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Live-weight gains of lambs on limed and unlimed pasture at similar levels of nutrition

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ABSTRACT

Experiments were conducted for monthly periods during the spring, summer and autumn of 1982-83 with lambs fed on pastures from limed (pH 6.1) and unlimed (pH 5.5) areas. Lambs were offered herbage allowances 1, 2, 3, 4 or 5 kg DM/d on both limed and unlimed areas (10 groups of 10 lambs). Pasture composition remained similar between the 2 areas as did *in vitro* digestibilities of the pasture on offer. Limed pasture showed an increase in Ca and Mo and a decrease in Mn compared with the unlimed. Lamb live-weight gains were similar between limed and unlimed groups at all levels of herbage allowance over the 3 seasons suggesting that herbage quantity rather than quality was the major factor affecting the growth rate of the animals.

Keywords Lime; pasture quality; herbage allowance; lamb live weight

INTRODUCTION

Lime (calcium carbonate) is applied to grassland soils in New Zealand primarily to increase pH and as a result of a number of chemical and biological changes in the soil, improves pasture production (Edmeades *et al.*, 1979; Edmeades, 1981). The calcium component of lime is relatively unimportant as calcium deficiency is extremely rare in New Zealand pastures.

A number of trials have shown increased pasture (and animal) production to lime (Elliot and Lynch, 1958; Bircham and Crouchley, 1976; Bircham *et al.*, 1977; O'Connor *et al.*, 1981; Thomson, 1982; M. R. J. Toxopeus, pers. comm.). Many farmers and advisors, however, are of the opinion that improved pasture quality *per se* is an important result of liming pastures. This paper reports on a trial with weaned lambs to investigate possible pasture quality effects of limed pastures on animal production.

EXPERIMENTAL

Lime was applied to 5 one-hectare paddocks of a Hamilton clay loam soil type on the Sheep Nutrition Unit, Ruakura, on 26 April 1982. The rate of application was 5 t/ha (88.2% CaCO₃). Five paddocks were left untreated. All paddocks received an annual top-dressing of 500 kg/ha 30% potassic superphosphate.

There were 3 monthly trial periods: spring (16 November to 14 December 1982); summer (18 January to 17 February 1983); autumn (7 April to 5 May 1983).

Groups of 10 lambs were offered herbage allowances of 1, 2, 3, 4 or 5 kg DM/lamb/d on both limed and unlimed paddocks (10 groups in total). Herbage allowance was increased by giving lambs access to larger areas. Fasted live weights were measured at the begin-

ning and end of each experimental period. New groups of lambs were introduced for each trial period. Some ryegrass staggers occurred in the autumn period particularly affecting the lower allowance groups on shifting and facial eczema symptoms were present in 2 of 30 livers analysed.

Herbage allowance, yield and apparent DM disappearance were obtained as outlined by Jagusch *et al.*, (1978). Pre-grazing pasture samples were analysed for *in vitro* digestibility. Herbage cuts were taken 3 times per trial period for pasture composition and chemical analyses.

RESULTS

pH Changes

Before lime application (April 1982) the soil pH was 5.5 and pastures would be expected to respond to lime. By the beginning of the spring trial period (November 1982) limed paddocks had increased to pH 6.1. This is similar to the expected pH increase on this soil, suggesting that at trial commencement pastures would be showing the full effects of the lime application.

TABLE 1 Pasture composition (%) in the 3 periods on limed (L) and unlimed (NL) areas (mean of 3 samples/period).

	Spring		Summer		Autumn	
	L	NL	L	NL	L	NL
Grass	69	71	37	40	51	54
White clover*	4	4	4	4	4	3
Weeds	6	4	9	5	8	6
Dead matter	21	21	50	51	37	37

* Clover content of dead matter not included.

Pasture Composition

A comparison of lamb production on limed and unlimed pasture at similar herbage allowance requires that pasture composition remain constant between treatments. An increased legume component in the sward due to liming for example, could improve the live-weight gain of that treatment (Ulyatt, 1970). Pasture composition remained constant over the 3 trial periods between lime and no-lime (Table 1) although seasonal differences occurred with the lowest grass (and highest dead matter) occurring in the summer period. Seasonal differences are also reflected in *in vitro* digestibilities (Table 2). There were no effects of lime on herbage digestibility.

TABLE 2 *In vitro* digestibilities (%) of spring, summer and autumn pastures from limed (L) and unlimed (NL) areas.

