

The Value of Soil Biology (and the Food Pyramid)

So...What's with this talk about soil biology, and putting microorganisms to work on plant roots, and "friendly fungi" anyway? Is this really something important for your daily lives, or just more navel-gazing science that produces ignorable fluff like the government's Food Pyramid?

I don't know about you, but to me it's very reassuring to know that our eating habits are being guided by hard-working government professionals. I'm certain that we'll all be getting slimmer now that a new pyramid has been developed, especially if we follow the breakthrough advice that exercise and eating smaller amounts can lead to weight loss. Astounding! This new information alone justifies however many millions we're spending to to keep these dedicated food researchers on the public payroll and to advertise their findings.

The Food Pyramid is a critically important part of our daily lives (although not by that name), at least mine, but should soil biology be considered more than an academic issue?

I fully understand the difficulty of pulling microbiological technology out of USDA and university labs into farm fields and home gardens. My general experience is that only a few farmers, landscapers, and gardeners are actively seeking alternatives for growing plants, and the idea that microscopic fungi can somehow out perform familiar fertilizers is a tricky concept to explain.

Those of us in the bio-products industry are doing our best to explain the "how" and "why" of using beneficial organisms to grow food crops and ornamentals, but obviously lack the kind of huge ad budgets that would really launch biological methods into the mainstream. So, it's basically one grower at a time for us. And when that grower is delighted with the survival rates, disease resistance, and performance of plants with mycorrhizae and a very little fertilizer, we make one more convert.

At some point, I have to believe that either enough successful bio-growers will form a critical mass that will spark widespread use, or that the USDA will begin actively conducting in-field trials and promoting alternatives to chemical methods - with luck, perhaps with at least a tenth of the investment and enthusiasm that is given to the Food Pyramid.

Shameless promotion section.... Our website now offers smaller, more affordable containers of all our mycorrhizal products (powder, micronized powder, root dip, endo/ecto landscape inoculant), plus we have just added our new MycoMinerals(tm) product for home gardens. The latter product is designed to be worked into vegetable or flower bed soil before seeding or transplanting, and produced some dramatic effects during initial trials last year. The giant pumpkin folks by themselves should make for a good market.

Cheers, my friends,

Don Chapman
President
BioOrganics, Inc.
www.bio-organics.com
January, 2005

What Fungi Do for Soil

In trying to think of a good way to illustrate the good effects that mycorrhizal fungi have on soil, my own experience in a garden should work.

We had just moved to a new home in Camarillo, California, and the back yard that sloped downward had a relatively level area that could be transformed into a terrace about 15 feet wide by putting up a retaining wall of railroad ties. After the wall was built, I excavated the upper part of the terrace and moved that soil toward the wall, ending up with a level area.

Eventually, I would build several raised beds on that terrace and amend the black clay soil with sand and compost, but as it was already getting past planting season I did a rush job of starting various vegetables. (Side Note: ignore anyone who tries to tell you that sand and clay make concrete. They don't. If you blend in enough clean sand and add some compost, you'll get beautiful loose garden soil to work with for years to come.)

At one end of my garden terrace, I pried open a few holes in the hard clay and planted potato seeds with a dusting of mycorrhizal inoculant - no fertilizer at all. A few weeks later, I was surprised to see that the potato plants were looking very healthy, but didn't really pay too much attention to them.

When they finished flowering, I went to "rob" a few new potatoes for dinner one night and was very surprised to discover that I didn't need a shovel. I could just poke my hand down into the soil near the plants and feel around in the loose soil for the potatoes. I also noted that this nice loose soil extended out in roughly an 18 inch circle from each plant. Beyond that area, the clay was as hard as a board.

I was seeing the effects of the mycorrhizal fungi. After colonizing the potato roots, the fungi sent their thousands of microscopic root-threads (hyphae) out into the surrounding soil to forage for nutrients and moisture, penetrating between the tightly-stacked clay platelets as they extended outward.

As the clay platelets were pried apart, oxygen was able to flow down into the soil and water drained away easily. Other beneficial aerobic organisms were then able to multiply and produce nitrogen and solubilize phosphorus, which the mycorrhizal fungi transported back to the potato host plant. I had a huge crop of potatoes that season as the plants grew in the equivalent of great potting soil - always staying moist, but not soggy.

