

Being Green and in the Black

Border Landcare Organic Group

Fact Sheet 1

What is this fact sheet about?

Soil & water are the two most important assets on any farm. They are the basis of good crop production. More and more growers are realising that a biological or organic approach is needed in managing these natural assets. This is because soil carbon, minerals, water and soil biology are all interlinked. An integrated, biological approach is critical for achieving optimal farm yields in the long term.

What is biological farming?

Biological farming is a term that covers a new way of modern agriculture in Australia. Other methods of farming based on biological principles include conservation, organic, ecological or low input farming.

A biological approach looks at crop production in an integrated way. In this approach soil chemistry is seen as important but so is soil carbon, soil biology and soil structure. Optimal crop production is impossible without all three in balance.

Biological agriculture sees the farm as a complex system of plants, soils, water, climate, animals and micro-organisms that needs to be kept in balance through careful management. Your farm is an ecosystem!

The outcome from biological methods is a healthy soil. This in turn leads to healthy plants and less reliance on farm inputs like chemicals and fertilisers.

Good soil biology not only gives good production outcomes, it also helps the plants in their struggle against disease and pest damage. ["Managing Insects on Your Farm: A Guide to Ecological Strategies"](#) is free, and available for download at www.sare.org

5 Principles of Biological Soil Management

1. Keep ground cover at all times
2. Rotate crops
3. Use biological inputs
4. Add carbon
5. Balance your soil chemistry

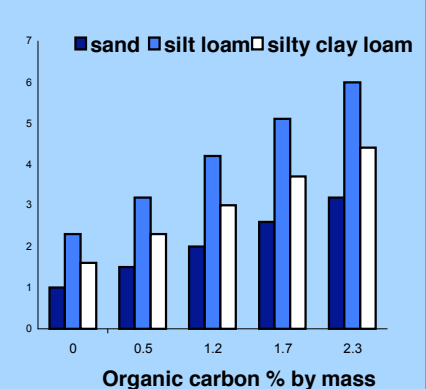
Fact Sheet 1

Soil and Water Management

Other Fact Sheets in this series:

- 1 - Soil and Water Management
- 2 - Inputs
- 3 - Plant Protection
- 4 - Contacts, Links etc
- 5 - Conversion to Organics

Water held in the soil



Increases in water held in top 25centimetres of soil:

As the % of carbon goes up in a soil so too does the amount of water that can be stored in it. This is true for most soil types. The above research shows that when organic carbon was over 2% there was twice the water in the soil as when there was only 0.5% carbon. *Research from: Hudson – Journal of Soil & Water Conservation*

Drought Proofing our Soils

The key factors to consider in drought proofing are texture, soil aggregation, organic matter and ground cover.

The same factors that we need to consider in building healthy soils. That is why soil and water management are so tightly bound together.

Good Soil Management is Good Water Management.

You can download these free books, ["Building Soils for Better Crops, 2nd edition"](#) and ["Managing Cover Crops Profitably, 3rd Edition"](#) at www.sare.org

