Urban Harvest

Science Explained: Why Organic Matter is Essential for Soil

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All plants will grow much better if a high quality mulch is spread before summer comes.

Philosophers of science use the term "paradigm shift" to describe scientific breakthroughs that question the basic assumptions of a science especially when an old concept fails to predict important results and a novel concept succeeds. For at least three decades, it has been clear to those of us with training in both agricultural chemistry and ecology, that eventually ecology -- the scientific study of the structure and function of nature -- would replace chemistry as the dominant paradigm in agriculture.

There are many reasons we have thought so. One is that the chemicals mainly come from ever decreasing fossil supplies that are also used as a main energy source for our cars and planes, as well as plastics. So the cost of chemical fertilizers inevitably will rise with fuel costs, and pesticides if applied by airplane on huge acreages will also. By one

estimate, 93 percent of the price of chemical nitrogen fertilizer is the cost of natural gas, and, it should be noted, natural gas's price has more than tripled since 1998.

But there is a more basic reason for expecting ecology to beat out chemistry in agriculture. Agriculture is about growing plants. Plants have spent millions of years developing ways to thrive without any help or expense from humans, so nature obviously has "secrets" that if we learn them might save us considerable effort and cost.

The science of chemistry had a head start. Mendeleyev published the first true chemistry text almost 150 years ago while Odum's first true ecology text is just over 50 years old. But agricultural ecology in universities has been catching up fast as it cracks nature's secrets about soil fertility, plant health and pest control in ever more successful ways. As ecologists get better at understanding nature's principles and using them to grow things, the main characteristics of natural sustainability -- self-maintenance, low labor, low energy, low input will certainly eclipse the high input efforts of chemical agri-culture.

The word "science" makes many of us uneasy because often it is hard to understand without special training. To be sure, both agricultural chemistry and agricultural ecology can be hard for most of us to understand, but agricultural scientists know this and have made efforts to make their advice user friendly. One of the best efforts I have ever seen to make a complicated subject natural soil fertility understandable to adults or children alike is the **USDA's Soil Biology Primer**. Each plain English short chapter and their wonderful photographs of soil microbes are available as links in the left-hand margin.
Briefly, this summary shows how a very wide range of soil micro-organisms for their dinners depend on rotting organic matter found on the surface of the soil. Such micro-organisms (and more visible creatures like worms) control all sorts of plant diseases, create good soil structure, help conserve soil moisture, and most importantly provide a steady stream of nutrients to plant roots.

They do this is in a variety of ways. Nutrients that pass through the digestive system of microbes become highly available to roots and to fungal colonies on these roots. Nutrients -- especially nitrogen -- also become available when microbes die and decay. Thus, the more microbes and types of microbes, the more nutrients will be in the soil.

As well, rotted organic matter increases substantially the cation exchange capacity of the soil (C.E.C.) and by gumming particles together into soil crumbs (or tilth) also increases the amount of oxygen and nitrogen in the soil, and this helps the microbes.

Soils differ substantially in their ability to hold nutrients and water -- clay holds a lot of nutrients like magnesium, phosphorous, potassium and calcium, as well as water -- while sands and gravels few. By contrast, clay has little space for air and easily becomes anaerobic and harmful to most plants, while sands and gravels have sufficient air (see **www.microsoil.com/CEC.htm**).
When the top inches of the soil have a highly decomposed, organic matter content, clay has both air and many colloidal particles to hold nutrients and water. When sand has organic matter, it too will hold more nutrients and water. These nutrients are in ionic form, so they can be exchanged easily with ions on the roots of plants. So, the plant can put less energy into root production to find the nutrients it needs and more into flowers and fruits.

Unfortunately for our area, organic matter leaves warm soils quickly, so typically our sands have poor C.E.C.'s and our clays lack air spaces. And as we move towards our warmest weather, organic material will deplete the fastest and hot dry soil will be inhospitable to roots.

So plants in our soils will be much healthier and more productive if there is a lot of quality organic matter decomposing on the surface. The wise gardener will therefore mulch with several inches of biologically active materials like homemade compost, or purchased products: leaf mold, native mulch, or alfalfa hay. Do this NOW!

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