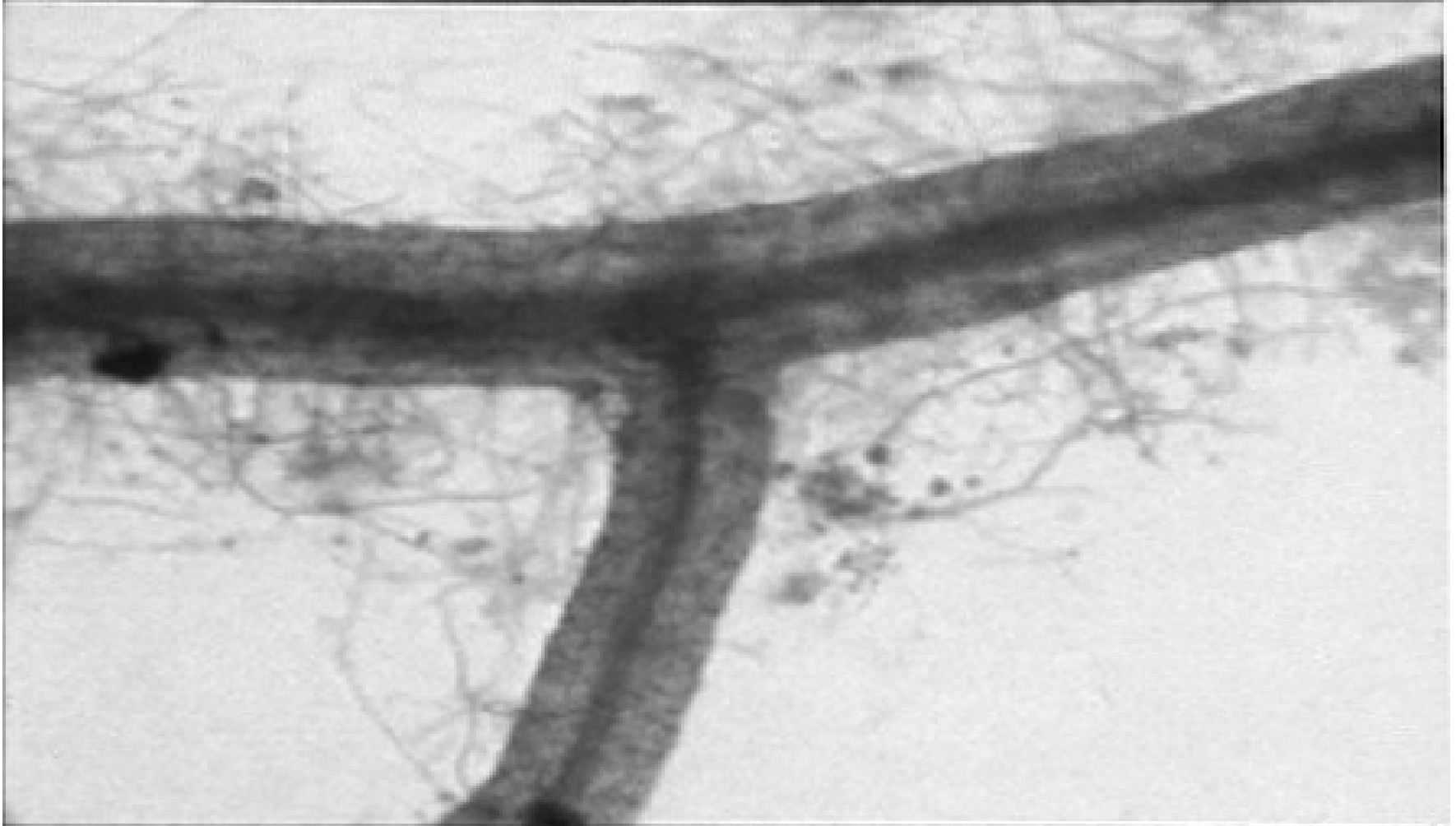


Vesicular Arbuscular Mycorrhizae (VAM)



Managing Biology

- Managing soil and plant microbiology *is not* “*alternative agriculture.*” Good growers do not need an alternative way to farm; unless they want to farm organically. Rather they desire additional information and assistance to improve the health of their land, the quality of their crop, all the while improving the profitability of their operations.
- Rather, managing biology is a *complimentary* practice that can be included in any farming system.

