Phosphorus in the South East Soils

HOW DO WE MAKE THE MOST OF OUR UNIVERSALLY DEFICIENT NUTRIENT?

Phosphorus plays an essential role in all living organisms. It is a vital component of the genetic code, DNA, which is made of carbon, hydrogen, oxygen and phosphorus. Phosphorus is critical for the transfer of energy in cells and limited phosphorus means limited growth. It is also a component of cell membranes, the barriers that separate living cells from the outside environment. In animals, phosphorus is important as a key component of skeletons and for carrying nerve messages around the body. In fact without phosphorus there would be no life as we know it.

SO WHERE DOES ALL THIS PHOSPHORUS COME FROM?

In natural systems, phosphorus is released from the weathering of rocks when soils are slowly being formed. Most soils in Australia are very old and most of the phosphorus has been washed away. Our soils are generally impoverished in terms of their phosphorus supply and we need to input phosphorus fertilisers to provide enough phosphorus to grow productive agricultural crops and pastures and correspondingly be able to produce animal products like milk, meat & fibre.[1]

The soil plays a key role in storing and supplying phosphorus and different soil types vary in ability to store phosphorus.

Depending on soil properties, a large proportion of added phosphorus reacts with minerals in the soil, rendering it poorly soluble. In most soils there is usually only a fraction of a part per million of phosphorus available at any given time.

HOW DOES PHOSPHORUS REACT WITH YOUR SOIL?

Phosphorus from Superphosphate is pretty soluble, around the same as gypsum. However soon after diffusing out of the granule it will turn into solid when a precipitation reaction happens with iron and aluminium creating phosphates in the soil, or it will attach to the sides of iron and aluminium oxides. Some will also become organic phosphorus.

This is a good thing! If not, phosphorus would be lost with the same inefficiency as nitrogen. This phosphorus is not lost but is only slowly released back to the soil water. As more phosphorus is applied to the soil the sites of reaction are used up, and more of the phosphorus is more rapidly available. Phosphorus lock-up (nutrients being unavailable for use or 'locked up') is, to an extent, a myth. It is more important to determine when the rate of supply will become limiting.

WHAT DOES THIS MEAN FOR YOUR PROPERTY?

It is important to consider your soil type and some key parts of the soil chemistry to make informed management decisions about your phosphorus. The application of phosphorus fertiliser can provide substantial increases in agricultural production and profitability, but these come at a significant and rising cost. Therefore, it is important that we make the most of our phosphorus.

It is important to remember:

95% of phosphorus uptake occurs within 0.1mm of a root hair, so young plants can struggle to access adequate phosphorus

