Agronomic Dilemma in Managing Acid Soils: Silver Grass or Barley Grass

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Abstract

Two permanent pastures (annual vs. perennial pastures) were established in 1992 as part of the long-term field experiment, MASTER - Managing Acid Soils Through Efficient Rotations. The primary objective of the experiment was to develop an agricultural system that is economically viable and environmentally sustainable on the highly acidic soils in south-eastern Australia. This paper reports the long-term trend of botanical composition for both annual and perennial pastures. Liming has changed the pasture botanical composition dramatically. The limed treatments had a greater proportion of high quality species and a lower proportion of weeds compared with the unlimed treatments. Lime has successfully kept silver grass (*Vulpia* spp.) content under 8% in perennial pasture and under 18% in annual pasture. However, the latest results showed that barley grass (*Hordeum leporinum*) has been gradually ingressing, especially on the limed annual pasture.

Key Words

Acid soil, botanical composition, lime, pasture, annual pasture, perennial pasture.

Introduction

The acidification of soils is a serious problem in the 500 - 850 mm rainfall zone from central NSW to central Victoria. Many pastures in this region are degraded (3) mainly due to soil acidity. A long-term pasture/crop rotation trial, known as MASTER - Managing Acid Soils Through Efficient Rotations, commenced in 1992 at Book Book (147?30′E, 35?23′S), 40 km southeast of Wagga Wagga in a 650 mm rainfall zone (2). The primary objective of the trial was to develop an agricultural system that is economically viable and environmentally sustainable on a highly acidic soil in south-eastern Australia. This paper discusses the long-term trend of the botanical composition changes under both annual and perennial pastures with and without lime application.

Results

Pastures were established in autumn 1992. Annual pasture was sown to annual ryegrass (*Lolium rigidum* cv. Wimmera) and subterranean clover (*Trifolium subterraneum* cv. Junee, Goulburn and Trikkala) and perennial pasture was sown to phalaris (*Phalaris aquatica* cv. Australian and Holdfast), cocksfoot (*Dactylis glomerata* cv. Currie), lucerne (*Medicago sativa* cv. Aurora) and subterranean clover (same cultivars). An initial lime application (around 3.7 t/ha) was incorporated into 0-10 cm soil depth on all plots of the limed treatments in 1992 to increase pH_{Ca} from 4.0 to 5.5 and the maintenance lime (around 2.5 t/ha) was top-dressed at the start of phase 1 at 6-year intervals to maintain an average pH_{Ca} of 5.5 in the 0-10 cm depth over the six year liming cycle. Botanical composition was measured by the dry-weight-rank method (1) at least twice a year from 1992 to 1999 and the paper reports the trend of botanical composition in September/October from 1997 to 1999.

Pasture responses to lime have been measurable as differences in botanical composition rather than pasture yield. Trends in botanical composition have become more obvious since 1997. The proportions of subterranean clover and introduced grasses were higher on the limed treatments than unlimed treatment on both annual and perennial pastures (Fig. 1). The proportion of silver grass was less than 8% on the limed perennial pasture, but more than 26% on the unlimed perennial pasture. A similar trend was found on the annual pasture, but with a much higher silver grass population on the unlimed treatment (up to 41%). In contrast, the proportions of barley grass on the limed treatment increased greatly from 1% on both annual and perennial pastures in 1997 to 19% on annual pasture and 13% on perennial pasture in

1999, whereas the proportion of barley grass was under 5% on both unlimed treatments (Fig. 1). By 1999, barley grass plus silver grass composition was 31% for the limed annual pasture, approaching the comparable figure for the unlimed annual pasture of 37% (Fig. 1).

