IPNI Stewardship SPECIFICS

Crop Fertilization Improves Soil Quality

No. 3

Consider all the roles the soil plays in the production of food and fiber for the world's people. It is the medium in which plants grow and the source of most plant nutrients. Soil, water and air bathe plant roots and help keep them and above-ground plant parts healthy and growing. The quality of soil in which plants grow is extremely important in determining crop yield and quality, as well as the sustainability of crop production.

One of the greatest benefits of crop fertilization, aside from increasing crop yields and improving farmer profit potential, is its effect on soil organic matter. It has long been known that organic matter positively influences structure, tilth, bulk density, water infiltration rates, water holding capacity, biology, and water and air movement within the soil; thus improving soil quality or soil health. Organic matter helps to bind soil particles together, reduces soil crusting, increases the stability of soil aggregates, acts as a reservoir for plant nutrients, and helps reduce soil runoff and erosion losses.

Farmers have known for hundreds of years that crop fertilization, whether it was a fish in a hill of corn or ground up rock phosphate applied to the surface of an acid soil, increased their yields. As science learned more about the benefits of fertilization, it was discovered that long-term sustainability of crop production is dependent on building and maintaining soil fertility, an important measurable soil quality attribute. Later, it was demonstrated that organic matter levels could be maintained and even increased through balanced fertilization. Harvested crop yield increases as a result of crop fertilization, but so does unharvested plant biomass left on the soil surface and crop residues remaining within the soil. Much of the unharvested surface biomass and underground residues wind up as soil organic matter.

Both organic and inorganic (mineral) fertilizer sources contribute to the buildup of organic matter in soils. There is widespread public misperception that organic agriculture is more environmentally friendly and better maintains soil organic matter levels. However, there are no generally accepted scientific experiments to support the superiority of either organic or inorganic plant nutrient sources. In fact, long-term experiments from around the world indicate that sustained yields and soil productivity can be accomplished with balanced nutrient applications using animal manures and/or commercially produced mineral fertilizers. Plant nutrient uptake occurs only in ionic form, no matter whether the ion derives from inorganic or organic sources. In soil, organic nutrient sources must first be decomposed by soil microbes before becoming available for plant uptake.

Example of applying a band of fertilizer under the conserved residue from the previous crop year.

Factors which boost soil biological activity and soil fertility usually lead to improved soil productivity and soil quality. Balanced plant nutrition increases yields, optimizes crop quality, and raises crop biomass that is essential to restoring or maintaining soil organic matter.

FOR FURTHER READING:

Bhandari et al. 2002. Soil Science Society of America Journal 66: 162-170.

Ladha et al. 2011. Journal of Environmental Quality. 40:1756-1766.

Zhang et al. 2009. Biogeosciences Discussion 6: 6539–6577.

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