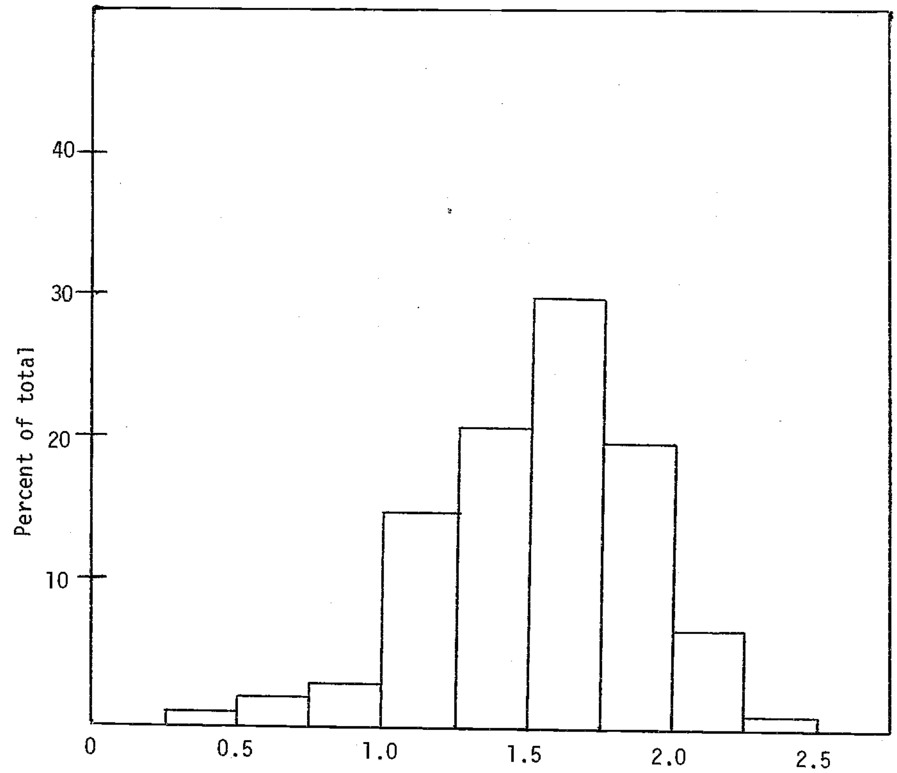

Figure 4. Frequency distribution of yield in 50 x 50 ft. blocks, August 8, 1982 cutting, tons per acre.

Excised Radicle Elongation of Alfalfa (Medicago sativa L.) in Various Salts at Differing Concentrations

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Summary

Excised radicle growth rates of the three populations of alfalfa in response to NaCl stress correspond to their original germination salt tolerances in NaCl solutions (AZ-ST 1982 > AZ-ST 1979 > Mesa Sirsa control). While this trend is not consistent for other salts studied (KCl, Na_2SO_4 and K_2SO_4), the control population always is less tolerant than either AZ-ST 1982 or AZ-ST 1979. This suggests that there may exist some biochemical connection or carry-over between germination salt tolerance and seedling salt tolerance.

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Three seeds lots of alfalfa seed cultivar Mesa Sirsa, representing three different levels of germination salt tolerance as developed by Dr. A.K. Dobrenz, were evaluated for excised radicle elongation in NaCl, KCl, Na_2SO_4 and K_2SO_4. The seed lots were as follows: foundation seed representing control populations unselected for germination salt tolerance; AZ-ST 1979 seed from parent plants that survived a moderate germination stress of -14 bar NaCl and AZ-ST 1982 seed from parent plants that survived a relatively high germination stress of -22 bars NaCl.

