

Results of the soil treatments at the Schinckels' farm

May 2012 update

The South East Natural Resources Management Board (SE NRM Board) has been implementing an Enhancing Soil Health project from 2010 - 2013, with funding provided by the Australian Government Caring for our Country program and the SE NRM Board.

As part of this project, the SE NRM Board is supporting demonstration sites on Peter Schinckel's property at Kybybolite. A demonstration farm is not a scientific trial; rather it tries to measure things that are happening in working farm situations.

Peter has been applying a lot of different treatments to the soil on his farm over the last decade. These treatment sites are being used by the Enhancing Soil Health project to test soil conditions such as carbon content and acidity levels following the treatments.

THE LANDSCAPE

The land at the Kybybolite Demonstration farm forms an undulating plains landscape, comprising mainly a range of loam over clay soils and cracking grey clays. The soils are moderately to highly fertile, but are prone to water logging.

The soils are generally structureless in the surface, with strongly layered horizons overlying very coarse structured, low permeability clays. Ironstone nodules are commonly found within a bleached layer of loam just overlying the clay horizons.



Perennial pasture at Schinckel's

WHAT ARE WE MEASURING?

A variety of treatments on the farm that can potentially influence soil pH and / or soil drainage are being measured. These treatments include:

- Surface liming,
- Mixing the soil profile using a clay delving machine,
- Establishing plant species with a range of acid tolerances.

SUMMARY OF PREVIOUS INFORMATION

9 paddocks investigated

1. Delving resulted in some reduction in hard subsoil layers/ soil strength but led to some surface sealing in the surface, and issues with trafficability. The delved soil appeared to have improved levels of surface **potassium (K)** and also improved surface pH.
2. Strong relationship between **aluminium (Al)** toxicity and pH with toxic levels of aluminium for sensitive species commencing just under pHCa 5.0. All 9 paddocks had a layer where the soil pH was < 5.0. Soils acidify at about 100-150kg lime equivalents/ha/yr. The only paddock where the surface pHca was > 5.0 occurred where 2 applications of lime had occurred over the last 16 years.
3. A relationship between total **phosphorus (P)** and Colwell P has been developed for this soil which could be used to determine how much extra P is required to get to a certain target level.
4. The soils on this farm are quite fertile, and tissue plant testing revealed no significant nutrient deficiencies in any of the paddocks that were assessed.



2011 – 2012 RESULTS

Further investigation was undertaken into 5 paddocks/ treatments during 2011/12. This included paddocks that had the following treatments

- Mouldboard ploughing
- Delved vs. undelved
- Limed lucerne vs. unlimed lucerne

Investigations included soil and plant analysis and bulk densities of soil layers. Plants were sampled in September 2011- this included lucerne and beans.

Soil analysis was undertaken in late 2011 and early 2012 for deep **nitrogen (N)**.

Acidity

(5 paddocks/ treatments by 3 depths)

Soil pH levels again indicated acidity is an issue on most paddocks with toxic levels of Al occurring when >2 mg/kg.

Aluminium toxicity is considered an issue on sensitive plants. Lucerne and beans are both generally considered sensitive plants. Where pH is less than pH_{Ca} 5.2 effects are observed on lucerne rhizobia.

Some new acid tolerant rhizobia strains are being developed by SARDI.

The lucerne limed paddock treatment did not show up as having a higher pH, however according to the notes this was limed in 1991 and this amount would have been neutralised by now. The delved and mouldboard ploughed areas showed some small improvement in pH.