Managing Biology

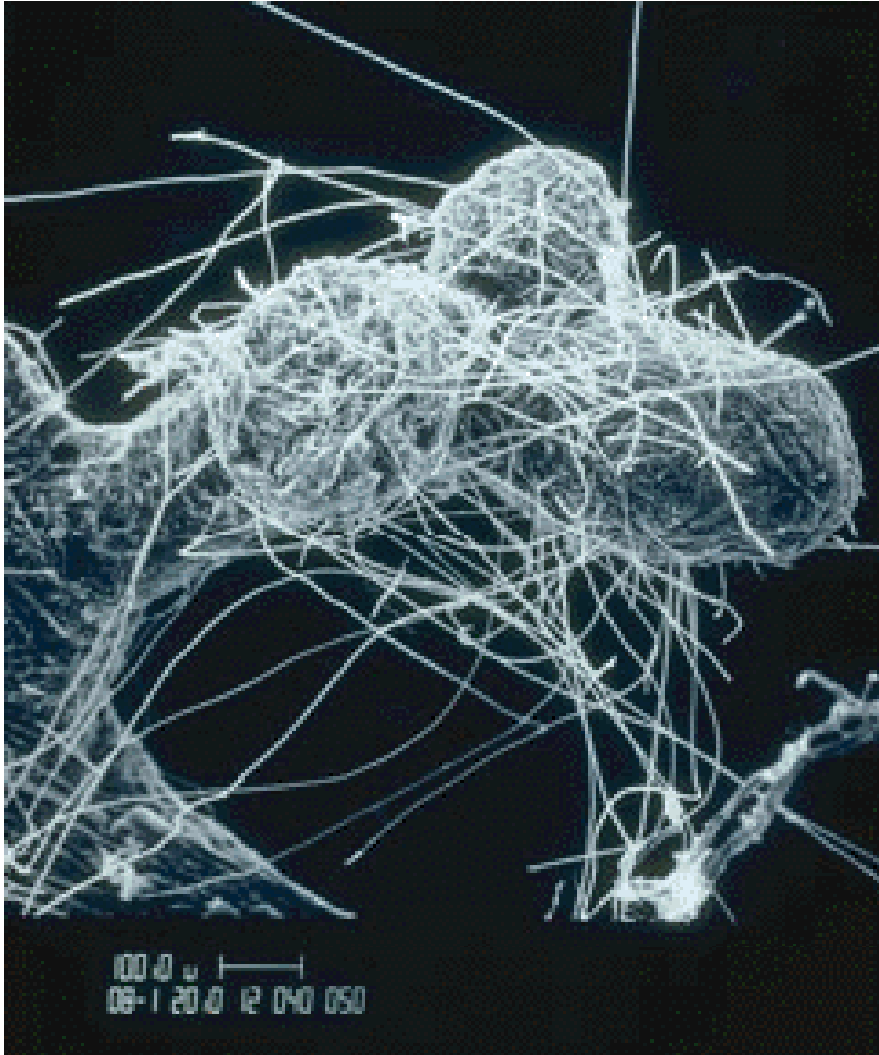
- Mycorrhizal fungi are not new technology. Their inclusion in farming has been around for some time.
- What is emergent, really re-emergent, is the increasing understanding of how to promote and manage for particular microbial communities to the benefit of the crop and for the long term benefit of the soil.
- VAM is but a single example of how biology can be managed.

Mycorrhizal Fungi

- Mycorrhizae is Greek for “fungal roots.”
- It is a symbiotic relationship between a host plant and the fungus.
- The plant provides energy (C) to the fungi, the fungi facilitate an additional flow of nutrients to the plant.



Mycorrhizal Fungi



- A simple way to begin is by using a mycorrhizal inoculant at planting.
- Done as a seed treatment where neither high soluble P levels nor high nitrate levels will inhibit their growth.

When to Use It

- Most crop species will form associations with VAM fungi.
- The exceptions are members of the mustard and broccoli family.
- Trees also benefit from mycorrhizal inoculation. But many of them require ecto mycorrhizae instead of, or in addition to, endo mychorrhizae.
- It is best used where soils are low in P or the P is locked up.
- It is particularly beneficial in soils that are drouthy. So it is no surprise that species that are known for their drought tolerance, like cotton or milo, can form strong mycorrhizal associations.

Why Add It At All ?