Preparation of Hoagland's solutions supplemented with either NaCl, KCl, Na_2SO_4, or K_2SO_4 at varying concentrations was conducted. Salt solution concentrations were theoretically determined on an ion equivalent basis, such that the Cl^- of KCl solutions were identical to the Cl^- of NaCl solutions and the Na^+ of Na_2SO_4 solutions were identical to the Na^+ of NaCl solutions. Actual water potential (ψ) values of all salt solutions were determined via a Wescor 5100 C Vapor Pressure Osmometer (Table 1). After germination for 2 to 3 days in sterile dd H_2O, one centimeter radicle segments measured from the root tips (10 per tubes, 2 tubes per salt concentration) were excised and allowed to elongate in the various solutions for 4 days in the dark, after which time total lengths were measured.

For all three populations, low levels of NaCl (7.09 g liter^{-1} or 278 millosmols kg^{-1}) stimulate elongation of radicles (Figure 1). With increasing concentrations of NaCl the 1982 germplasm invariably exhibits a higher growth response than the other two populations, although this was not proven statistically significant. The KCl experiments do not display a stimulation at low concentrations, with the exception of a very slight increase in radicle elongation in the 1982 population (Figure 2). There appears to be no clear-cut superlative germplasm in the KCl experiments, although the control germplasm in most solutions is less vigorous than the 1982 and 1979 populations.

The lack of a superior germplasm is even more apparent in Na_2SO_4 (Figure 3). All three populations generally respond to increasing concentrations of Na_2SO_4 with decreasing radicle length. In K_2SO_4 experiments, the 1979 germplasm appears less affected by the increasing concentrations of salt (Figure 4). In general, for all four salts, the control population of radicles displays less elongation than the germplasm selected for germination salt tolerance. This may reflect a generally less vigorous seed lot, since the control seedling radicles elongated less in unsupplemented Hoagland's solution than the selected populations, although this difference was not statistically significant.

In conclusion, this technique of evaluating radicle growth in salt solutions may provide a faster, less expensive preliminary screening method to evaluate seedling salt tolerance in a variety of genotypes of alfalfa and may possibly be expanded for use in other plant species as well. Additionally, other parameters, such as internal water status and cellular ion concentrations, besides growth could be evaluated via this procedure.

Table 1. Osmometer readings for radicle elongation salt solutions.

Solution	#1	#2	#3	#4	#5	#6
<u>milliosmols/kg</u>						
NaCl	32	278	327	382	475	575
KCl	32	251	329	385	445	500
Na_2SO_4	34	181	239	271	308	363
$_2SO_4$	38	144	196	225	254	288
<u>bars</u>						
NaCl	-0.80	-6.95	-8.18	-9.56	-11.88	-14.38
KCl	-0.80	-6.28	-8.23	-9.63	-11.13	-12.51
Na_2SO_4	-0.85	-4.53	-5.98	-6.78	-7.70	-9.08
K_2SO_4	-0.95	-3.60	-4.90	-5.63	-6.35	-7.20

<u>Conversion formula</u>

-bars = (osmol) (0.0831) (^{o}K) ^{o}K = 301.