	Digestibility (%)	
	L	NL
Spring	72.8	72.3
Summer	67.8	67.6
Autumn	72.9	72.1

Mineral Content of Pasture

Lime increased calcium and molybdenum and decreased manganese (Table 3). Such effects have been well documented (Edmeades, 1981). Trace element analyses of the lime used suggested cobalt and zinc as the main contaminants (10 and 20 ppm respectively = 50 and 100 g/ha applied) but neither had any effect on herbage levels (Table 3). Mineral element content

TABLE 3 Mean element contents of the no-lime pasture in the 3 trial periods (lime pasture values in brackets where they differ significantly from no-lime).

Element	Spring	Summer	Autumn
% in DM			
N	2.40	1.80	3.00
S	.30	.25	.29
P	.34	.22	.36
Mg	.18	.21	.21
Ca	.53 (.59)	.50 (.63)	.51 (.66)
Na	.09	.08	.08
K	3.00	2.00	2.80
ppm in DM			
Mn	196 (126)	250 (188)	sc
Zn	28	36	sc
Cu	7	7	sc
Fe	298	225	sc
B	NA	10	sc
Mo	.22 (.49)	.23 (.43)	.39 (.71)
Co	NA	.10	sc

sc = soil contamination.
NA = not analysed.

of the pasture was more than adequate to meet the requirements of sheep (Cornforth, 1982).

Lamb Live-weight Gains

Live-weight gains are shown in Fig. 1 where curves were fitted to the lime and no lime means for each trial period. There is no indication in any of the 3 seasons that limed pastures had any beneficial effects on animal production.

DISCUSSION

Over a range of pasture allowances the growth rate of lambs on limed pastures did not differ significantly from those grazing unlimed pasture suggesting that

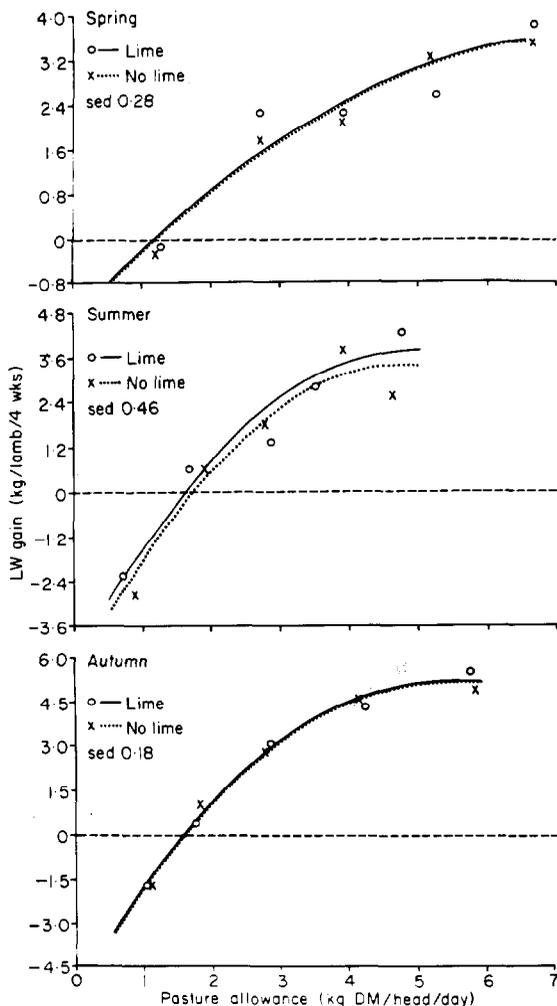


FIG. 1 Lamb live-weight gain (kg/lamb/4 weeks) at 5 levels of feed allowance for the spring, summer and autumn periods.

liming did not improve the quality, or feeding value, of the pasture. Despite seasonal differences in herbage quality as reflected in herbage digestibility (Table 2), herbage allowance remained the dominant factor in determining live-weight gain.

These results were obtained on high producing, ryegrass-white clover pastures with mean annual yields (4-year period) of 14.8 t DM/ha (Jagusch *et al.*, 1978). They differ from Australian experience with Pangola grass (*Digitaria decumbens*) (Rees and Minson, 1976), which showed an increase in digestibility due to liming together with an increase in voluntary intake associated with a shorter retention time of feed in the rumen. However, digestibilities were much lower in the tropical grass (45 to 48%) than in our ryegrass-clover pastures (67 to 72%) as were most of the herbage mineral elements.

Our results are consistent with those obtained from other animal grazing studies with lime in New Zealand (Bircham *et al.*, 1977; O'Connor *et al.*, 1981; Thomson, 1982), showing that the major effect of lime is to increase pasture production and, through the increased quantity of pasture available, animal production. Possible animal behavioural responses to limed pastures such as grazing preference appear secondary to this effect.

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