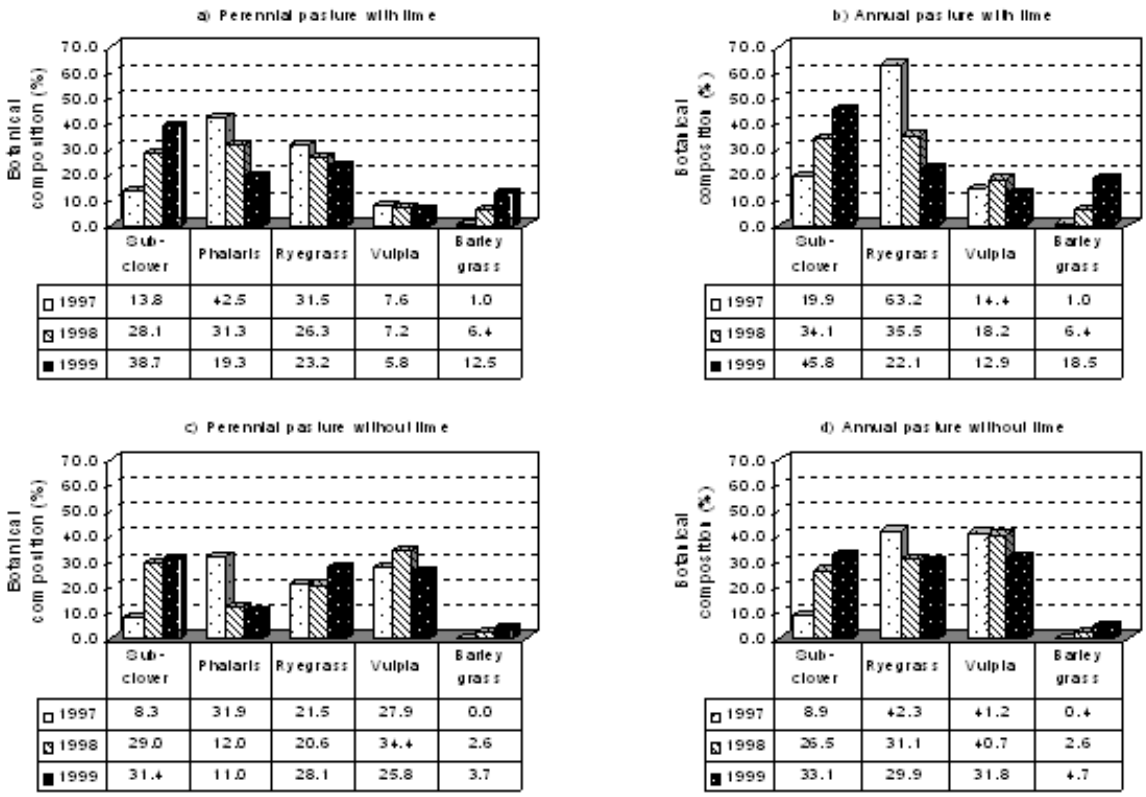

Figure 1. Botanical composition (%) in September/October 1997-99.

Discussion

The phalaris based perennial pasture was more sustainable in terms of maintaining the sown species than annual pasture. The combination of phalaris and liming has been effective to date in restricting the silver grass component of the pasture. It remains to be seen whether barley grass could be controlled effectively on the limed phalaris pasture. In contrast, the annual pasture is not stable. Liming has kept silver grass under 18% to date, however, the annual ryegrass has been gradually replaced by barley grass. The dominance of silver grass is an indicator of degraded pasture of this region. This is typical for the highly acidified soils. Liming changed the botanical composition dramatically. Higher proportions of subterranean clover and the introduced species in pastures resulted in higher quality feed on offer. Results of animal responses to lime from the MASTER experiment show that the limed pastures carried 21% more sheep (up to 4 extra dse/ha) compared with the unlimed pastures while maintaining comparable liveweight gains and wool production per head (averaged across 8 years). As a result, sheep on the limed treatments produced 27% more liveweight and 22% more wool per hectare compared with the unlimed treatments (G. D. Li and K. R. Helyar, unpublished data). These increases in sheep production have been sufficient for lime to be profitable on the permanent pastures in southwest slopes of NSW when the wool price exceeds about $4.50/kg (19 micron greasy wool).

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