At-home soil and plant testing for landholders

Interest in soil and plant health has grown over the last few decades with many landholders undertaking annual testing in conjunction with their agronomist in order to inform future management decisions.

While laboratory-processed testing can be used to determine a broad range of factors, there are also a number of ways that landholders can assess their soils and crops without the associated cost or time lag. This provides landholders with the ability to quickly identify the factors that may be influencing crop health and effectively implement practices to remediate any potential issues.

NDVI and yield map data

Aerial NDVI maps can help landholders to identify poor performing areas, which can then be followed up and ground truthed with on-ground inspections and testing. NDVI tools such as Data Farming and DecipherAg provide free biomass imagery and even available water capacity layers. This information can be used in isolation in order to identify poor performing zones, or over time and seasons with variable rate fertiliser applications used to efficiently remedy any issues.

Yield maps also provide an idea of in-paddock variability and can overlay the NDVI data to provide a richer understanding.

Using mapped data

Once this information has been generated, divide up the paddock into good and poor performing areas. Poor performing areas can then be ground-truthed to see if there are any visual indications of the factors restricting performance.

Soil pits

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Digging a soil pit provides an unrivalled opportunity to assess the visible and physical characteristics of soil, as well as providing a basis to undertake tests to develop an understanding of the biological and chemical aspects.

Soil pits can be constructed in both poor and well performing areas of a property, and this is particularly beneficial in order to compare soils and develop observations about lagging soils. In order to be of most benefit, soil pits should be dug to a depth of 1.8 m. Where larger machinery is not available, a spade could be used to uncover a smaller area to examine.

Once constructed, the following observations can be made:

- The compaction zone or a zone that plant roots cannot penetrate
- The soil structure and shape of soil aggregates show how water can penetrate the soil and if soil amelioration might be required
- Root depth can be ascertained to determine physical and chemical soil constraints and to calculate water holding capacity
- Look at the roots – are they thick, or weak and straggly? In a multi species crop, are the various plant roots filling up different parts of the root zone? Are any soil particles congregating around the roots? If soil particles are present, it is likely that microbes are present and the plant is producing exudates (sugars). In legumes, it might be possible to see the nodules around the roots which indicates the crops ability to fix nitrogen.

In addition, the following soil tests can be carried out:

- Soil horizon levels and the depth of these horizons and the soil texture (hand ribbon method). From this, the water holding capacity for the paddock can be calculated.
- A fizz test can be done to show carbonate layers using dilute (HCL acid) squirting down the face of the pit
- A pH test can be carried out on soil from each horizon
- Dispersion testing and aggregates stability
- Water repellence can be tested by applying a water drop to the soil surface to see if it infiltrates the soil or stays on the surface.

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While the soil pit is available and the horizon levels are visible, soil samples can be taken for laboratory testing:

- Take a composite soil sample down to a desired depth (preferably down in horizon depths to 30 cm) and mix 5-10 samples in a bucket.
- Fill the appropriate soil sample bags and send the sample off to soil labs to determine soil nutrient levels.
- Review the results in conjunction with other test results, observations and agronomist / consultant input.

Soil microbiology

Microbiology fluctuates throughout the year but the best time to test it is in spring after rain.

1 - Take a number of samples down to 10 cm to and mix to form a composite sample.

2 - Fill the bag to sample line and place it in the fridge to keep it cool.

3 - Label well and send off on a Monday for testing. Sending soil off at the beginning of the week reduces the chances of the sample being stuck in a mail facility over a weekend when the sample will heat up and cause microbes to die.

When your test results arrive, compare the results with the data in the below table to see if the individual measurements fall within the ideal range.

Group	Factor	Ideal range

Organism biomass (ug/g)	Active bacteria	15-25
	Total bacteria	100-300
	Active fungi	15-25
	Total fungi	100-300
Protozoa (numbers/g)	Flagellates	10,000+
	Amoebae	10,000+
	Ciliates	50-100
Total nematodes (numbers/g)		20-30
Mycorrhizal colonisation (%)	ENDO	40-80%
	ECTO	40-80%
Organism biomass ratios	Total fungi: Total bacteria	0.8-15
	Active fungi: Total fungi	0.25-0.95
	Active bacteria: Total bacteria	0.25-0.95
	Active fungi: Active bacteria	0.75-1.5

There are also a number of easy, at-home tests that can be used to provide a quick idea of soil health. One example is the Solvita CO2 soil burst test which shows how much carbon dioxide the soil produces. The carbon dioxide level provides an indication of soil microbial biomass levels, as higher amounts of CO2 production indicate higher levels of microbial activity.

Another easy at-home test can be carried out by burying a piece of clothing made of either cotton or calico. Dig an area in a paddock, bury the item of clothing, and return the soil on top of it. The piece of clothing can then be dug up after a month. Microbial activity is evident where the piece of clothing has deteriorated significantly. Conversely, an item of clothing which is reasonably intact would indicate a low level of microbial activity.

Earth Worms

Earth worm counts are an easy way to see how healthy the soil is. Best done in winter or spring, dig an area to a depth of 20 cm and see how many worms you can find. If the paddock has been recently grazed, look out for dung beetles or dung beetle holes. Both worms and dung beetles provide an excellent service by building soil matter, turning the soil over and making nutrients more

available for subsequent plants.

Plant tissue testing

Testing plants to determine their sugar level can provide an insight into plant health and resilience to stress. The sugar level of a plant provides an indication of how effective it is at photosynthesising and therefore how well it is performing.

An easy, at-home method uses a refractometer and can be used across all plant types including crops and pastures.

To ascertain the brix level (sugar content) of a plant, you will need a garlic crusher, refractometer, distilled or ionised water, a small, clean container, a pipette and a sample of the plant you wish to test.

The best time to take a Brix test is 2 hours after sunrise when sugars are available in the plant (rather than the roots) and the plant isn't affected by mid-day water loss. Testing shouldn't be done immediately prior to a storm as the result will be inaccurate. If you're tracking the health of a crop of pasture over time, take readings at approximately the same time of day to get a more accurate picture.

Take the plant leaves, scrunch them up and roll them into a ball. Squeeze the ball with your hand or the garlic press to get a couple of drops of plant sap into the container. Use the pipette to suck up a few drops of the liquid and lift the plastic flap on the refractometer. Place a couple of drops of the plant liquid on the glass and then close the flap to remove any air bubbles. Look through the eyepiece and correspond the line with the scale to determine the brix level.

For more information on measuring brix levels, please refer to our refractometer webpage.

More information

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LANDSCAPE SOUTH AUSTRALIA MURRAYLANDS AND RIVERLAND

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