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FACT SHEET | AUGUST 2026

Know your soil biology series
Part 1: Soil biology testing

Understanding what lives in your soil can help you implement practices that boost your soil health and crop health outcomes. Healthy soils are teeming with beneficial organisms that support nutrient cycling, suppress disease, and improve soil structure - testing helps you see the invisible, and to decide next steps to take to either improve or enhance your farms soil biology.

KEY STEPS

1. Identify why you want your soil tested.
2. Note the sampling tips in *Part 2* of this series to ensure your sample is valid.
3. Determine which test is best.
4. Understand other indirect indicators and their limitations.
5. Refer to *Part 3* of this series to help interpret results from a testing laboratory and actions required.
6. Find a laboratory that can carry out your chosen test.

Why test for soil biology?

Soil health depends on the interaction of biological, chemical, and physical processes. Soil organisms play a critical role in nutrient cycling, organic matter decomposition, building soil structure and crop health. Invertebrates also play an important part of soil biology. Organisms such as earthworms, nematodes, mites, springtails and other arthropods help break down organic residues and support nutrient cycling, creating conditions that allow microbes to further decompose organic matter.

Soil biology testing can help:

- Assess soil health and biological function
- Monitor the impact of management practices over time to identify signs of soil degradation or improvement
- Track changes in biology over time and benchmark soil health
- Measure beneficial and pathogenic microbial populations
- Assess the risk of soilborne diseases
- Identify microbial imbalances affecting nutrient supply (N, P etc.)
- Guide decisions on bio-stimulants and other inputs, compost and soil amendments

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Which test is right for me?

Table 1: Decision table to help navigate the tests (commonly available soil biology tests)

If you want to...	...this is the recommended test
Population analysis	
Get a comprehensive picture of microbes in your soil – identify who is it your soil	• DNA / Metagenomics • Microscopy-based testing
Identify functional groups and count active bacteria/fungi, total bacteria/fungi, protozoa, and mycorrhizal colonisation in your soil	• Microscopy-based testing
Measure the living microbial biomass and community balance (bacteria vs fungi, microbial diversity, etc.)	• PLFA (phospholipid fatty acid analysis) • Microscopy-based testing
Estimate the number of culturable microorganisms in your soil	• Plate Count (CFU - Colony Forming Units)
Quantify the total weight/size of microbial carbon in your soil	• MBC (microbial biomass carbon)
Identify or monitor plant-parasitic or beneficial nematodes	• Nematode analysis / count • Microscopy-based testing
Assess the amount of mycorrhizal fungi colonisation of roots	• Mycorrhizal root colonisation test
Assess disease risk from soil-borne pathogens before planting susceptible host plants with conducive environmental conditions	• DNA – pathogen specific
Biological activity	
Check overall biological activity quickly and at a relatively low cost	• CO_2-Burst / Microbial respiration • Microscopy-based testing
Understand how active your soil microbes are (nutrient cycling)	• Enzyme Assay • Microscopy-based testing
Assess the fraction of organic nitrogen that soil microbes can convert into plant available nitrogen	• Potentially Mineralisable Nitrogen (PMN)
Field tests you can do on your farm	
Monitor earthworm populations	• Earthworm count
Assess visible soil invertebrate activity	• Visual assessment of soil invertebrates (e.g. earthworms, mites, springtails and other arthropods). Could use hand lens for better visibility.
Assess soil structure and biological effects	• Spade/soil pit - observe soil structure, roots, earthworms and other visible organisms

Indirect soil biology indicator tests

These tests do not directly measure soil organisms but provide information about soil conditions that indicates soil biological health.

They are typically measured through soil chemical analysis, physical assessments, or specialised laboratory methods.

- Soil organic carbon (SOC): Measures the total amount of carbon stored in soil organic matter, which provides an important energy source for soil organisms.
- Particulate organic carbon (POC): Measures the carbon contained in partially decomposed organic matter, which acts as a food source for soil microbes.
- Dissolved organic carbon (DOC): Measures the amount of dissolved carbon compounds available for microbial activity.
- Ground cover percentage: Measures the proportion of soil covered by living plants or residues, which influences soil temperature, moisture, erosion, organic matter, and microbial habitat.

Test descriptions of common tests

DNA / Metagenomics (microbial community profiling)

DNA/Metagenomics identifies what microbes are present in your soil and shows the microbial community composition (bacteria, fungi, archaea, protists), presence of pathogenic organisms, and proportion and diversity of the microbial community.

