

# Soil Food Web: Saving our Soils

By [Adrian Woodman](#)

A healthy soil, far from being an inert medium, is a complex and dynamic system that is teeming with life. A large percentage of the organisms that reside within healthy soil systems are beneficial micro-organisms such as fungi, bacteria, protozoa, and nematodes. While seemingly insignificant, they are represented by the millions, providing a range of important services that promote plant growth and vigour.

The collective term for all of these organisms is the soil food web. The interactions amongst these organisms can provide plants with many of the requirements that they need to survive and flourish including nutrient retention and availability, disease suppression, and building soil structure. However, soil biology is an aspect of agriculture that has largely been overlooked. The use of chemicals to kill pathogens and pests also kills the beneficial organisms. The result is a sterile environment conducive to further disease and nutrient deficiencies because the natural soil processes have been destroyed. The soil is a living system that needs to be managed. A balanced and healthy soil food web will suppress disease, cycle nutrients and improve aggregation, meaning that fertiliser, pesticide and water requirements can be substantially reduced.

The decomposers of the soil food web, bacteria and fungi, have an important role in nutrient retention. They retain nutrients in their biomass, preventing their leaching through the soil profile and possibly into waterways. In a soil that is lacking beneficial bacteria and fungi, a large percentage of the nutrients in the soil will be lost before the plants have access to them.

Higher organisms of the soil food web, such as protozoa and beneficial nematodes, consume the nutrient rich decomposers. This process releases the nutrients that were stored in the fungal and bacterial biomass into the soil. Importantly, protozoa and nematodes excrete these nutrients as plant available forms such as ammonium.

Plants have an important role in facilitating this process. Plants release exudates (proteins, amino acids etc.) from the roots. This increases organism activity around the roots because the exudates are a food source for beneficial fungi and bacteria. The significance of this is that nutrients are retained and made available where the plants need them - around the roots. If all beneficial organism groups of the soil food web are present in sufficient diversity and abundance then

nutrient requirements can be significantly enhanced by biological processes thereby reducing inputs.

Organism activity around the roots is also important in preventing disease. When there is a healthy soil food web, the beneficial organisms around the root system act as a protective barrier against disease. This is a result of resource competition, predation and the production of pathogen inhibiting compounds. If the soil food web is degraded then the capacity of the plant to naturally resist soil-borne diseases will be reduced.

Bacteria and fungi are also instrumental in building soil structure. Soil particles are physically bound together by fungi forming macro-aggregates or glued together by bacteria forming micro-aggregates. Without these organisms the soil becomes compacted which inhibits root development, reduces the soils water holding capacity, and reduces infiltration which in turn increases run-off and erosion.

The soil food web of landscaped areas, or any ecosystem that is impacted by humans, has generally been altered. Cultivation, pesticides and inorganic fertilisers all impact the soil food web. When this occurs, the benefits of the soil food web are significantly reduced and plants become exceedingly reliant on fertiliser and pesticide applications.

[Compost](#) is the most common and effective method of introducing beneficial micro-organisms into the soil. A well made compost contains a huge amount of micro-organisms including fungi, bacteria, protozoa and nematodes. However, composts aren't always beneficial. It depends on what conditions have been maintained during the composting process. Conditions favourable to beneficial organisms need to be maintained throughout composting.

Thermal composting requires temperatures to have reached at least 55°C for three days to kill weed seeds and pathogens but it is also important that the compost doesn't get too hot. The compost will need to be turned before it reaches 70°C or else the beneficial organisms will be harmed and nutrients may be lost through volatilisation as conditions become oxygen depleted. When the temperature remains ambient after turning the compost is mature and ready to be used.

[Compost tea](#) is another method of returning beneficial micro-organisms into the soil. Compost tea is made by actively brewing compost in a water filled container with aeration. This process is usually carried out over a 24 hour period which allows the extracted micro-organisms to grow and reproduce. Vigorous aeration is an important factor as it provides the necessary energy to extract the organisms from the compost and maintain aerobic conditions.

Compost tea is also used as a foliar application to suppress foliar diseases. This is an effective method providing the organisms are active when applied to the leaf surface and sufficient organism coverage has been achieved. Making a quality compost tea is a bit of a learning curve although the benefits make it worth the effort.

Once the soil has the right set of organisms there will be a lesser reliance on fertilisers and pesticides to maintain healthy vigorous plants. As Dr Elaine Ingham says “The plant you see is the above-ground part of a complex symbiosis with soil microbes in the root zone.”