

# Productive pastures

Focus on soils

*Compiled by David Hall and Jill Alexander*

## Managing soil health and nutrition – the bottom line

Pastures are often viewed as the inferior cousins of crops when it comes to preparation for sowing and ongoing monitoring and management. If you look at the high cost associated with establishing high-yielding pastures, you will soon understand that this is a misguided perspective. Getting the soil nutrition right can have a significant impact on the yield, and ultimately, the long-term carrying capacity of the paddock. Correcting deficient or imbalanced soil nutrients in an old cultivation paddock can lift pasture productivity and long-term carrying capacity by over 100%.

## Should I get a soil test done?

Soils should be considered in a three-dimensional way; by their very nature they will vary across the paddock as well as down through the profile. Just walking across the paddock looking at the soil is not going to give any real indication as to the soils fertility, this can only be done with any accuracy by collecting a sample to be analysed at a laboratory. The overall cost of a soil test is minimal and will be easily recovered in fertiliser savings or a better fertiliser recommendation.

Unless different paddocks have exactly the same soil type, have historically been managed exactly the same way, growing exactly the same crop or pasture, it's a pretty safe bet that the health and fertility of soils will vary across a property. The only way to definitively know what might be restricting plant growth and by how much, is to get a soil test done. If you haven't recently had one done, a soil test is a must if establishing a new pasture.



## What sort of soil test/s should I get done if I am sowing a new pasture?

To ensure all potential deficiencies within the root zone are identified, it is ideal to get a soil test for **0-10cm, 10-60cm at multiple sites** bulked together across the paddock. A description of soil texture and colour is also important when it comes to making the final fertiliser recommendation. If only a surface soil test is taken, then you are making many assumptions as to just what level and availability of nutrients are in the depths below that the plants roots will move into during the drier periods when they are chasing soil moisture.

## What to ask your agronomist for when soil testing

In general, based on the soil test results there are normal trends with relation to nutrient levels as you go down the soil profile; due to each nutrients varying solubility or ability to bind with clays i.e. it is normal for phosphorus, potassium and organic carbon %'s to decline as it is normal in our soils for soil chlorides, sodicity, electrical conductivity and pH to increase. Similarly, there are not necessarily absolute numbers for each soil nutrient level more so a range of values (an upper and lower) and ratios that we aim for the nutrient to be within.

During the discussion with the person taking the sample think about what information you would like to get out of your soil sample think about the possibility of **what could be obstructing the root development of your plants** (both crop and pasture root systems will easily extend down to 40 cm and greater).

Generally, you are only interested in the organic carbon % in the top 0 – 10 or 15 cm as this is the active portion of the soil for soil microbiology that cause the decomposition of the organic matter.

Soil nitrate nitrogen should be considered throughout the soil profile as plants root systems will be looking for this nitrogen at depth as the roots grow deeper into the soil profile. Phosphorus; not being anywhere near as mobile as nitrogen, should be considered in a few different ways to get a clearer understanding of if fertiliser phosphorus is required and just how much:

- a. You want to know the Phosphorus (Colwell) amount; this is the amount of phosphorus that the plants root system will be able to use.
- b. The Phosphorus Buffering Index (PBI); this number will give you an indication as to whether your soil is a high “P fixing” soil or not.

It is highly desirable that a soil sample should test for the major nutrients as listed below.

Table 1: What to ask for in a soil test

Nutrients	Units	Surface 0-10cm	Depth 10-60cm
Soil Colour		●	
Soil texture		●	
Soil pH	pH units	●	●
Electrical Conductivity (1:5 water)	dS/m	●	●
Electrical Conductivity (Saturated Extract)	dS/m	●	●
Chloride	mg/kg	●	●
Organic Carbon (OC)	%	●	
Nitrate Nitrogen (as N)	mgN/kg	●	●
Phosphorus (Colwell)	mg/kg	●	●
Phosphorus Buffer Index (PBI-Col)	-	●	●
Sulphur as Sulphate (MCP)	mgS/kg	●	●
Cation Exchange Capacity	cmol(+)/kg	●	●
Calcium (Amm-acet.)	% of ECEC	●	●
Calcium (Amm-acet.)	cmol(+)/kg	●	●
Magnesium (amm-acet.)	% of ECEC	●	●
Magnesium (amm-acet.)	cmol(+)/kg	●	●
Sodium (Amm-acet.)	% of ECEC	●	●
Sodium (Amm-acet.)	cmol(+)/kg	●	●
Potassium (Amm-acet.)	% of ECEC	●	●
Potassium (Amm-acet.)	cmol(+)/kg	●	●
Available Potassium	mg/kg	●	●
Calcium/Magnesium Ratio	-	●	●
Zinc (DTPA)	mg/kg	●	
Copper (DTPA)	mg/kg	●	
Iron (DTPA)	mg/kg	●	
Manganese (DTPA)	mg/kg	●	

It is important when sending the soil sample off that the laboratory chosen is a reputable one, by that it is meant that it has certain standards such as being **Australasian Soil and Plant Analysis Council (ASPAC)** certified. There may be other additional nutrients analysed as standard by some laboratories (Aluminium) which unless the soil is quite acid will not be a problem.

