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CHANGES IN PASTURE GROWTH RATE DUE TO FERTILISER AND GRAZING MANAGEMENT

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Abstract

It is imperative that sheep production systems in southern Australia continue to be refined so producers remain financially viable but at the same time the environment is not degraded. As part of a national thrust for development and promotion of better production systems, one research site has been established in Victoria where pastures and animal production are measured together with water and nutrient movement. Results for pasture growth rates over two years are presented here and will be used to develop best industry practice at completion of the project.

Keywords: Phalaris, subterranean clover, phosphorus, stocking rate, sheep

Introduction

There is an urgent need for many livestock producers in southern Australia to increase the efficiency of production in order to remain financial viable. A contributing factor to this pressure has been the decline in the quality of pasture over large tracts of this region during the last three decades (Quigley *et al*. 1992, Kemp and Dowling 1991). Causes have included reduced fertiliser inputs, reduction in resowing, over-grazing in summer and autumn, and under-grazing in spring (Mason and Andrew 1998). Perennial ryegrass (*Lolium perenne* L.) pasture and animal production can be substantially increased by optimising rates of applied phosphorus fertilisers in this climatic region (Cayley *et al*. 1998, Cayley and Kearney 2000). The additional benefits from using improved pasture species together with appropriate rates of phosphorus fertiliser have now been demonstrated for pastures based on perennial ryegrass and phalaris (*Phalaris aquatica* L.) mixtures (Saul *et al*. 1993) or for ryegrass alone (Waller *et al*. 1999). Other research has shown that phalaris-based pastures have potential for higher productivity when some form of controlled grazing is implemented (Lodge 1997). In Australia, however, farm pastures are normally continuously grazed (Cook *et al*. 1978). This paper reports preliminary data for growth rates of pastures subjected to different grazing management treatments. The project was designed to develop best industry practice for sheep production from pasture in the temperate zone of southern Australia.

Material and Methods

The site for this experiment (37^0 24’ S, 141^0 55’ E) formed part of a national network of sites, each examining different tactical strategies for improving animal production, and at the same time maintaining environmental sustainability. The 20 ha site was sown to phalaris cv. Australian and subterranean clover (*Trifolium subterraneum* L.) cv. Trikkala in 1994. In July 1997, five grazing management treatments were replicated three times in plots 1.5 to 2.25 ha each (Table 1). These were stocked with Merino ewes. Those in the 4-paddock rotation were moved to fresh pasture every 2 weeks, except in spring when they were moved weekly. Ewes on the variable rotations were moved every 2 to 12 days, depending on pasture growth, except from lambing (August) to weaning (November) when they were set-stocked. Ewes were weighed every 4 to 6 weeks, and stocking rates were adjusted several times per year to achieve similar liveweights across all treatments.

The low and high P treatments received 8 and 30 kg of phosphorus respectively, applied as superphosphate in autumn each year. The nitrogen treatment had 50 kg N/ha applied in March and 50 kg N/ha applied in late July.

Pasture growth was measured monthly during the 1998 and 1999 growing seasons using 20 or 24 exclosure cages per plot (Cayley and Bird 1996). Herbage mass was determined using a falling-plate pasture meter (manufactured by Arborline Pty Ltd, Hamilton, Victoria). The meter was calibrated using 12 herbage cuts, each time measurements were made.

A linear mixed model was fitted using ASREML (Gilmour *et al*. 1997) to test for the effects of treatment on pasture growth rate interacted with a cubic smoothing spline of time.

Results and Discussion

The level of P on the set-stocked treatments (A and B) did not affect pasture growth rates. It is likely that, after 2 years from starting this experiment, there has been insufficient difference in soil available phosphorus to lead to differences in pasture growth rates. Measurement for an additional two growing seasons, with continuing differential fertiliser application, will assist in clarifying this conclusion.

There were no significant differences among any of the rotational-grazed treatments (C, D, and E), therefore only treatment E is shown in Fig. 1.

A combination of nitrogen fertiliser and rotational grazing (E) significantly (P<0.05) increased growth rates above set-stocked treatments (A and B) (Fig 1). The set-stocked, low P treatment (A) had significantly (P<0.05) lower growth rates than all the rotation treatments (C, D and E) which also had high P. There was a significant curvature trend between years

($P<0.05$) but no significant interaction between year and management treatment. These differences in growth have been attributed to differences in phalaris tiller size but not differences in tiller density (Cullen *et al*. 2000).

