



Quantifying soil health after long term cover cropping

Introduction. Quantifying all the interacting components of soil health - the physical, biological and chemical factors - is essential to understanding cover crop benefit.

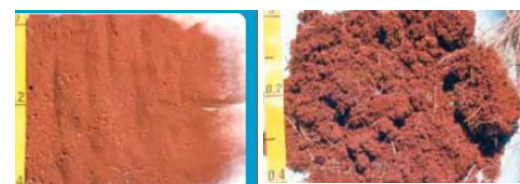
Traditionally many measures of soil health have been subjective and non-rigorous. Typically a basic soil chemistry test may be the only quantitative test used by a majority of farmers. Yet physical and biological properties are both key components of understanding soil health, particularly their long term trends.

This factsheet identifies and provides preliminary data on some soil health measures after long term (13 years) cover cropping.

Key Points

- Manage **cover crops** as you would a cash crop.
- **Physical and biological soil tests** may complement traditional chemistry tests.
- **Organic matter** is critical for soil health. **Keep something growing** or covering the ground as much as possible (track levels over time).
- **Useful measures for monitoring soil health include:** basic soil chemistry tests, PreDicta, aggregate stability, soil community analysis, beneficials.
- **Financial benefits** (both on and off farm) may result from well-managed cover cropping.

	Total C	Organic Matter	Aggregate stability		
			Stable	Unstable	
			>2mm	0.5-2mm	<0.5mm
Fallow	3.8%	6.1%	18.4	44.9	36.7
Ryegrass	4.2%	6.8%	32.9	39.5	27.6
Caliente	4.3%	6.9%	28.6	42.8	28.6



Fine, powdered unstable soil

Stable aggregates (fine roots present)

Organic matter and cover crops

Organic matter is critical for soil structure, biology, aeration, infiltration, nutrient and water retention, internal drainage and soil resilience.

- Keep something growing in, or covering, the soil as much as possible to minimise erosion & maintain root channels.
- Use the most suitable cover crop mix that does the job you want - a legume for nitrogen, a tap-rooted species for 'biological tillage', a vigorous grass species for bulk production of fibrous roots and a thick stand to out-compete weeds.



Soil tests – quantitative measures

Basic soil chemistry tests are important to monitor crop nutrient requirements. In particular,

- Take note of **carbon levels** and how they change over the long term – they are a good surrogate measure of soil health.
- **Aggregate stability** provides a measure of soil structure and resilience to physical stresses such as wind and water erosion.

Biological properties

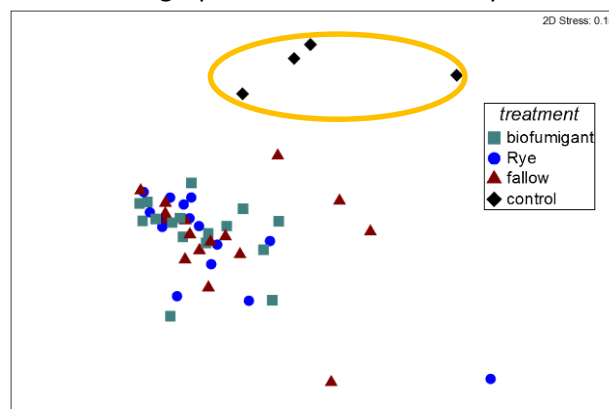
Pathogens – Available tests - **PreDicta** quantification of key soilborne pathogens and provide a measure of disease risk.

Pathogen/disease complex	<i>Rhizo</i> <i>AG</i> <i>2.1</i>	<i>Rhizo</i> <i>AG3</i>	<i>Powdery</i> <i>scab</i>	<i>Club root</i>	<i>Sclerotinia</i>
Fallow	+	0	-	-	+
Ryegrass	0	0	+	-	++
Caliente	+	0	0	++++	++

Weed seedbanks– just prior to cover crop termination - data 'was obtained from the University of New England, Hort Innovation-funded project VG15070 .

Weed density (plants per sqm)	<i>Total</i>	<i>Chickweed</i>	<i>Nightshade</i>
Fallow	22	4	9
Ryegrass	189	167	0
Caliente	262	259	0

Soil community analysis – eukaryotes, bacterial, fungal communities – fingerprints of the functionality within the soil.



Eukaryote communities – similarity matrix

Spring/summer crop performance

Estimated yield	<i>Carrot (15/16)</i> (t/ha)	<i>Broccoli (16/17)</i> (DW/plot)	<i>Potato (17/18)</i> (t/ha)	<i>Carrot (18/19)*</i> kg per plot
Fallow	70.5	531.7	75	14.42
Ryegrass	82.4	541.3	72.7	14.79
Caliente	86.8	544.8*	76.5	14.94

Other points – work in progress -

- Biofumigants – maximal glucosinolate levels tend to occur under higher temps (John Duff, DAFF Qld).
- Look out for new tests that quantify beneficials/microbial activity and arthropod presence, e-nose.
- Future work should utilise different biofumigants (or mixes).
- Economic analysis underway – difficult to measure the absolute benefit of improved soil structure.



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Hort Innovation

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