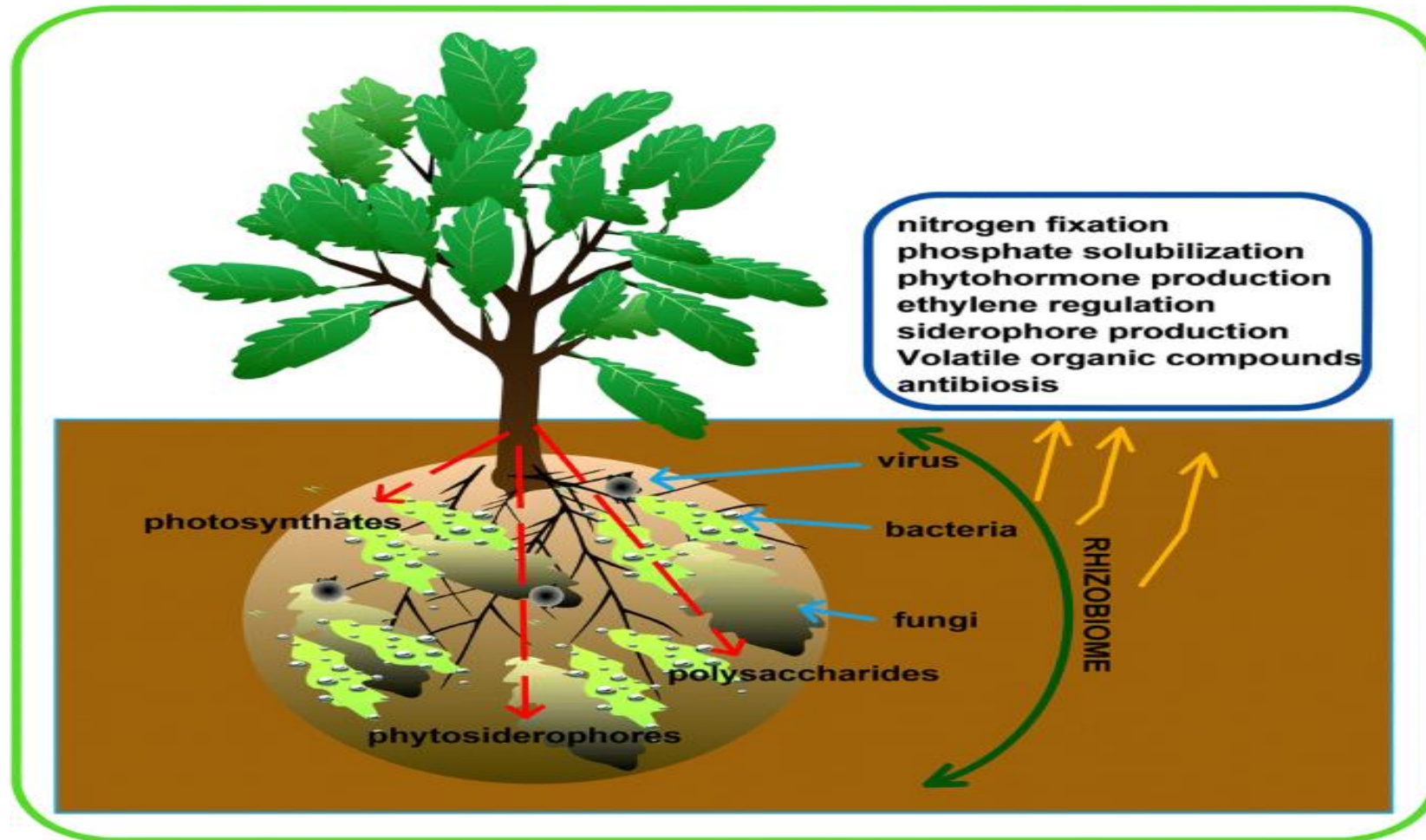


Understanding the Role of Soil Microbes

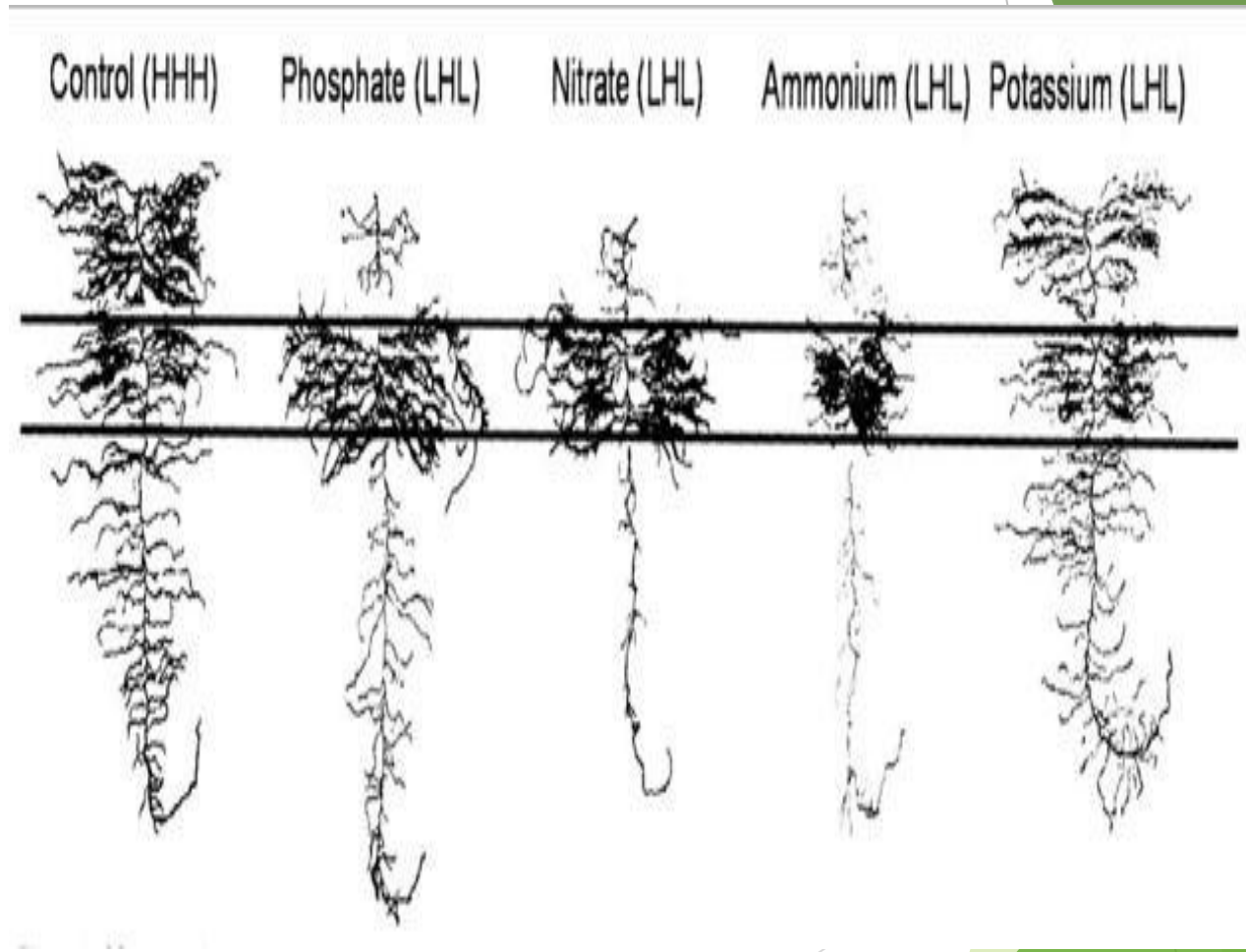
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Symbiosis: Plants and microbes



