



Information Sheet

7. NUTRITION

7.15 Liming under minimum or reduced tillage conditions

Why and when is this necessary?

Many acid soils of the hinterland and Natal Midlands on which cane is grown are situated on slopes in excess of 20%, and often have toxic levels of aluminium thus requiring lime. Under these conditions, minimum tillage practices are required to reduce soil loss and water runoff. However, the incorporation of lime under these conditions is extremely difficult.

How was the problem of lime incorporation researched?

A trial was conducted to establish the effectiveness of various methods of incorporating lime under minimum tillage.

Major objectives of the trial were:

- To measure the volume of soil disturbed under various treatments.
- To assess how efficiently lime was distributed within the soil profile.
- To monitor power and traction requirements for lime incorporation on steep slopes.
- To determine the appropriate methods of incorporating lime under minimum tillage.

Details of the field trial

- The trial was situated on a Glenrosa sandy clay with an average slope of 21%.

- The crop was burnt before harvest.
- Dolomitic lime was broadcast manually at 7 tons/ha on alternate cane interrows (Figure 1), except where a deep limer was used.
- A 58 kW front wheel assisted tractor was used for all implements except the deep limer, which was pulled by a 45 kW crawler tractor.
- After six weeks (59 mm rain recorded) a trench was dug across each treatment in order to measure the volume and depth of disturbance (Figure 3).
- An adjustable profile template was used to measure the cross sectional area of the disturbed soil (Figure 4).
- Top and subsoil samples for chemical analysis were taken in each treatment.



Figure 1. Broadcasting dolomitic lime.

Methods of incorporating lime

Treatment No.	Equipment and order of operation
Control	Not limed - undisturbed
1	Plough/disc/ridger
2	Alu-Buster (deep)/ridger
3	Disc min tiller/ridger
4	Rotary min tiller with ridger
5	Deep limer/ridger
6	Alu-Buster (shallow)/ridger
7	Hand chipping
8	Rotary min tiller/Alu-Buster
9	Ridger only

Table 1. Summary of operations for incorporating lime.

Alu-Buster



Rotary min tiller



Deep limer



Hand chipping



Figure 2. Treatments used for incorporating lime.



Figure 3. Trench used for measuring volume and depth of soil disturbance.

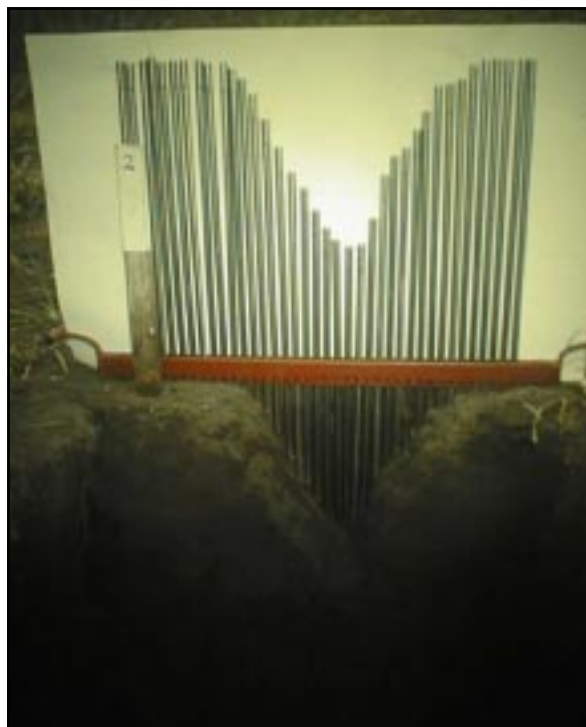


Figure 4. The adjustable profile template showing soil disturbance in treatment 2.

Important results

■ Under the conditions of the trial the most effective methods of mixing lime to depths of 300 mm or more were:

- Alu-Buster (deep)/ridger (treatment 2).
- Rotary minimum tiller with ridger (treatment 4).
- Deep limmer/ridger (treatment 5).
- Rotary minimum tiller/Alu-Buster (treatment 8)

Note:

■ Conventional tillage (treatment 1) would be unacceptable where minimum tillage is mandatory to meet the requirements of the Conservation Act.

■ In all the soil treatments, lime was incorporated to some extent. However, treatments 2, 4, 5 and 8 gave the greatest response to liming (Figure 6).