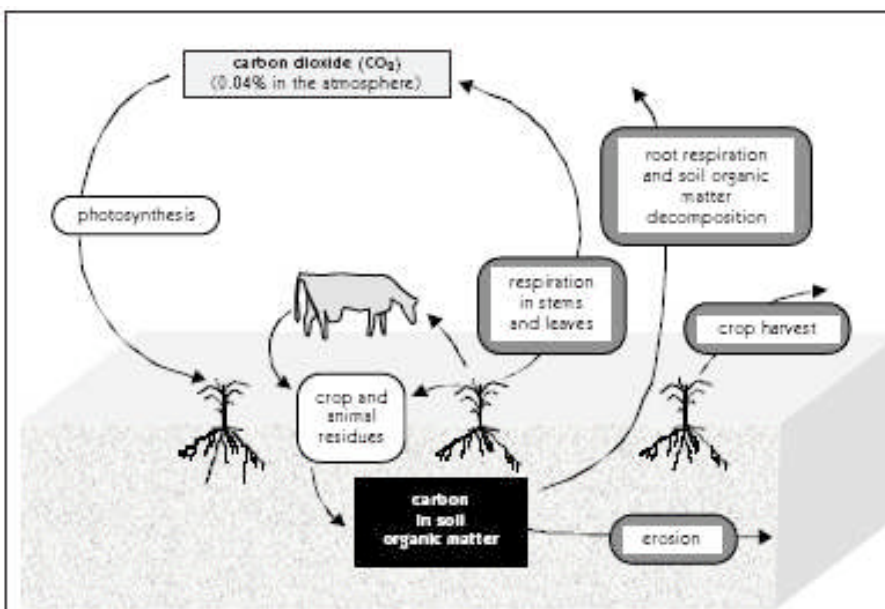


Figure 4.6 The role of soil organic matter in the carbon cycle. Losses of carbon from the field are indicated by the dark border around the words describing the process.



Soils

Why are soils important?

Soils are the base from which plants grow and crop and pasture production is what underpins profit on all farms. Therefore without healthy, effectively functioning soils, agricultural production declines.

The key functions that soils carry out on your farm include:

Catching & storing water: Healthy soils act like a sponge, soaking up water and holding it in the ground where it is available for plant growth.

Storing and recycling nutrients: Soils are the main source of nutrients for plant growth. Healthy soils store more nutrients and the soil micro-organisms recycle these nutrients making them readily available to plants.

Providing a base for plant roots: Soils need to provide a suitable environment for plant roots to thrive. The roots in turn provide plants with both water and nutrients. Healthy soils provide an optimum environment for plant roots, increasing plant production and health.

Although using chemical fertiliser approach can bring about impressive short term yield results it can also lead to soil productivity

issues such as declining organic matter, acidity, leaching and nutrient imbalances.

Also, agriculture chemicals, including fertilisers, can adversely impact on your soil biology. Biological activity is essential for productive soils.

Research and field experience are also indicating that poor soil health leads to lower plant health and opens the door to pests and diseases in crops.

Benefits from a biological approach

Taking a biological approach to soil management leads to some key benefits to your farm:

Soil protection and regeneration: A soil that is chemically balanced, high in organic matter and always protected by surface cover tends to be stable. Issues such as erosion & surface sealing are less likely. Ground cover and good aeration also helps to moderate soil temperature. By using biological practices you are also able to rebuild your soil's fertility.

An increase in plant available water: Increasing soil carbon significantly increases your soil's water holding capacity. This means more water for production and a better ability to grow crops

ORGANIC PRODUCTION PRINCIPLES

Organic production systems are guided by the following principles and outcomes:

- ☺ Production of naturally safe, high quality, nutritionally vital foods.
- ☺ Optimal production output, with rational and minimised use of inputs
- ☺ Use of recycling and biological cycles within the farming system
- ☺ Biodiversity protection and enhancement within the farm and surrounding areas
- ☺ Regeneration of lands and soils and best environmental practice of farming activities

Nitrogen for Free

It is well known that legumes can host symbiotic bacteria to fix nitrogen.

But it is less well known that the so called "free living" bacteria also fix nitrogen. These bacteria, (*Azotobacter spp*; *Azospirillum spp*; *Agrobacter spp* etc) are available to all plants and function on leaf and in soil. However, they do need to be near living plant roots, have a nice place to live and are averse to toxic farm chemicals and fertilisers.

Endophytes are another group of nitrogen fixers, but are less sensitive to harsh chemicals





during low rainfall seasons. Especially important in our uncertain climate.

An increase in stored and available nutrients: By building soil humus you are increasing the potential of your soil to hold and deliver nutrients to your crops. Biology & carbon are the only ways to build humus. Biologically active soils make more nutrients available to plants than those that are not biologically active.

For example some fungi assist in the uptake of Phosphorous and Zinc nutrients to plants. With these fungi more nutrients are available to the plant roots.

