Improving the Germination Salt Tolerance of Alfalfa

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ABSTRACT

The development of alfalfa that can germinate at extremely high NaCl levels will improve early emergence and establishment of this important forage crop in saline soils. We have identified plants in the eighth cycle of selection that germinated at -3.0 MPa (30,000 ppm). Seed from these plants displayed a 40% better germination at -2.1 MPa (21,000 ppm) than the previous cycle. Germination at higher salt concentrations were not different between the two germplasm sources.

Alfalfa is very sensitive to salt in the germination stage of plant growth and development. We have been identifying plants which can germinate at increasing levels of salinity over the past 7 years and are now in the eighth cycle of selection for this particular trait.

Plants showing the ability to germinate at salt levels that eliminate 99% of the population are transplanted into crossing blocks at the Marana Agriculture Center; seed is produced for use in the next cycle of selection. We started with the cultivar 'Mesa-Sirsa', which germinated about 1% in NaCl solutions of - 1.35 MPa (13,500 ppm). At present, we have raised this selection pressure to -3.0 MPa (30,000 ppm) which is slightly more concentrated than sea water.

Cycle8 Syn_1 seed germinated better than Cycle7 Syn_1 seed at all salinity levels except -2.5 MPa (Figure 1). Germination was not different between the Cycle7 and Cycle8 seed at the highest and lowest salinity levels.

However, at salt concentration of -2.1 MPa (21,000 ppm), the Cycle8 seed germinated more than 40% better than the previous cycle. Plants from the Cycle8 seed, which germinated at -3.0 MPa, have been transplanted to the Marana Agriculture Center and are being cross pollinated this summer. We plan to continue to select for germination salt tolerance until the maximum gene expression for this trait is obtained.

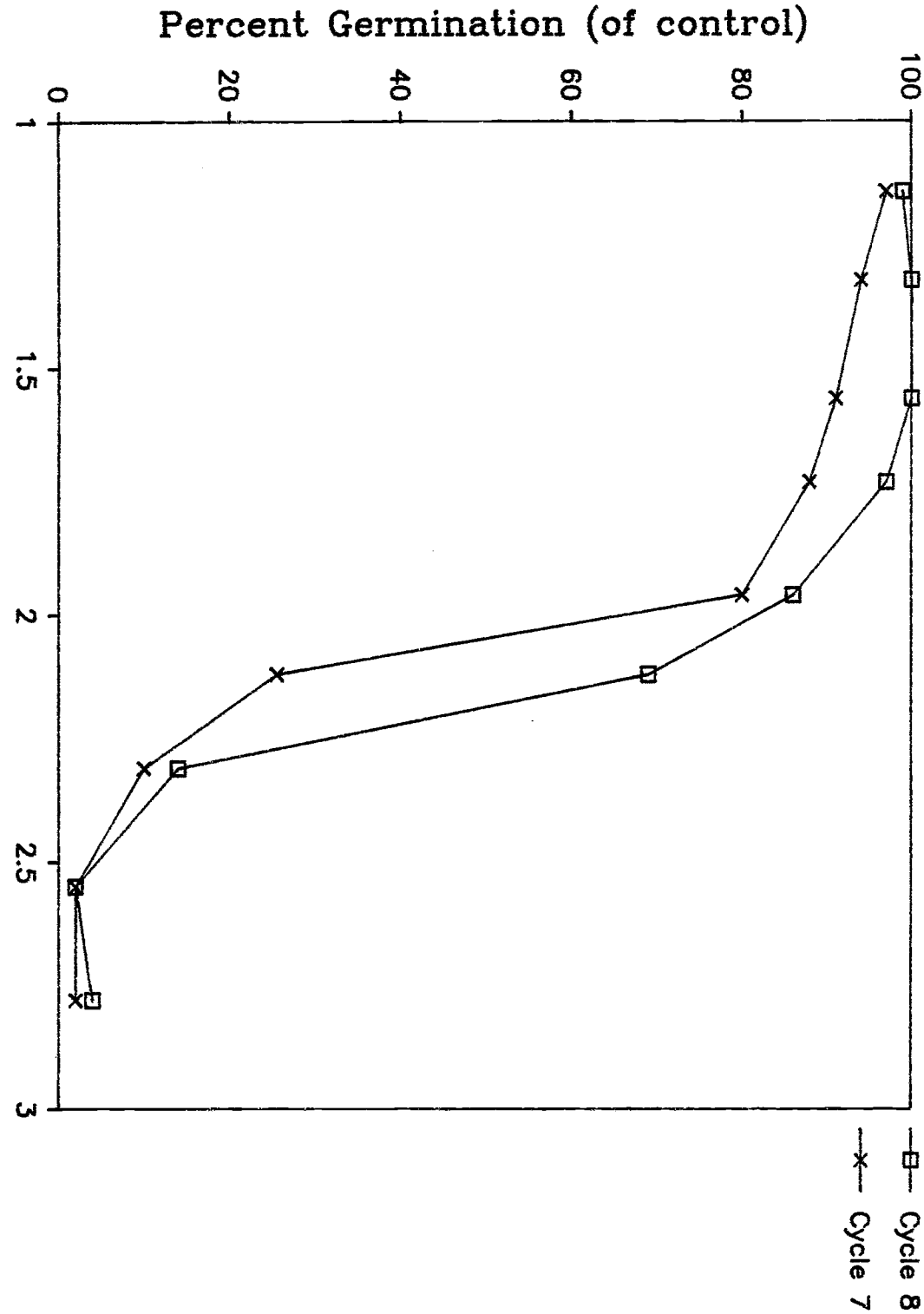

Figure 1. Percent germination of Cycle$_7$ and Cycle$_8$ germination salt tolerant alfalfa at osmotic potentials of NaCl ranging from 1 to -2.8 MPa.