Acid soil tolerant lucerne – a pasture legume option for acidic soils in New South Wales

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Introduction

In NSW soil acidification is limiting the pasture options for livestock enterprises (Mead *et al.* 2002) and it is estimated that 13.7 million hectare of agricultural land is seriously affected by acidification, and a further 6 million hectares would develop this problem (Fenton 2001; Fig 1). Perennial pasture legumes such as lucerne are sensitive to low pH soils (<4.8 $CaCl_2$) with high aluminium levels. The combination of aluminium toxicity and pH sensitivity leads to poor root growth with low dry matter production (Edmeades *et al.* 1991). The application of lime is an option for low pH soils in some instances, but it is not an economically viable option for amending subsurface soils (Scott *et al.* 1997; 2000).

The lucerne breeding and development program based at Tamworth is providing a genetic solution to this complex and difficult problem through the development of lucerne germplasm with improved tolerance for lower pH soils and aluminium toxicity. This work was initially conducted in collaboration with SARDI through funding support from the CRC for Plant Based Management of Dryland Salinity and Industry & Investment NSW.

Methods

Populations of lucerne seedlings were initially evaluated using a modified solution screening method developed and implemented at Wagga Wagga Agricultural Institute by Scott *et al.* (2008). Several thousand seedlings were initially

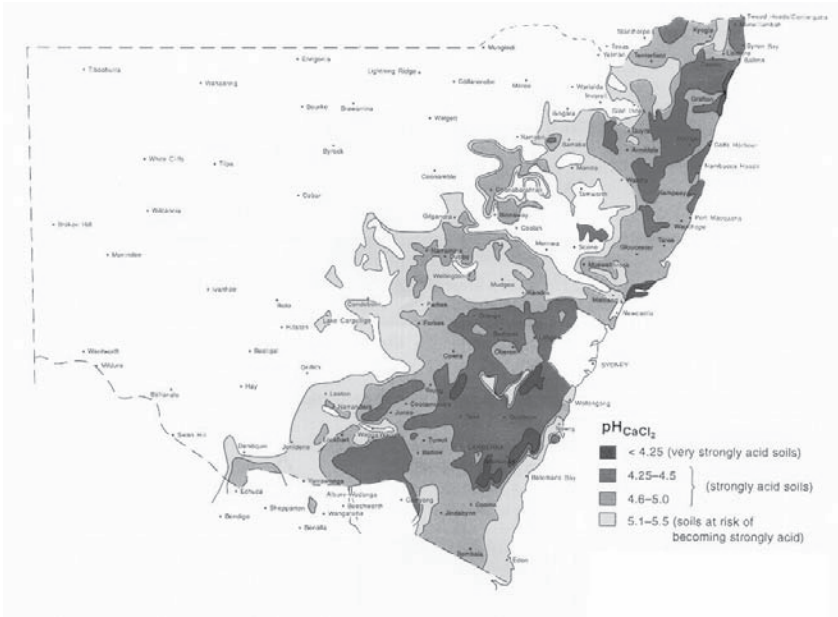

Figure 1. NSW map showing acidic soil areas (from Fenton 2001).

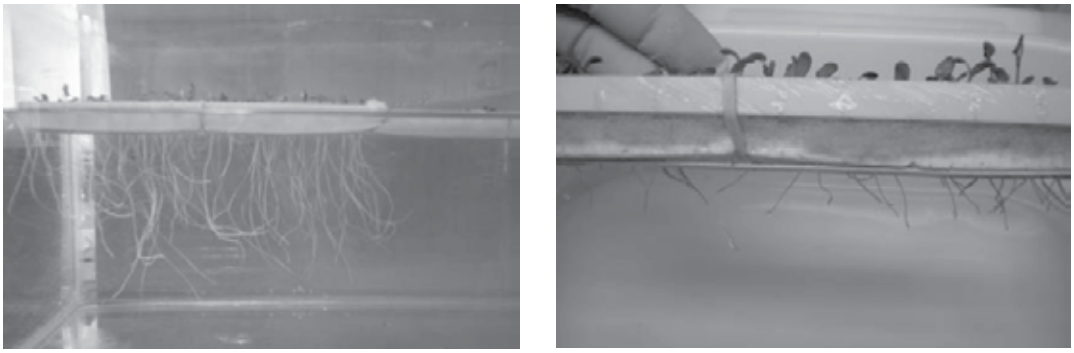

Figure 2. Seedlings of lucerne showing normal root growth (L) and with root re- growth after being subjected to an Al pulse and pH 4.3 solution in culture (R).

screened, recurrent selection was conducted, and plants were selected for their tolerance to the "aluminium pulse" with a solution culture pH of 4.3 (Fig 2). Root regrowth was measured for each seedling and the seedlings with the highest root regrowth were selected (Fig 2) for further crosses in the glasshouses at Tamworth. With each recurrent selection cycle, crosses were conducted to improve the populations for their tolerance to aluminium toxicity under low pH conditions.

A field trial was sown at Binnaway in 2006 to evaluate the improved germplasm selected from the laboratory based screening method. The trial was established with the assistance of weekly watering due to drought conditions. Dry matter production was recorded although growth was slow during some periods due to limited moisture availability. Putative candidate lines will be selected for further advancement.

Results and discussion

Evaluation of germplasm in the field has demonstrated a positive correlation between plant populations selected through the solution screening method in the glasshouse and their field performance. Several populations have been identified as having potential to progress further through crossing. It is expected that once the trial is completed and results analysed there will be germplasm with improved tolerance to acid soils suitable for selection in the near future. It is anticipated that the work currently being conducted through the Future Farm Industries CRC will result in selections of acid soil tolerant rhizobia. The combination of both acid soil tolerant germplasm and rhizobia will provide an exciting new perennial legume pasture option for NSW growers.

References

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