It can be used to observe changes in microbial communities in response to management practices such as tillage, and to measure improvements in soil microbial health over time. It can also be used to determine the fungal to bacterial ratio.

Limitation: May show organisms that are no longer active or alive.

Microscopy-based testing

Microscopy-based methods directly observe and quantify microbial groups in soil samples under a microscope. Fluorescent stains may be used to distinguish metabolically active microorganisms from inactive or dormant populations. These methods can assess microbial groups such as bacteria, fungi, protozoa and other soil food web organisms.

PLFA (Phospholipid Fatty Acid Analysis)

PLFAs are biological molecules that are key components of microbial cell membranes. Different microorganisms have different types of PLFAs, so this test gives an estimate of the size of specific microbial groups and the total living microbial biomass. Unlike the DNA test, PLFA only analyses living microbial components.

The test can also quantify the fungi-to-bacteria ratio, and biomass of mycorrhizae, and microbial diversity. Changes in management (e.g. tillage, cover crops, organic amendments) are reflected in microbial responses detected by PLFA.

Limitation: Identifies broad microbial groups rather than specific microorganisms.

Microbial Respiration / CO_2- Burst Test

The microbial respiration test measures the amount of carbon dioxide (CO_2) released from dry soil when it is moistened. CO_2 respiration indicates soil health, nutrient release potential, and carbon sequestration.

High respiration rates indicate active microbial communities and strong organic matter decomposition; low respiration may suggest poor microbial health due to imbalances or excessive soil disturbance.

Limitation: the test shows the overall level of biological activity but does not distinguish between microbial groups or between beneficial and pathogenic activity.

Soil Enzyme Assay

Microbes cycle soil nutrients using enzymes. The soil enzyme test measures the activity of key enzymes produced by soil microbes. Higher enzyme activity indicates more nutrients available for plants and is associated with healthier soils.

Unlike the DNA test, enzyme assays measure how active your soil microbes are, not just which microbes are present.

Limitation: Results measure potential activity under lab conditions, not necessarily in-field rates.

Nematode Analysis

Nematode analysis uses microscopy to identify and count nematodes present in soil samples.

It is useful for monitoring levels of plant-parasitic nematodes prior to planting susceptible crops. Not all nematodes are harmful. Free-living nematodes, beneficial bacterial feeders, fungal feeders, and predatory nematodes play important roles in nutrient cycling, which can also be detected using this test. Contact the lab to know which nematode groups can be detected.

Plate Count (CFU - Colony Forming Units)

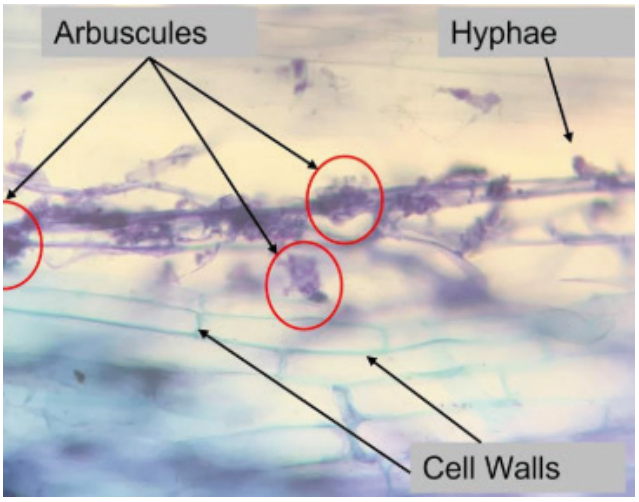
Plate counts estimates the number of culturable bacteria and fungi in a soil sample.

Results are expressed as CFUs per gram of soil. The test can be useful for monitoring selected culturable groups of bacteria or fungi.

Limitation: Does not measure the total soil microbial community because many soil microorganisms cannot be grown using standard laboratory culture methods. Only a small fraction of total soil microbes are culturable, so plate counts underestimate true microbial diversity compared to other methods such as PLFAs and DNA-based methods.

Mycorrhizal Root Colonisation Test

This test measures the percentage of plant root length colonised by arbuscular mycorrhizal fungi (AMF, also known as VAM, Vesicular Arbuscular Mycorrhiza). Mycorrhizal fungi form symbiotic relationships with plant roots, improving nutrients (especially phosphorus) and water uptake. It has also been reported to help cleaning polluted soils (bioremediation).



Microscope image of mycorrhizal fungi colonising roots

Potentially Mineralisable Nitrogen (PMN)

PMN measures the amount of nitrogen that soil microbes can release from organic matter over a defined period. It indicates the biological capacity of your soil to supply nitrogen to crops, helping guide fertiliser decisions.

