



STUDIES ON WATERLOGGING TOLERANCE

IN LUCERNE, *Medicago sativa*, L.

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by

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SUMMARY

The tolerance to waterlogging of eight lucerne varieties was assessed in the glasshouse using three South Australian soils which are prone to waterlogging during the winter. Four introduced varieties from Russia and North America, which have a common ancestry in the floodland ecotypes of central European Russia, were more tolerant than four Australian registered varieties. Under flooding the introduced varieties were higher yielding and retained a higher proportion of actively growing plants. The effect of flooding varied between the three soils, but the ranking of the response of the varieties was generally similar in all the soils.

In a second glasshouse experiment hybrid populations of crosses between the four tolerant varieties and the four Australian varieties were intermediate in performance when assessed for yield, shoot production, retention of meristematic activity and a score for leaf colour, senescence and loss. The population x soil interactions within the flooded treatment were again generally insignificant.

A group of four parents, two tolerant and two intolerant under glasshouse conditions, and hybrids between these tolerant and intolerant parents were studied as replicated clones of individual plants in a flooded field experiment conducted during the winter at Meadows, near Adelaide. Survivors from the previous experiment and unselected control clones were included. There were few significant differences between the survivors and the control population when they were compared by measuring components of plant growth and assessing their appearance.

In the field the tolerant introduced parents were more winter-dormant than the intolerant Australian varieties and for a number of weeks after flooding was imposed they suffered less deterioration of their leaf tissue and the hybrid populations once again were intermediate.

After prolonged flooding almost all the surviving clones were hybrids and all the parental clones, except for a small number of one introduced variety, had been killed.

The most consistent criteria for assessing the tolerance of populations and clones in either the glasshouse or field were the retention of meristematic activity and the appearance of leaf tissue. Plant yield was not a reliable criterion for selection in the glasshouse because the prevailing temperature and light conditions did not permit resolution of differences in winter-dormancy. Regrowth after flooding in the glasshouse was not a suitable index for the selection of tolerant plants. Shoot production per plant under both flooded and nonflooded conditions reflected varietal differences in the propensity to produce shoots and plant dormancy rather than flooding tolerance.

The methods which might be used to continue selection for a lucerne population incorporating both waterlogging tolerance and other desirable agronomic characteristics are discussed. The intravarietal variation expressed by the four introduced varieties and one Australian variety, 'Demnat', and the superior performance after prolonged flooding of some individual clones from first generation hybrids indicate that the breeding of a waterlogging tolerant variety adapted to southern Australia can be pursued.

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STATEMENT

This thesis contains no material which has been accepted for the award of any other degree or diploma in any University and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except when due reference is made in the text of the thesis.

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