Supplying plant nutrients by chemicals alone stunts the development of healthy roots



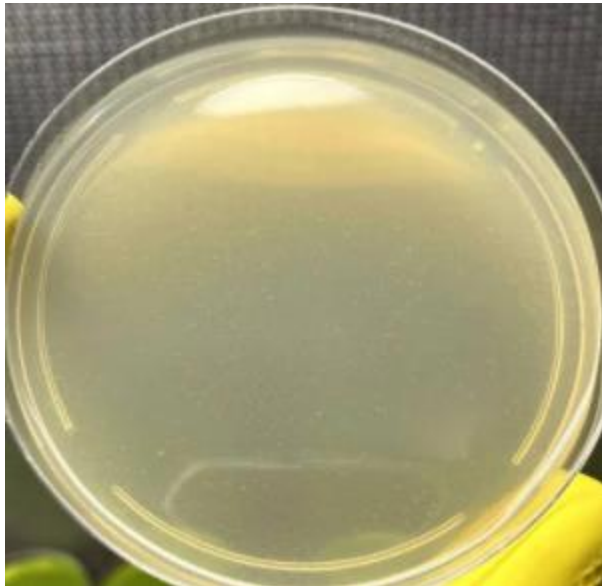
Healthy soil is dependent on the microbial community for:

