3. Co-infect: The Art of Inoculation

There are billions of microbes in a handful of soil. 90% of these microbes are neutral; they don't affect the soil toward disease or health when left on their own. However, according to Dr. Higa, in abused or diseased-chemical based soils, 5 to 10% of the overall colony is pathogenic made up of disease causing organisms. They steer the neutral microbes and create low productivity. Some soils are so bad that less than 1% of the organisms are beneficial.

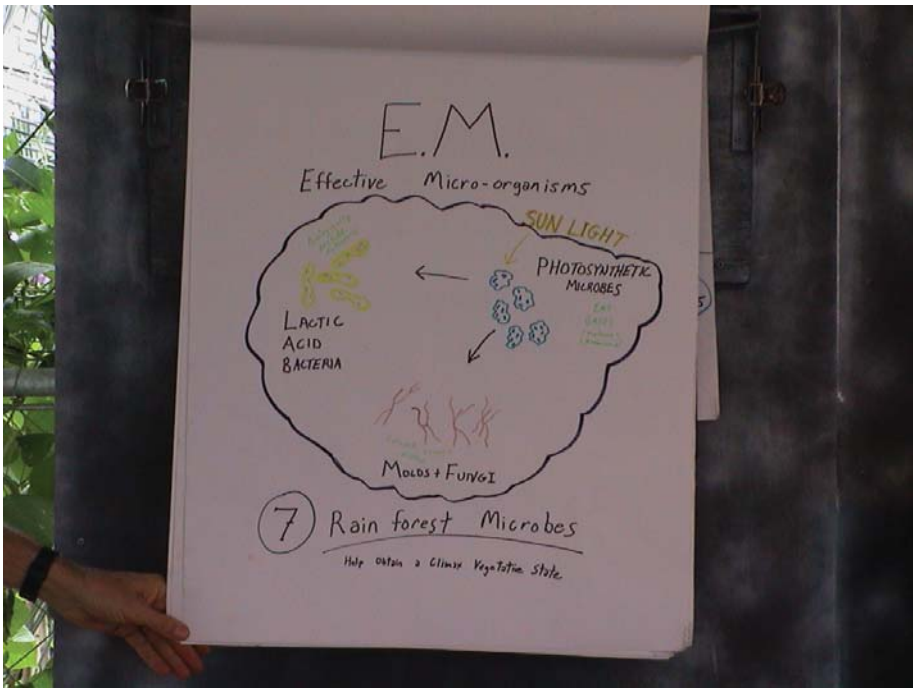
The dominant pathogens lead the neutrals into rot, decay and disease with great inefficiency. All we have to do to turn the tables is out number the bad guys with the good guys. Beneficial and effective

microorganisms will take over the helm and direct the neutrals into a balanced productive state. We don't need to disinfect, rather we co-infect. Overwhelm the bad guys through foliar sprays, soil drenches and compost treatments. In livestock housing we spray the bedding, cement and walls. The EM will work to biologically exclude the pathogens as well as minimize methane gasses and ammonia.

Think of biological exclusion as a litter of hungry puppy dogs. Let's say the mother has a shortage of teats and two pups can't feed properly. The little guys will not be killed by some battle of the best. Rather, the smaller will be excluded by the bigger; the better feeders that have the ability to compete for the food source will prosper. If the bigger pups get all the milk, the others will be held to a nominal role in the pack and may even die from lack of nutrients.

It's the same in the soil. The beneficials don't have to do battle; rather they out eat and out compete against the pathogens, because of their design. This is the synergistic value of microbial stability. There is constant antagonism to the pathogens by way of food

monopolization. That means balance is achieved with the natural order coming into equilibrium.



The EM consortium prevents disease and also builds up natural immune systems in the host plant as they co-prosper symbiotically. We don't need to disinfect; we co-infect.

We call this co-infecting, outnumbering the bad guys with the good guys. The neutrals follow the lead of the dominant controlling system. You should not disinfect. This will kill the beneficials, the neutral majority and the pathogens all at once. It's the destructive ones that always return first. Just outnumber the pathogens with beneficial microbes.

It's like politics. We have all observed that choosing good leaders allows the citizens to prosper. Corrupt governments always lead the people into graft and corruption. Honesty seems to be the first casualty in survival. Politicians are less than 5% of the populace

(hopefully), yet they can guide the masses, an entire nation, to success or failure in one administration. It will take much more effort to turn it back around. Microbial management is the same; today's management practices affect future crops. If we outnumber the bad with the good we will eventually succeed. If we *radically* outnumber the bad with the good we will succeed more quickly.

The Three Way Model of Microbial Management chart below shows you how valuable it is to inoculate in the beginning of your project. Use beneficial microorganisms in your natural system at the start, or to help in converting from chemical use. It only has limited effects on systems where fungicides and pesticides have been sprayed, because chemicals disinfect the entire area of application.

