A Bright New Year For Biology?

Best wishes for a wonderful 2003 to all of you.

Here at BioOrganics, we are looking forward to a very substantial increase in the use of our mycorrhizal inoculants, as we added more dealerships in the U. S. and other countries during 2002.

The use of beneficial microbial agents, especially mycorrhizal fungi, as an alternative to NPK fertilizers continues to gain strength, although it will still be some time before most growers switch away from the idea that proper soil chemistry is the only factor that needs to be considered for good plant performance.

I think water contamination and soil depletion/compaction problems will eventually force growers to abandon the unsustainable practice of spreading tonnages of synthetic fertilizers on crop soil, but as usual the problems will have to reach crisis levels before there is any great motivation for change. Human nature versus Mother Nature!

While I do believe strongly that biological alternatives will become the primary tool for both agricultural and horticultural growing in the future, I've come to realize that the use of bio-methods cannot outpace the practical understanding of such methods. The USDA, ag/hort university researchers, and supplier companies such as ours must all contribute to expanding the body of knowledge that will lead to productive and predictable results from using microbial inoculants. Based on the number of jars of our product that were ordered by researchers around the world during 2002, this is happening. The camel's nose is definitely under the tent.

The last half of the 20th Century could probably be labeled as the Golden Age of Soil Chemistry. This force-feeding of plants with incomplete NPK fertilizers brought great short-term increases in crop production, but after a few decades of whoopee yields some bad side-effects are showing up. I think we are now ever-so-gradually entering the Age of Soil Biology, and expect that it will be far more permanent in duration once it gets established.

But I feel like the old joke, "Lord, give me patience...and give it to me NOW!"

Happiness and prosperity, my friends,

Don Chapman
President, BioOrganics, Inc.
www.bio-organics.com
Jan. 2003

Growing Good Plants In Bad Soils

One of the benefits of mycorrhizae - the symbiotic linking of a plant root system with microscopic fungi - is the ability of the fungi to selectively regulate the uptake of elements from the surrounding soil. This is quite common knowledge among experienced soil restoration people, who routinely see transplants all die in “toxic” soils (mine tailings, etc.) unless mycorrhizal fungi are on the plant roots. In simple terms, the fungi seek out what is needed by the plant and block out what would be harmful.

I’ve witnessed this first-hand at a Central Valley California farm where a market vegetable grower had a few acres in a low swale where the soil was so extremely alkaline it had a white crust. He had tried several times to grow plants there, but none had survived. As an experiment, he dusted pepper plants with our mycorrhizal inoculant and transplanted them into the field.

Later, the grower invited me to see the results. I noted that the healthy plants were typical of those grown with mycorrhizae - short and stocky with very thick stems and nearly every blossom had set a pepper. It’s normal to see similar effects with tomato vines, where even beefsteak types form crowded clusters of fruit - a fully-nourished plant apparently senses that it is able to support a heavy fruitset.

Why is there such a great difference in ability to tolerate bad soil between a mycorrhizal plant and one that has only its own root system to uptake nutrients? I asked that question of a USDA scientist who had studied these beneficial organisms for more than twenty years, and he told me that the fungi, in effect, disable the plant’s own uptake system and take complete control of that function.

Mycorrhizal fungi not only seek out nutrients in required amounts, (working in cooperation with nutrient-producing bacteria) but they also prevent the plant from taking in harmful elements from the soil. This is nature’s survival design for both organisms. As the fungi’s only food source is root exudates, it is imperative that their host plants be kept alive; consequently, the fungi evolved the ability to completely regulate uptake.

What does this all mean to growers? Well, for one thing, it means that soil tests can be one of the worst things a grower can do. The measuring of a few macro elements and pH level is a chemistry-based way of thinking and can lead one down the wrong path as far as healthy soil is concerned.

Think about it: When a “scientific test” indicates that a crop soil is “deficient” in some element or the pH level is “too high/low”, the typical grower will rush to add N or P or K or pH-adjustment products to “correct the problem”, right? This has become so routine that it is rarely questioned. Why would it not be a good idea to change the soil so it is better suited for plants?

Unfortunately, such corrective chemistry processes often damage the very bio-life in the soil which might have made those additives unnecessary. If the plant-tending fungi are destroyed by chemicals, then plants have only their own roots for nutrient uptake and seem to lack the ability to regulate that uptake. After all, smart foraging is the fungi’s evolved responsibility, not the plant’s.