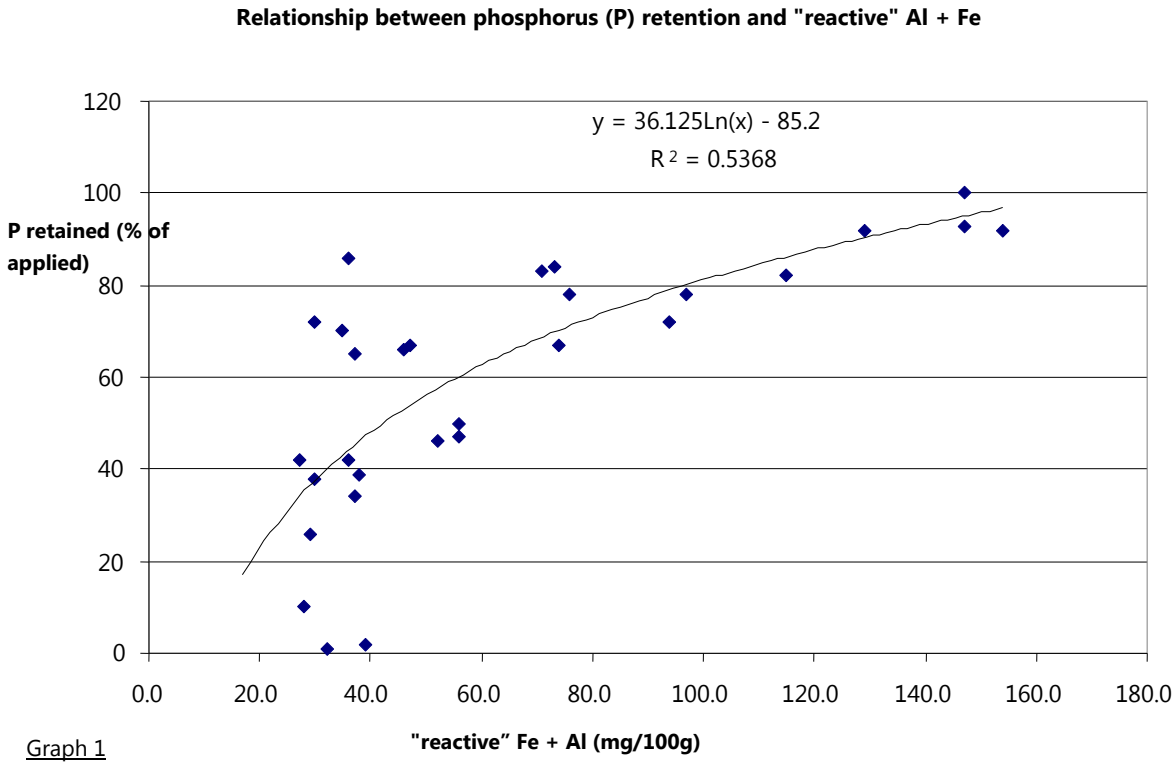
Mycorrhiza fungi can extend the reach of the roots

Less than 5-10% of applied phosphorus may be used in the year of application
In many soils of the South East, phosphorus has good residual value, a bit like money in the bank. However, if not applied for 5 to 10 years, even those soils with excellent fertiliser history are likely to develop a phosphorus deficiency.

In sandy soils phosphorus has a tendency to leach out of the soil. Sandy soils have been measured to lose up to 100% of applied phosphorus to leaching in the first season. Certainly 50% losses are common. Soils with sufficient levels of 'reactive' iron (Fe) and aluminium (Al) will tend to resist phosphorus leaching (see Graph 1). So what does this mean? If you have sandy soils with low 'reactive' levels of Fe and Al then you should test your phosphorus levels and apply less phosphorus more often, so that you don't lose your expensive phosphorus dollar to leaching

[1] Quoted from the Vic DPI Elinbank Phosphorus Budget Estimator Factsheet, Elinbank Centre www.dpi. vic.gov.au

Available phosphorus tests like the Colwell and Olsen's



Graph 1

Phosphorus retention measurements from a range of sandy surfaced soils from the SE of SA.

Lewis, D. Clarke, A. and Hall, W (1981). Factors affecting the retention of phosphorus applied as superphosphate to sandy soils in the south east of South Australia. Aust. J. Soil Res. 19, 167-74

In soils with high free lime (10-20%), phosphorus will react with calcium carbonate in the soil to create insoluble calcium phosphates. Lock-up of phosphorus occurs on these soils at high pH and more sophisticated methods of applying phosphorus may be needed.