Interestingly, within a week or so after harvesting, the soil where the potato plants had been growing was nearly as hard-packed as the surrounding soil. The "friendly fungi" are obligate life forms and cannot remain active without a host plant. Their survival strategy is generally the same as plants that leave behind seeds for next spring, but these fungi leave tiny dormant spores in the soil. The spores will not become active until they receive a chemical signal from a new growing root nearby.

Other grow tests have shown that the fungi can also perform their magic on poor sandy soil - with the hyphae clumping the sand particles together to form the same sort of potting-type soil as from clay - only working from the opposite direction! This is simply the role of mycorrhizal fungi in nature - to improve soil for their host plants and, working with other microbial agents, to supply their plants with nutrients as needed. Clay gets loosened, sand gets clumped, plants thrive. So very simple.

But all it takes to mess up this elegant soil system is to add “fast-acting plant food” and systemic fungicides to your garden. Think about that the next time you are scraping sticky clay off your shovel.

Cheers and good growing, my friends,

Don Chapman
President, BioOrganics, Inc.
www.bio-organics.com
February, 2005

What You May Not Know About Plants

Last spring, I offered to send sample jars of our new MycoMinerals product (volcanic minerals with mycorrhiza spores) to home gardeners to test. One of the participants in Michigan sent back a glowing review, but I had to chuckle when he said how terribly difficult it was to follow my instructions not to add any fertilizer during the entire growing season.

It seems that serious gardeners want to pamper their gardens so much that a biological approach, where one relies on microbial action to “feed” plants, seems like neglect. The chemical industry has done a remarkable job of convincing people to more or less constantly apply synthetic fertilizer, either in the form of side-dressings or liquid drenchings. Their psychological sales message generally is suggestive of a mother feeding her children.

However, when one keeps soils artificially rich in macro nutrients, it disrupts natural bioorganisms that would normally generate nitrogen, convert soil phosphorus, and seek out other as-needed elements. In effect, loading up soil with NPK fertilizer fairly quickly creates chemically-dependent plants that could otherwise be largely self-reliant.

If you wish, you can try a low-input approach for yourself. Just set aside a section of a garden or flower bed and blend in MycoMinerals before planting - with NO added fertilizer before or during the growing season. If the plants in that section don't perform as well or better than the fertilized ones, I'll send you a full refund, including the shipping cost.

Something to think about: Let's say you planted a little seedling tree in a big pot containing exactly 100 lbs. of soil, let the tree grow to a good size, and then removed it leaving the soil behind in the pot. You find that the tree and its roots weigh 50 lbs. How much will the soil in the pot weigh now?

A somewhat related question: How can wild trees, shrubs, and grasses grow in the same soil for hundreds or thousands of years without ever depleting those soils? Where do those unattended non-leguminous plants get the nitrogen that plants seem to require in heavy doses?

First Answer: The soil in the pot will still weight 100 lbs., so where did the 50 lbs. of solid wood come from? From the only inputs - water, air, and sunshine. Sort of a miracle, eh?

Second Answer: Plants that didn't figure out reliable ways of feeding themselves (with the help of symbiotic soil organisms) would have gone extinct millions of years ago. Different plants employ different strategies, but in general they can all thrive without frequent side-dressings and drenchings of “plant food.”

Good growing, my friends,

Don Chapman
President, BioOrganics, Inc.
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March, 2005

Why Insects Attack Plants

Our newsletters have often explained how mycorrhizal fungi attach to plant roots and bring great amounts of needed nutrients to the plant, functioning like millions of extra feeder roots. These well-nourished plants become more disease resistant and produce higher yields or more flowers.

A less obvious benefit is reduced insect attacks. In our grow testing, we can often tell the mycorrhizal plants from control plants from some distance away, not just by size but also by a difference in leaf damage.

This same sort of difference can be seen by comparing plants fertilized with slow-release fertilizer versus those given fast-acting forms, especially liquids. The quick greening and rapid burst of growth that you get after drenching plants with liquid fertilizer is obviously an invitation to harmful bugs.

So what's going on? There are different theories about this subject, but one is that certain insects are programmed by nature to eliminate sick or otherwise imperfect plants. When you create unnaturally lush growth on a plant, something about those leaves seems to be like a neon sign that triggers the "must destroy" instinct in bugs, even though the plant may look normal to our eyes.

Another theory is that completely healthy plants produce a substance that tastes bitter to insects - sort of a natural repellent - but a plant that is pushed with fast NPK fertilizer apparently does not form those anti-bug substances and tastes delicious.