- ▶ Plant required minerals and nutrients
- ▶ Digestion of litter
- ▶ Creating soil structure-- increased water holding capacity and protection from erosion
- ▶ Information about soil conditions that allows the plant to adapt and protect itself
- ▶ Sequestering carbon in the dead and alive microbial biomass

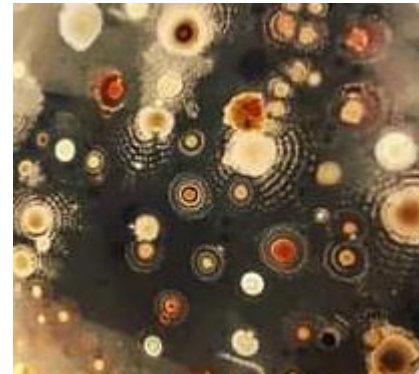
Interdependent populations: MB is so interdependent because bacteria have about 1/1000 th DNA that we have

Bacteria A can't grow till bacteria B has broken down cellulose and released its favorite sugar. Bacteria A now produces a vitamin that helps bacteria C etc.

This is how the plate on the right would look 24 hours after inoculation.

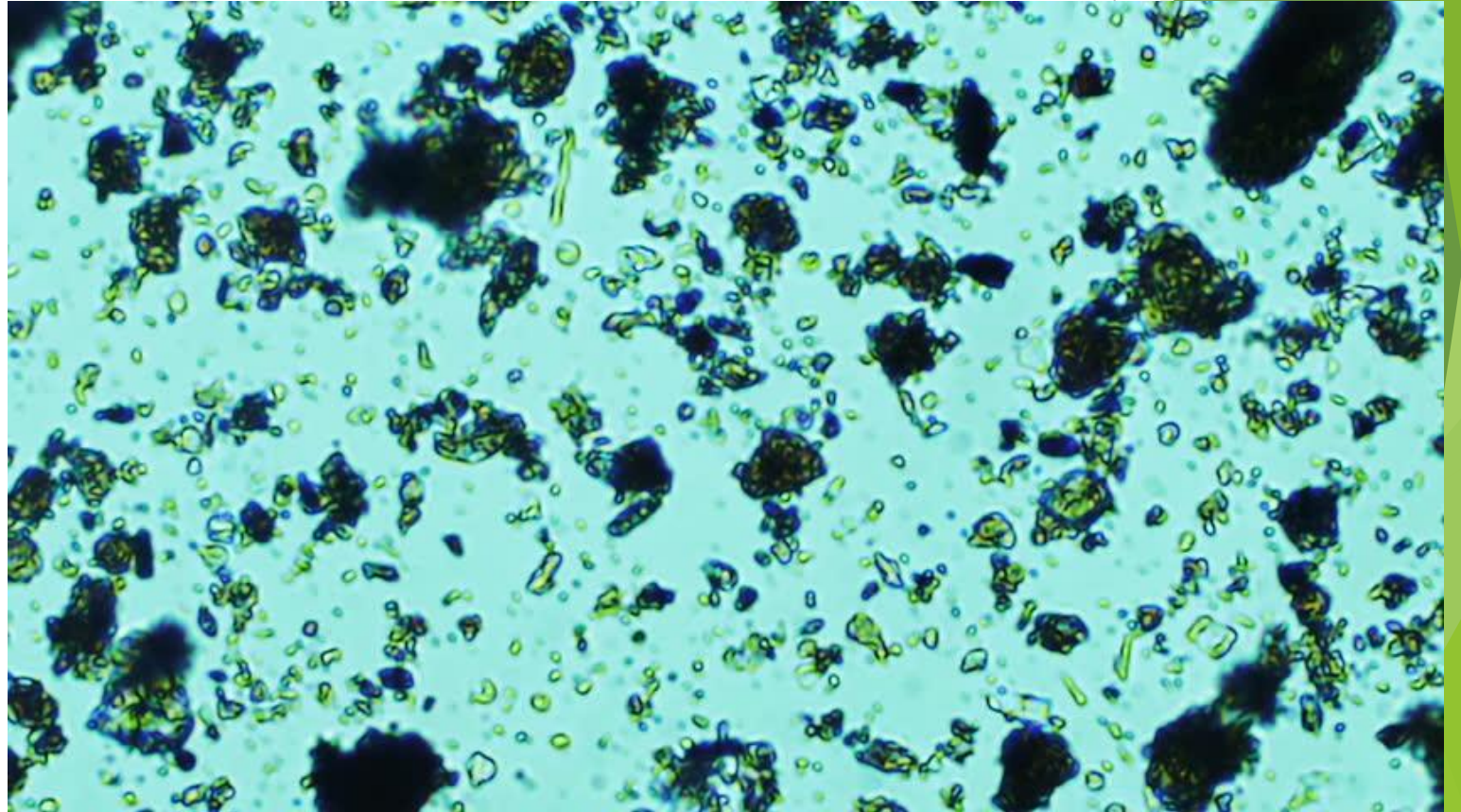


This is the plate surface 2 months later. Differ colonies have slowly emerged.