Without the regulating fungi, plants are hyper-sensitive to any soil problems. With sensitive and vulnerable plants to tend, growers perform more chemistry tests, make more “corrections” in their soil preparation/fertilization, and further mess up their soil biology. It is both difficult and expensive for humans to replicate what mycorrrhizal fungi do instinctively correct day and night all season long.

In the long run, I think better use of natural plant-fungi partnerships will let us produce good crops in marginal or poor soils with minimal inputs. To me, this makes more sense than continuously “testing and fixing”.

Cheers, my friends,

Don Chapman
President, BioOrganics, Inc.
www.bio-organics.com
Feb. 2003

Sentimental Over Ornamentals?

Most of the scientific research and widespread publicity about using mycorrhizal fungi to grow plants has been focused on food-type plants, but these beneficial organisms can be put to work equally well on ornamental plants.

Just like food plants, many ornamentals have evolved a dependence on mycorrhizae and have largely lost the ability to efficiently uptake nutrients without the fungi on their roots. Without mycorrhizal fungi, we humans must take on the job of providing all the nourishment to fungi-less plants - usually by continuously applying "plant foods" that mostly wash right through the root zone into underground water supplies.

Keeping a mycorrhizal-dependent plant nourished when it lacks its fungi partnership is difficult and expensive. In effect, the soil must be kept artificially overloaded with nutrients (typically incomplete NPK fertilizers) to the point where even an inefficient root system can suck in enough food to survive.

Besides being environmentally harmful, this abnormal loading-up of NPK is harmful and disruptive to soil biology. If there were any beneficial organisms present (and many urban/disturbed soils are lacking in them to begin with), repeated doses of "plant food" can prevent them from multiplying into large populations. Ornamental plants that would normally use mycorrhizal fungi and nitrogen-producing bacteria to thrive are made dependent on artificial chemical feedings.

This almost makes me want to write one of those angry letters to a newspaper that always ends with, "Wake up, America!" but I'm not quite that old and cranky yet.

Turf grass is by far the most egregious example of creating a high-profit industry by making simple-to-grow plants dependent on direct feeding. Grass is ridiculously simple to grow if there are good populations of soil microbes present, and ridiculously difficult/expensive to keep alive and healthy without such organisms.

A biologically-active lawn where mulched clippings are returned to the soil instead of being removed needs virtually no additional input, does not build up thatch, suffers few disease problems, and provides its own soil aeration.

You would think that the chemical fertilizer companies, with all their good knowledge about plant physiology, would realize that they are disrupting the biological processes that would allow plants to grow with very little input. (Pause for thought)

About the only negative I can think of for using a biology-based approach to turf grass is that golf courses do not like the idea of having little mounds of earthworm castings appear on their fairways and greens, but most grass growers should be happy to see such evidence of healthy soil.

I might mention that many golf courses, including some listed in the top 10 nationally, are now using our inoculants. Golf courses are increasingly under fire because of nutrient runoffs and are also faced with the need to fight turf diseases with relatively non-toxic methods for the safety of the golfers. (Ironically, golf courses would probably not dare to use some products that are routinely applied to our food crops, but that's another story.)

Decorative trees, shrubs, flower beds - all can be very successfully grown without pouring on the great amounts of synthetic fertilizers that we have been instructed to apply. But as I watch the artful

TV commercials showing smiling happy people lovingly caressing the fantastic-miracle-lush grass or flowers that Brand X has given them, I can understand why the cash registers at garden centers go ding-ding-ding-ding with "lawn food" sales.

And, as you might imagine, I do a little tooth-grinding when I see homeowners buying soil fungicides that will harm their plant-protective mycorrhizae. To me, this is like fogging your yard or orchard with a general pesticide that kills all insects...including those that would have happily eaten the harmful bugs at no cost.

I'm also reminded of a lady who asked what she could do about honeybees that were "invading" the flowering shrub next to her front door. She was spraying them with an aerosol pesticide, but more kept coming! Can you imagine how she would have panicked if she learned there was fungus on her plant roots?