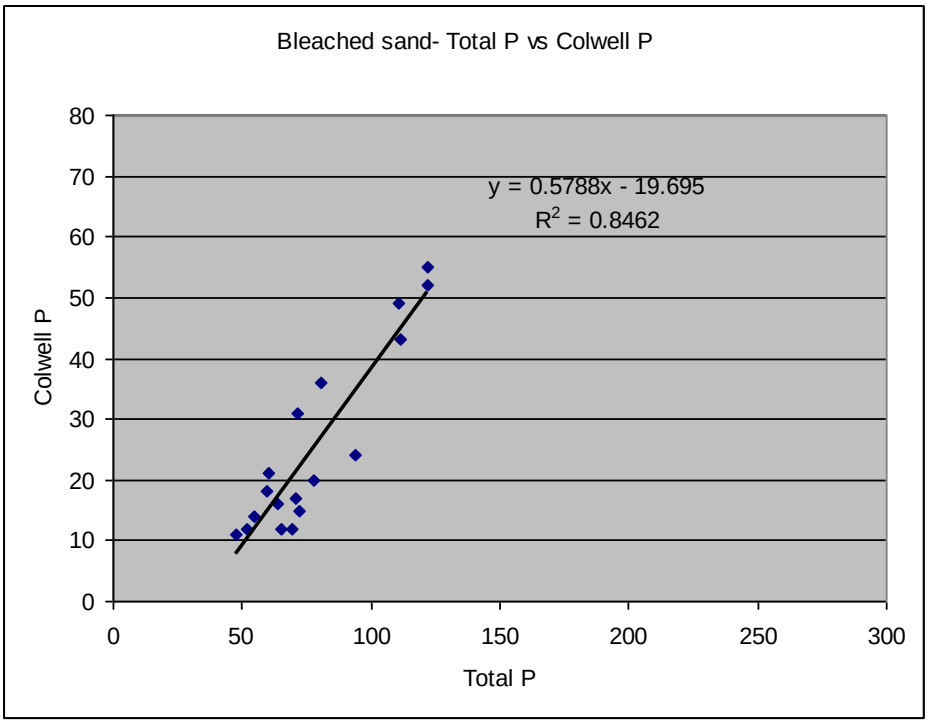
TESTING YOUR PHOSPHORUS USE

Testing of the phosphorus levels in your soil is important and will help in the budgeting of your phosphorus dollar.

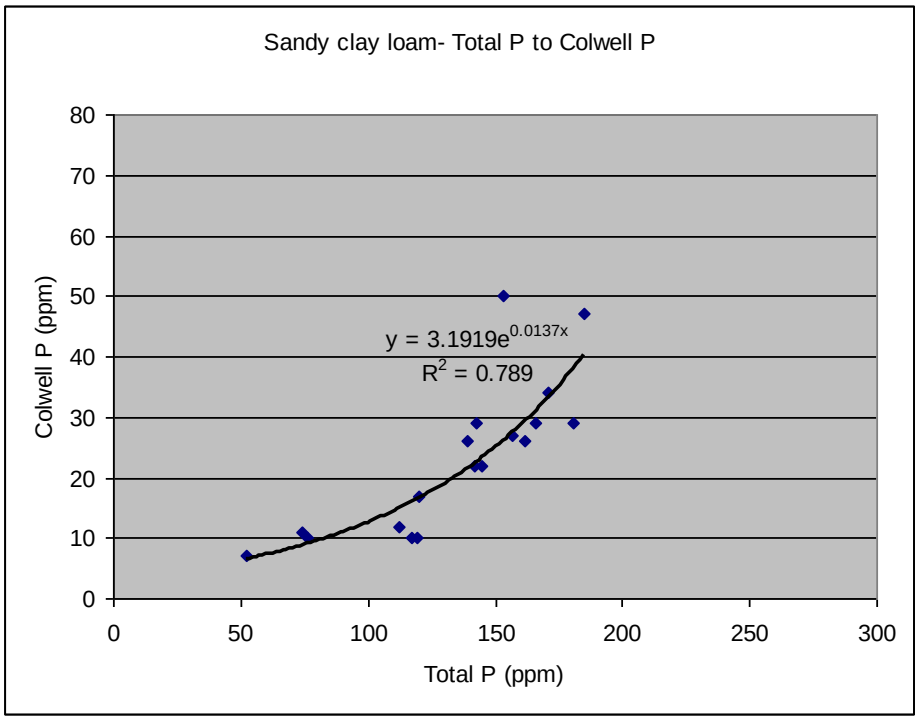
The release of phosphorus is related to:

