How do I make sense of soil test results?

The issue:	Soil test results provide information on soil nutrient levels and soil conditions such as acidity, salinity and structure.
The impact:	Tests can help identify if soil fertility or conditions are limiting production. Failing to act on the findings from soil tests can result in sub-optimal feedbase productivity.
The opportunity:	Understanding soil test results gives you the confidence to invest in appropriate inputs to address aspects of soil fertility and conditions which can limit production.

Soil testing provides a range of information on nutrient levels, conditions and other measures, such as carbon status. Tests can identify if there is an aspect of the soil which is limiting production and also rate soil conditions against industry benchmarks. The results can be used to determine if inputs are required and what nutrient or product can be applied to address the deficiency. Understanding soil tests results can help identify which is the most cost-effective product to apply.

What test results are important?

Soil fertility

The three most commonly deficient nutrients are phosphorus, potassium and sulphur.

Phosphorous (P)

Phosphorous is measured as Olsen P or Colwell P. Olsen P measures the amount of nutrient immediately available to plants. Olsen P remains stable throughout the year.

Colwell P measures the immediately available phosphorous (Olsen P) plus the phosphorous that is bound to the soil particles and released over time. This means the Colwell P is always higher than the Olsen P. The relationship between Olsen P and Colwell P varies with soil type.

Potassium (K)

Potassium levels are measured using the Colwell K test which identifies the amount of nutrient immediately available to plants and remains relatively stable throughout the year.

Sulphur (S)

Sulphur is assessed using the KCL 40 test which identifies the amount of sulphate sulphur immediately available to the plant. Other sulphur – elemental sulphur – is stored in organic matter and only becomes available as organic matter breaks down.

Other nutrients

Trace elements such as copper (Cu), zinc (Zn), manganese (Mn), iron (Fe) and boron (B) are only required in small amounts. Soil testing only provides a guide to the levels in the soil and can help identify gross deficiencies or toxic levels. Tissue testing provides a more accurate measure of trace element imbalances.

Soil tests can also tell you about:

Soil acidity (pH) and aluminium (Al)

Soil acidity and alkalinity are measured as pH. There are two methods to measure pH – one is in calcium chloride ($CaCl_2$) and the other is in water (H2O). The water measure is the traditional method but results can vary throughout the season.

Aluminium is stored in the soil in a number of forms that can be toxic to some plants. The level of toxic aluminium is affected by pH. As pH decreases (soils become more acid), more aluminium is converted to the toxic form.

Salinity

Salinity is measured using electrical conductivity (EC) by passing a current between a water extract from the soil sample. As salt conducts electricity, the more total soluble salt (TSS), the higher the reading, which is recorded in deci-siemens per centimetre (dS/cm).

Soil structure

Poor soil structure affects root growth and water infiltration. The stability and structure of soil depends on soil organic matter, the levels of calcium (Ca), which hold soils together, and elements which disperse soil, such as magnesium (Mg) and sodium (Na).

Useful soil test results include the ratio of calcium to magnesium (Ca:Mg) and the total amount of sodium compared with other elements (called the Exchangeable Sodium Percentage or ESP).

Additional indicators

A number of other figures and calculations are provided in soil tests which are used to calculate the rate and type of product to apply.

These include the following:

- Phosphorous Buffering Index (PBI): a guide to the amount of phosphorous applied to a pasture or crop that is 'locked up' on soil's clay particles and is not available for plant growth.
- Cation Exchange Capacity (CEC): cations are soil components that trap and release nutrients to the soil water.
- Soil texture: a measure of the proportion of sand, silt and clay in the soil. It influences the availability of some nutrients, a plant's reaction to salinity and the requirement of soils for products such as lime and gypsum.
- Organic carbon: levels of organic carbon influence soil structure and CEC. The breakdown of organic carbon is critical to the release of other nutrients.

Interpreting the results

While soil tests can help identify which soil factor or factors are limiting production, the target application of various products will depend on the soil type, rainfall, pasture species grown and the stocking rates.

Consult your local agronomist or product reseller. They can identify which deficiency is limiting production and calculate the quantity of particular products to apply in terms of nutrients, lime or gypsum. They can also look at the products available and calculate which one is the most cost-effective to apply.

More information

More Beef from Pastures: *Pasture growth: Build and maintain soil nutrients* module mbfp.mla.com.au

Making More From Sheep's: *Healthy Soils* module makingmorefromsheep.com.au/healthy-soils/index.html

Download the MLA Tips & Tools: *Managing soils to keep them healthy and productive* mla.com.au/managing-soils

CSIRO's *Making Better Fertiliser Decisions for Grazed Pastures in Australia* guide makingmorefromsheep.com.au/healthy-soils/procedure_6.3.html

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