Nutrition

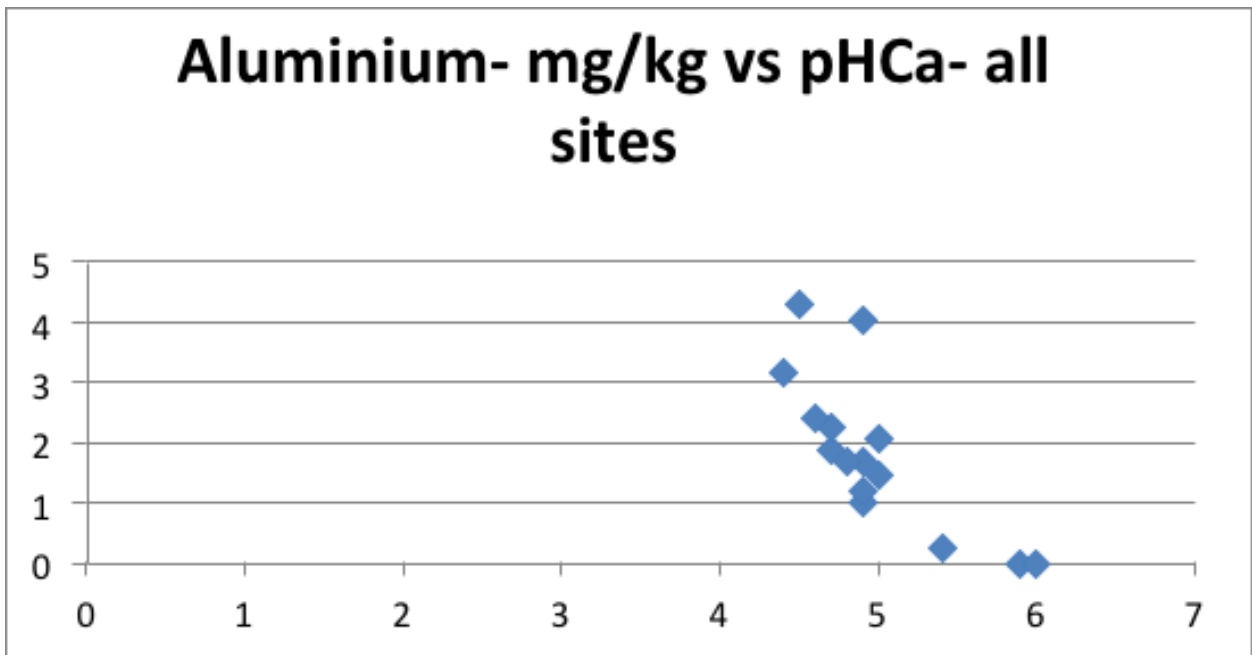
Nitrogen

Soil analysis to 80cms measured the nitrogen and sulphur within the soil profiles. Most of the treatments had around 110-120 kgs/ha of available nitrogen (nitrate + ammonium). The exception was the delved layer which had a much lower level of around 80kgs/ha with much lower levels in the surface.

This may be related to the soil mixing or less vigorous production of previous crop.

