

# The Effects of Alfalfa Seed Scarification in Saline Environments

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## ABSTRACT

*The handling of alfalfa and other crop seed may result in seed scarification. Scarification may not affect germination of alfalfa seed in a non-saline environment, but may decrease germination where farmer's fields are severely salt-stressed.*

## INTRODUCTION

Alfalfa yields have tripled in Arizona since the early part of this century. Much of this increased productivity is due to cultural techniques, including improved seed quality. Seed scarification may inadvertently occur in the interval between seed harvesting and planting. While scarification reduces hard-seededness, it may also reduce protection against salinity offered by the seed coat and other tissues. The objective of this study was to determine whether scarification significantly affects the germination and salt tolerance of alfalfa seed.

## MATERIALS AND METHODS

Synthetic generations 1, 2 and 3 of an alfalfa population (AZST 1985) with significantly improved germination salt tolerance were compared with the parental cultivar, Mesa-Sirsa. The test seed was produced in the same year (1987) to avoid the effects of seed aging. Percent germination, germination speed index (GSI) and radicle length (RL) were evaluated in 0 and -2.0 MPa NaCl solutions. A fungicide (2.5 g/L Captan) was also added to each solution. Prior to planting, half of the seed was bulk scarified in a Forsberg scarifier. The seed was scarified by a 2-3 second cycle in the Forsberg accompanied by a single upward twist of the seed canister.

Petri dishes were planted with 50 seeds from each population and placed in plastic bags to prevent evaporation. The seed was germinated in a dark growth chamber at 26 °C and measured every day for 10 consecutive days. Percent germination and GSI were evaluated in the scarified treatment as the percent of non-hard seed. Hard seed, defined as non-imbibed seed, was counted at the end of the test period. The experiment was replicated 4 times and analyzed in a split split-plot design.

## RESULTS AND DISCUSSION

Overall, scarification of alfalfa seed led to increased percent germination, GSI and radicle length over non-scarified seed in the control solution (Table 1). However, the three parameters were greater for non-scarified seed in the salt treatment. The table demonstrates the salt treatment interaction, which was significant for all three germination parameters. Post hoc testing (Tukey HSD) revealed the significant differences between the means in the interaction.

For percent germination, no significant difference existed between scarified and non-scarified seed in the control, demonstrating that scarification does not harm germination in a non-stressful environment. On the other hand, non-scarified seed germinated significantly better than scarified seed at -2.0 MPa. Alternatively, it may be conjectured that scarification caused decreased germination in a saline solution.

Scarification appears to have significantly increased seed GSI in the control solution. However, germination onset and rate were not improved in a saline environment by seed scarification. Radicle length, a more sensitive measure of seedling vigor, showed significant differences between scarified and non-scarified seed in both the control and the salt solutions. Whereas scarification contributed to greater radicle length in the control, it may have led to decreased RL in the salt treatment. Conversely, the intact seed coat or other non-embryonic tissues may offer some temporary relief from corrosive NaCl which thereby promotes the radicle length of non-scarified seed.

It is recommended that seed be handled as carefully as possible to avoid scarification which might lead to lower germination, particularly in extremely saline environments. However, while the potential loss of germinated seed due to scarification is between 2 and 13 percent (Table 1) in the control and salt treatments respectively, losses of total seed in the sample are much greater due to hard-seededness in the control and roughly equal in the saline treatment. Scarification of alfalfa seed may have a more benign and possibly beneficial effect on germination in moderate salinities.

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Table 1: Salt x Treatment Interaction

	PG		GSI		RL		% Hard Seed		Potential % Seed Loss (Scarification)	
(MPa NaCl)	0	-2.0	0	-2.0	0	-2.0	0	-2.0	0	-2.0
Non-Scarified	96	49*	92*	22	4.4*	0.41*	16	12	---	---
Scarified	98	36	98	20	4.6	0.26	0	0	2	13

\*(HSD 5%)

PG: Percent Germination. GSI: Germination Speed Index 0 = no germination and 100 = 100% germination on the first day after planting. RL: Radicle length 0 = imbibed but no radicle visible; 1 = radicle 0.2 to 1.0 cm; 2 = radicle 1.0 to 1.5 cm; 3 = radicle 1.5 to 2.5 cm; 4 = radicle > 2.5 cm (all at 120 hours post initiation); 5 = radicle > 2.5 cm (at 72 hours post initiation).