Organic vs Conventional: Do N-fixing bacteria care?

May 25, 2011 by Margaret Reeves

Healthy crops come from healthy soil. Soil fertility depends on an incredible diversity and abundance of soil critters, from the microscopic to the flying and creepy crawly. Together these critters cycle nitrogen (N) and many other essential minerals and nutrients, making them available to plants. The complexity of what goes on in healthy soil is truly awe-inspiring.

A key group of organisms that provide the soil with one nutrient that's often in short supply are the N-fixing soil bacteria. And according to a recent study by UK scientists, it turns out these organisms do a better job when they're working on organic farms.

The study authors concluded that **nitrogen-fixing bacteria are particularly sensitive to the toxic effects of chemical pesticides.** They found that nitrogen fixation dropped off when pesticides were used, compared to when farmers employed organic pest management tools.

N-fixing bacteria help farmers' bottom line

The National Academy of Sciences estimated in 2007 that in Brazil, nitrogen fixation reduced the need for nitrogen fertilizers to the tune of $1.3 billion in farmer savings. How do these specialized bacteria pull this off? They transform abundant but unusable nitrogen in the air (constituting 79% of the air we breathe) into plant-available nitrogen.

In a finding that supports the UK study, the authors of the 2007 NAS report also described how pesticides reduce the capacity of legumes (such as beans, peas, soybeans and alfalfa) to fix nitrogen by disrupting the chemical signaling between the legume host plants and the bacteria. The scientists estimated that pesticides and other contaminants can reduce legume plant yields by as much as one third.

In an apparently contradictory finding, the UK study also reported that use of conventional fertilizers, compared to organic manures, led to greater nitrogen-fixing activity immediately following fertilizer applications. This is somewhat confusing, as you would think N-fixing bacteria would thrive best with organic soil amendments like manures and composts, rather than petroleum-derived, greenhouse gas-generating fertilizers.

But, organic amendments are still the way to go — for many reasons.

Helping the soil help itself

Organic practices, unlike conventional chemical-dependent practices, focus on helping the soil help itself: building soil health and fertility by protecting and increasing levels of organic matter. Soil organic matter, organic amendments and soil critters support each other, and together supply the myriad nutrients necessary for healthy and vigorous plant growth.

Chemical fertilizers, on the other hand, are environmentally "expensive" shortcuts requiring fossil fuels for production, transportation to far-away farms and eventually driving water contamination both in the form of nitrate-laced drinking water and in the form of our huge and growing oceanic deadzones.

As the authors of the UK article rightly point out, it is likely phosphorus (P), rather than nitrogen, that explains the jump in N-fixation after conventional fertilizers are applied (which makes good sense, as legumes tend to be rather P-demanding). But this topic of soil P and the important role of another group of specialized soil microorganisms — fungi — will have to wait for another post.

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