Table 1 – Three Way Model of Microbial Management

The Three Way Model Of Microbial Management		
Inoculation without Natural Inputs	Traditional Organic Method	Sustainable Inoculation Method
NO RETURN on investment	SLOW RETURN on investment	FASTER RETURN on investment
If you use microbes on depleted soil, with low organic matter, and no natural inputs, then the microbes have nothing to transform and success is not obtained.	Traditional organic farming adds organic matter to the soil, but it can take 4-5 years for the microbes to show up and make the soil profitable.	Inoculate from the beginning with a wide variety of symbiotic microbes. They work as a team; success can be seen in the first year, without major lose of productivity.

EM contains some of the following organisms; photosynthetic bacteria, lactic acid bacteria, yeasts, Actinomycetes and fermenting fungi. In EM literature, the key idea is that the microbes form a consortium, a group that works as a team. They all work better with each other rather than alone. The photosynthetic bacteria are also known as phototrophs, Rhodopsudomonas sp., Rotobactor, PNSBs (Purple Non Sulfur Bacteria) and seem to guide the hundreds of other microbes in a beneficially productive state. There are now many manufacturers of EM like inoculants. Some of the best available have the proper balance of LAS, phototrophs, molds and fungi for the region they are prepared in. Most of these cultures are already available through commercial suppliers to the food industry, brewers and scientific community.

Co-infect in the nursery and green house to keep plants strong and healthy. We add high anti-oxidant ingredients like ginger, garlic, chili and neem for natural insect management.

Effective Microorganisms consist of a wide variety of beneficial organisms. The white molds are a sign of healthy processes in the soil or compost.

They crowd out pathogens and minimize odors and disease. The pioneer and discoverer of EM is a professor in Japan, Dr. Higa. According to EM materials:

> Photosynthetic bacteria support the activities of other microorganisms. The photosynthetic bacteria also utilize substances produced by other microorganisms. This phenomenon is termed "coexistence and co-prosperity".
>
> When Effective Microorganisms increase as a community in soils, populations of native effective microorganisms are also enhanced. Thus, the micro flora becomes rich and microbial ecosystems in the soil become well balanced. Specific microorganisms, harmful ones, do not increase. Thus, soil borne diseases are suppressed.
>
> Plant roots secrete substances such as carbohydrates, amino and organic acids, and active enzymes. Effective microorganisms use these secretions

> for growth. During this process, they also secrete and provide amino and nucleic acids, a variety of vitamins and hormones to plants.
>
> Furthermore, in such soils, effective microorganisms in the root zone co-exist (symbiosis) with plants, feeding each other. Plants grow exceptionally well in soils that are dominated by effective microorganisms.

The favorite specie seems to be the Rhodopseudomonas sp., and various Rhodobactor species. These microbes convert, or synthesize, sunlight when applied to plant leaves.

Through its leaves, the plant utilizes the waste from the microbes. They are not a fertilizer, but they make fertilizer. When buried in soil and composts they retrieve their energy from heat instead of sunlight. The Creator made some highly adaptable switch-hitters; they are key players in fermentative systems. However, they need organic matter to do their job.

Organic matter is previously living components from the natural world. This includes leaves and roots, bark and hulls, grass and straw. Manures, bones, seashells and rock powders can also be included. Chemicals such as Malathion and urea do not qualify.

The reason we had success in our system early on was due to adding as much organic matter as economically possible in the beginning, while inoculating with the beneficial microbes. Truckloads of manure were composted with seaweed or rice mill waste. We sprayed them, poured them, mixed them and fed them to the soil, to the compost, to the leaves, and to the bark. Now our compost needs are being met by farm-generated fertility. In addition, we spray less often than at the beginning.

Fungi and mushrooms are helpful in the soil.

After you have been spraying with beneficial microorganisms for a few months and quit using chemicals, you will start to see mushrooms. Don't be alarmed! This is a sign of a healthy ecology and they are good for the soil. The mushroom is the fruiting body from miles of mycelium crawling through your layers of organic matter and topsoil.

Fungi help break down courser material and make it available to bacteria. Fungi break down the high carbon content components like wood fiber and bark while enriching the soil for perennials and trees. Bacteria create a favorable habitat for annuals such as vegetables. The entire food web is multiple cycles of dismantling and building food for your plants.

Horticulturist Simon Gill joins us at Aloha House in some of the advanced trainings, showing students how to succeed in growing the appropriate varieties for their climate and soil conditions.

I have cataloged the ten most effective means of adding and managing this organic matter into the soil. This organic matter is the feedstock for your microbes. Consider the microbial colonies in your soil as miniature livestock; living in the earth and grazing on your organic matter. Your microbial composition needs to have diversity to process the organic matter you keep layering up with each fundamental. They need to be in balance so they can work hard to bring you good food. I now call these main principles the Ten Fundamentals of Sustainable Agriculture. There are many variations but the principles are timeless. We will look at these basic ideas in the coming chapters, but first, let's prepare our microbes.

El Nido Foundation attends our weekly seminar on Sustainable Agriculture. We have a nominal materials fee for the course. This weeds out the idle and curious and motivates students to practice what they learn.

At Aloha House's advanced training- Students are always seeking more practical knowledge. The lecture phase is supplemented with video course work, a flip chart presentation and hands on application. We finish with a working tour of our organic farm. Our internship program is gaining interest also.