

Compost and the Soil Food Web

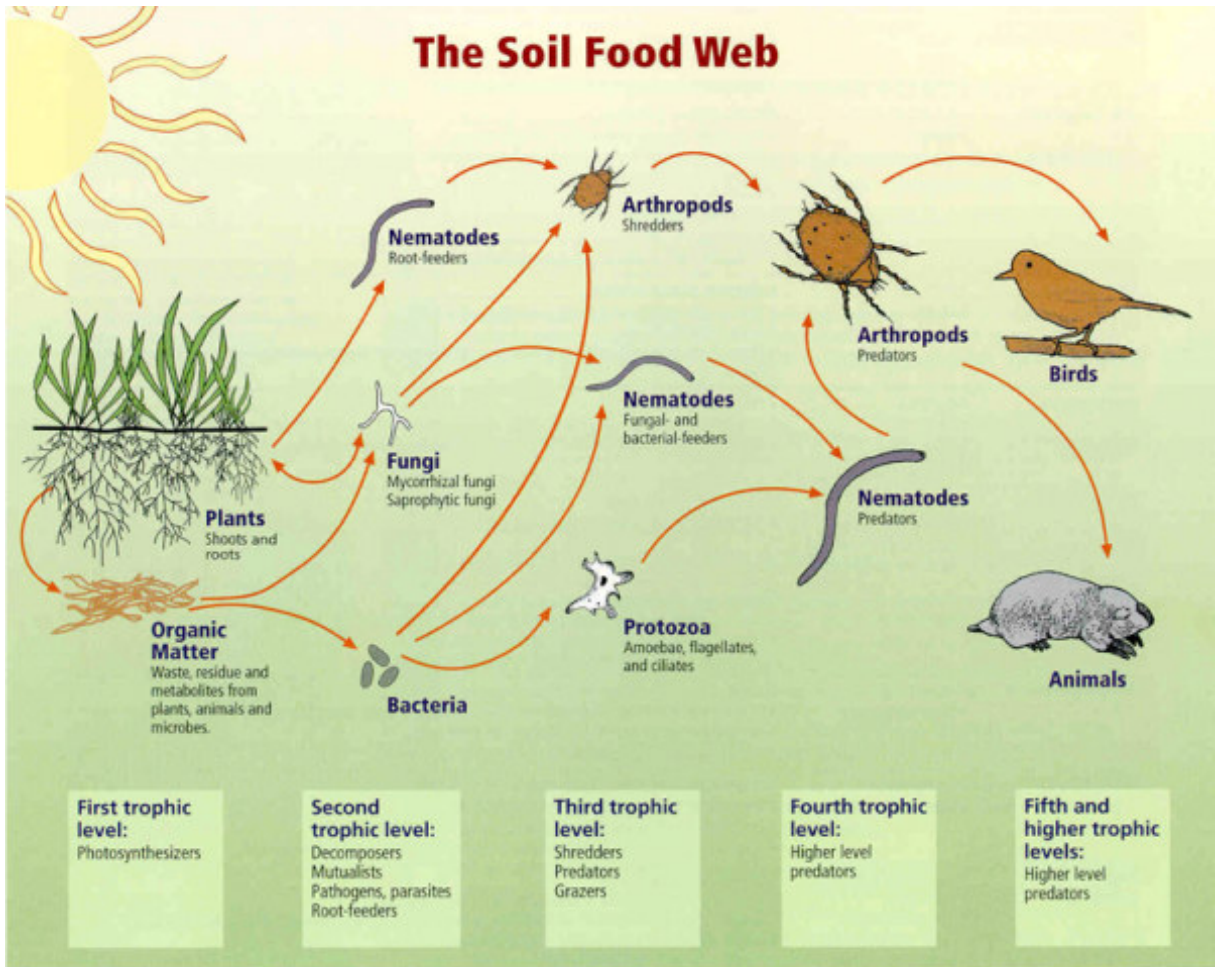
The Microbes in Your Compost Pile

First Edition



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Compost & the Soil Food Web



Relationships between soil food web, plants, organic matter, and birds and mammals
Image courtesy of USDA Natural Resources Conservation Service
http://soils.usda.gov/sqi/soil_quality/soil_biology/soil_food_web.html.

The illustration above is known as the Soil Food Web. Similar to the food chains you learned about in grade school, the Soil Food Web depicts the interrelationship of organisms within, and dependent on, your soil and compost. It is very important to your composting, and gardening, success that you understand the basics of the Soil Food Web. So let's begin...

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Plants = Microbe Farmers

As you can see in the illustration on the previous page, the Soil Food Web starts with plants. Plants receive their nutrients from several sources. They can gather nutrients from the atmosphere (via photosynthesis and the air around them), or from the soil.

As plants grow, they convert the sun's energy via photosynthesis into carbohydrates and oxygen. Some of these carbohydrates, as well as some proteins, are then shuttled down to the plant's root zone (the rhizosphere), where they are secreted into the soil. These secretions are known as exudates.

Plant exudates attract and feed various soil microbes in the area around the plant's root zone. As these microbes (e.g. bacteria and fungi) grow and multiply, they attract various predators (e.g. nematodes and protozoa). These predators consume, digest, and excrete the more simple microbes (i.e. bacteria and fungi) and expel their wastes into the soil around the plant's root zone. These waste products provide a readily available form of nutrients, which plants quickly take up and utilize. Now for the amazing part...

Depending on the season and which nutrients plants require, they will secrete specific exudates to attract specific microbes containing those nutrients. All in all, plants are literally farming the microbes around their root zone in order to feed themselves. Isn't that amazing?

