# It's a Jungle in There: Who's Living in Your Soil?©

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## INTRODUCTION

Monrovia quality has been improved by paying close attention to the soils in which we grow our containerized plants. One aspect of our soils is the compost that we make and add to our soil, which gives benefits such as waste reduction and disease supressiveness. This presentation will cover the basics of how we make our compost, why a living soil is important, and the benefits that come from compost use.

Monrovia did not set out to make a great living soil. In the 1990s, Conrad Skimina, Monrovia's Research Director, was interested in reducing the amount of waste that was generated by dumping plants. Monrovia has always had a commitment to growing healthy, high quality plants. Plants that do not meet Monrovia's quality standards are dumped. Conrad reasoned that if the plant material were ground up, it could be added back into the soil mix, eliminating the waste disposal problem and making it a resource which could reduce the amount of bark that needed to be purchased for the soil mix.

Plants are dumped for many reasons including poor quality, over production, and broken plants. But plants are also dumped for disease, insect, or weed reasons. If the plants are to be ground up, and added back to the soil, the pest issues need to be dealt with. Skimina's solution was to fumigate the ground-up plants, using methyl bromide. This method was very effective at eliminating the pests; in fact it eliminated everything living in the pile.

In the late 1990s, Victor Sahakian, staff researcher at Monrovia's Dayton, Oregon, nursery came up with the idea of composting the ground plant material, using the heat of composting to eliminate pests. After some experimentation, an aerated static pile method of composting was shown to be effective at eliminating the pests. In this system, a 1000-$yd^3$ pile was built with perforated pipes in the pile. A blower is set up to blow air into the pipes, which dispersed the air throughout the pile, keeping it aerated.

It is important that the compost pile be aerated in order to promote the growth of thermophyllic organisms which create heat in the pile while decomposing the organic matter. These organisms colonize the pile, and occupy the space which helps to keep harmful organisms from colonizing the pile.

## SOIL, IT'S A JUNGLE IN THERE

Good soil is rich with living organisms. Jeff Lowenfels and Wayne Lewis write: "A mere teaspoon of good garden soil... contains a billion invisible bacteria, several yards of equally invisible fungal hyphae, several thousand protozoa, and a few dozen nematodes."

The community living in the soil and around the roots of plants can affect how well plants grow. Much of the energy that keeps the soil community fed comes from plants. The sun provides energy, which plants store by making sugar and other complex carbon molecules. When leaves fall or plants die, they become food for soil saprophytes. Living plants can also transport some of the organic molecules they

make to the roots, and exude them into the soil. This provides an energy source for soil fungi and bacteria. Protozoa also live in the soil and graze on the bacteria and fungi; larger nematodes and insects are also a part of the soil ecology. The complex food web of a healthy soil, that plant will thrive in, can be disturbed if disease organisms kill or damage the plant that supports it. Many beneficial organisms have developed mechanisms to prevent disease organisms from disrupting the system. For instance, antibiotics are produced by some bacteria and fungi, which will inhibit disease organisms. Other fungi may form a barrier on the surface of the roots that is difficult for disease organisms to penetrate.

At Monrovia, we use compost to help create a healthy soil community. The ground plant material that had been fumigated (not composted), did not have a reservoir of beneficial organisms in it. It was essentially sterile, and beneficial organisms may be able to move in, but pathogens could just as easily colonize it. By adding compost with a diverse set of beneficial organisms to our soil, we create a soil environment that is less conducive to diseases, and more inviting for beneficial organisms.

Disease suppression is one of our goals. Here is a description of disease suppression mechanisms from the Soil Biology Primer (2000). "A complex soil food web contains numerous organisms that can compete with disease-causing organisms. These competitors may prevent soil pathogens from establishing on plant surfaces, prevent pathogens from getting food, feed on pathogens, or generate metabolites that are toxic to or inhibit pathogens."

The results that we see in our nursery are suppression of diseases. Soil-borne pathogens such as *Phytophthora*, *Pythium*, and *Fusarium* have been reduced. Sahakian conducted a trial at the nursery in which *Rhododendron* PJM Group, a plant that is very susceptible to *Phytophthora*, was grown in disease suppressive soil which included compost and was compared to soils without compost. Also, various treatments using *Phytophthora*-specific fungicides were used and compared. The plants were then challenged by adding *Phytophthora* inoculum to the soil. Virtually all the plants grown in the nonsuppressive soil were killed, regardless of the fungicide treatments. On the other hand, almost all the plants grown in the *Phytophthora*-suppressive soil survived, even plants with no fungicide treatments. Other trials at the UDSA-Agricultural Research Service lab in Corvallis, Oregon, conducted by Steve Scheuerell and Bob Linderman have shown that Monrovia's compost can suppress soil-borne diseases.

In order to be successful with compost, you must be sure that your compost is of high quality and is a consistent product throughout the year. If compost is not aerated, it will not be compost, it will just be mulch. If it is anaerobic, it will not support the beneficial organisms that provide disease supressiveness. Even good compost that comes from a commercial source may be different at different times of the year. In the spring and summer, it may contain lots of grass clippings, while in the fall it may contain mostly fallen leaves. At Monrovia, I believe that part of our success with compost is in its consistency. It is always made from our plant material, with the largest mass being the soil ball. Also, it is thoroughly aerated throughout the production and storage phases to keep it alive.

At Monrovia, the use of compost has reduced the amount of waste that we produce, reduced the amount of pesticides that we use, reduced our costs, and improved the health of our plants. This is all possible because of the healthy community of organisms living in the *"Jungle"* of our soils.

## LITERATURE CITED

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