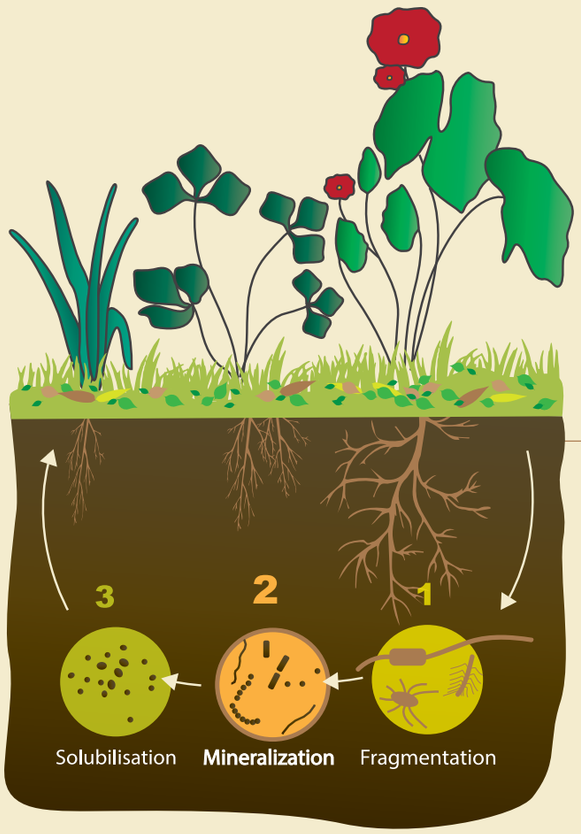
Teaching as if the Earth Matters
with Radha Gopalan

Why soil micro-organisms are essential



1. FRAGMENTATION:
Animals living in the soil break the litter into progressively smaller fragments, increasing its surface area.

2. MINERALIZATION:
Bacteria and fungi release enzymes that act on the exposed surfaces of the fragments to convert organic macromolecules to soluble nutrients.

3. SOLUBILISATION:
Small organic compounds and inorganic nutrients are released into the soil solution, from which they can be taken up by plants and other microorganisms.

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Meet some soil microbes!

(a) **Bacteria** are the most abundant microbes in soil. They show extraordinary biochemical variability, decomposing organic matter and forming symbiotic relationships with root cells to make many essential nutrients available to plants.

(b) **Fungi** represent 2/3rds of the microbial biomass of the soil and perform diverse functions. They are the only organisms that can decompose lignin in the cell walls of plants. Since lignin is also the main source of humus in soil, this is the first step in the formation of humus. Spraying plants with fungicides destroys this very critical category of microbes, preventing humus formation.

(c) **Filamentous bacteria** enable numerous biochemical reactions like bacteria, but are filamentous in structure and can secrete antibiotics to keep other bacteria in check like fungi. Not only do they mineralize organic matter, some filamentous bacteria also form symbiotic associations with certain shrubs and trees to fix nitrogen.

(d) **Algae** grow on the surface of the soil because they need sunlight for photosynthesis. Most active when the soil is humid, algae play an important role in sourcing organic matter and fixing nitrogen.

Did you know that every gram of rich, fertile soil is likely to contain a billion living micro-organisms?
Surprising as this may seem – it is these microbes that cycle organic matter in soil, and nature in general. And, in doing this, they perform the indispensable function of bridging the mineral and the living world.

So, what would happen if they were to disappear from soil?
Without them, most naturally occurring elements that are essential for plant growth would remain stored away in inanimate plant and animal residues. In fact, if microbes did not exist at all, life as we know it, may have disappeared from our planet long, long ago.

Does this mean that we describe soil health in terms of the micro-organisms it contains?
Well, no. Most people (including scientists and agronomists) prefer to think of soil quality in terms of the crops and livestock it supports. This is because it is easier to see and handle crops and livestock, and measure soil fertility through yields and productivity. It's only rarely that we think about the microscopic organisms that form the basis of our entire agricultural system!

How does this change the way we see soil?
Understanding the role of micro-organisms, we begin to see soil as the site of a great living fermentation process. We also begin to appreciate why using purely chemical farming practices cannot ensure the balanced nutrition of plants or the sustainability of agricultural soils.

Poster Design: Vidya Kamalesh

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