

# The effect of two lime sources on short term changes in soil pH under Marlborough hill country pasture



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## Introduction

It is uneconomic to apply high rates of lime to Marlborough hill country but it may be economic to apply smaller amounts more frequently. One local option applies low rates of lime as a fine slurry.

In 1998 a one year trial compared the effect of fine and agricultural (ag) lime on soil pH at two depths in the presence and absence of fertiliser.

## Materials and methods

- sunny facing Wither Hill (Pallic) soil, Wairau Valley, Marlborough.
- pH 5.21 (0-25 mm), 5.17 (25-75 mm).
- **Main plots** with and without 188 kg/ha of Sulphur Super 20 (10% e l S, S<sup>0</sup>) fertiliser were replicated three times, with four lime treatments as subplots.
- **Lime treatments:** nil lime control; 200 kg/ha Taylor's fine (Ngarua) lime, (98% CaCO<sub>3</sub>); 400 kg/ha and 2,500 kg/ha of local Clarence Valley ag lime, (88% CaCO<sub>3</sub>).
- Treatments were applied 24 June 1998 and soil pH (0-25, 25-75 mm) measured six times until 15 June 1999. The site was fenced and trimmed.
- Annual rainfall was 850mm, 25% above normal with dry summer conditions.

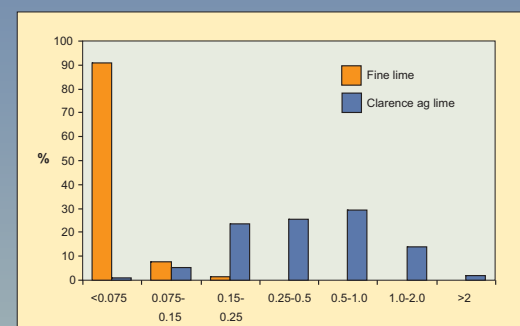


Figure 1 Lime particle size of Taylor's fine lime and Clarence Valley agricultural lime, Marlborough, mm.

## Results

Lime data is presented as the change in pH from the 'control' pH at that harvest.

### A: Lime only effects (in the absence of fertiliser)

In the top 25 mm (Figure 2A) all lime treatments significantly increased pH ( $p < 0.05$ ) for the 355 days especially the high rate of ag lime compared to the other treatments.

In the 25-75 mm zone (Figure 2B), responses were smaller. Ag lime treatments significantly raised pH over the control from day 14 but fine lime was less effective.

### B: Lime with fertiliser effects

Responses were smaller than without fertiliser, particularly in the top 25 mm of soil (Figure 3A), when using the two low rates of lime.

In the 25-75 mm zone (Figure 3B), fertiliser caused short term depressions in soil pH at the two low rates of lime.

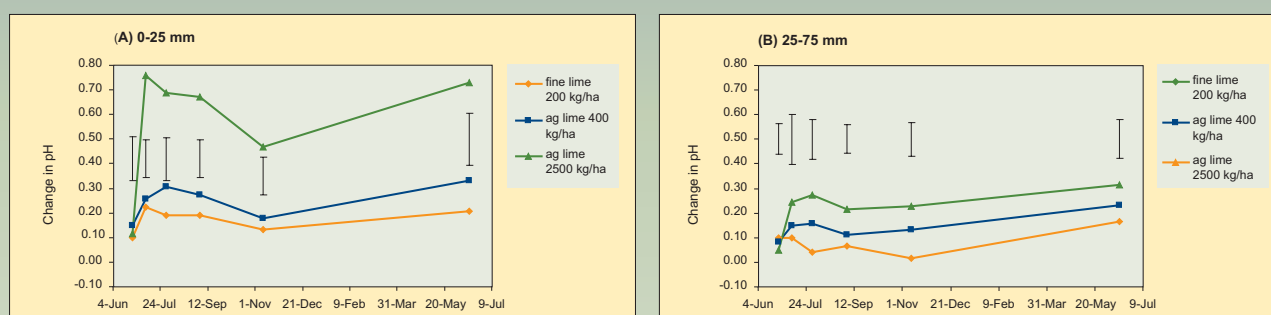


Figure 2 Change in top 25mm pH (A) and 25-75mm soil depth (B) 1998-99 following lime application.