Whatever the reason, the way to grow plants that won't require drenchings of toxic rescue chemicals is to use small amounts of slow-release nutrients that are delivered as-needed to the roots by biological action. The use of any high-analysis fertilizer, especially in liquid form, seems to be a major cause of insect attacks.

Of course, the nice companies that so heavily promote their wonder fertilizers are also happy to sell you bug sprays later. But I'm sure they don't realize that their plant food is creating the need for insect protection. Real sure.

Cheers, and good growing my friends,

Don Chapman
President, BioOrganics, Inc.
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April, 2005

Please Pass the Nutrients

In past newsletters, I've described how mycorrhizal fungi add a certain "intelligence" to the root zone. This beneficial fungi colonizes the surrounding soil to bring nutrients and moisture to their host plants, guards roots against pathogens, and fluffs up heavy clay to admit oxygen.

However, there is another aspect to these complex organisms that is worth exploring; the movement of nutrients not only from the soil to host plants, but also between plants.

A few quotes:

1. From *The Growing EDGE* magazine: "...fungal mats connect plants of different species, transferring substances produced by one plant to other, possibly even unrelated, species. Dr. Robert Griffiths at Oregon State University in Corvallis reports that in seedling trees in the midst of established stands, as much as 30% of the photosynthates (compounds produced by the plants through photosynthesis) could be traced to other mature trees in the area. That means the young trees are getting as much as a third of their nutrition from older, established trees."

2. From *Agricultural Research* magazine, describing formal USDA trials: "Agricultural Department scientists have found that growing tomatoes in a living mulch (hairy vetch) increased yield by about 138 percent and reduced insect infestation so much that it was hardly a problem. ...an added bonus was no tillage and less fertilizer, herbicides and pesticides. ...plants grown under the vetch mulch averaged a yield of more than 45 tons per acre, trailed by 35 tons for plastic mulch and 34 tons for paper. Plots with no mulch averaged 19 tons per acre."

3. From the book, *Let Nature Do The Growing, The Fertilizer-free Vegetable Garden*, by Gajin Tokuno (translated from Japanese): "In short, instead of regarding them with hostility, it is wiser to realize that weeds loosen the soil and provide important nutrition and to allow them to grow together with vegetables in a natural ecological system."

4. Again from *The Growing Edge*: "Fruit trees found growing in forests often have less overall disease and insect infestation than similar ones in cultivation. When starts of what seemed to be an exceptional tree found in a forest were taken into cultivation, they tended to vary from their performance in the wild. Cultivation enhanced vigor and productivity, but qualities such as flavor and disease-resistance often decreased or at least changed. It seems likely from the discoveries with mycorrhizal fungi that the tree in the forest could have been receiving substances from other plants that increased its health and perhaps even entered into the quality of its fruit."

What a wealth of potential agricultural research topics! The USDA scientists conducting the living mulch experiment were unable to explain why the companion vetch produced such huge benefits to the tomatoes, but after working with mycorrhizal fungi for years, the answer seems pretty obvious to me.

I'm particularly fascinated by the potential effects on flavor by these nutrient transfers and I would think that wine grape growers in particular might want to carefully consider which cover crops to strategically plant between their rows. Other growers and crop advisors should note the effects on yields and the non-chemical disease resistance.

The reduced insect damage is consistent with our company's own observations, as noted in my previous newsletter (see Newsletter Archives at our website).

I incorporate this nutrient-transfer information into my own vegetable garden by seeding narrow rows of Crimson Clover next to my tomatoes, inoculating both the clover seeds and the tomato transplants with mycorrhizal fungi spores. I cut the annual-type clover off at the soil line after it blooms but before they go to seed, and get exceptional yields of wonderfully flavored tomatoes with only tiny amounts of dry organic fertilizer and some volcanic trace minerals scratched into the topsoil before planting.

For those who want to try this low-input biological approach, I recommend our MycoMinerals product. Just note that the method will NOT work as well if you use high-analysis NPK fertilizer or apply added fertilizer (especially liquids) during the growing season. Those artificial "plant foods" disrupt the biological processes.

Mmmmmm, I can almost taste those sun-ripened 'maters now!

Good growing, my friends,

Don Chapman
President, BioOrganics, Inc.
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May, 2005

Tomato Plants with the True Look of Health

As another growing season is underway and my tomato plants begin climbing upward - on 10 ft. high netting for the indeterminate types and in wire cages for the bush-types - it is interesting to observe the effects of mycorrhizae on their root systems.

