Evaluating selection criteria to improve salt tolerance in white clover (trifolium repens l.)

C. L. Noble and M. E. Rogers

Institute for Irrigation and Salinity Research, Department of Agriculture and Rural Affairs, Tatura, Victoria 3616

In Southern Australia, white clover (Trifolium repens L.) occupies a large area of irrigated land affected by salinity. Improving its salt tolerance is a high priority to maximise pasture production but is dependent on the genetic variation for salt tolerance within white clover and on the identification of efficient selection criteria. Our research examines the use of physiological selection criteria to improve salt tolerance in white clover.

Methods

A more detailed description of the Methods is given elsewhere (1). In a series of experiments white clover cv. Haifa plants were grown in solution culture tanks containing modified half strength Hoagland solution and NaCl levels ranging from 0 to 80 mMNaCl. Phenotypic measurements (survival, leaf damage, yield) and physiological measurements (tissue ion content) were made on each plant. Based on these measurements over several harvests, individual plants were selected. Plants were subsequently crossed amongst themselves within each selection group.

Results and discussion

The selections for increased salt tolerance based on yield were not entirely successful and it was concluded that yield is influenced by too many genetic and environmental factors to be a useful criterion in rapid selections for salt tolerance of white clover unless extreme selection pressures can be applied.

The use of physiological criteria such as the accumulation or exclusion of Na or Cl ions have proved to be effective especially at higher salinities (Table 1). Both Cl and Na exclusion from the shoot are heritable and may be associated with high growth under saline conditions.

Table 1. Shoot Cl of the selection derived populations high Cl' and 'low Cl' and the parent cv. Haifa when grown over a range of salinities.

Salt Concentration		Shoot Cl (% Dwt)	
mM	Haifa	High Cl	Low Cl
0	0.95	1.17	0.75
15	2.04	2.00	1.51
30	2.49	2.83	2.11
45	3.15	3.40	2.61
60	3.47	3.93	2.79
75	3.75	4.20	3.09

Further research, studying the use of osmotic criteria (eg osmotic adjustment under salt stress) to identify salt tolerance at low salinity levels, is currently underway.

1. Noble, C. L., and Shannon, M. C. (1987). Proc. 4th Aust. Agron. Conf., Melbourne, 305.