### When should I get a soil test done?

Soil tests should be done well enough in advance of sowing a pasture so that if any soil additives or pre-plant fertilisers which may be required, can be sourced and applied in good time. For example, if your goal is to plant pasture in mid-Spring, the soil test should be done in late Autumn/early winter to ensure the results are back and fertiliser ordered.

### What is the likely turn-around time for soil test?

Most laboratories that are of a larger through put will be able to turn the soil around in about **10 working days**, so allow a few extra days for the sample getting to the lab. Try not to post the samples on a Friday, especially in summer, as this could mean that the sample could sit unnecessarily in a hot packet, try to put in the fridge not freezer until Monday.

### Interpreting a soil test

The information below is but a brief guide to assist in interpreting the soil test results, for a complete interpretation consult with a reputable agronomist.

Table 2: Interpreting your soil test

Result	Comments
<b>pH (CaCl<sub>2</sub> test)</b>	pH 5 to 7: ideal for plant growth
<b>Organic carbon %</b>	Aim for about 2% organic matter (or better)
<b>Nitrate nitrogen (N)</b>	Assess through the profile for a better idea of plant availability
<b>Available sulphur</b>	Especially important in legume plants and for nodulation
<b>Phosphorus</b>	Essential building block for all plants, consider at depth as well.
<b>Potassium</b>	Will move in the soil more than phosphorus but generally not too mobile in clay soils.
<b>Cation Exchange Capacity (CEC)</b>	The more clay or organic matter in soil the higher the CEC. A high CEC usually means high soil fertility.
<b>Exchangeable sodium percentage (ESP)</b>	Would like to be less than 5% and can cause soil physical problems if excessive
<b>Calcium: Magnesium (Ca:Mg)</b>	This ratio should be 2:1. Higher calcium levels OK, but higher magnesium levels can cause a dispersive effect similar to that of sodium. Will generally find that the ratio gets less with depth, i.e. the amount of magnesium increases.
<b>Chloride and Electrical Conductivity (EC)</b>	Measures of salinity i.e. a total of all salts in the soil not any specific one.
<b>Trace elements</b>	Consider these (zinc, copper, iron and manganese) in the surface sample only, treat the numbers as a guide and confirm with a plant sample if concerned.

### Once the pasture is established, should I get my soil tested again & how often?

Once the pasture is established when the next soil test should be taken will **depend on the level of the soil nutrients prior to planting**.

If the soil was already quite fertile then the fertiliser applied pre-plant would have been more of a maintenance application and therefore the next soil test taken in **2 to 3 years** would simply be to

monitor soil nutrient levels with respect to seasonal production; the test would be timed about late autumn so as to get fertiliser applied prior to the next spring growth flush as soil nutrient levels will not change to much over winter.

If the soil pre-plant was quite deficient or had subsoil constraints, then the fertiliser programme would include capital amounts of nutrients or soil amendments. In this case I would suggest to sample again in **18 months to 2 years** see if the soil nutrients are now in the optimum range.

### Should I fertilise established pastures?

Yes, if they need it and it is economically viable. Once again you need to get a soil test done to be sure about this. With time, a paddock that has had nutritional deficiencies corrected and is not over-grazed, should need little, if any fertiliser or soil conditioners for optimal pasture productivity.



One of the best ways to correct minor soil imbalances and deficiencies is simply by building soil organic matter. Always retain a good body of residual grass stubble, regardless of season and rotationally spell paddocks during the growing season so that the plants can rebuild their root and shoot systems. Fertilisers can be used to maximise plant growth and yield to accelerate this process.

If nutrient deficiencies and imbalances aren't corrected, property managers must accept that the current substandard level of pasture vigour is not likely to improve. Paddock stocking rates should be adjusted down to align with the projected long-term carrying capacity of the rundown pasture. In big paddocks, it may more economical to supplement the animal to improve productivity, than correct a soil nutrient deficiency.

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