The combination of very small amounts of dry organic fertilizer, plus the addition of volcanic trace minerals and mycorrhizal fungi spores produces tomato plants that look and perform considerably different from typical garden tomatoes.

My goal is for the plants to not lack any essential major, minor, or trace element. A chemically-oriented soil expert would say that they were not given enough NPK - what they would mistakenly call "complete" or "balanced" fertilizer. This idea that growers must provide all the nutrients that plants uptake is as prevalent as was once the idea that the sun revolves around the earth.

In fact, a healthy biologically-active soil contains living organisms that produce N and also convert mineral elements into forms that plants can use. Intensive plantings do call for supplemental fertilizing, which is why I add a little feather meal or fish pellets before planting. This and broad-spectrum rock dust are all the fertilizing my plants receive all season. The mycorrhizal fungi, beneficial bacteria and other soil biota generate all the "plant food" that my veggies require.

Having a full spectrum of nutrients continually available in ideal amounts creates tomato plants with stockier stalks - as much as 3-4 times thicker than those of chemically-fed plants. There is also shorter distances between branches. The result is a stronger, more compact plant that produces yields closer to full genetic potential. Nearly all blossoms set fruit, a measure of good nutrient uptake, and there are never any serious disease or blossom-end rot problems, another mark of a fully-fed plant.

The "Wow!" factor is high for these plants. Visitors are always impressed with the crowded numbers of fruit on the vines, but for me the more impressive features are the minimal inputs of fertilizer and water they have received. In effect, my plants are pretty much self-reliant after the initial soil preparation. A little training and pruning are about all the care they require, and any drenching of liquid fertilizer or side-dressings of granular "plant food" would only diminish their health and productivity.

Finally, there are the flavors. If you have never tasted a fully-ripe tomato grown in a mineral-rich soil with limited water, you quite honestly do not realize what you are missing. There are complex acidic-sweet mixes of flavors that add depth to even modern hybrids not necessarily bred for superior taste qualities.

It's too bad that so much R&D funding went into soil chemistry instead of soil biology after WWII. We could all be enjoying dramatically better tomatoes with fewer problems today.

Cheers, my friends,

Don Chapman
President, BioOrganics, Inc.
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June, 2005

Bio-Methods...A Slow Awakening in Farm Country

When I was first introduced to the concept of growing plants with biological methods nearly ten years ago, it was an exciting moment. From the perspective of someone raised on a farm, I could immediately appreciate the appeal of cutting back on expensive fertilizers and chemicals.

And from the perspective of a business entrepreneur, I saw the potential for a billion-dollar new market - one that could some day rival the soil-chemistry industry. Why, if ten percent of the farms in Kansas converted over to biology-based techniques, or even just one percent, suppliers of beneficial fungi and bacteria could make huge amounts of sales. Huge!

So I embraced mycorrhizal fungi inoculants as a new career, and it has been an interesting experience to say the least. Those Kansas farmers are still pretty much all ignoring soil biology and probably will until either their yields plummet, the cost of petro-fertilizers soars upward, or the government begins to limit inputs of water-contaminating nitrates. That billion-dollar game plan will require more patience, but if the word "unsustainable" means what I think it means, time is on the side of biology (as always).

Instead of big farms, the more immediate market for biologicals has turned out to be growers of higher-value plants and ornamentals, along with home gardeners and landscapers. Wine grape growers, rose fanciers, market vegetable farmers, and people planting expensive trees, shrubs, and lawns represent the bulk of our customers.

I actually think that home gardeners will end up leading the way to wider acceptance of biological methods as they see the benefits, and that routine use will go from smaller growers up to larger ones.

Why the delay in using biological science on farms? Well, let's remember that changes do not come easily to conservative rural areas, plus there are industrial giants constantly touting the effectiveness of chemical products, and until very recently the USDA barely acknowledged the existence, let alone importance, of biological soil elements.

Also, we must keep in mind that we are talking about people's livelihoods. Until our bio-methods can promise equal or greater yields THIS season - no maybes or down the road - you really can't blame farmers for sticking to what has worked in the past. Until a neighbor out-produces them five years in a row, more tons of NPK fertilizer based on soil chemistry tests are going to be applied every spring.

I guess the question is whether it will turn out to be a bigger gamble to continue as-is, with the potential sustainability problems noted above, or to begin working on restoring biological health to crop soils.