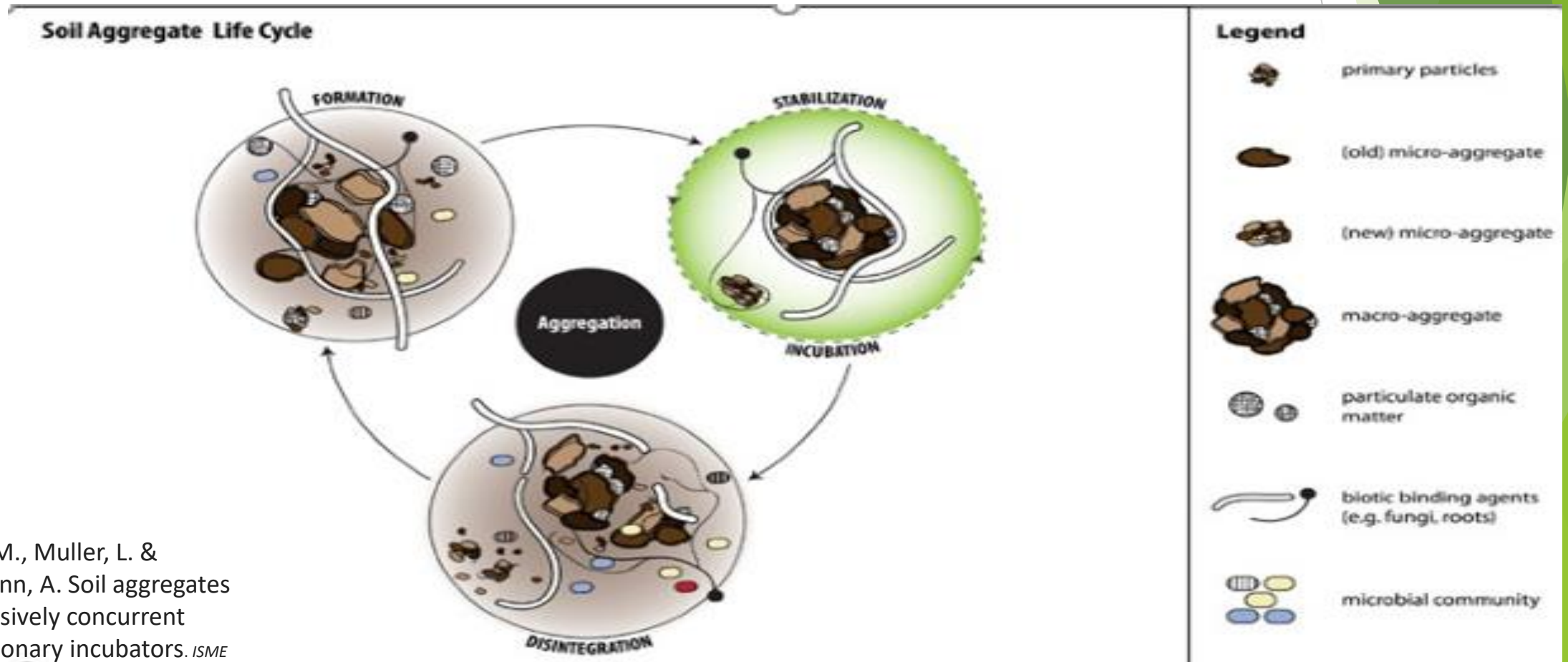
How do microbes build soil structure

- ▶ Microbes attach themselves to soil particles by secreting sticky substances called EPS (extracellular polymeric substance.)
- ▶ When microbe dies the sticky substance remains creating soil aggregates and soil carbon

