Stewardship SPECIFICS

Nutrient Use and Beneficial Soil Organisms

No. 6

Soil organisms are essential to crop production. Among their many roles, they are important recyclers of soil nutrients, and they help breakdown organic residues so the nutrients they contain are changed into the inorganic forms used by crop plants.

Since many of microorganisms have a vital role in crop growth, one of the measures of soil quality is their abundance in the soil. Does the use of fertilizer nutrients—from inorganic and organic sources—have an impact on these organisms? The answer is YES. There is a very positive relationship between soil fertility and soil organisms. The nutrients in fertilizer foster their necessary nutrition. Additions of organic matter (from crop residues or manure) improve the soil physical condition and provide an energy source for microbial growth.

Plant roots form a complex relationship with soil microorganisms to improve plant health. A properly-fertilized plant has a healthy soil zone surrounding its roots. This environment encourages the growth of beneficial organisms and can depress the presence of disease-causing organisms.

Research has confirmed that indiscriminate use of both mineral fertilizers and animal manures may result in a decline in the numbers of beneficial organisms in the soil. However, when properly managed, the overall impact of fertilizer nutrients on soil biology is a positive one. Generally, those management decisions that optimize the efficiency of nutrient use will also have a beneficial impact on soil organisms.

Nitrogen (N) inputs change the way microbes influence soil organic matter. Until recently, there has been debate about whether N additions hasten or slow losses of soil organic matter. We now know that fertilizer N inputs, when managed properly in different cropping systems, contribute to soil organic matter increases and maintenance.

Certain bacteria living in a symbiotic relationship with plant roots convert (fix) atmospheric N into a form that legumes such as alfalfa and soybeans can use. These bacteria play an important role in crop production by helping to supply much of the N requirement of legumes and a portion of the N required by the crops that follow them. The amount of N these bacteria fix depends on several factors—the specific legume crop being grown, overall plant health, soil pH, temperature, nutrient supply, etc. As a rule of thumb the amount of plant-available N in the soil must be low in order to maximize the biologically fixed N.

The presence of the more highly developed organisms such as earthworms is generally indicative of a high quality soil with good structure and low in soluble salt content. Observations on controlled tillage plots prove that worm populations increase when soil conservation practices are complemented with adequate crop fertilization and proper crop residue management. Earthworms are excellent nutrient recyclers. Tillage practices can have a major impact on soil biology.

The incredible diversity of soil organisms range from the tiniest one-celled bacteria, algae, fungi, and protozoa, to more complex nematodes and micro-arthropods, to earthworms, insects, small vertebrates, and plants.

Historically, the primary reason for applying fertilizer nutrients to the soil has been to increase crop yields and improve quality. During the past few decades the impact of nutrient use on environmental quality has received its share of attention as well. Nutrients do affect the quality of both soil and water. The good news is that when proper nutrient management is practiced, the balance between crop yields, soil productivity, and environmental quality can be maintained. This includes the impact of nutrients on beneficial soil organisms.

FOR FURTHER READING:

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