In 1998, pasture growth commenced following rainfall in April (77 mm monthly total) but conditions after this were generally dry until further heavy rain in June (93 mm monthly total), by which time mean daily temperature was 7.6^{0}C and limiting pasture growth rates. In 1999, growth commenced in March (54 mm monthly total) with additional good rainfall in May (99 mm monthly total). Although combined winter and spring rainfall was higher in 1998 (439 mm) than 1999 (299 mm), maximum growth rates were approximately 57 kg DM/ha/day and 67 kg DM/ha/day in 1998 and 1999, respectively. Thompson *et al*. (2001) have shown that sheep production from this site was substantially improved in response to these changes in pasture production.

Considerable progress is being made in development of better management systems that increase financial viability of meat and wool production in temperate rainfall regions of Australia. As a consequence of the national program, progressive landholders are now beginning to implement these management systems, with suitable adaptations to fit their needs.

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Table 1 - Treatments and details for the experiment.

	Description	Potential stocking rate (DSE/ha)[a]	Target Olsen P (mg/kg)	Paddock area (ha)
A	Set stock, low P [b]	12	4 – 6	2.25
B	Set stock, high P [c]	16	12 – 14	1.5
C	Simple rotation, high P	20	12 - 14	1.5
D	Intensive rotation, high P	21	12 - 14	1.5
E	Intensive rotation, high P + N[d]	24	12 - 14	1.5

[a] dry sheep equivalent based on a 45 kg wether [b] Approximately 8 kg P/ha/year; [c] Approximately 30 kg P/ha/year; [d] 100 kg N/ha/year

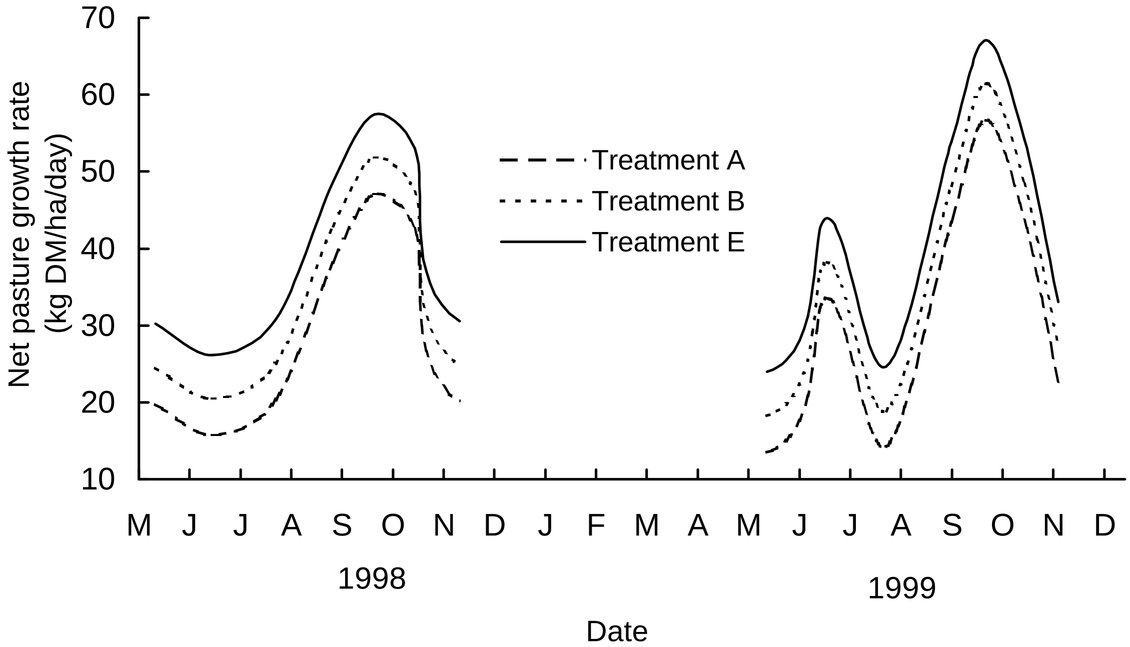

Figure 1 - The effects of three management treatments on pasture growth rates in 1998 and 1999.