- The total amount of phosphorus in the soil
- The abundance of iron and aluminium oxides
- Organic carbon content
- Free Lime/ Soluble Calcium Carbonate
- Phosphorus Buffer Index (PBI)

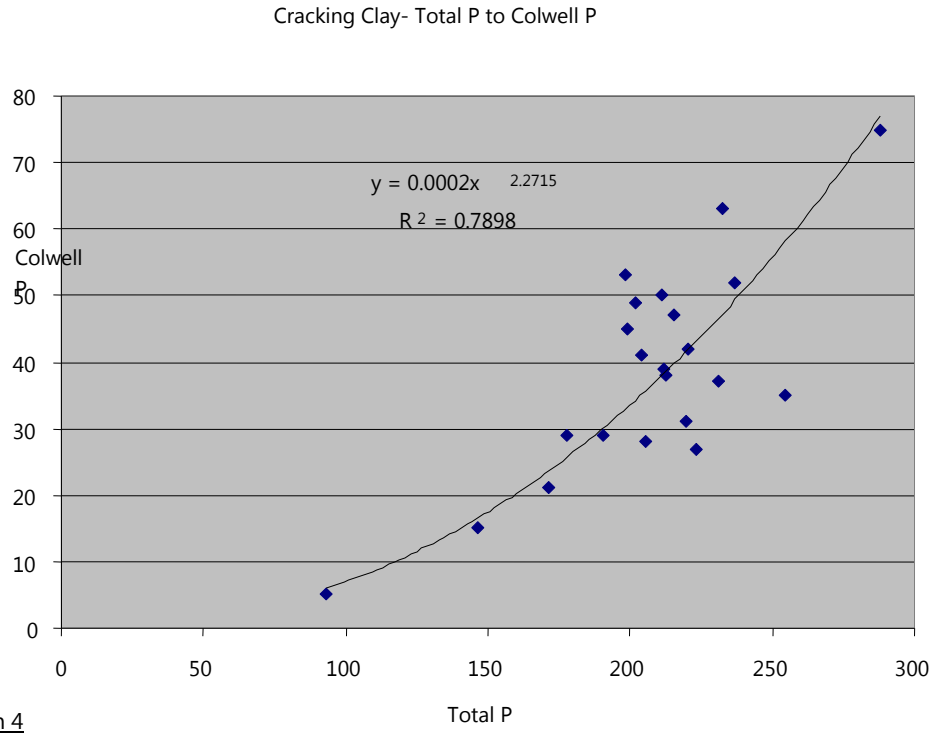
phosphorus test don't measure available phosphorus. Rather they express an indication of the rate at which phosphorus may be extracted from the soils. This indicator of rate is calibrated with field trials. There is a relationship between Total Soil Phosphorus and Colwell Phosphorus and this can enable you to predict when a given level of phosphorus input (fertiliser) or output (product removal) will result in a risk of phosphorus rate of supply becoming a limiting factor. Graphs 2-4 show this relationship for three different soil types commonly found in the South East.



Graph 2



Graph 3



Graph 4

The Phosphorus Buffer Index (PBI) is an indicator of the soil's ability to take up applied phosphorus fertilisers, and helps with phosphorus decision making.

In order to closely monitor your phosphorus use you should invest in a Total Phosphorus test, if possible a Phosphorus Buffer Index (PBI), a reactive iron (Fe) and Aluminium (Al) test, and a carbonate percentage test if you suspect you have high free lime.

More information on interpreting phosphorus soil test results can be found in the factsheet 'Standard Tests and Interpretation Guidelines RSSA', available on the Natural Resources SE website. Many government websites also carry further general information that may be helpful e.g. http://soilhealthknowledge.com.au.

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AUTHORS: Glenn Bailey, Rural Solutions SA & Tarnya Brooksby, SENRMB

For further info please go to our website: www.naturalresources.sa.gov.au/southeast or contact our Land Management Adviser on 08 87351177

MFMG MacKillop Farm Management Group Inc

Natural Resources South East

Government of South Australia