To learn more on this topic, look at all the mycorrhiza studies that have been done on food plants and remember that the same symbiotic logic applies to ornamentals...and wake up, America!

Cheers, my friends.

Don Chapman
President, BioOrganics, Inc.
www.bio-organics.com
April. 2003

Don’t Get in the Way of the “Good Little Soil Bugs”

The more I learn about how soil and worms and fungi and bacteria and plants interact, and how their underground “systems” work, the more I realize how mistaken we are about so many things. Our intentions are good - we’re following prevailing soil chemistry advice given in textbooks, articles, and by crop advisors - but much of what we do for (or to) our plants and crops is horribly wrong.

To understand the problems, first consider the natural cycle of plant-soil-microbial relationships which have evolved over millions of years)greatly, greatly, simplified).

1. Leaf litter, dead plants, bird and animal droppings fall to the ground.
2. Decomposing fungi and bacteria “digest” the fallen material.
3. Earthworms feed on the decomposed material and then transport it underground.
4. Other types of fungi and bacteria feed on the earthworm castings, further digesting it.
5. The bacteria produce nitrogen and digest minerals into forms plants can use.
6. A plant seed sprouts or new root growth occurs in the biologically-active soil.
7. Mycorrhizal fungi attach to the roots and send millions of root-threads out into the soil.
8. The plant extends its leaves up into the sunlight, and performs photosynthesis.
9. Mycorrhizal fungi and bacteria feed on root exudates generated by photosynthesis.
10. In return, the fungi forages for whatever nutrients the plant requires for full health.
11. The plant thrives aboveground with these symbiotic actions going on underground.
12. Leaves drop and/or annual plants die and we go back to Step #1.

The closer we can replicate the above cycle, the better our crops and plants perform. It’s difficult, and I would even say impossible, to improve on it. It seems that our goal should be to figure out how to work WITH the established method instead of trying to take over the complex soil functions ourselves.

But aren’t we helping the plants when we “feed” them? Well, not when we drench the soil with immediate-acting fertilizers, synthetic or organic. Small amounts of gradual-release broad-spectrum fertilizers and minerals can offset the leaf litter (crops) that we remove from the field, but whenever possible the crop residue should be allowed to remain in place.

Are we helping when we turn over the crop residue by plowing it under? Well, a no-till or limited-till program will keep the underground biological communities from being disrupted. A rototilling is the equivalent of a powerful hurricane leveling a human city. There are impressive results being reported from no-till agricultural studies and I expect many more farmers and gardeners will adopt this practice.

The “little soil bugs”, if encouraged to develop into large populations, will keep the soil fluffed-up for good aeration, will provide nutrients (in ideal proportions) for plants, and will protect the roots from pathogens. They will happily do all this work for free and will not contaminate our water supplies.

A side note on “Organic” additives: From my biological perspective, the “nature=good,” “manmade=bad” orientation is an imperfect way to judge materials. It does have the general benefit of prohibiting the most harmful fertilizers, such as high analysis fast-acting synthetics (i.e., 20-20-10) which can be lethal to mycorrhizal fungi, but it gives the impression that all natural materials are OK. In fact, a drench of liquid fish can disrupt the soil system far more than applying dry pelleted fish. A slow continuous supply of the broadest possible array of nutrients is the feeding objective for biogrowers.

Don’t Get in the Way of the “Good Little Soil Bugs” continues

For good reading on this subject, the March/April issue of The American Gardener (the magazine of the American Horticultural Society) has an article entitled “Fertile Ground.” One quote from a gardening writer: “I believe the biology of the soil creates the chemistry. It is only when the biology is killed off, as it is with salt-based fertilizers, pesticides, tilling, etc., that the chemistry takes over.” I say Amen!

The June issue of Mother Earth News will also have an excellent article on mycorrhizal fungi written by Doreen Howard, who has considerable first-hand knowledge of biological inoculants.

Both articles are geared toward home garden issues, but the overall descriptions of natural soil systems are certainly worthy of study by commercial growers, landscapers, plant researchers, and government officals concerned about agriculture and/or environmental issues.

Good growing, my friends,

Don Chapman
President, BioOrganics, Inc.
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May, 2003

Chemistry and Biology - Working Together?

