

Lucerne decline - the role of soil acidification and herbicides

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There is widespread concern that pasture legumes, particularly *Medicago* species have shown a marked decline in productivity over the last 10 to 15 years in South Australia (2,4). One area where this has become evident is the Mid-north of South Australia where lucerne. *Medicago sativa*, seed and hay yields have declined significantly. A survey conducted by the author (D.J.K.) has shown a decline in average seed yields from 400 kg/ha to 50 kg/ha over the last ten years (5). As part of the initial research into the problem soil acidification was identified as a possible factor, as pH (H₂O) at 0-10 cm was as low as 4.9 in problem paddocks and a response to lime was obtained in pot experiments (5).

Methods

Questionnaire surveys in 1992 of 100 farmers in the Mid-north of South Australia were used to determine the extent and severity of declining lucerne yields and to identify management practices which may be contributing to the problem. The survey was analysed using cross tabulations (Statistical Analysis System. Carey N.C.). From survey results 50 paddocks were selected to sample soil pH and *Rhizobium* populations. *Rhizobium* numbers were determined using most probable number counts (1).

Results and discussion

Most probable number counts of *Rhizobium* under mature and newly established lucerne stands in the Mid-north of South Australia in 1992 were low, regardless of whether the seed was inoculated at sowing. All paddocks sampled had less than 1000 *Rhizobium* per gram of soil, which is insufficient for effective nodulation. The pH (H₂O) of soil at 0-20 cm ranged from 4.9 to 6.2 which is below the optimum level for lucerne growth.

The survey highlighted the heavy reliance on herbicides in the farming system, particularly Glean (chlorsulfuron). 78% of farmers surveyed use this herbicide on the lucerne crops annually. These herbicides and their residues are of significant concern because of their effects on annual legumes. They may have an adverse effect on populations of *Rhizobium*, while also retarding or inhibiting the nodulation process either directly or through general effects on host physiology (3). The information so far suggests low lucerne yields are related to the lack of effective *Rhizobium* in the soil which has resulted from soil acidification and herbicide use. These hypotheses and Methods of ameliorating these problems and improving lucerne production are currently being investigated.

References

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