

Nature's workforce



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Cover up! Protect your hidden workforce

Research has found that there are millions of “workers” contributing towards soil health waiting to be unearthed and acknowledged. Look down not out and measure your ground cover as an indicator of soil health.



Cotton growing in wheat stubble

In summary...

The science

Soil organisms break down organic matter from dead plants, releasing trapped nutrients and making them available for new plants to absorb. Some soil organisms also help plants to absorb essential nutrients whilst others improve the soil structure.

Helpful hints

- The most important thing in maintaining a healthy soil is to keep it covered with organic matter.
- Increase organic matter and improve soil structure through stubble retention, crop rotations and green mulch.

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- Maintain greater than 70% groundcover by rotating stock to increase seed set, soil biota and grass diversity.

Benefits to the farmer

- Healthy soils produce healthy plants which lead to healthy profits.

Are you making a difference?

- Look down not out! Using a small quadrant, record the percentage groundcover and amount of litter and green plant material.



Cotton Catchment Communities CRC

What does the science say?

Soil organisms are responsible for breaking down organic matter from plants. This releases trapped nutrients and contributes towards increasing soil fertility. Some soil micro-organisms glue soil particles together to improve soil structure, whilst others like mycorrhizal fungi attach themselves to plant roots and assist plants in absorbing essential nutrients like phosphorus and zinc.

In 1 hectare of healthy soil you could find 20 000 kg microscopic organisms, 50 kg micro-fauna, 20 kg slightly larger organisms (2 – 10 mm), 900 kg organisms > 10 mm e.g earth-worms and termites (Bradshaw 2001).

This highlights the importance of preventing a decline in soil health. Soil degradation not only has a negative effective on farm productivity but also the losses of biodiversity are potentially enormous.

Plants and the soil are intrinsically linked, both depending upon each other. Soil micro-organisms in the rhizosphere, which is the space 1mm from the roots, feed on the plant exudates like water, amino acids, sugars and organic acids. The micro-organisms then produce nutrients which can be absorbed by the roots. Roots and mycorrhizal fungi also bind soil aggregates and stabilise the soil by improving the soil structure. The uptake of moisture from the soil via the roots also helps improve the soils structure. The roots and the macro biology like worms and beetles also form channels in the soil which improves water infiltration. Plants also influence the soil by covering and protecting the soil from degradation like erosion.

What can you do about it?

The most important thing in maintaining a healthy soil is to keep it covered with organic matter. Plants above ground keep the soil healthy through providing organic matter and feeding the soil microfauna and microbes. The roots below also feed the soil micro-organisms as well as providing chan-

nels for water infiltration. In fact plants help form the soil. Here are some tips for keeping the soil healthy:

- Increase organic matter and improve soil structure through stubble retention, crop rotations and green mulch.
- Maintain greater than 70% groundcover by rotating stock to increase seed set, soil biota and grass diversity.
- Reduce disturbance to the soil like unnecessary cultivation.
- Reduce compaction and water logging.
- Keep plants and roots in the soil for as long as possible.
- Maintain a good diversity of plants in your pasture as they will provide a range of nutrients and a greater diversity of root types.



These pictures are of Ammonium Oxidiser bacteria in a media that allows us to quantify their number. These bacteria convert ammonium to nitrite in soil, an important process in plant nutrition and in the immobilisation of nitrogen in clay vertisols. *Oliver Knox*

Am I making a difference?

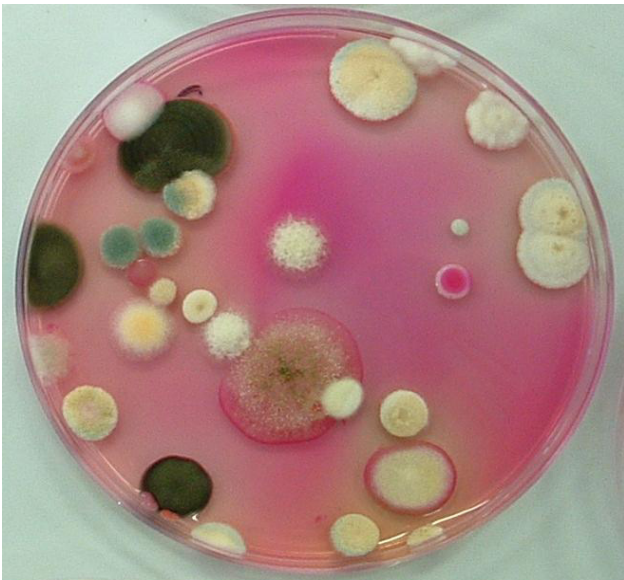
- Look down not out! Using a small quadrant, record the percentage groundcover and amount of litter and green plant material.
- Measure organic content of your soil using a jar with water. Place a sample of soil in the jar, shake it up and note how much organic material floats to the top.
- Arrange a soil test from your local DPI for a more accurate look at your soils health and for what indicators to use in assessing and monitoring soil health.

Benefits for the cotton grower

- Increased infiltration and storage of water, faster breakdown of residual herbicides and increased rotation flexibility.
- A healthy soil means that the hidden workforce is able to provide essential ecosystem services like nutrient recycling, releasing of nutrients, aerating soil and reducing water logging, improving soil structure and promoting plant growth.
- Promotes beneficial soil biology like mycorrhizal fungi which are important for the growth of cotton, maize and chickpeas.

Benefits for biodiversity

- The roles and interactions of many soil biota are still not fully understood. It is important to maintain them so the importance of soil biodiversity can be fully evaluated in time.
- Healthy soils will support a greater biodiversity of plants and greater biodiversity of plants will improve the soil.



This is a picture of fungi and yeast (the dark pink colony) growing on Rose Bengal Agar. The fungi on this plate represent about 1/100th of the fungi found in a gram of soil. The majority of fungi are not pathogenic and are involved in essential soil processes. *Oliver Knox*

For more information:

Web pages

- <http://www.agric.nsw.gov.au/reader/soil-biology>
- http://www.cotton.crc.org.au/content/Catchments/Publications/Environment__NRM_Publications.aspx
- <http://live.greeningaustralia.org.au/GA/NAT/TipsAndTools/exchange/>
- <http://www.carbonsmart.com.au/> Landcare Carbonsmart
- <http://www.namoi.cma.nsw.gov.au/>

Scientific Publications

Bradshaw, W. (2001) Critters and crops: The critical connection. Greening Western Australia, Fremantle, WA.

Joint Venture Agroforestry Program (2000) Determining the Effectiveness of Vegetation Management Programs: Measures and methodologies – literature review. Joint Venture Agroforestry Program and Environment Australia, Publication No. 99/130, Canberra, ACT.

Knox, O.G.G, Vadakattu, G., Seymour, N., Rouke, K., Whiffen, L., Midgley, D. and McGee, P. (2004) Cotton information sheet; Soil Biology-What's hiding in the ground?

Lines-Kelly, R. (2005) Soil biology basics- The rhizosphere. NSW DPI.

