

# Soil Biology

## LEARNING ABOUT WHAT LIES BENEATH



*Humula landholders examine their soils at a soil biology workshop*

Soil organisms play a crucial role in decomposing organic matter, cycling nutrients and fertilizing our soils. Understanding the different soil organisms present, along with their functions and relationships, can allow us to better manage our soils, to encourage and maintain healthy soil biology and help generate more productive pastures and crops.

### Benefits of soil organisms

Some of the many important benefits soil organisms provide include:

- Promotion of plant growth
- Enhanced nutrient supply to plants
- Increased mineralisation and nutrient cycling
- Nitrogen fixation
- Carbon sequestration
- Stabilisation of soil structure
- Reduced impact of soil pollutants
- Reduced soil-borne pests and diseases.

### Microflora

The microflora are generally microscopic, and include bacteria, fungi and algae. Bacteria and fungi carry out 80-90% of all biological activity in the soil. They are the primary decomposers of organic matter, and are responsible for nutrient cycling and transforming nutrients into forms which plants can take up and use.

### Bacteria

Bacteria are some of the smallest and most abundant soil microbes. In a single gram of soil, there can be billions of bacteria. Most live in the top 10 cm of soil, where organic matter is present. They are generally found around the root tips of plants, and depend on flowing water to move through the soil.

Bacteria are important in the decomposition of organic materials. Rhizobium bacteria, found on the roots of legumes (eg clover, beans and wattles), can convert nitrogen gas from the air into forms that plants can use.

### Fungi

Fungi consist of hyphae, which grow as 'threads' through the soil. Hyphae can be as small as a few cells, or can stretch as a network for metres or even kilometres throughout the soil.

Fungi are important in the decomposition of hard, woody organic matter. They also help improve soil structure, as the hyphae bind soil particles together to create water-stable aggregates which in turn create pore spaces in soil that enhance water retention and drainage.

Mycorrhizal fungi colonise plant roots and help the plant to obtain nutrients such as phosphorus from the soil, by providing a greater root area through which the plant can obtain nutrients.

*"In one kilogram of surface soil there can be up to 100 km of fungal hyphae and one million protozoa"*

### **Microfauna**

Microfauna are small soil animals, including protozoa and nematodes, ranging in size from microscopic to those that can just be seen with a magnifying glass. Most depend on flowing water to move. They graze on the microflora, and are able to ingest small particles of soil organic matter, which are then decomposed by enzymes within the organisms.

#### **Protozoa**

Protozoa need bacteria to feed on. They are particularly active in the soil rhizosphere, and help release plant available nutrients to the soil

#### **Nematodes**

Nematodes are non-segmented 'worms' less than 1 mm long. They live in the thin films of water surrounding soil particles, and are generally found in well-structured soils with large pore spaces, or coarser soils with easily available food.

Nematodes help break down organic matter, and release nutrients into the soil when they eat bacteria and fungi. They also help by dispersing bacteria and fungi, which cannot move around in the soil without 'hitching a ride' inside or on the back of nematodes. Nematodes can also attack and kill a range of pests such as borers, grubs, thrips and beetles. The digested pests are then added to the soil organic matter reserves.

### **Mesofauna**

Mesofauna are organisms you can see with the naked eye, including spiders, mites and springtails. They need moist soil to avoid drying out, and generally remain on or near the soil surface, within larger soil pores, channels and other sheltered sites such as litter. Mesofauna graze on fungi, algae and lichens in the soil, and play an important role in mixing the soil.

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