Soil acidity in Kangaroo Island soils

Background

Most of the farmland soils on KI are naturally acidic and further soil acidification is a natural process, albeit hastened by many of our farming practices. Strongly acidic soils can cause nutrient deficiencies and/or toxicities which will severely reduce crop/pasture growth. In addition soil microbes (important for nutrient cycling and nitrogen formation with legumes) can't survive in strongly acidic soils. Rates of soil acidification and the area of affected land continue to increase in the most productive agricultural areas on KI. Long term soil monitoring indicates declining soil pH levels in most Hundreds.

What was done

Many producers on KI have taken advantage of incentive funding offered by the KI NRM Board for lime sand spreading. In 2012 and in 2013, 25 sites were selected each year that had been limed in recent years. The paddocks were re-tested for soil pH post liming and results were compared to the pH level prior to liming.

At each site nine soil samples were taken along a 100 metre grid line. Soil was collected at two depths 0-10 cm and 10-20 cm and sampling points were GPS located. In addition, a paddock sample of approximately 30 cores, taken from 0 – 10 cm, was also collected. All samples were analysed for pH (1:5 H_20 Extraction and 1:5 0.01M $CaCl_2$ Extraction) by the CSBP Laboratory, WA.

Results

Soil pH is an indicator of the chemical processes that occur in the soil, and is a guide to likely deficiencies and/or toxicities. Although plant tolerances to acidity vary, a generally accepted lower threshold is pH 5.0 ($CaCl_2$). Once soil pH falls below this level, severe declines in productivity can occur, refer to TABLE 1.

TABLE 1. **Criteria for liming**

$pH_{(CaCl_2)}$	Interpretation	Lime requirement for pastures or dryland crops
<4.8	Strongly acidic	Lime or equivalent required immediately
4.8-5.2	Moderately high acidic	Lime or equivalent required in near future
5.3-5.5	Moderately acidic	Consider liming as preventative strategy or for highly sensitive crops

Trial work conducted on KI in the 1990's demonstrated that the incorporation of 2.5t/ha of lime sand would increase pH by approximately 0.5 unit.

TABLE 2: **Results from 25 sites retested in 2013**

Year limed	No. of paddocks tested	Method of application	Rate lime applied t/ha	*Average initial paddock pH_{CaCl}	Average paddock pH_{CaCl} post liming	Average increase in pH with liming
2007	1	Incorporated	2.5	4.6	5.5	0.9
2008	7	Broadcast	2.6	4.6	5.0	0.4
2009	4	Broadcast	2.6	4.7	4.9	0.3
2009	2	Incorporated	2.5	4.6	4.8	0.2
2010	2	Broadcast	2.9	4.8	5.15	0.35
2010	2	Incorporated	2.5	4.9	4.7	-0.2**
2011	4	Broadcast	3.25	4.75	5.4	0.65
2012	2	Incorporated	2.5	4.6	4.8	0.20
2012	1	Broadcast	3.75	4.6	4.6	0.0

* *where initial pH was taken more than 5 years prior to the lime application an adjustment figure of 0.025 unit pH decrease/yr was used.*

** *Two sites showed a decrease in pH after liming. The apparent decrease may be due to errors in the initial sampling done some years prior to the lime being applied.*

Whilst there was considerable variability over the 25 sites, the average increase on pH across all sites was 0.40. Most of the lower increases correspond with the most recently limed (2012) paddocks. This is principally due to the particle size of our lime sands ie the coarser the product the longer the reaction time, so it can be reasonably expected that the paddocks limed in 2012, will further increase in pH over time. The work in 2013 correlates strongly with the results in 2012 which found a 0.45 unit increase.

Of concern is that 18 out of the 25 paddocks tested still had soil pH at critical levels, i.e. although limed and the pH had increased, it was still at pH 5 or below and limiting productivity. It's important to not assume that once a paddock is limed that it will be at the correct pH. Re-testing paddocks a few years after liming (thus allowing time for the lime to fully react) is the best way to ensure the paddock is at the correct pH or requires liming again.

It is better to lime more frequently than to apply heavier applications initially. Too dramatic an increase in pH in one application can cause some nutritional issues ie manganese deficiency.

Take home messages

- Over time applications of lime (2.5-3t/ha) increase soil pH by an average of 0.45 unit.
- Monitor pH levels, retest 2 to 3 years after liming and reapply lime if required.
- Amelioration of soil acidity, through lime spreading, needs to be conducted to prevent soil acidification.

Funding/Sponsors

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- KI Landholders.

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