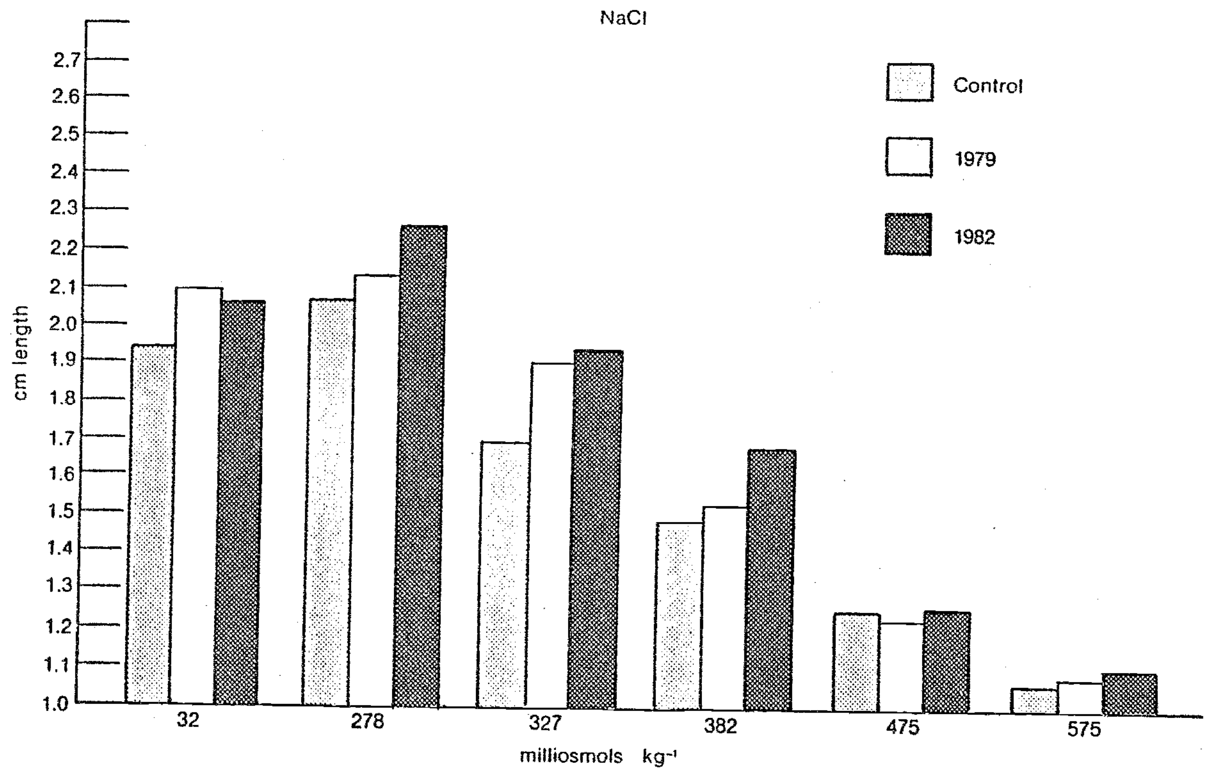

Figure 1. Radicle elongation responses of all three alfalfa germplasm lines in increasing NaCl solutions after four days at 28°C in the dark with continuous agitation.