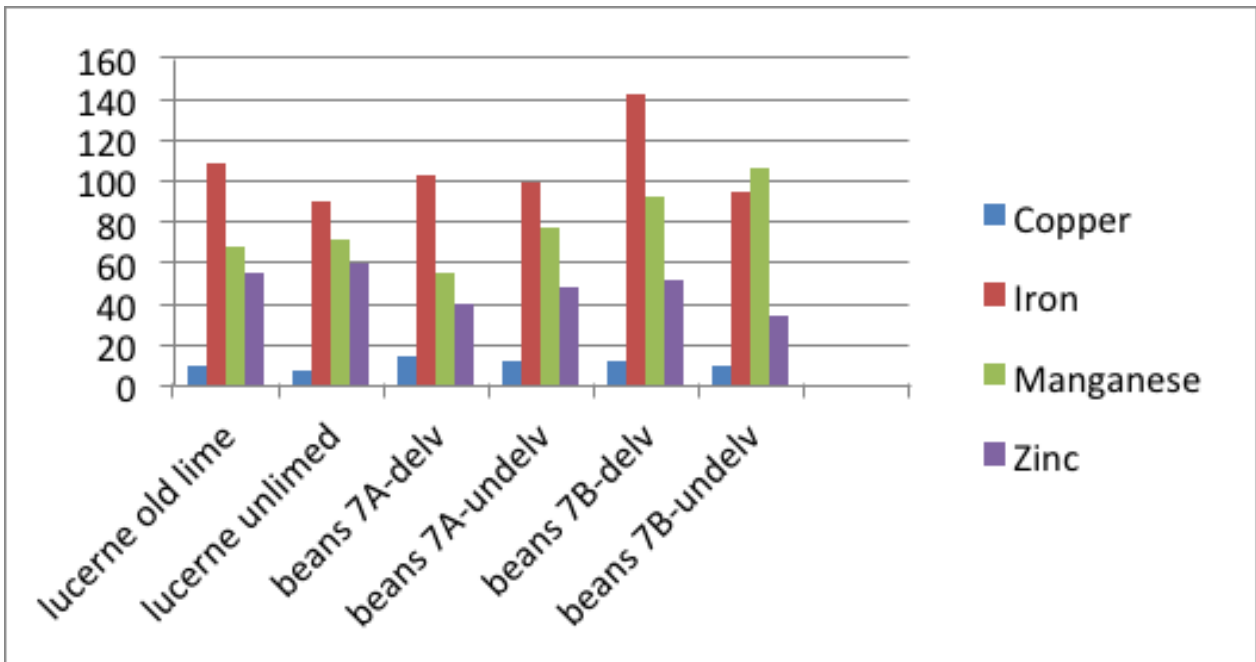
Trace Elements

Trace elements were assessed during spring 2011 by tissue testing and through soil analysis. Lucerne levels seemed adequate for main trace elements. With beans delving seemed to reduce the plant manganese levels but was inconsistent with other trace elements.



Graph 1: Soil Aluminium from all sites.





Graph 2: Plant Trace element availability (mg/kg)

Critical levels:

Lucerne	Copper >5	Iron >45	Manganese >25	Zinc >20
Beans	Copper >7	Iron >30	Manganese >50	Zinc >20

All found to be adequate

Soil Structure Post Delving

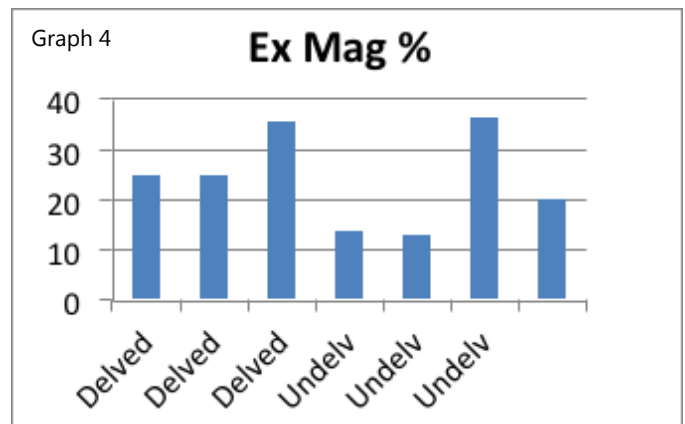
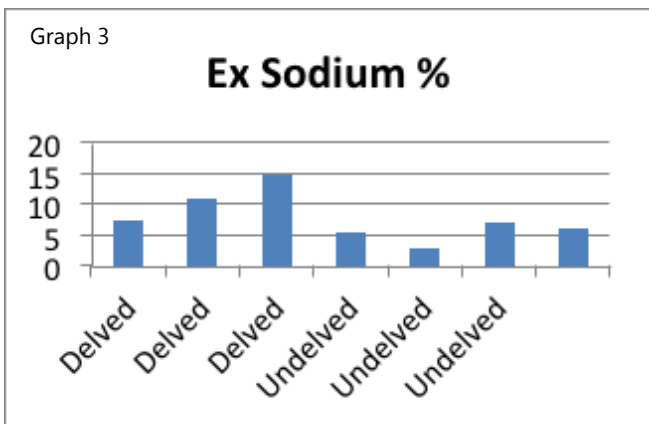
Chemical analysis of the delved area shows high levels of sodium (Exchangeable Sodium Percentage or ESP > 6) and magnesium (Exchangeable Magnesium Percentage or EMgP >20) on the delved areas compared with the non-delved. These higher levels lead to the surface structure issues on delving at this site if above the critical levels above.

The use of gypsum or organic matter may be required to reduce these.