Maybe just one-tenth of one percent of those Kansas farmers while I'm still alive?

Cheers, my friends,

Don Chapman
President, BioOrganics, Inc.
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July, 2005

Less Water, Bigger Yields...Huh?

I recently noticed an interesting article in an agricultural trade paper that described the results of a Michigan State University tomato trial. The researchers designed a program to test plant response to various water inputs, and found that withholding water for three to five weeks after transplanting resulted in a yield increases of up to 15% while using 40% less irrigation water.

These results were duplicated in two consecutive growing seasons, working in partnership with southwestern Michigan farmers. The article did note that it is critical that the soil be moist at planting time - see www.green.msu.edu

As an explanation for the findings, the project coordinator said that over-irrigation after transplanting probably washes away nutrients from the soil. This is consistent with almost all ag-college studies -suggesting that there is some chemical reason behind all observations.

If these chemistry-oriented researchers would have wandered over to MSU's Biology department for a few minutes, they might have gained a different perspective/explanation. It is well-documented that mycorrhizal fungi, which bring nutrients and moisture to plants on an as-needed basis, can go into a "higher gear" when their host plants are stressed. Withholding water is a routine part of the propagation process when creating mycorrhizal inoculants.

When a plant senses a shortage of water, it sends a specific "help" signal through its roots, which causes beneficial fungi to step up their efforts to keep the plant from dying. This is simply the way that nature gets plants through drought years.

As I have suggested many times in past newsletters, by putting some research investment behind soil biology we can learn to manipulate natural biological relationships for agriculture. Bio methods could save enormous amounts of fertilizer and water, reduce environmental run-off problems, and prevent soil degradation. But soil researchers must acknowledge first, that soil biology actually exists, and secondly, that living organisms in the soil serve any useful purpose.

The MSU results were completely predictable to anyone with even the slightest awareness of how mycorrhizal fungi function. These are powerful organisms that can be the key to achieving superior plant performance with lower grower input.

I do hope these scientists keep experimenting with watering practices...but hope that they recognize that overabundant irrigation has biological as well as chemical implications. "Washing away nutrients" might not be the best explanation for their observations. "Not calling up the fungi" could be a better answer, or at least one that should be mentioned in any modern ag article.

By the way, this is about the time of year that I stop watering my tomatoes and melons - another effect of water stress is for plants to ripen their fruit quicker. You might be surprised to find how long they will go before showing any wilting in the morning hours. (Note that this strategy may not be appropriate for container plants that have a restricted foraging zone.)

Good growing, friends,

Don Chapman

President, BioOrganics, Inc., www.bio-organics.com, August, 2005

The So-Easy Bio-Lawn

One of the most logical candidates for biological methods is a lawn. By simply creating favorable conditions for beneficial microbial organisms and providing a broad range of minor/trace minerals, grass can thrive with no added fertilization beyond clippings and will be far more drought resistant than chemically dependent turf grown in lifeless soils.

There will also be no thatch build-up, as the clippings are happily eaten by the large populations of soil organisms (and then, of course, their excretions become free fodder for the grass). A mulching mower is advised - don't routinely remove clippings.

For new lawns, we recommend tilling in compost, volcanic minerals, and mycorrhizal spores before seeding. If the soil is heavy clay, adding a couple inches of clean builder's sand is also advisable. This extra soil prep will pay off in long-term easy-care results. What you are doing is making soil conditions perfect for plant supporting organisms, from earthworms down to nitrogen fixing bacteria. These will all play roles in becoming "underground caregivers" for the grass roots.

And by the way, pay no attention to those who mutter the old "clay and sand make concrete" line. I guarantee they won't. If any sceptics want proof, just dump a bag or two of sand 3-4 inches deep on one spot in your garden and work it into the top 6-8 inches of soil, along with a little compost and a handful of trace minerals - add NO fertilizer. Then plant a mycorrhizae inoculated tomato or melon plant in the middle of that spot and see if it doesn't out perform others by a wide margin. Note how nice and loose and moist that soil will stay during the growing season - about like good potting soil.

Back to lawns. For established lawns, the fall season is the best time to renovate them. For serious results I'd suggest starting by hiring a professional aerating service. Be sure that they use a large machine that actually removes plugs several inches deep and doesn't just poke holes in the lawn. Have them dispose of the plugs.

