

DEVELOPING SALT TOLERANT ALFALFA BEYOND THE GERMINATION STAGE

T. MCKIMMIE AND A.K. DOBRENZ

Seven years of selection for salt tolerance at germination has produced alfalfa seed with excellent germination quality. This work, carried on in the laboratory of professor A.K. Dobrenz, is now being taken a step further.

Although tolerance to salinity at germination is essential for growing plants in salty soils and/or salty irrigation water it does not ensure survival at later growth stages. Tolerance to salinity at the seedling stage and beyond probably involves different mechanisms from tolerance at germination.

Recent efforts by the authors involve a two-pronged attack at development of mature salt tolerant plants. In 1983 seedlings were grown to two weeks of age and then exposed to salinity equal to nearly two-thirds of sea water. The few survivors were placed in the field for crossing. The resultant seed is now being tested against the parent for germination, osmotic adjustment and survival during treatment similar to that from which the plants were selected. Although one generation of selection may not be adequate especially for a cross-pollinated tetraploid such as alfalfa, preliminary results do show some changes. An increase in vigor under salt stress seems to occur for some of the progeny. The reason for this may be better osmotic adjustment and therefore increased salt tolerance. The germination quality of this seed appears to have dropped in saline conditions however, and it remains to be seen whether this is acceptable.

The second stage of this effort combines both germination and emergence-establishment. An irrigation treatment box has been designed for greenhouse use which can handle 7,000 seed planted in flats. Using germination salt tolerant seed germination and emergence will occur below about -12 bars salinity (about one third seawater). Although the plants grow very slowly and many die after emergence, a few exhibit superior size and vigor and are chosen for transplanting and seed production in the field. The first year, 1984, of selection resulted in 80 plants selected from nearly 50,000 seeds screened. Seed from these plants will be harvested in the summer of 1985 and put through similar selection pressure. Comparison with the parent population on factors such as germination, establishment, vigor, osmotic adjustment, etc., will be done and another cycle of selection will follow.

When suitable material has been produced, perhaps as early as 1986, yield tests on some of Arizona's more saline lands will be conducted. Besides development of an alfalfa line with salinity tolerance at all growth stages the authors hope ultimately to answer questions concerning the physiological basis of salt tolerance. In order to accomplish this both tolerant and sensitive plants are needed for study. There has been difficulty obtaining such material, especially at the same growth stage. Further selection should produce this material and together with heritability data, help us to determine why one plant can cope with salinity better than another.