How quickly do our lime-sands work?

Background

Soil acidity affects over 70% of Kangaroo Island farmland. In these acid prone areas, soil monitoring has shown that 86% of topsoils (0-10 cm) and 78% of sub surface soils (10-20cm) are below a critical level of pH_{CaCl_2} 5.0.

Liming is the most cost effective and practical way to ameliorate these soils. Monitoring of pH change following liming on KI has shown that typical lime sand application rates of 2.5 to 3.0 t/ha will increase pH by approximately 0.5 of a pH unit; however, there is concern that current sources of limesand on KI are relatively coarse and thus take time to change the soil pH.

What was done

A trial was set up in 2013 on R & K Stanton's Bark Hut Road property, to monitor how quickly surface applied lime would change the pH deeper in the soil profile. All treaments were broadcast onto an existing annual pasture.

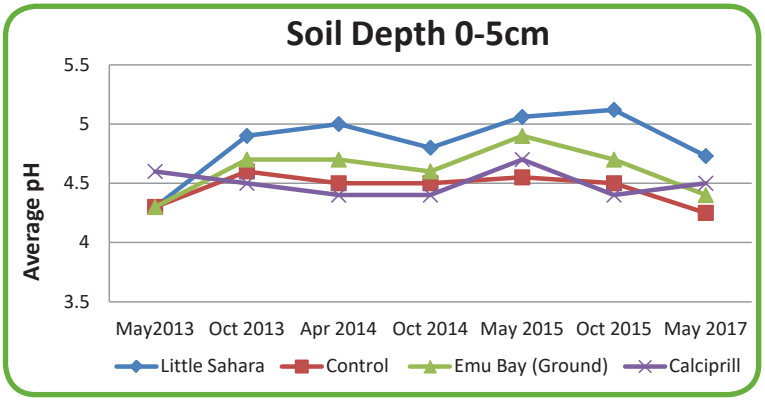
The treatments are described below:

- Little Sahara lime sand applied at 3 t/ha. This treatment was replicated 3 times
- A single replicate of Emu Bay limesand applied at 3 t/ha. This product was ground to achieve fineness comparable to the Little Sahara product
- A single replicate Calciprill applied at 400kg/ha. Calciprill is a commercially produced ground and pelletised lime product. Calciprill recommends an application rate of 100kg/ha will increase pH by 0.1 unit. Thus 400 kg/ha of Calciprill was considered comparable to an application of 3t/ha of local lime sand

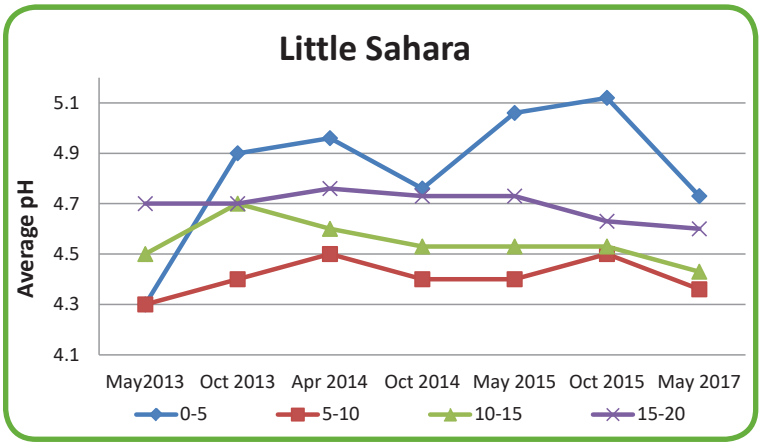
Soil sampling was conducted on each treatment in April 2013, before any treatments were applied, with analysis of $pH_{(CaCl_2)}$ undertaken at 5 cm intervals to a depth of 20 cm (i.e. 0-5, 5-10, 10-15 and 15-20 cm). All plots were then resampled at 6 monthly intervals to Oct 2014, with a final analysis undertaken in May 2017.

Results

The application of lime sand resulted in a significant pH increase of 0.6 pH units in the 0-5 cm layer within 6 months. The impact of this initial pH increase has lasted for four years, (albeit with some minor variation annually). (Refer to GRAPH 1). Soil analysis in 2017 (four years post application) showed limited movement of alkalinity from this lime application to depths deeper than 5 cm. (Refer to Graph 2)



