



Soil Productivity



Excerpt: "Uncovering the Real Dirt on No-Till" by J. Clapperton & M. Ryan

When we are standing on the ground, we are standing on the roof top of another world. Living in the soil are plants, roots, viruses, bacteria, fungi, algae, protozoa, mites, nematodes, worms, ants, maggots and other insects and insect larvae (grubs), and larger animals. Together with climate, these organisms are responsible for the decay of organic matter and cycling of both macro- and micro-nutrients back into forms that plants can use. Agricultural practices such as crop rotations and tillage affect the numbers, diversity, and functioning of the organisms in the soil community.



The root exudates, hyphae of the fungi and the secretions and waste products of the bacteria are binding small soil particles and organic matter together to improve soil structure. Fecal pellets from soil invertebrates and casting from earthworms increase the number of larger sized soil aggregates, allowing for more water infiltration, aeration and better rooting. The activities of soil animals mix smaller organic matter particles deeper into the soil acting to increase the water holding capacity of the soil.

Soil productivity is mostly

measured in terms of yield and is a function of soil structure, fertility, and the population, species composition, and activities of soil organisms.

In undisturbed soil, most of the nutrient cycling, roots, and biological activity are found in the top 20-30 cm., called the rooting zone.

The rhizosphere is a partnership between the plant, soil and soil organisms. Plants provide the carbon food source for soil organisms that bind the soil particles into aggregates and recycle soil nutrients, and soil provides the habitat, water, and mineral nutrients for both soil organisms and plants. Any factor or soil management technique that changes the amount and quality of carbon going into the soil, as either residue or root exudates, will effect change in the soil biological community. Change which ultimately has consequences for plant growth.

The presence of earthworms in the soil is often considered to be a positive indicator of soil quality and productivity. Earthworm numbers increase dramatically with no tillage and in undisturbed systems. The burrowing activities of earthworms increase soil aeration, water infiltration, nitrogen availability to plants, and the microbial activity in the soil. The lining of the earthworm burrow has been found to have higher populations of nitrifying bacteria than the soil outside the burrow.

The fastest way to increase earthworm populations is by reducing soil disturbance.

Management practices that affect the placement and incorporation of residues like tillage can make it harder or easier for the soil organisms responsible for cycling nutrients. Tillage collapses the pores and tunnels that were constructed by soil animals, and changes the water holding, gas, and nutrient exchange capacities of the soil. Reduced tillage and particularly no tillage reduce soil disturbance, increase organic matter, improve soil structure, buffer soil temperatures, and allow soil to catch and hold more melt and rain water. No tillage soils are more biologically active and biologically diverse, have higher nutrient loading capacities, release nutrients gradually and continuously, and have better soil structure than reduced and cultivated soils.

The benefits of diversified crop rotations married together with reduced tillage and especially no tillage can dramatically increase soil productivity while reducing off-farm costs.