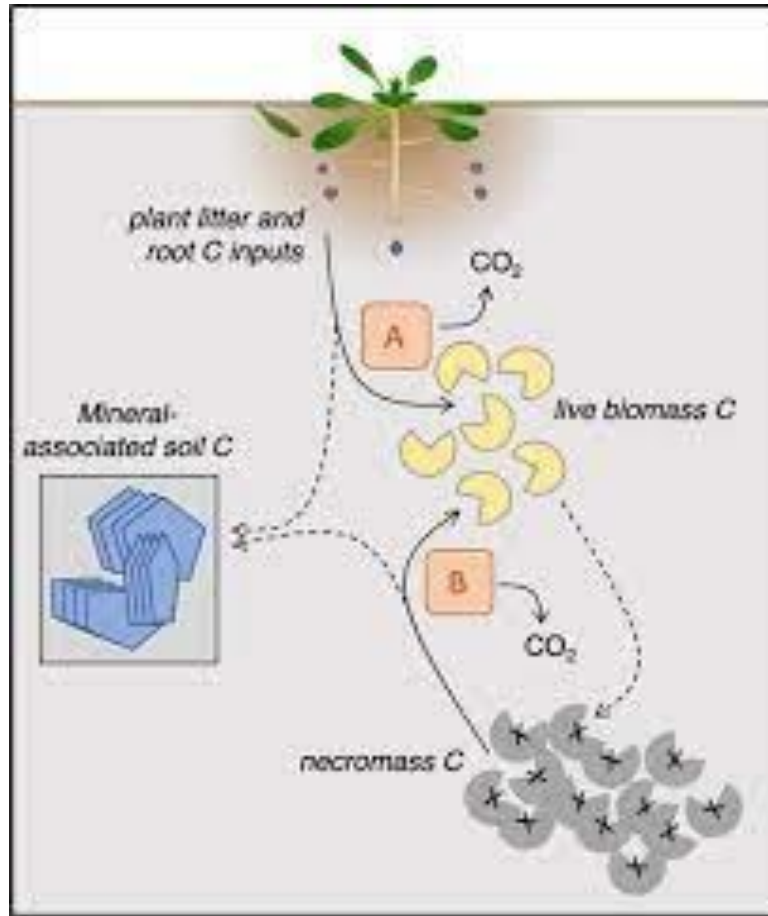


Soil Aggregate Cycle: microbial homes

- ▶ Aggregates are formed by small roots and fungi and stabilized by microbial exudates
- ▶ The microbes in aggregates are protected from predators.
- ▶ Aggregates provide space for oxygen and water to be stored.



Microbial food security: Carbon Stores



- ▶ SOC is broken down plant material:
 - ▶ Soluble : Fresh SOC
 - ▶ broken-down plant material is close to the surface and available to microbes as soluble organic carbon. Using this easily accessible carbon, microbes can multiply.
 - ▶ Stored: Stable SOC
 - ▶ Carbon from dead microbes
 - ▶ Litter from plants. the molecular remnants of the bodies and refuse of dead animals and microbes that digested the plant material.

Microbes increase food security in soil:

Food security in the form of SOM is necessary because after the plant or an amendment stimulates microbial population increase, they need to find more food.

If they don't they will die.

Priming meal



Humus



Building a balanced microbial community

There is no formula for this. It depends on your soil, climate, and crop.

- ▶ Goal is to create optimal conditions for microbes to thrive.
- ▶ The microbial community can do this given the right foods
- ▶ Feeding microbes enables the microbial community to start rebuilding cycle

Solutions: Chemical Fertilizers, microbial inputs, and bio stimulants

- Chemical fertilizers (NPK)
 - Expensive and over time depletes natural microbial population
 - Effective with judicious use
- Microbial Inputs (ie. mycorrhizal fungi)
 - Often issue is that the soil cannot support microbes, not that microbes are missing from the environment.
 - Research is on-going but unclear how much microbial populations vary by location and/or crop.
- Cover Crops
 - Mantra of eco-ag- no bare soil.
 - Right cover crop keeps microbes active- building soil structure; increasing SOC; mining soil for nutrients.
- Bio-Stimulants - Growers Mineral Solution
 - Work because they provide better conditions for microbes to grow.
 - Perpetuate a system that reduces reliance on expensive chemical fertilizers and pesticides/herbicides.

What is the optimal microbial or fungal to bacteria level?

What limits the MB of your soil?

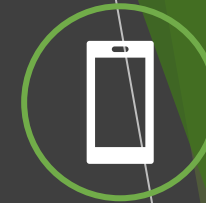
- ▶ Soil composition
- ▶ pH: *natural and created*
- ▶ Compaction: *natural and created*
- ▶ Stores of SOC- Fresh and Stable
- ▶ Temperature/ Season
- ▶ Salt and other chemicals: *natural and created*
- ▶ Crop history
- ▶ Water availability

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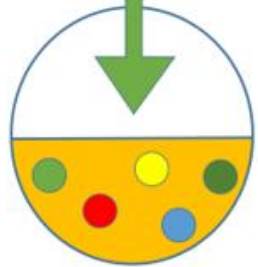


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