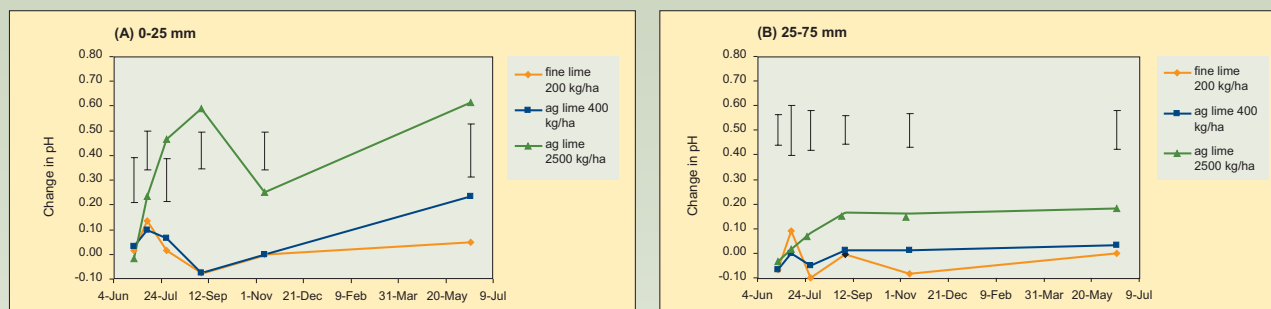


Figure 3 Change in top soil pH (A) and 25-75mm soil depth (B) 1998-99 following lime application in the presence of 188kg/ha Sulphur Super 20. Bars represent LSD<sub>5%</sub> between treatment, LSeffect<sub>5%</sub> for comparison with no lime control = LSD<sub>5%</sub> x 0.7.

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## Discussion

Rainfall at application was ideal for lime dissolution.

**Fine lime** effects were rapid but short lived. Sufficient lime was applied to neutralise the soil acidification (0-75 mm) if the site were grazed. However insufficient was added to also neutralise the oxidation of the S<sup>0</sup> applied, (Sinclair *et al.* 1993). It is unlikely 200 kg/ha of fine lime will meet long term requirements as oxidation of S<sup>0</sup> continues beyond one year.

**Agricultural lime at 400 kg/ha** achieved similar initial and better long term lifts in pH as fine lime despite its lower CO<sub>3</sub> content and coarseness. This rate will more than adequately meet annual lime requirements. It cost approximately \$42/ha to apply compared to \$60/ha for 200 kg/ha of Taylor's fine lime.

**Agricultural lime at 2,500 kg/ha** significantly changed pH for a longer period and to greater depth compared to other treatments. Providing ag lime meets the New Zealand standards for particle size and purity then sufficient will dissolve to quickly raise soil pH to 75 mm.

**Fertiliser** is important – on this site dry matter responses to S<sup>0</sup> fertilisers are 12.5%/yr. The lime model of Edmeades *et al.* (1985) would suggest at these pH's, dry matter responses to lime would be < 6%.

## Conclusions

- In Marlborough hill country fine lime at 200 kg/ha generally only increased pH over 355 days in the top 25 mm of soil and then in the absence of S<sup>0</sup>.
- 400 kg/ha of local agricultural lime was sufficient to lift and hold pH for at least one year in the top 75 mm of soil, although the effect was reduced when S<sup>0</sup> was also applied.
- 2,500 kg/ha of local agricultural lime gave significantly higher soil pH's than the other lime treatments in the top 75 mm of soil irrespective of whether fertiliser was used and would therefore have a greater residual effect.
- Low rates of lime must be sufficient to address annual maintenance lime needs. In Marlborough 400 kg/ha of agricultural lime was a cheaper and more efficient alternative to 200 kg/ha of fine lime slurry to address this.

## Acknowledgements

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**Ravensdown Fertiliser**  
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