

Does Fertilizer Harm Soil Microbes?

Microbes in the soil are important to the nourishment of plants. Many of them facilitate the chemical conversions and physical transport needed to make nutrients available. Some people claim that soil microbes should supply all the nutrients needed by plants. Some also claim that applying soluble forms of plant nutrients harms the biology in the soil and reduces its capacity to make the native soil nutrients available. Let's look at the evidence.

The microbes that supply nitrogen (N) are from two categories—symbiotic and free-living. The symbiotic types are mainly rhizobial bacteria that infect the roots of legumes, such as alfalfa and soybeans. These bacteria supply the bulk of the N needs of legumes. However, even genetic engineering has not yet been able to coax the non-legume crops—corn, wheat, canola, potatoes, and many others—to fix N. Most crops depend on N applications in the form of fertilizer, manure, or organic materials.

The free-living bacteria in the soil supply some N as well, but the amounts are limited and are not influenced by fertilizer. A paper published in the journal *Nature* in 1998 compared nutrient dynamics in three Pennsylvania crop rotations: one fertilized, one manured, and one legume-based. The study found that the free-living bacteria supplied less than 5 lb/A/year, an amount that did not differ between the three rotations. No evidence of harm.

Microbes that help supply phosphorus (P) form an association with plant roots. The association is called “mycorrhizae”, a term that means “fungus-root.” Fungi explore the soil better than roots, because their hyphae are narrower. They can bring P to the root from as far as 4 in. away.

Mycorrhizal fungi depend on the plant for energy in the form of sugar. It is well known that they are more active when P is deficient. But sugar used to feed the mycorrhizae is sugar taken away from grain yield. For example, in a recent field experiment in Quebec, corn depending on mycorrhizae yielded 14% less than when fertilized with P. The fertilizer—even though it was applied at twice the recommended rate—reduced the density of fungal hyphae by 24%, but certainly did not eliminate it. When soil test levels are low, P additions can actually increase mycorrhizal development.

Scientists have recently discovered that mycorrhizae produce a unique substance called glomalin. It may form as much as 30% of the organic matter in soil, and it seems to help maintain soil structure. Dr. Sara Wright, a noted expert on glomalin, recently stated that the best field-scale management for the production of glomalin is to “use minimal disturbance, add no more phosphorus than is required for crop production, and use cover crops.”

Soil microbes depend on plants for their nourishment. Fertilizers that nourish plants also nourish the biology of the soil. EB

References

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These soybean root nodules contain N-fixing bacteria. Phosphorus encourages root growth and N fixation in legumes such as alfalfa, soybeans, and other crops.