Bulk Density

Bulk Density is a measure of soil hardness and density in grams/cm³. Soil density is weight by a standard volume - therefore, the higher the figure the denser the soil. Generally normal soil is about 1.3-1.4. Where density is greater than 1.6 g/cm³ root growth issues can occur.

Therefore under mouldboard plough treatment there is a possible hard pan developing in the A2 layer. Under delved areas lower soil density levels occur than the undelved treatments.



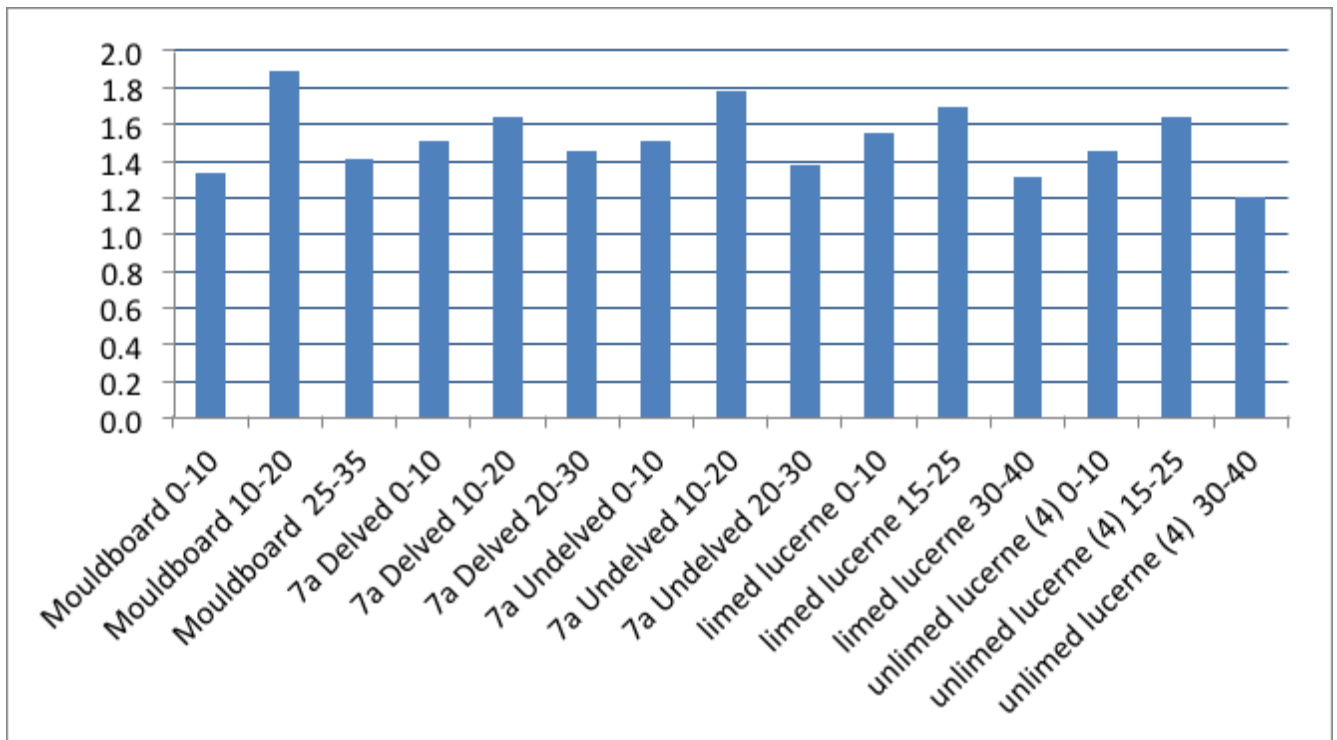
ESP=Exchangeable Sodium % EMgP= Exchangeable Magnesium %



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Graph 5: Bulk Density on all sites

If you are interested in finding out more about the Enhancing Soil Health Project please contact Natural Resources South East by phone on 08 8735 1177 or by visiting the South East Natural Resources Management Board's website www.senrm.sa.gov.au

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