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THE EFFECT OF A LOW RATE OF LIME ON NORTH ISLAND HILL COUNTRY PASTURE AND ANIMAL PRODUCTION AND THE ECONOMICS OF USE

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SUMMARY

A low rate of lime on a steep hill-country soil near Te Kuiti increased pasture and animal production. There was no response for 15 months but thereafter lime increased liveweights by approximately 5 kg/ewe, fleece weight by 0.5 — 0.6 kg/ewe and lamb liveweight at weaning by at least 6%, enabling earlier drafts to be taken. The response appeared to be due to an increased pasture production rather than any improvement in pasture quality. An economic appraisal of the results suggests lime usage is very profitable.

INTRODUCTION

Although information is available on the phosphorus requirements of many of our hill soils less is known about the value of lime.

This paper reports three years' results from a trial at the Te Kuiti Research Area where production responses to a low rate of lime (1.25 t/ha) are being investigated. The soil is a Mahoenui steepland soil with a pH of 5.5 and is typical of approximately 400,000 ha of North Island hill country.

MATERIAL AND METHODS

In February 1977, seven 0.4 ha paddocks received high grade lime (85-90% calcium carbonate) at 1.25 t/ha with seven others remaining as controls. Molybdic superphosphate (250 kg/ha) was applied as a basal dressing and superphosphate (250 kg/ha) subsequently in January each year.

Mixed-aged Romney and Border Leicester-Romney ewes were stocked at 14 ewes/ha on both treatments. Ewes were rotationally grazed except at lambing when they were set stocked. Lambs were removed at weaning except in 1979 when wether lambs continued on the treatments until slaughter.

The following measurements were made: monthly ewe and lamb liveweights; annual wool weights and quality; weekly feed

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availability assessments; pasture composition assessed visually and by point analyses; soil analyses and fortnightly soil moisture determinations.

RESULTS AND DISCUSSION

EWE LIVEWEIGHT AND PASTURE AVAILABILITY.

A delayed response to lime was evident with no effect on pasture availability or ewe liveweight until 15 months after application. The autumn of 1978 was dry with rainfall 40% below normal but ewe liveweights were maintained on limed areas over this period through an increase in available pasture. This effect continued and became more pronounced as the trial progressed (Fig. 1). The delay was probably due to the low rate of application and the low solubility of the limestone. D. C. Edmeades (pers. comm.) found that even after applying 5 t/ha it can take up to a year for ground limestone to have its maximum effect on soil pH and calcium levels.

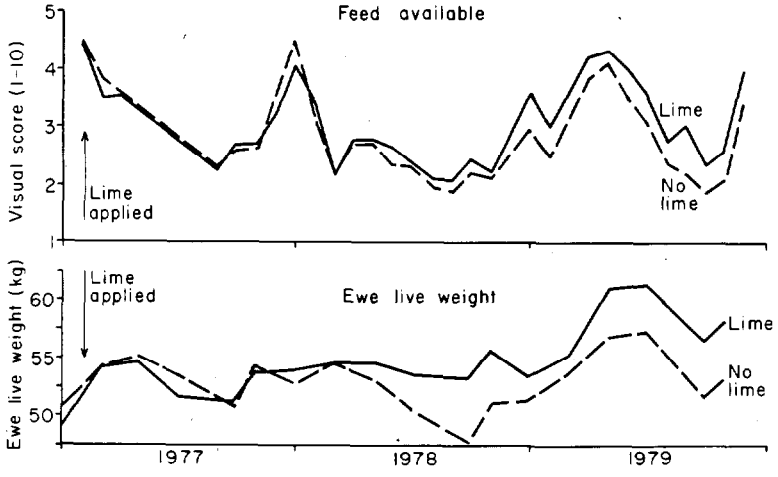

FIG. 1: *Pasture available (mean of weekly visual assessments) and ewe liveweights 1977/9.*

Wool Production

Fleece weights of both ewes and lambs showed a response to lime (Fig. 2). An additional 0.5-0.6 kg greasy wool per ewe and up to 0.13 kg per lamb was obtained in 1978 and 1979. This effect was attributed to the better overall plane of nutrition of the lime treatment.