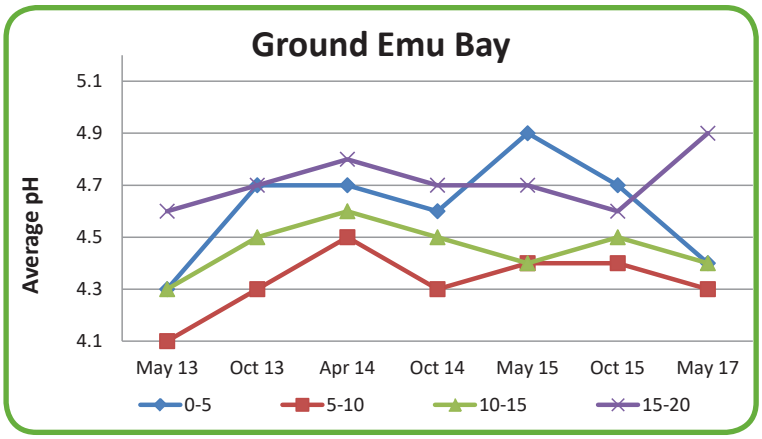
GRAPH 1: pH changes 0-5 cm



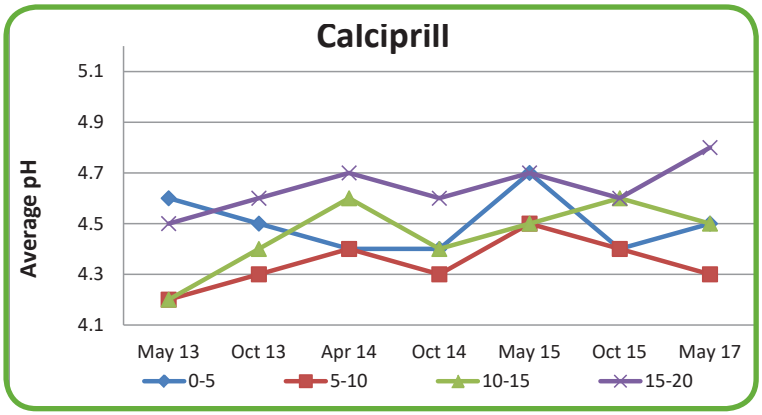
GRAPH 2: pH changes with Little Sahara Lime over time

The ground Emu Bay lime also initially increased pH in the surface 0-5 cm, but after four years the pH had returned to pre-liming levels. (Refer to GRAPH 3). Subsurface pH levels (5-10 and 10-15 cm) also initially increased but returned to pre-liming levels within four years.

These results show that the surface application of lime sand can increase the top soil pH (0-5 cm layer) and help maintain the pH in the 5-10 cm layer. However, as the lime did not move below the 10 cm mark there was continued acidification of the 10-15 and 15-20 cm layers. In addition, the top soil was beginning to re-acidify four years post liming. All these factors highlight the need to maintain soil pH above 5.5 to minimise the risk of subsurface acidification.



GRAPH 3: pH changes with Ground Emu Bay Lime over time



GRAPH 4: pH changes with Calciprill over time

***TABLE 1**: pH changes over time.*

Treatment	Depth (cm)	April 2013 (before liming)	Oct 2013	April 2014	Oct 2014	May 2017
Little Sahara lime	0-5	4.3	4.9	4.9	4.8	4.7
	5-10	4.3	4.4	4.5	4.4	4.4
	10-15	4.5	4.7	4.6	4.5	4.4
	15-20	4.7	4.7	4.8	4.7	4.6
Control	0-5	4.3	4.5	4.5	4.5	4.3
	5-10	4.3	4.4	4.3	4.4	4.3
	10-15	4.6	4.5	4.6	4.6	4.4
	15-20	4.8	4.6	4.7	4.8	4.6
Emu Bay (Ground)	0-5	4.3	4.7	4.7	4.6	4.4
	5-10	4.1	4.3	4.5	4.3	4.3
	10-15	4.3	4.5	4.6	4.5	4.4
	15-20	4.6	4.7	4.8	4.7	4.9
Caliprill	0-5	4.6	4.5	4.4	4.4	4.5
	5-10	4.2	4.3	4.4	4.3	4.3
	10-15	4.2	4.4	4.6	4.4	4.5
	15-20	4.5	4.6	4.7	4.6	4.8

There was no significant pH change in the Calciprill plot pH at any depth. This may have been due to the lower rates of Calciprill used (400 kg/ha compared to 3.0 t/ha of limesand). However, as the Calciprill and ground Emu Bay limesand treatments only had one replicate each it is difficult to quantify the responses to these treatments and no statistical analyses can be conducted. (refer to GRAPH 1 and 4). The control showed some variation in pH. As no lime was applied to these plots no positive pH change should be expected and any pH change observed is considered to reflect normal soil variability.

Take Home Messages

- 3t/ha Little Sahara limesand will increase the pH in the top 5 cm of soil within 6 months and the effect will last for 4 years before re-acidification occurs
- It can take up to two years to get a pH change down to 10 cm in the soil profile
- Maintain surface pH above 5.5 to minimise risk of sub surface acidification.

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