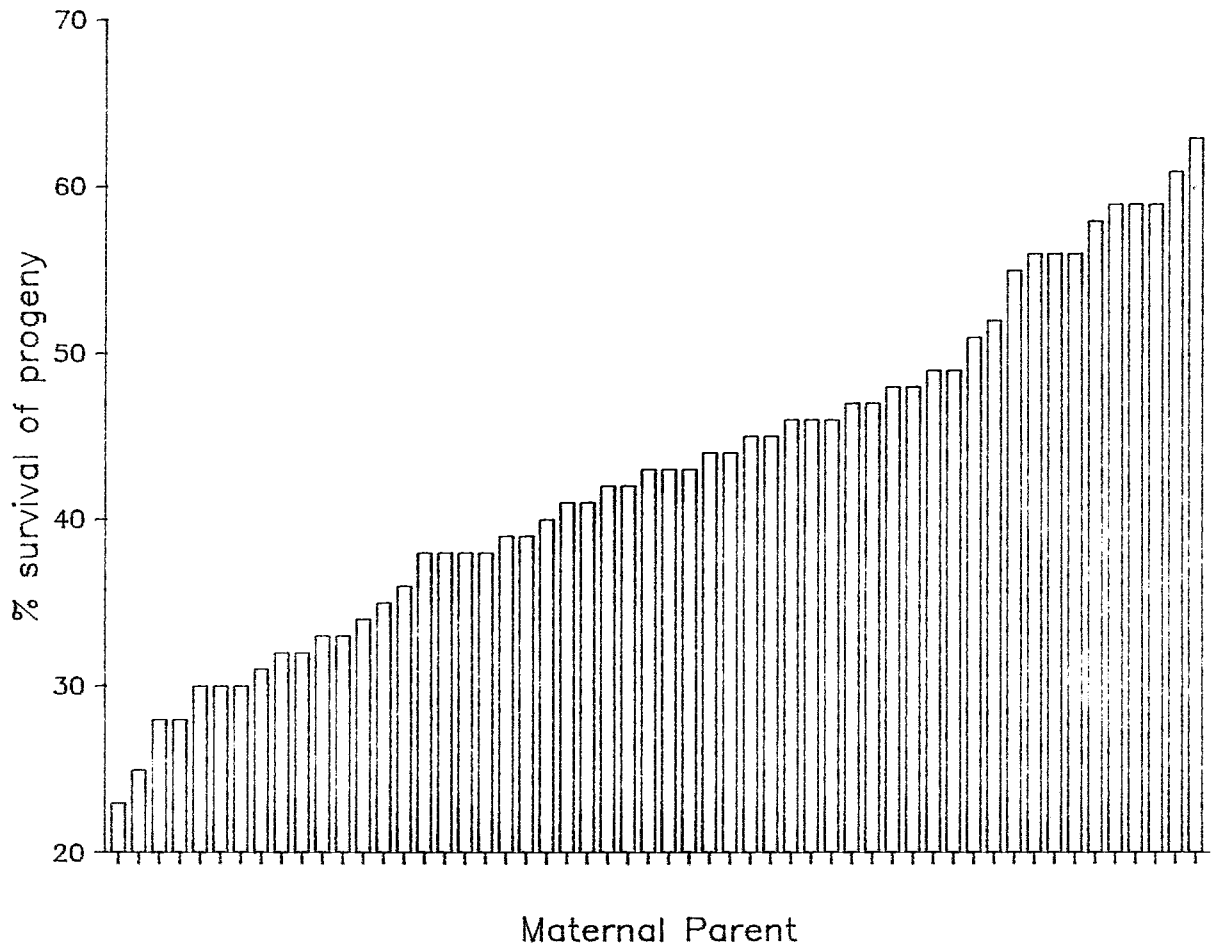


Figure 1. Percent survival of individual parent clones grown at -0.7 MPa NaCl for 6 weeks in the salt box.