As the use of biological methods for crop production and landscaping gains wider popularity, it seems some people view it as a some sort of rival to soil chemistry, which has dominated agriculture for several decades. To me, this is the wrong way to look at the issue. This need not be a contest between two different approaches to growing plants - it's not biology looking to wipe out chemistry (or as some seem to see it, good versus evil). An intelligent perspective would be to blend together elements of both sciences in a way that provides the maximum benefits to plants in a sustainable, non-polluting manner.

A plant in biologically-active soil has many advantages. It is more resistant to diseases, insects, soil pathogens, and drought because of superior nutrient uptake and natural defense mechanisms that come from association with mycorrhizal fungi. Therefore, it is a given that growers should introduce and encourage large populations of beneficial microorganisms.

As these beneficial soil microorganisms can be easily damaged or destroyed by strong fertilizers, a basic guideline for bio-growers is to avoid all fast-acting, high-analysis "plant food". The harm that such fertilizers cause to valuable soil bio-life far outweighs any short-term benefits.

The alarming contamination of underground drinking water and streams just adds a further reason to cut the use of cheap NPK fertilizer, including the vast tonnages of lawn food and water-soluble stuff being routinely overapplied by homeowners. Farmers aren't the only offenders in this category.

Many growers also seem to have become nitrogen junkies - thinking that N is the solution to any and all plant problems. True, one can usually produce a quick greening effect by applying nitrogen. But in truth, it is no more important than any other element to the overall health of a plant. A broad range of elements are needed, all in differing amounts (just as for humans).

In nature, this is one of the most important roles of mycorrhizal fungi - to seek out nutrients in the soil for their host plants and to regulate the amounts of the various elements. You could think of the fungi as being responsive to the needs of their companion plants, and for good reason. The fungi are entirely dependent on the symbiotic relationship with the plant for their own survival. Without root exudates, the fungi die (leaving behind spores which will only activate when a new root comes nearby).

This leads to the point that soil chemistry cannot be totally ignored, although under a biologically-oriented program the standard NPK chemistry is not all-important. The soil biota will perform corrections to pH, generate N from the atmosphere and solubilize other soil elements - functions that chemistry-oriented growers try to duplicate with varying degrees of success.

The goal of the bio-grower is to ensure that the widest possible spectrum of minor and trace elements are available to the foraging fungi, while providing much-reduced amounts of NPK in gradual-release forms. If tiny amounts of boron or selenium or any other essential minor/trace element are absent from the soil, then the fungi cannot find it and plants cannot enjoy full health. This is the appropriate chemistry side of the equation: to provide every possible chemical element to the soil-searching fungi so that they can bring them as-needed to the plants. Note that it is not necessary to provide all elements in ideal ratios to each other; the fungi will make the appropriate uptake adjustments. Of course, extreme overdoses of any element are to be avoided.

This is a different way to view soil chemistry - in a supportive role to the microbial populations - but the net effect is a powerful and non-polluting way to produce high-yielding crops and ornamentals.

Chemistry and Biology - Working Together? continues

Simply put, the current overemphasis on NPK fertilizers needs to be redirected to include many more elements in small amounts.

The simplest way to ensure a broad range of elements is to occasionally apply volcanic-origin mineral powders or rock dust to the soil. However, be aware that not all rock dust contains the desired broad range of elements. The best I've found is called hydrothermally-changed Dacite. This is basically a soft volcanic rock deposit that has been steamed for millions of years and is now a crumbly form containing virtually every element. A commercial product called Zeolite is also good, as is greensand.

Getting the soil chemistry right is indeed important, but not the kind of blunt-instrument NPK chemistry that we have been practicing. Keep the soil organisms happy with a wide-range diet, and their host plants will also be happy.

Cheers, and good growing, friends.

Don Chapman
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June, 2003

Underground Give and Take

One of the most widespread wrong ideas in horticulture is that roots simply serve to anchor plants in the soil and suck up nutrients. This perspective leads to many mistakes, not the least of which is the overuse of “plant food”. I won’t go into any detail about the process of photosynthesis, but the gathering of solar energy by plant leaves is crucial for healthy soil.

As a plant’s roots grow and push out into surrounding soil, they exude a thin layer of mucus which acts as a lubricant. This gel is rich in nutrients and provides nourishment for microbial life underground. Mycorrhizal fungi spores which may have laid dormant for decades are brought to life by a signal from the root exudates, as are many types of beneficial bacteria that convert nitrogen, phosphorus, and other elements into forms that the roots can uptake.