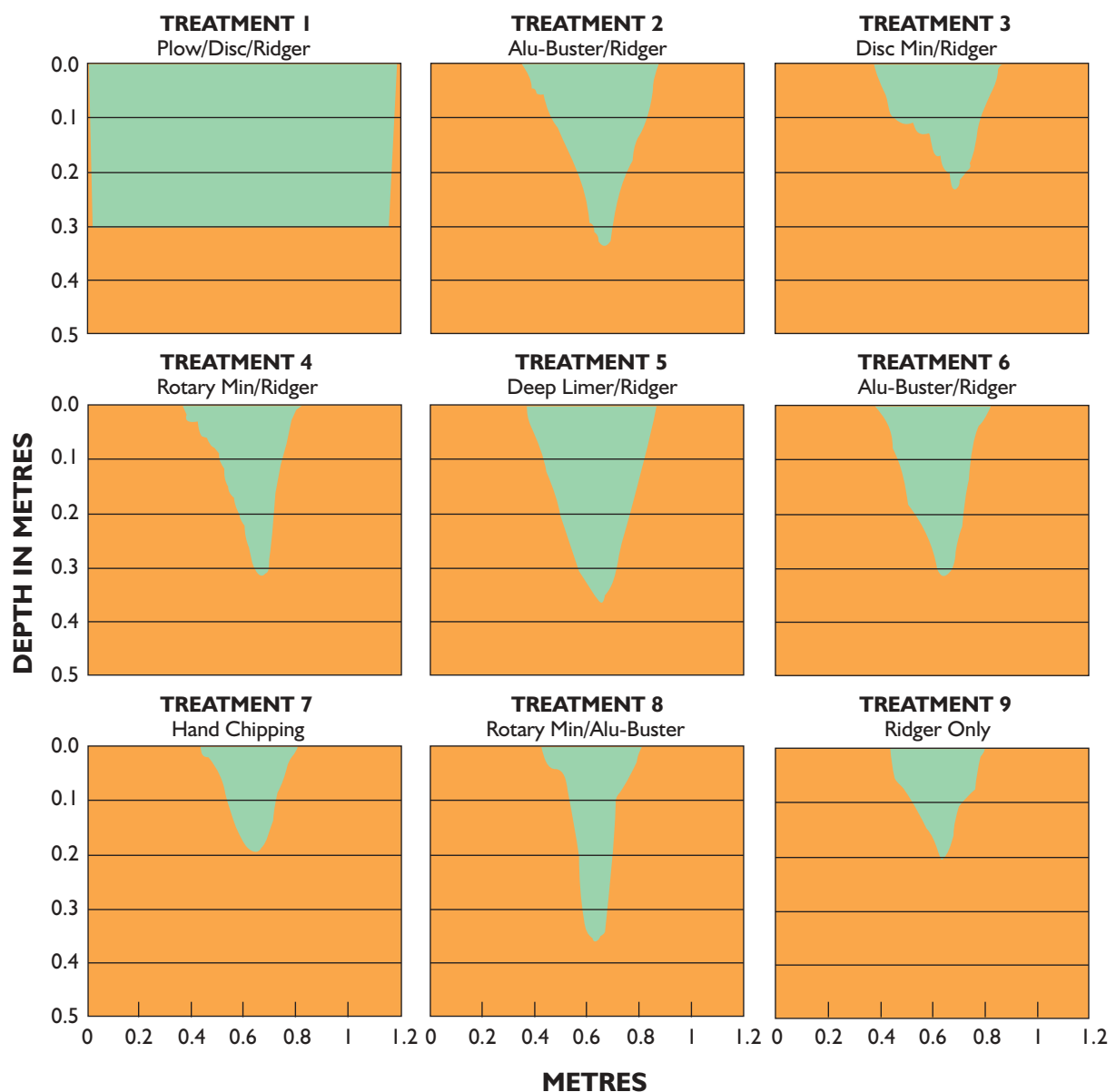


Figure 5. Comparison of soil disturbance for the nine treatments.

Treatment No.	Maximum depth mm	Disturbed area cm ²	Percentage disturbance
1	300	3 600	75
2	335	863	18
3	225	554	12
4	310	609	13
5	350	1 045	22
6	300	682	14
7	235	373	8
8	360	562	12
9	210	378	8

Table 2. Effect of treatment on depth and percentage disturbance of soil.

Recommendations for liming under minimum tillage

Low rates (less than 3 t/ha lime)

Spread the lime over the entire field at the start of the penultimate ratoon. Hand hoeing in the interrows will allow some mixing with the soil. The ridging operation at planting will further enhance this process.

Moderate rates (4 to 6 t/ha)

Spread half the amount of lime over the field at the start of the penultimate crop and mix by hand hoe

into the interrow. Apply the other half six weeks before planting. On slopes up to 21%, any of the following operations using a front wheel assisted tractor are effective:

■ Rotary minimum tiller with ridger

■ Alu-Buster/ridger

■ Rotary minimum tiller/Alu-Buster.

N.B. Deep application of lime or gypsum (more than 300mm) for the amelioration of aluminium toxicity at depth is not currently recommended as it is not cost effective.

On slopes over 21% a small crawler tractor is preferred. On steep slopes the use of powered implements will improve the performance and stability.

High rates (more than 6 t/ha)

As for moderate rates but substitute a third of the lime recommended with either gypsum or phosphogypsum as this helps to move displaced aluminium more quickly through the soil profile.

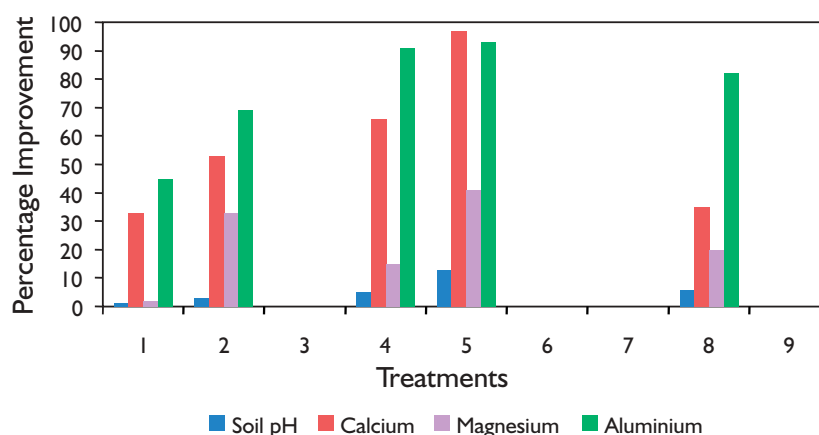


Figure 6. Relative change in soil chemical properties, 150-300 mm depth.

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