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The Effect of Aluminium on the Nodulation of Lucerne: A Comparison of Two Rhizobia Strains and Two Lucerne Lines

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A significant barrier to wider adoption of lucerne is the sensitivity of this legume to acidity, which is often correlated to high available aluminium (Al^{3+}). This affects the survival of rhizobia (1) and interferes with the legume–rhizobia symbiosis (2). Recent work in Australia has identified acid tolerant rhizobia that can increase nodulation at low pH (3). However, the effect of Al^{3+} on these strains has not been investigated. This study compared the effect of Al^{3+} on the nodulation of lucerne plants inoculated with the current commercial strain of *Sinorhizobium meliloti* used in Australia and New Zealand (RRI128) alongside an acid tolerant strain (*S. meliloti* SRDI736).

The experiment was conducted in a hydroponic system. Nodulation of lucerne by RRI128 and SRDI736 was tested at four Al levels (0, 2, 4 and 8 μ M) at pH 5.1. ‘Stamina 5’, a cultivar sown in New Zealand, and ‘TA37’, a line bred in Australia with increased Al^{3+} tolerance, were compared.

The combination of Al^{3+} tolerant lucerne (TA37) inoculated with an acid tolerant rhizobia (SRDI736) produced more nodules per plant (3.3 vs. 1.0; $P<0.01$) and a higher percentage of plants nodulated (91 vs 41%; $P<0.01$) compared with TA37 plants inoculated with RRI128. Stamina 5 inoculated with SRDI736 also produced more nodules per plant (1.1 vs 0.3; $P<0.01$) and had a higher percentage of plants nodulated (46 vs. 12%; $P<0.01$) compared with Stamina 5 plants inoculated with RRI128. Overall, however, Stamina 5 had a lower percent of plants nodulated compared with TA37. As the concentration of Al^{3+} increased, nodules per plant decreased ($P<0.05$) for plants inoculated with SRDI736 and RRI128, irrespective of cultivar. However, the combination of TA37 and SRDI736 still had more ($P<0.01$) nodules per plant compared with standard lucerne/rhizobia combinations at 8 μ M of Al. This confirms progress in selection of aluminium tolerant plants and rhizobial strains, and highlights potential for lucerne production in soils previously seen as having problematic levels of Al^{3+} .

References:

- [1] Wood (1995) *Plant and Soil* 171:63-69
- [2] Alva et al. (1988) *Agron J.* 80: 836-841
- [3] Charman et al. (2008) *Aust J Exp Agric.* 48:512-517