Subclover and perennial grass pasture growth and botanical composition responses to liming South Australian acidic soils

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Surveys of South Australian permanent sown pastures in the south-east region (2) and the Mt. Lofty Ranges and Kangaroo Island (3) showed the incidence and degree of soil acidity, low soil fertility, and poor pasture growth and composition. In the south-east two commonly occurring acidic soil types, siliceous sand over clay (Db/Dy) and siliceous sand over organic matter/sesquioxide pan (Lk). had clear associations between acidity. soil fertility, pasture composition and growth, and length of time under improved pasture. The more complex variety of soil types in the Mt. Lofty Ranges and Kangaroo Island did not show clear associations between the above factors and pasture age.

Methods

In May 1986, liming rate experiments were established on 9 of the major acidic soil types surveyed (2 in the south-east, 4 in the Mt. Lofty Ranges, 3 on Kangaroo Island). These included yellow, and brown duplex (Dy/Db) podzolic and lateritic soils varying in surface texture from loamy sand to loam. Initial soil pH_{ca} in the 0-10 cm depth ranged from 3.9 to 4.5. Average annual rainfall ranged from 550 to 900 mm. A good quality lime (Mt. Gambier) spread at 12 rates from 0 to 4. 6, or 8t/ha, depending on soil pH buffering capacity, was incorporated to 10 cm. Subclover and perennial grass mixtures were sown using rates, cultivars, grass species and fertilizer, according to district recommendations for high productivity. The experiments have been monitored intensively for soil and plant responses, periodically cut and/or grazed with sheep, and annually topdressed with maintenance fertilizer as reported in (I) and (4).

Results and discussion

At the Mt. Lofty Ranges and Kangaroo Island sites changes in soil pH and plant leaf nutrient concentration due to liming occurred in the first year (4). Plant growth and botanical composition responses took longer to become evident. Growth responses (of up to 60%) were most commonly found in late autumn to mid winter. Sites differed in time lag between lime application and growth response. varying from I to 7 years. This time lag appears to be related *infer a/ia* to initial soil extractable Al concentrations (0.01 M $CaCl_2$ by ICP-AES). The first site to show a lime response had about 7pprn Al; the latest site to respond had the next to lowest concentration of 2.7ppm; the lowest site (1 .7ppm) responded in the sixth year. Once responsive, Mt. Lofty Ranges sites have continued to respond.

Pasture composition changes have varied with site. Perennial ryegrass was generally unresponsive to lime. Subclover proportion increased with lime at the most growth responsive sites (limited by high lime rates at some sites with low Mn levels in leaves). Phalaris (probably cv. Australian) originally present at two sites has been the most responsive perennial grass to increasing lime. Cocksfoot responses at two sites out of four were masked by cocksfoot deaths where waterlogged. The annual grass soft brome has gradually invaded heavily limed (>3t/ha) plots at one site. Generally, sown species have gradually outcompeted weedy species such as sorrel and winter grass *(Poa annua),* where limed.

Acknowledgements

This project was funded by the Wool Research and Development Council of Australia.

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