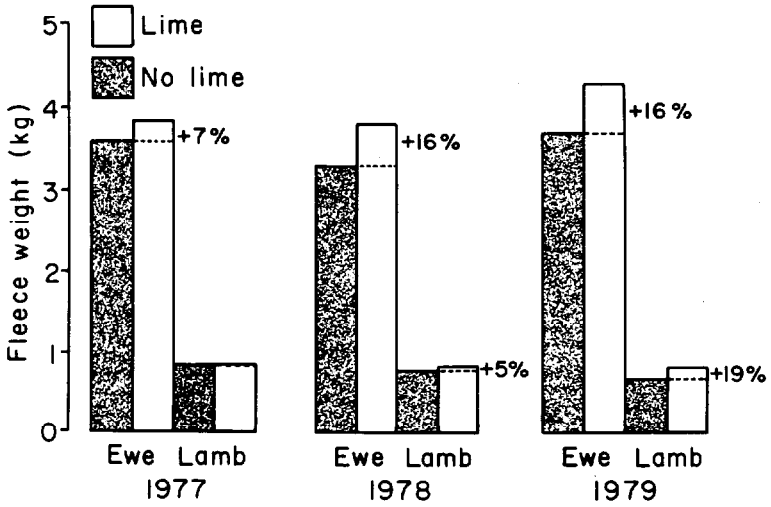

Fig. 1: *Ewe and lamb fleece weight (kg/head) 1977/9.*

Lamb Performance

Because of constraints associated with the trial design lamb numbers were not always uniform between treatments and this may have influenced lamb performance (Table 1). However, in 1978 when lamb numbers were equal, the superiority of the lime treatment lambs at weaning (end of November) was evident. In 1979, wether lambs were continued through to slaughter. By the 19th February, 55% of the lime treatment lambs were ready for slaughter as against 38% of the controls. No differences in carcass grading were evident.

TABLE 1: LAMBING PERCENTAGE AND LAMB WEANING WEIGHT (KG) 1977/7 ON LIMED AND UNLIMED PASTURES

	1977	*1978*	*1979*
Lambing % No Lime	110	115	146
Lime	127	115	131
Weaning wt. No Lime	22.9	21.2	18.7
Lime	23.2	22.5	21.7
	NS	*	***

Reasons for Improved Stock Performance with Lime

The evidence suggests lime has increased animal production through an increase in pasture production. With a stocking rate of 14 ewes/ha, a sufficiently high stocking pressure was imposed to graze any additional pasture growth.

In addition, it appears that lime improved the legume component and provided less litter (Table 2a). In contrast, point-analysis of line transects in the paddocks suggested no permanent change in species composition due to lime (Table 2b) nor any trend to improved composition with time (Table 2c). Any apparent increase in clover was probably the consequence of improved plant vigour rather than any increase in plant density. The exception seems to be on the steep intertrack areas where active recolonisation by legume species was observed. The overall nutritional effect seems to be due largely to an increase in pasture production rather than any improvement in pasture quality.

TABLE 2: PERCENTAGE SPECIES COMPOSITION OF LIMED AND UNLIMED PASTURES

(a) Visual assessment and indicator paddocks

	Clover	*Litter*
No Lime	19	13
Lime	25	8

(b) Annual point analysis (mean of all paddocks)

	Ryegrass	*Other Grasses*	*Legumes*	*Weeds/Litter*
No Lime	25	35	14	26
Lime	23	37	15	25

(c) Pasture composition changes

	Ryegrass	*Other Grasses*	*Legumes*	*Weeds/Litter*
1977 No Lime	26	33	18	23
Lime	24	35	18	23
1980 No Lime	20	44	17	19
Lime	20	44	14	22

No obvious reasons for the pasture production response to lime have been found. Some factors can be discounted. For example, there was no moisture effect due to lime nor any suggestion of a phosphorus "release" due to lime. Molybdenum responses have been noted in previous work but molybdic superphosphate probably overcame any deficiencies in this trial. It is possible that aluminium toxicity may have been involved as the availability of aluminium in soils can be substantially reduced by low rates of lime. There was only a small effect of lime on soil pH (5.5 to 5.7) but a trend towards increased earthworm numbers.

TABLE 3: MEAN RESPONSE TO LIME — EWE FLEECE WEIGHT CULL EWE LIVEWEIGHT, LAMB LIVEWEIGHT AND LAMB FLEECE WEIGHT — THE FINANCIAL BENEFIT.

	Production Response (kg/ha)	*Annual Revenue ($/ha)*
Ewe fleece weight	6.4†	14.70 (230 c/kg)
Cull ewe liveweight	13.4†	4.00 (60c/kg carcass wt.*)
Lamb liveweight	20.9‡	11.50 (110c/kg carcass wt.*)
Lamb fleece weight	0.6‡	1.40 (230c/kg)
TOTAL		31.60

* assumed to be 50% of liveweight
† mean of 1977-9 production data
‡ 1978 production data

Economic Analyses

The financial benefits of liming derived from 3 years' data, are summarised in Table 3 and assume constant costs and prices based on the current situation. Overall, an annual return of $31.60 resulted. The cost of liming (lime $10/t; aerial spreading $20/t) was $37.50/ha. This cost was an initial outlay which can be considered as an annual cost spread over the period of the lime response. A comparison of the profitability of lime, considering both the period of the response to lime and the rate of application, is shown in Table 4. Lime usage is obviously profitable and becomes more so as the period of response from the initial application is extended. In this trial 1.25 t continued to show a good response in the fourth year and the associated trial work D. C. Edmeades (pers. comm.) suggests that 1.25 t is giving the same pasture production as 2.5 t/ha.

TABLE 4: ANNUAL COST — BENEFIT ANALYSIS OF USING LIME : $/HA

Lime (t/ha)	*Period (yrs)*	*Cost*	*Profit**
1.25	3	12.50	19.10
	4	9.40	22.20
	5	7.50	24.10
2.5	4	18.75	12.85
	5	15.00	16.60
	6	12.50	19.10

* assuming an annual revenue of $31.60/ha from lime (Table 3).

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