Microbes key to healthy soil

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“In Teaming with Microbes: A Gardener’s Guide To The Soil Food Web” (196 pp, Timber Press, 2006), Jeff Lowenfels and Wayne Lewis suggest that we shouldn’t treat our lawns as we do human cancers — by killing everything off and then trying to help the weakened body (or lawn) recover.

It’s simply too much work. When we use pesticides, herbicides and inorganic fertilizers to create the perfect lawn, we’ve create an addict, into which we must pump chemicals perpetually. The same goes for gardens and ornamental beds.

Instead, feed the immune system — the soil’s food web — and let it do the work for you.

To help us understand this approach, the authors describe life in the soil and how it functions, teach us to manipulate that wonderfully balanced system, and try to convince us why it’s worthwhile to do so.

If you think dirt is dead, you’re partly right. Much of it consists of once-living plants and animals. One acre of good garden soil can harbor two pounds of mammals; 133 pounds of protozoa; 900 pounds each of earthworms, arthropods (bugs) and algae; 2,000 pounds of bacteria; and 2,400 pounds of fungi. With enough food, one bacterium can divide to create 5 billion more in 12 hours. Fungi and nematodes (tiny worms) are “the second most dominant form of animal life next to the arthropods,” the book says. Arthropods make up three-quarters of all organisms, though both nematodes and protozoa exceed them in weight. Two to three million earthworms can inhabit this same acre, moving 18 tons of soil annually.

The soil benefits from all this through “decompaction, aeration, better water retention and drainage, and increased retention and availability of nutrients.”

Here’s how it works: through photosynthesis plants create foods (sugars, etc.) in lures called “exudates” at their roots and leaves that attract bacteria and fungi. Arthropods and other larger creatures eat these, making their stored energy available to the plants. The stickiness of both bacteria and fungi helps give the soil structure; the arthropods and others help aerate it. The goal is “complete digestion of soil matter.” And it’s self-perpetuating, requiring only soil, water, sun, plants, organic food for the soil web’s creatures, and other creatures to eat them.

To manipulate the food web — to grow healthy crops and ornamentals without chemicals — we need to know that long-lived plants (trees, shrubs, perennials) grow best in acidic, fungi-dominant soils. Annuals — including most vegetables — prefer slightly alkaline, bacteria-

laced soils. This is partly because fungi are better at digesting lignin, associated with woody plants, and bacteria better at digesting cellulose, the softer tissue of annuals.

We can give plants all they need, the authors say, using compost, mulches and compost tea. When “brown” materials, such as newspapers, fallen leaves and straw, dominate compost, fungi thrive. With “green” items — grass clippings, kitchen scraps — bacteria dominate. The same goes with mulches. Brown materials, unless finely shredded or worked into the surface, encourage fungi; green favor bacteria. Fungi like dry mulch; bacteria, wet. So mulch long-lived plants with wood chips or fallen leaves.

Compost tea jump-starts the soil food web’s activity since it contains, in high concentration, the bacteria and fungi necessary to deliver nutrients to plants. To get fungi-dominant tea, use fungi-dominated compost. Ditto for tea that favors bacteria. Actively aerated compost tea is made with finished compost, pure water and a bubbler — like an aquarium pump. The aeration assures quick, live, sweet-smelling tea. The authors give instructions for brewing and applying it, using equipment most householders can come by readily and cheaply, though some of the additives may not be in everyone’s cupboard.

How can you tell what shape your lawn and garden are in now? A simple test is watching for birds pulling worms. If you see that frequently, you’re probably OK.

Wean yourself from the rototiller (it destroys the soil food web) and avoid nitrogen fertilizers, which quickly flush out, kill natural nitrogen-containing organisms and encourage weeds. Find natural substitutes for pesticides and herbicides — vinegar, heat, boiling water, corn gluten, or blasts from your garden hose. Leave grass clippings on the lawn or pile them around annual beds. Compost kitchen scraps and garden waste. Become a compost tea brewer and a mulcher. Do all this and you’ll be teaming with microbes, and they’ll soon be teeming in your soil.