Then, quickly before the holes grow shut, add about an inch of clean sand, volcanic minerals and mycorrhizal inoculant. Rake as much of the material into the holes as possible. DO NOT use any chemical fertilizer ever again - that will only disrupt the healthy biological process that you are trying to establish.

In the spring when new growth begins, lightly top dress the lawn with compost (mushroom compost is an excellent material if available, but any composted vegetable matter will do). Again, DO NOT put any high-analysis "lawn food" on the grass. You are now using a powerful natural biological approach instead of quick-green, fast-fade, soil chemistry.

I occasionally still apply some low-analysis dry organic fertilizer - either pelleted fish or a feather-meal blend - to my own lawn, but this is probably not really necessary. In years when I don't bother fertilizing, I don't see much difference and the grass looks nice all summer with minimal watering.

NOTE: We offer a combination volcanic minerals and mycorrhiza spores product - MycoMinerals - that is ideal for lawns or golf course greens. Visit our website for ordering information. If you don't want to go to the full effort of aerating/sanding your existing lawn, just scattering the MycoMinerals and watering it in this fall will provide benefits. Test a 4-lb. jar (\$29.50) on 200 square feet, mark that

area and compare the results next spring, and, again, do refrain from fertilizing that area - that will ruin the test.

I have also been asked if we sell the volcanic trace minerals separately and we may do that in the future. The mine site owners are planning to make a very large investment in developing the unique deposit near Crater Lake. They are mostly thinking of agricultural uses, but I think they will package it into 40-lb. bags. If so, we will add them to our product line.

Cheers, and good growing,

Don Chapman
President, BioOrganics, Inc.
www.bio-organics.com
September, 2005

“The American Gardener” Touts Mycorrhizal Fungi

An excellent article in the July/August issue of *The American Gardener* (the magazine of the American Horticultural Society - www.ahs.org) has information about mycorrhizal fungi that should be of interest to both commercial growers and home gardeners.

The article was authored by Doreen Howard, who was among our first customers nearly 10 years ago. She had been frustrated trying to garden in a hot, humid, Texas climate when she noticed a comment about mycorrhizae on an internet discussion site and decided to try our inoculant.

In Doreen's own words, “That purchase proved to be a turning point in my gardening life. Fungi saved my gardens when disease, bugs, and weather conspired to destroy everything I grew. They soon became the strongest weapon in my organic arsenal.”

A couple of her specific observations:

“The inoculated (tomato) plants flowered and set fruit two weeks ahead of the control group. At the end of the season - late June in tropical south Texas - I was amazed at the difference in harvest totals. The inoculated ‘Garden Peach’ variety produced 103 fruits, whereas the control bore only 28. Even large-fruited ‘Southern Night’ had 74 tomatoes on the inoculated plant versus 14 on the control. The control plants were infested with early blight (*Alternaria solanil*), but the inoculated plants were disease-free.”

“I bought three new bare-root roses, sprinkled inoculant powder over their roots, and planted them with high hopes. Rosa ‘Oklahoma’, R. ‘Mirandy’, and R. ‘Medallion’ rewarded me with huge flowers just 60 days after planting and no black spot or mildew appeared even though I did not spray.”

Doreen also includes comments from others who have experimented with mycorrhizal inoculants, including a landscaper in New Mexico, a major California nursery, and a fellow gardening author in Alaska. The landscaper noted much improved survival of valuable ornamentals, the nursery produces plants that are more resistant to drought and transplant shock, and the Alaska gardener says that a big benefit is not having to water as much.

So, if nurseries, commercial growers, landscapers, and home gardeners can all use a very simple biological technique that greatly improves plant survival, calls for less watering, prevents diseases and boosts yields, why would anyone ever put plants in the ground without giving them an inoculation?

Beats me.

Cheers, my friends,

Don Chapman
President, BioOrganics, Inc.
www.bio-organics.com
October, 2005

Mycorrhiza: Plant-Specific or Soil-Specific?

The most basic goal of mycorrhizal inoculation is to introduce any type of the beneficial fungi spores to plant roots. The nature of these fungi is to deliver nutrients and moisture to their host plants, and they can be an extremely useful tool for growers.

A much more sophisticated goal would be to introduce specific types of mycorrhizal spores that represent the best possible match with a grower's specific plants in specific fields. But which of the more than 150 (so far) named types of the fungi will be the best for a given situation? Which of those types will give maximum benefit to a individual grower's crops or ornamental plants? Which will help his or her plants thrive with the very least amounts of fertilizer and water, or produce the greatest yields? And where does a grower go to buy the best of the 150+ types?