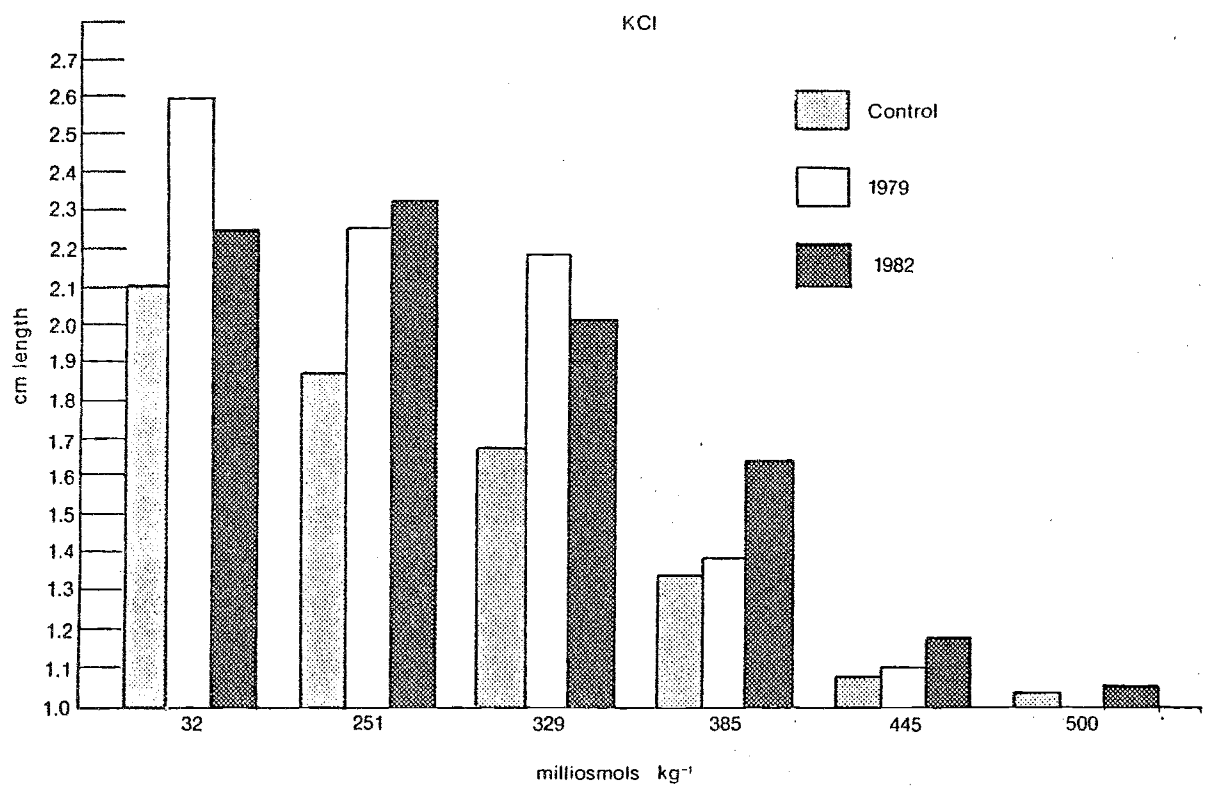

Figure 2. Radicle elongation responses of all three alfalfa germplasm lines in increasing KCl solutions after four days at 28°C in the dark with continuous agitation.

