



## Nutrient Dense Soil

### Transcript – Module 4

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Hey, Tom Bartels from GrowFoodWell.com and welcome to module four of the soil certification workshop. Today we're going to be talking about one of my favorite subjects really, the soil food web. This is where a lot of the magic happens in your garden. It's about the rich, healthy fertility that's created in your soil by the interrelationships between microorganisms, the organic matter and the plants themselves. It's really interesting. I think you're gonna like it, so let's get right into it.

One of the key concepts of effective organic gardening is to understand how healthy soil works. When I finally came to realize how important the diversity of microorganisms in the soil were to my garden success, it changed how I approached everything. My main job from then on was to feed the soil organic matter to increase the diversity and numbers of microorganisms in the soil but let me back up. Some people might ask what I'm feeding exactly. The answer to that question requires a bit of flexibility in your mind when it comes to sheer numbers. In a teaspoon of average garden soil, there can be a billion bacteria and within that population there can be over 10,000 different species of bacteria in the same teaspoon along with tens of thousands of other microorganisms like fungi, mycorrhizae, protozoa, nematodes, and microarthropods and science has only cataloged about 3% of that population.

We don't know what all their roles in the soil are, not even close. What we do know is that if allowed to live freely and abundantly in the garden, and by that, I mean having a gardener who knows what to feed them, they pay their way tenfold. Bacteria, beneficial nematodes, protozoa and fungi play key roles in helping plants grow. There are billions of interactions taking place between the hunted and the hunters every day in the soil on the microscopic level. It mostly happens in the top six inches of soil. For example, protozoa in the soil hunt and consume the bacteria and transform their protein into more nitrogen waste that the plants can use. The soil is very much alive from the smallest bacteria that feed the larger beneficial insects and worms that then feed larger organisms like birds. There's a dynamic balance between things dying and decaying and the plants and organisms that are feeding off of them to create more life.

So, imagine you've got these billions of organisms in your soil that are constantly looking for minerals, carbohydrates, and organic matter to break down into plant food. The garden plants themselves can orchestrate part of the process by recruiting the microorganisms to the area right around the tips of their roots called the rhizosphere. The plants will excrete just the right chemical combinations to attract the organisms and continually adjust their activity in this root zone to not only feed off their excrement, but also acquire all building blocks they need from the soil organisms and surrounding soil if those organic building blocks are present in the soil. So, to mention that again, the plant releases these exudates, these sugars and proteins. It's like releasing cookies for the bacteria and fungi, which then flock to the rhizosphere and they eat this sugar and protein mixture. And then because they're colonizing that area, that attracts the other predators, which are bigger. These are the nematodes and protozoa which feed off of the bacteria and fungi. Now the waste products from the nematodes and protozoa and everything else happening in this relationship is excreted and then the plants use those nutrients to grow and this party is happening all the time in healthy soil and all you have to do is add the finished compost to the soil to begin with.

The amazing part is when given the right conditions and opportunity, the plants are in control of the process. Their release of exudates varies during the growing season, adjusting to the population type and the numbers of organisms

that it needs for different nutrients. So, it controls what nutrients are generated at any one time down there by corralling all these organisms around their roots. So, the plants are the orchestra leaders of this whole system.

This is basically how forests work or grasslands. You don't see anyone running around with liquid fertilizer to keep the plants alive. Forests don't need our help to feed the soil because they drop leaves every season that decompose and feed those organisms. That decaying organic matter keeps the system going. In the case of your veggie garden, you have to create the conditions for this to take place in the first place. You have to align the design of your beds to set up the basic building blocks. You have to initially feed those bacteria in your garden soil, and when you do, you get this. Here's a section of beds in my garden this year. I haven't added any plant food or liquid fertilizer or anything. I just worked the soil once in the spring, added the compost and let it roll. Once you get these natural systems going and there are enough populations of bacteria and fungi feeding the baseline of your soil food web, you consistently get robust growth like this and this. You don't have to worry about micromanaging the soil or worrying about NPK levels of certain plants or beds. If that plant can grow well in your climate conditions, it will, and it will do so with enthusiasm.