Limitation: Results are measured under controlled laboratory conditions and represent the soil's potential nitrogen supply rather than actual field release rates. In-field nitrogen mineralisation is influenced by environmental conditions such as soil temperature, moisture, oxygen availability, soil type and organic matter inputs.

Microbial Biomass Carbon (MBC)

MBC is a measure of the total potential weight / carbon contained within the living organisms in soil, such as bacteria and fungi.

Limitation: Does not give information on community composition (e.g. Fungi vs bacteria), or specific species.

Monitoring and benchmarking

These soil biology tests are useful when repeated over time. Use them to establish a baseline before implementing a new management practice, or to monitor changes after practices such as cover cropping, compost application or reduced tillage.

Before testing, be clear about the question you want to answer. Sample when the results will inform a management decision, and use a consistent location, timing and sampling method for repeat testing.

Where can I get my soil biology tested?

The table below summarises which test types are available from each lab. Contact labs directly or visit their website for current pricing and sample submission requirements.

Table 2: Test availability and different laboratories. ✓= test type available — = not offered or not confirmed

Lab	DNA/ Meta genom-ics	PLFA	CO_2 Respi-ration	En-zyme Assay	Nem-atode Analy-sis	CFU	Mycor-rhizal root coloni-sation	PMN	MBC	Micros-copy based testing
1. MLABS (Microbiology Labs Australia)	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
2. Metagen Soil Health Laboratory	✓	–	–	✓	–	–	–	–	–	–
3. Eurofins APAL	–	–	✓	–	–	–	–	–	–	–
4. EAL (Environ-mental Analysis Laboratory)	–	✓	✓	–	✓	✓	–	✓	✓	–
5. Agpath Pty Ltd	–	–	–	–	✓	✓	✓	–	–	✓
6. The Soil Foodweb Institute (Australia)	–	–	–	–	✓	–	✓	–	–	✓

Contact information

1. Microbiology Laboratories Australia
PO Box 230, Melrose Park DC, SA 5039
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2. The Soil Foodweb Institute (Australia)
12 Ridge Terrace, Millicent, SA 5280
08 8733 4457 (Office); 0412 247 290 (Chris Ellery)
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3. Eurofins APAL – Adelaide
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PO Box 155, Welland, SA 5007 (Postal)
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08 9477 2277
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apal.com.au

4. EAL
PO Box 157 (Military Road), Lismore, NSW 2480
02 6620 3678
eal@scu.edu.au; scu.edu.au

5. Agpath Pty Ltd
105 Gunn Road, Garfield, VIC 3814
0413 013 247
lab@agpath.com.au; agpath.com.au

6. Metagen Soil Health Laboratory
98 Chadwick Road, Gatton, QLD 4343
1800 229 994
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soilhealth.metagen.com.au

Further reading

Factsheet:
What you need to know about soil biology

Factsheet:
Part 2: Soil biology sampling

Factsheet:
Part 3: Interpreting soil biology results

References

https://www.soilquality.org.au/factsheets/soil-biological-fertility

https://pmc.ncbi.nlm.nih.gov/articles/PMC3443552/

https://ausveg.com.au/knowledge-hub/soil-microbiology-and-pathogen-testing-whats-out-there/

https://pmc.ncbi.nlm.nih.gov/articles/PMC12029357/

https://attra.ncat.org/publication/soil-health-indicators-and-tests/

https://agcrops.osu.edu/newsletter/corn-newsletter/2019-09/plfa-soil-health-test

https://solvita.com/co2-burst/

https://ausveg.com.au/knowledge-hub/soil-microbiology-and-pathogen-testing-whats-out-there/

https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0018/41643/Soil_biology_testing.pdf

https://www.pir.sa.gov.au/__data/assets/pdf_file/0019/236233/sampling_for_nematodesA.pdf

https://soilhealth.metagen.com.au/soil-enzyme-testing/

https://www.soilquality.org.au/factsheets/soil-sampling-for-soil-quality-south-australia

https://www.nsw.gov.au/regional-and-primary-industries/agriculture/soil/testing

https://www.scu.edu.au/media/scu-dep/services/environmental-analysis-laboratory/documents/Soil-sampling-guide.pdf

https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0018/41643/Soil_biology_testing.pdf

https://www.soilquality.org.au/factsheets/a-practical-test-to-assess-the-biological-status-of-australian-grain-growing-soils