A decrease in pests & diseases: Research is now clearly showing that plants with optimal nutrition and growing in a healthy soil can be more resistant to attacks by pests and diseases.

For example strong plant cells are able to withstand fungal attack to a greater extent than those that are lacking in strength. Healthy, diverse micro-organism populations in soils and on plants can regulate pathogens and diseases.

Optimal plant growth and health: With optimal nutrition and soil conditions crops can grow to

their full potential. This means effective photosynthesis and high quality grains, fibre, forage and oil seeds. It also means that plants have deep and vigorous root systems that further build the soil system as they shed carbon to feed the soil ecosystem.

Overall biological farming can lead to less need for pest and disease inputs. This saves both time and money.

[Northern Rivers Soil Health Card](http://www.tuckombillandcare.org.au/shc.htm)
at www.tuckombillandcare.org.au/shc.htm

The soil health card lists ten tests and provides space for you to rate your own soils after carrying out the tests. By testing regularly and keeping the cards, you can build up a record of your soil health, and understand the effects of management practices on soil health.

The Soil Health Card tests cover:

1. Ground Cover
2. Penetrometer
3. Infiltration
4. Diversity of Macrolife
5. Root Development
6. Soil Structure
7. Aggregate Stability
8. Earthworms
9. Soil pH
10. Leaf Colour

How micro organisms help with water holding.

Three species of actinomycetes will breakdown the wax barriers on sand particles. This increases water infiltration and helps solve the problem of "non wetting sands". Species are Rhodococcus and mycobacterium.

Lime applications can increase their populations up to ten fold.

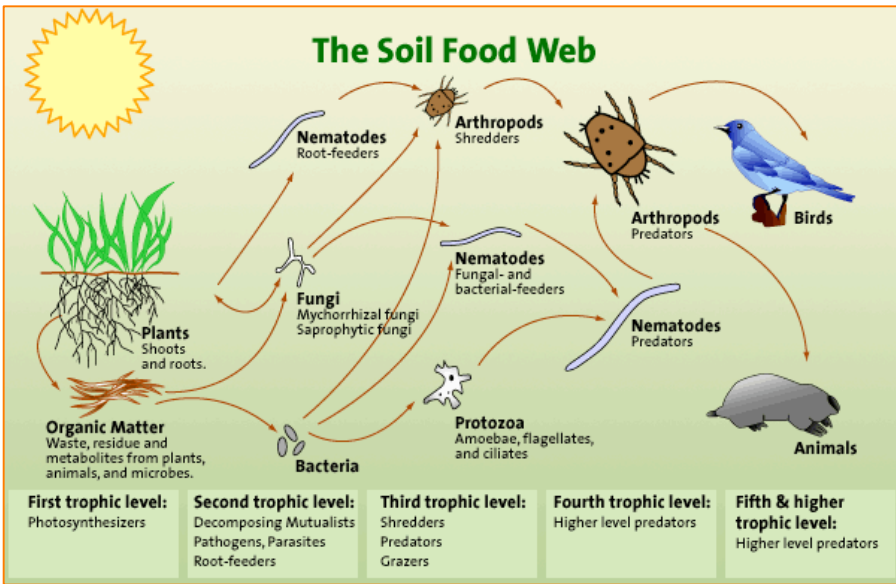


What does a "no till, permanent cover crop vegetable and cropping farm look like?
Go to <http://www.cedarmeadowfarm.com/>, have a look at the equipment and see the results.

How can I build my organic matter, cheaply and easily?

Download this book [MANAGING COVER CROPS PROFITABLY](http://www.sare.org) at www.sare.org. *Building Soil Fertility and Tilth* (p.16) shows how cover crops add organic matter and greater productivity to the biological, chemical and physical components of soil.

Want to know more?
Where to go to get info?
See the BLOG Fact Sheet 4 [Contacts Links and Information](#) .