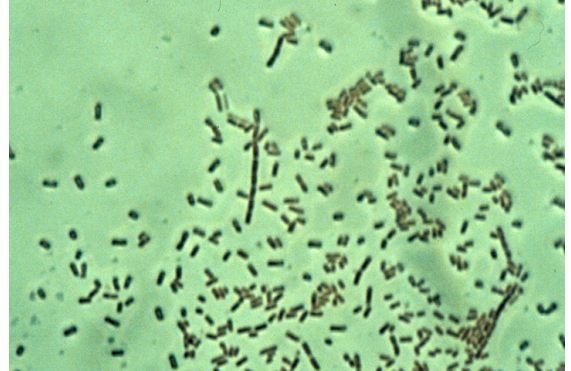
As you can now see, ensuring that the right nutrients and diversity of microbes are present in your soil is tantamount to your gardening success. When gardeners use pesticides, they are killing their soil microbes and severing the connection between their plants and their food supply. Doesn't make much sense, does it?

We're now going to highlight some important facts about four types of microbes that are typically found in high quality compost and soil.

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Bacteria

- Other than plants, bacteria are the foundation of the Soil Food Web. It is important to feed them properly in your compost, and garden soils, since so many other organisms are dependent upon them.



Credit: Michael T. Holmes, Oregon State University

- Adequate moisture levels are a must for the success of bacteria because they use it to take in nutrients, expel wastes, and move about your compost pile and garden soils. Bacteria also require moisture to digest the organic matter in your compost.
- Bacteria feed on organic matter (carbohydrates/simple sugars), and store most of these nutrients inside themselves until they die or they are eaten by a predator. Bacteria can be thought of as tiny containers of plant nutrients.
- **What is a bacteria's favorite food?** Fresh green matter, such as grass clippings, weeds, and other green foliage. Bacteria love the simple sugars in these materials. This is also the reason why we use simple sugars like molasses in our compost tea brews – it feeds the bacteria.
- Fun Fact – The group of bacteria known as actinomycetes produce enzymes that give compost/soil that “earthy” odor that we’ve all come to know and love.

Before we go much further we wanted to mention an incredible book that is an absolute must for all serious composters and gardeners. The book is called ***Teaming with Microbes: The Organic Gardener's Guide to the Soil Food Web, Revised Edition*** by Jeff Lowenfels and Wayne Lewis.

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Fungi

- Unlike bacteria, fungi can grow towards their food sources, and therefore aren't reliant on moisture to move about your compost pile and garden soil.
- Oftentimes, when people think of fungi, they think of mushrooms, which are one of the means of fungal reproduction (via spores).
- Fungi feed on more complex carbon materials (e.g. woody structures like decaying trees/woodchips) and break it down into simpler sugars and amino acids. Once broken down, these materials can be consumed by bacteria. Fungi produce very strong enzymes in order to successfully break down these complex carbon materials. One such carbon material is lignin, better known as the woody component in plants.
- Have you ever noticed white thread-like material in your composting pile? If so, they are most likely mycelia, or masses of fungal hyphae. Hyphae are invisible to the naked eye unless they are massed. This is usually a good sign, but may also indicate low moisture levels in your pile.
- Fungi are similar to earthworms in that they help to build soil structure. As fungi grow throughout your compost pile, or soil, they create pathways through which air, water, and microbes can pass. Nature does do her own rototilling. 😊
- **How do you build fungal-rich soils and compost?** 1 - Stop rototilling and disturbing your soil/compost. Rototilling cuts fungal strands up into little pieces. 2 – Reduce the compaction in your soil and compost pile. This is why we recommend including some larger ingredients (e.g. large wood chips) into your compost pile.



Credit: <http://bioweb.uwlax.edu>

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Protozoa

- Protozoa feed mainly on bacteria and some fungi. They are one of the predators we mentioned on page two of this document. As protozoa (and the next group of organisms called nematodes) feed and excrete bacteria and fungi in your compost and soil, they release many of the nutrients stored within these organisms.



Credit: <http://carcd.org>

- Like bacteria, protozoa do require moisture for transportation.
- Although protozoa are not primary consumers of the organic materials in your compost, they do eat some, indirectly, when they are consuming the bacteria and fungi in your compost.
- There is a simple test to determine whether or not your finished compost or garden soil has a good supply of protozoa. Since earthworms depend on protozoa as a primary food source, if you see worms in your finished compost pile or garden soil, you can assume you have enough protozoa to sustain them.
- **What is the best way to ensure adequate levels of protozoa in your compost?** Feed the bacteria! If you ensure that your bacteria have a constant supply of simple sugars, you'll indirectly increase the number of protozoa in your pile since they're dependent on bacteria for their food.

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Nematodes

- Nematodes, like protozoa, feed mainly on bacteria and fungi.
- There are hundreds of thousands of different types of nematodes, including root-feeding and predatory. Root-feeding nematodes often cause root knots, a common annoyance that avid gardeners frequently encounter.



Credit: <http://kentsimmons.uwinnipeg.ca>

- Some predatory nematodes (like the ones you can buy in many garden centers) feed on protozoa, grubs, slugs, and even other nematodes. Oftentimes, gardeners see the word “predatory” and fear the worst, however, more often than not these are beneficial to have in your compost and garden soil. If anything, you should be concerned with the herbaceous nematodes that can harm your plants.
- Pound for pound, beneficial nematodes tend to release more nutrients into your soil than protozoa.
- Good news for composters – Some nematodes have been known to consume and breakdown organic matter.
- **How to foster nematodes in your compost and garden soil** – Avoid compaction! Compacted soils greatly reduce nematode numbers.

The above information merely touches on the surface of the Soil Food Web. If you'd like more specific information about the Soil Food Web and how it relates to your compost, please [write to us](#). And remember...we can't become the Web's biggest tribe of compost enthusiasts without your help, so please visit us again soon.