Hard to say. I'm not aware of any wide-scale research being done to evaluate the effects of matching all the various fungi types to various plants in various soils in various climates (with millions of possible combinations). For most fungi types, there are simply not enough of their spores being propagated to conduct extensive trials even if someone wanted to.

A fundamental question that also remains largely unanswered is whether these fungi are more plant-specific or soil-specific. In other words, will a particular fungus make a powerful match with, say, tomato plants anywhere they are planted? Or will that same fungus match up strongly with nearly any plant in, say, sandy desert-type soils but not do anything worthwhile elsewhere?

We need to recognize that these are expensive questions to answer. It's hard to see any entity except the government undertaking such research, and I suspect that the USDA's prevailing soil-chemistry orientation would make it hard to obtain funding for any large biological studies.

Five soil scientists will have at least six opinions on this sort of issue, but it seems there is a leaning toward regarding fungi types as being more soil-specific. Fungi apparently interconnect all plants in a given area, creating what has been called a food web. I hasten to mention that there are plant-specific fungi, given nature's unique arrangements. Orchids are one such example.

At the moment, our industry's best answer to the above described areas of uncertainty is to include multiple types of widely-adapted spores in inoculants - a "shotgun" approach, if you will. Our widest range landscape product (LA) contains the spores of eight Endo and seven Ecto types. This pretty much ensures that at least one will work for nearly any planting situation, but it would be more efficient if we could better target the types - employ more of a "rifle" approach.

I think if I were beginning college again instead of banging up against retirement age, I'd set out to learn as much as I could about how to use the many types of mycorrhizal fungi on crop plants. I bet I could somehow find ways of profitably using that knowledge in the future.

Cheers, my friends,

Don Chapman
President, BioOrganics, Inc.
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November, 2005

Deferred Rewards Versus Instant Gratification

What could be more satisfying? - you drench liquid fertilizer on a pale plant and within a few days it turns a lovely dark green; or you see a bug chewing on a leaf, spray it and get to watch the little #%& drop stone dead. We live in an era of quick fixes - see problem, spray problem, end problem! All due to dedicated chemists at MegaCorp Plant Food and Bug Killers.

You gotta hand it to them, though. Since the end of World War II, when the major chemical companies needed to find a new market for their production capacities, their tens of millions of research dollars spent on developing artificial fertilizers and insecticides has taken chemically-oriented methods of plant culture to amazing levels.

Growers no longer need to concern themselves much with soil issues - just plow, fertilize, seed, and destroy harmful insects when they appear. Oh, there might be some need to spread lime or sulfur to adjust pH levels, but the soil chemists can easily prescribe the right dosages for that.

And if the soil builds up toxic levels of salts, or is getting more rock-hard each year, or yields are falling off, well farmer, that just means you've got to plow deeper or apply more fertilizer.

Sound about right? I'd be happy to pass along opposing views, but to me the general abuse of our valuable cropland soils is nothing short of a preventable tragedy. Does the word "unsustainable" have no meaning at all to today's agricultural managers? No? OK, then let's use shorter words and say "can't keep doing things the way we're doing them now and expect good yields tomorrow."

Crop soil is far more than inert root-holding matter laced with NPK fertilizer. The living organisms in a truly healthy soil can account for one-third or more of the total weight, and the most productive topsoil will also have a broad spectrum of minor and trace elements - some of which are needed in only tiny amounts but are still essential to the performance of plants.

If farmers will make extra efforts to keep organic matter levels up, occasionally add good rock dust, promote large populations of beneficial fungi and bacteria, and back off the overuse of petro-fertilizers, then they will be doing more than just mining the topsoil until it's depleted. They can also take satisfaction in knowing that their grandchildren will enjoy abundant food from those fields.

I know I may sound like one of those religious nuts standing outside a bar yelling "Repent, you sinners!" at the patrons, but when I see how biologically-oriented techniques can produce better yields and healthier bug-resistant plants, I feel compelled to argue against chemistry-only methods. The right contributions from both the fields of chemistry and biology can keep our crop soils productive far into the future instead of being depleted within a few decades.

And I realize that well-entrenched "conventional agriculture" methods won't change overnight, or even much during my lifetime, but the next time you read any article about crop soils and there is no mention whatsoever of living components, if you question the completeness of that article I'll feel that I've accomplished something.

Cheers, my friends - good growing and best wishes for the New Year.

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