It really is fun to watch it happen. This is how vegetable plants want to grow if given the proper conditions in the soil. The microbiology works in concert with the plants and you get resilient growing systems. One note of warning though, chemical additives disrupt this balance. When liquid fertilizer is used, the relationships with the soil food web are severed, the plant stops releasing exudates, and the colonies of helpers are reduced. The plants become dependent on you for feeding schedules, so that's more work for you and a weaker plant. The bacteria and fungi are the base building blocks and need to be present in the soil in diverse populations for all of this growth to occur. All of these symbiotic relationships succeed more readily if the soil has enough organic matter and nitrogen-rich compost. It's a seeming contradiction, but the more diversity of dead and decaying things you have in your garden, the more life it can support.

It's how the entire biosphere works on the planet. Don't be squeamish. It's much like your own digestive system. The more intestinal flora you have, the better you can digest food and the stronger your overall system becomes. Once you have a full orchestra of healthy organisms in the soil, they can help fight off infestations of pests as well. So, they work for you on many levels. And when you put seedlings into live soil with a diverse group of organisms, great things happen. So, your main role as a gardener is primarily to increase the diversity of organisms in the soil. The best way to do this is add organic material and lots of it. This is why the use of organic compost as the main garden amendment is so successful. It renders chemical additives obsolete. Once you realize how interconnected all these populations are and how you can orchestrate them to help your plants grow, you'll never consider using synthetic pesticides or liquid fertilizers in your garden. If you feed the soil food web instead with organic matter, compost, manure, and worm castings, the plants will dynamically create symbiotic connections with the soil organisms. The resident organisms flourished by breaking down organic matter and transforming the nitrogen into a mineral form your garden plants can utilize. The compost also improves soil structure, aeration and water retention. And what's really nice about organic matter is you can produce most of it yourself and finding it elsewhere is usually free. The primary collection point for organic matter is in worm bins, compost bins and chicken coops, but for now, let's concentrate on the human behavioral component. Much of this organic matter can come from our own kitchens. Americans throw away about a third of our food every year, so in my case, about a decade ago, we set up a countertop compost container that's been the main tool for moving food scraps that would have been thrown into the waste stream and instead are now processed by worms, microorganisms and chickens.

Then it gets added to our soil every year in the form of composted black gold. It takes a bit of behavioral modification if you don't compost already. What it means is every scrap of vegetable waste you generate gets put into this container and not the trash can. The fascinating part about all this is the sheer scale of where all our surroundings come from. All the materials that make up our planet, including every element in the periodic table originally came from explosions of supernovas and the chemical soup of space billions of years ago. Over millennia, the thin layer of life on earth began to feed off these elements. The microbes in the biosphere spent millions of years breaking down carbon dioxide and

minerals to make oxygen and soil and devolving billions of microorganisms that all continued to orchestrate the process of soil production and plant life. That symbiosis between microorganisms and plants has continued through today.

It's how forests work. It's the reason large tracts of forested land and grasslands all over the planet don't need humans to run around with fertilizer and chemicals to keep them alive. They do it very well on their own, thank you, by enlisting cooperative residents below the soil to make the minerals and nutrients available in a consumable form. Those same elements are critical for keeping our human bodies healthy and through photosynthesis, plants make them available to us. All we have to do as food growers is manage the components and they can complete the process to make food for us right outside our doors, that we then ingest and that become the actual cells in our bodies. You are in fact composed of star dust. When you actually think about what's happening in that process, it really is quite amazing. We can utilize the scientific understanding of what's happening, but there are just too many variables to call food gardening a science.

It's more of an art form and a magic one at that. Resilience is one of the key benefits of having a robust soil food web in the garden. It allows your plants a stable supply of nutrients which reduces stress in the plants and allows fast growth, which produces tender leafy veggies. The point about a healthy soil food web in your garden is that it isn't the best way to grow one plant versus another. If you help your soil get to this point, everything grows well there so you don't have to micromanage your soil. And as far as pests are concerned, the ones that do take hold in your garden are typically preying on weak plants that are stressed to begin with. So, if your plants have enough food on their own, they remain stronger. So there are less targets for pests and less need for pesticides. So start some diversity. Build a compost pile and close the loop on any plant matter that enters your property in any form. Let it rot and return to the soil. Building your soil food web in the garden is one of the primary goals you should have as a dedicated gardener.