

## TEAMING WITH NUTRIENTS

In Jeff Lowenfels' *Teaming with Nutrients: the Organic Gardener's Guide to Optimizing Plant Nutrition* (250 pp, Timber Press, 2013), there's little grist for teaming or guiding, and its audience is more likely chemists and horticulturalists, not organic gardeners.

Seven of the 10 chapters describe in highly technical language the anatomy and physiology of plants and plant cells; the chemistry of plants, nutrients, soil and water; and their movements into and out of plants.

Only in the last two chapters (chapter 8 covers soil testing) does Lowenfels turn to matters gardeners can control – temperature, pH, soil aeration, soil composition and moisture, as affecting nutrient uptake, and, in chapter 10, fertilizers – but even here there's not much guidance or strategy for teaming.

Nevertheless this is a book about plants, and Lowenfels makes some points gardeners will appreciate.

Justus Von Liebig's mid-19<sup>th</sup> century introduction of inorganic fertilizer, for instance, meant farmers no longer needed to keep animals, their dung having been superannuated. But later Von Liebig realized that inorganic fertilizer harmed his garden soil, and he became a vigorous promoter of organics.

Lowenfels takes us inside and around specialized cells – some for transport, others for storage; cells for recycling and manufacture of new cells; some as information and message centers. Ten thousand kinds of proteins – 10 billion total – inhabit each microscopic cell, so there's lots of noise, motion and activity inside.

All life consists of combinations of four molecules – carbohydrates, lipids, proteins and nucleic acids; the only difference between a gardener and a bacterium is the way these four are mixed. Of the 90 naturally occurring elements, living things use just 17.

Trees transport water and nutrients sometimes more than 350 feet from roots to leaves, without energy input. Transpiration from leaf surfaces pulls water upward, molecule by molecule, creating a pressure deficit in the roots, so more water enters. Water molecules cohere to each other and adhere to the sides of transport tissues, so there's a chain broken only as molecules escape through leaf stomata. A tree can move hundreds of gallons a day, one molecule at a time.

Inside leaves are chloroplasts, where photosynthesis takes place – 500,000 of them per square millimeter: a “sugar factory” sustaining all life.

Root hairs live a few days to two weeks, and develop only if there are nutrients to seek, and calcium available. So if the soil is too rich, root hairs may not need to develop.

The force inside a swelling seed can be great enough to split a rock.

Foliar feeding, though often good for a quick nutritional boost, can never substitute for soil borne foods because some nutrients aren't mobile in plants, and so can't go where they're needed.

When a fruit, leaf or branch falls, it returns to the soil exactly the same nutrients as the parent contains. So never remove plant detritus. It feeds the soil which feeds your plant.

Even if the least used essential nutrient is missing, it won't help to have an abundance of the others. Thus all essential nutrients are equally important, whether the plant needs a pinch or a pitcher full.

Add lots of organic matter to help control soil temperature, moisture, pH, and aeration – and hence, nutrient availability.

Of the natural fertilizers Lowenfels names, beware of cottonseed and gluten corn meal, which may contain pesticide residues and derive from GMO seeds; also feather meal and fish products, which may attract critters.

Since biofertilizers – rhizobia, Frankia, micorrhizal fungi – are regionally specific, gather soil from around healthy plants near you, and use it to inoculate your own garden soil.

This time, settle for the review and skip the book.