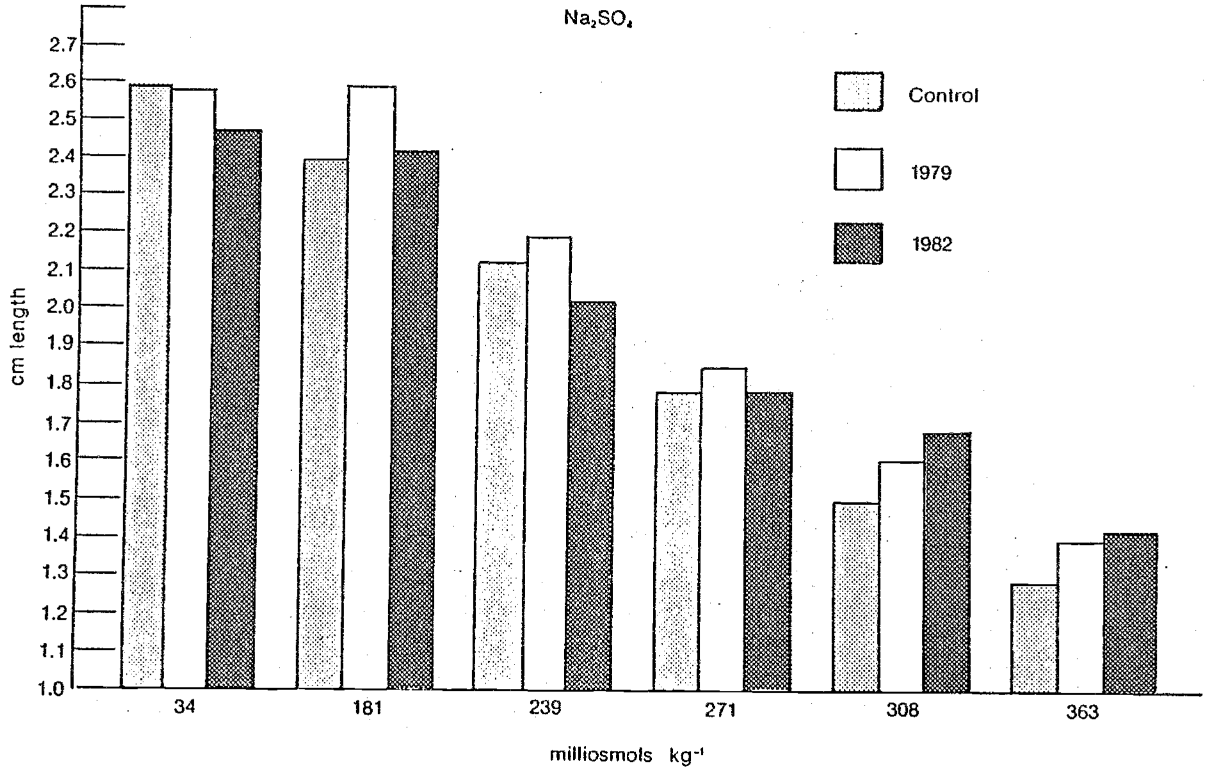

Figure 3. Radicle elongation responses of all three alfalfa germplasm lines in increasing Na_2SO_4 solutions after four days at 28°C in the dark with continuous agitation.

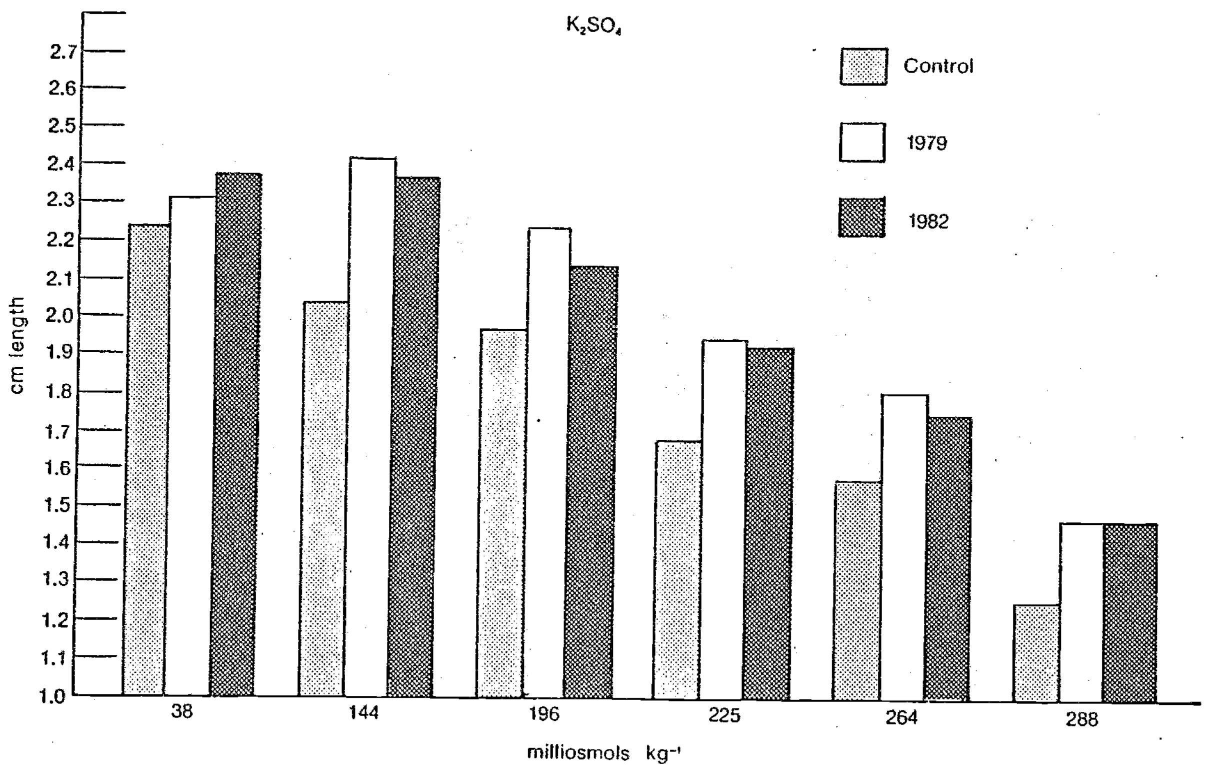

Figure 4. Radicle elongation responses of all three alfalfa germplasm lines in increasing K_2SO_4 solutions after 4 days at 28°C in the dark with continuous agitation.