- Mycorrhizal fungi are obligate anaerobes. They need a living host to survive.
- These fungi are heavily disfavored by row cropping since there are, typically, extended periods on those fields where nothing is growing. Even no till systems will not keep them around for long if there is not something growing for them to survive on.
- Even where crop soils may have a bit of inoculum, such as a recently plowed down pasture, it can be a good practice to add these beneficial organisms so that the good things they do happen more quickly and to a greater extent.
- The intent is to enhance and accelerate the natural processes.

Crops with Mycorrhizae



Benefits of Increased Mycorrhizal Biomass

- Improved mineral nutrition, including N, through direct supply to the plant.
- There is evidence that a synergism exists between VAM and diazotrophic (free living N fixers) bacteria.
- Improved drought tolerance.
- Increased microbial diversity in the rhizosphere. For example, VAM hyphae are a very popular food source for other organisms such as mineral releasing protozoans.
- Improved soil fertility.

 **CARBON**



 **SOIL FERTILITY**

GLOMALIN

- Glomalins have recently been identified as substances that contribute in a major way to carbon sequestration within soils.
 - So called because these very tough carbon molecules are produced by members of the Glomale family, which includes mycorrhizae.
- Increasing the amount of stable organic matter in the soil is a building block process. There must first be a stable base, like glomalin or some humins, that can be added on to.
 - And it is an increase of a mineral soil's stable organic fraction that increases its fertility.

A Word About Bacteria

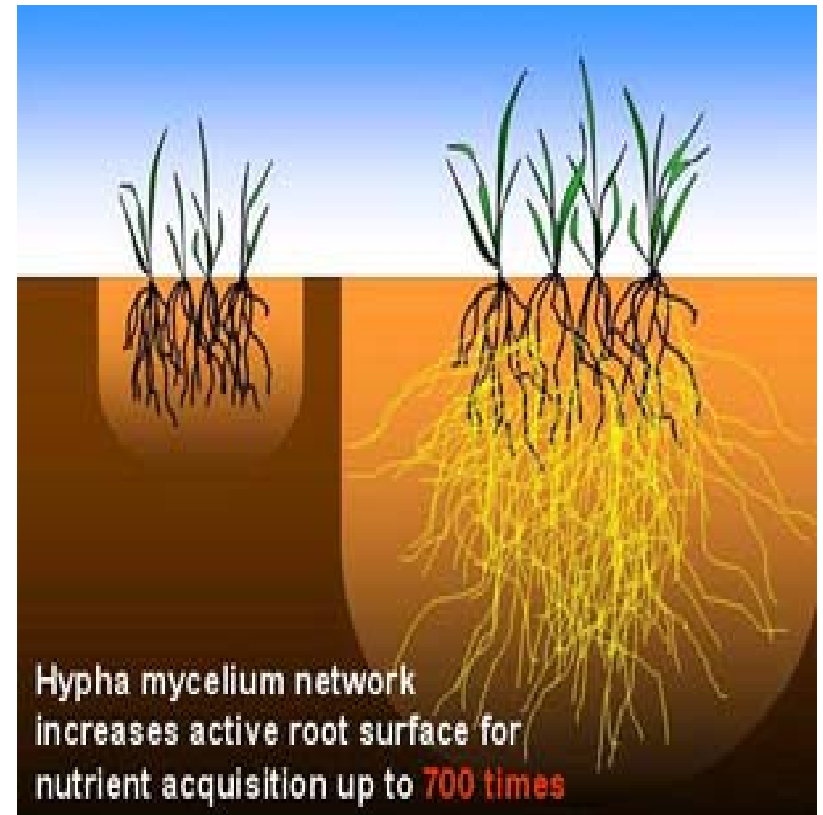
- There is a “substantial body of literature describing the presence of mycorrhizal helper bacteria in natural ecosystems.”
- Thus for a mycorrhizal association to form and flourish, the root rhizosphere needs happy bacteria for company and for protection.
- This suggests that when inoculating with VAM one should concurrently inoculate with beneficial bacteria.
- *Beneficial bacteria also penetrate into the plant and actually move through the xylem as far as the stomata. A healthy potato tuber has more bacterial cells than potato cells. But that is another story.*

Managing soil biology is not a new idea. Modern chemistries have just allowed us to forget about it. Yet it is something we can re-learn. Perhaps it is something we must re-learn.

Comeback Player of the Year



Comeback Player of the Century





Would Dr. Carver be taken seriously today since the agronomic recommendations he made were based on “anecdotal evidence?”

Dr. George W. Carver: America’s greatest Agronomist

“Look about you. Take hold of the things that are here. Let them talk to you. You learn to talk to them.”