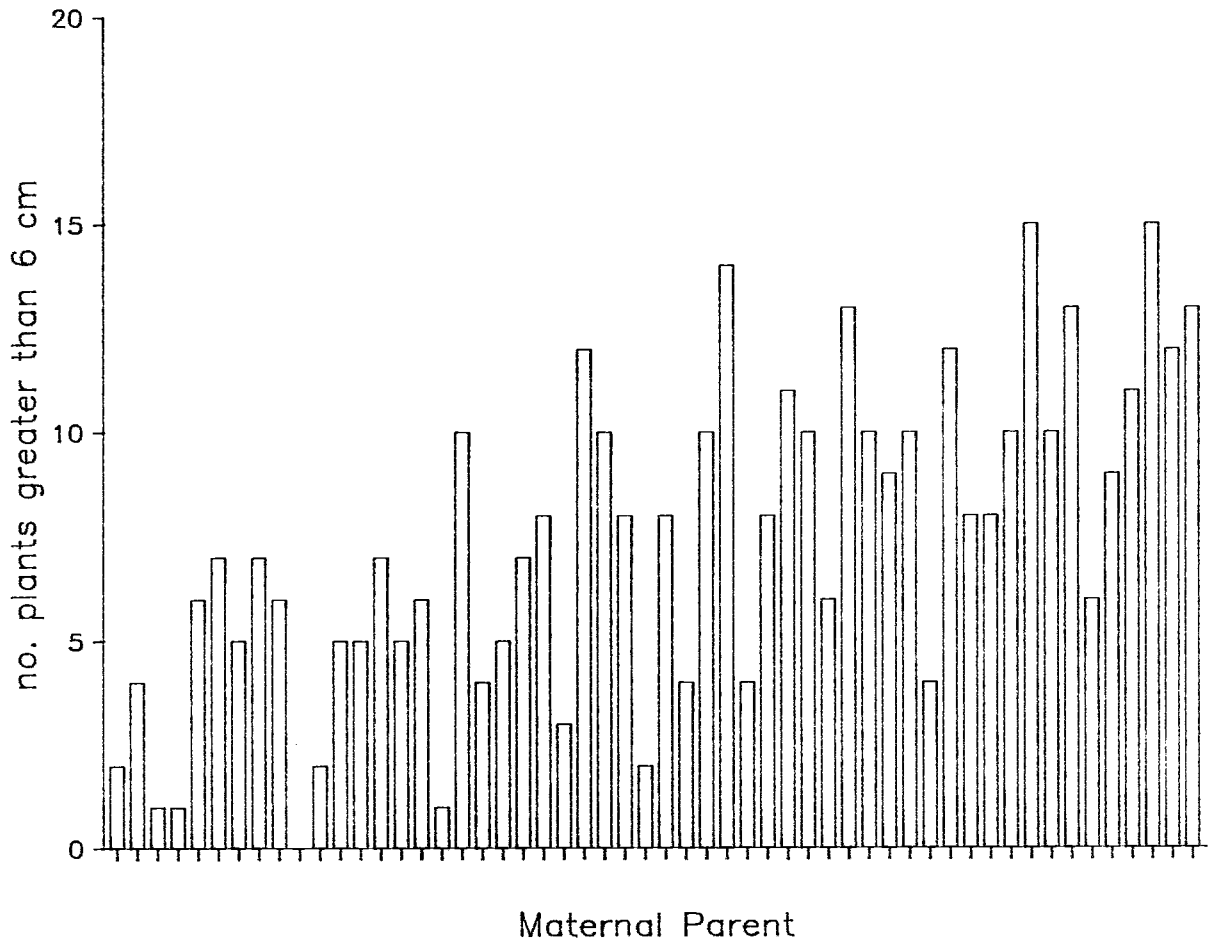


Figure 2. Number of tall seedlings (from 100 seed planted) of individual parent clones grown at -0.7 MPa NaCl for 6 weeks in the salt box. Clones occupy the same position as in Figure 1.