See this graphic and more at the Soil Food Web web site



Key Practices

There are some key management practices which can assist in building the biological health of your soil. These include:

1. **Using no till or minimum-till techniques:** keeping cover on your production areas at all times is an important way to build soil health. No till techniques involve sowing seeds or seedlings into residue of a cover crop. No till involves changing planting gear and managing cover crops. Successful no-till horticulture farms are now running in Australia. Horticulture Australia has a *Best Practice Guide* to

help farmers convert to this method.

2. **Using bio-chemicals:** Some agricultural chemicals, including fertilisers, herbicides and pesticides, have been shown to negatively impact on your soil's micro-organisms. These bugs are essential for effective nutrient cycling. Minimise the use of strong synthetic chemicals by following an IPM program and try to use inputs that are biologically based. There are a wide range of mineral and bio fertilisers on the market along with new generation, bio-pesticides

which do not impact on your micro-organisms. Ask your local agricultural supplier and if you do not find what you need then shop around!

3. **Use compost and manures:** These can add carbon and nutrients to your soil which builds your soil both physically and chemically. Using these inputs also stimulates soil biology. The DPI has fact sheets on how to compost on farm. A number of commercial composts are also on the market.

4. **Balance your soil chemistry:** Soil chemistry is more than just NPK. Many nutrients are needed in small amounts and the right proportion of nutrients are also needed. Put in place a fertility program that considers all your nutrients both major and minor.

5. **Use crop rotations:** By implementing a crop rotation program you can ensure healthy soil conditions for your crops. Different crops can work with each other to build a diverse soil ecosystem that is balanced and disease resistant.

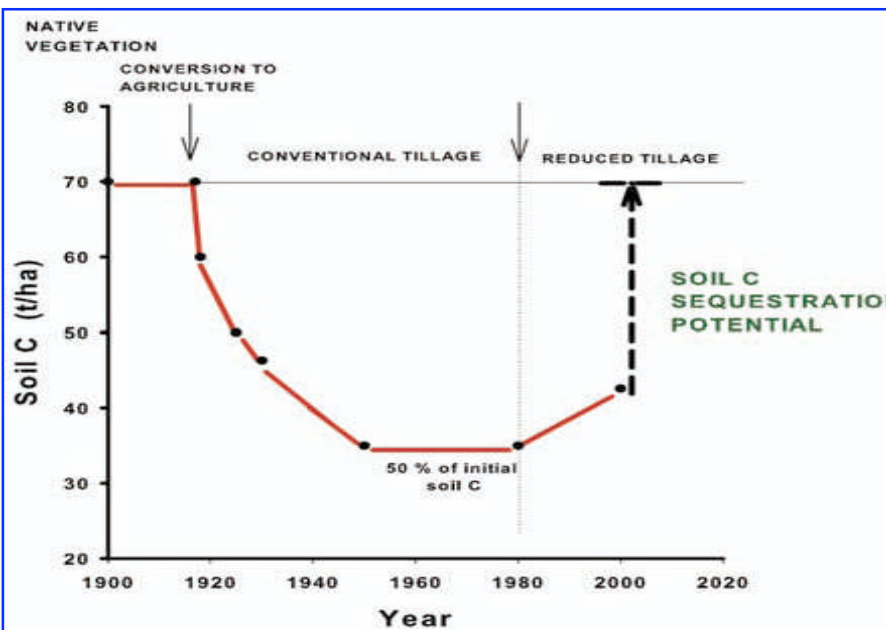


Figure 3. Historical change in SOC as a result of agricultural development, showing soil carbon sequestration potential. 1% Soil Organic Carbon, over a hectare and over 30 cm depth of soil would sequester 42 tonnes of carbon.

From NSW DPI Fact Sheet (DPI Prime fact 735) [Increasing Soil Organic Carbon on Agricultural Land](#)



This Fact Sheet is also available online at the BLOG website (www.granitenet.net.au/groups/BorderLandcareOrganicGroup/page.cfm) or at the BLOG Wiki (gb-blog.wikispaces.com/)

This project supported by:



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