Soils without growing plants tend to be relatively lifeless and compacted. But when a seed germinates and a new root extends into that soil, there is a powerful reaction from the living organisms, something like children hearing the sound of an ice cream truck coming down their street. Here comes food!

Fueled by the photosynthates, fungi attach to the roots and send their own root-threads (hyphae) out into the soil to forage for the nutrients their host plants require. Soon the surrounding soil is loosened by the fungi hyphae and great populations of bacteria develop, supported by the roots and fungi.

The fluffed-up soil allows more oxygen to penetrate deeper, which further promotes the microbial life that is now busy seeking out and also creating plant nutrients. For example, a major source of N is the excretions and dead bodies of soil microbes - it is to a plant’s advantage to support the living organisms in soil. The further out the plant roots extend, the more soil becomes alive with helpful “associates” that are all benefitting from the aboveground plant leaves absorbing solar energy. Of course, in return the plant is receiving valuable nutrients and improved soil conditions for its roots.

For the grower, this all argues for avoiding bare soil and also for using companion plants as much as possible, such as legumes or wildflowers between the rows in orchards or vineyards. The more leaves that are gathering and sending energy to underground organisms, the better. This is why “living mulches” increase yields so much in USDA trials, as compared to inert mulches. In reading the reports of these trials, the scientists seem rather puzzled as to why the yields are higher when tomatoes are planted into vetch fields, but the answer is quite simple and predictable to a soil biologist: More solar energy has been captured and “sent downstairs” to helpful soil critters. The tomato plants then benefit from the increased life in the soil that has been supported by the vetch.

All of the above can be disrupted by fertilizing with fast-acting synthetic fertilizers. It’s hard to improve on a system that has taken many millions of years to build. We simply need to learn how to better work within that elegant system instead of trying to impose our mistaken ideas about feeding plant roots.

Cheers, my friends,

Don Chapman
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July, 2003

Giving Plants A Perfectly Balanced Diet - Automatically!

There is some debate about how many elements are really, really, essential to good plant health. Growers with a chemistry orientation always focus on the macro elements - NPK - which are indeed needed in relative large amounts. Some more advanced chem-growers also pay attention to minor elements - calcium, iron, magnesium, etc. - which are needed in lesser amounts. Probably not one in ten thousand ever worries abouttrace elements, believing that they are either not as important or are hopefully in the soil already.

The critical need fortrace elements in a plant's diet has been well documented, and their absense in some soils is probably the cause of many puzzling diseases and yield problems. A parallel situation is the human need for minute amounts of Iodine to prevent goiters - solved by making iodized salt.

The chemical grower faces a major problem in that all the essential elements - Macro, Minor, andtrace - must be kept in roughly correct proportions to each other. If the uptake of any essential element is too high or too low, the plant will suffer. Overdoses and deficiencies of individual elements are very common (perhaps even the norm) in chemically-amended soils - usually not to the point of killing the crops, but still preventing plants from performing at peak levels.

So how does a grower deal with a plant that needs twenty units of element A, ten units each of element B & C, two units each of elements D through G, and varyingtrace amounts of elements H-Z? How does one give crops ideal combinations throughout the life cycle of the plant? (This can get more complex, as the nutritional needs of plants change as they go from seedlings to maturity.)

The simple answer is that chemical growers find it impossible to measure, add, monitor, and regulate the uptake of all the essential Macro, Minor, andtrace elements in ideal proportions. The best that can be done is to test for the major elements, conduct leaf analyses, and try to apply additives that will "correct deficiencies". At one level, this does work, at least in the short run, but all too often the result is fields, orchards, or vineyards filled with imperfectly-nourished plants that invite disease and insects.

I think this is a key difference between chemical and biological methods. With chemistry as a base, there is little margin for error as far as proportions between elements and mistakes cause big problems with crops. Under biology-based methods, where bacteria process elements into plant-useful forms and mycorrhizal fungi regulate nutrient uptake according to the needs of their host plants, growers can have large variations in their soil elements and plants will still thrive.

For example, an excessive amount of boron in soil will not bother mycorrhizal plants because the regulating fungi will not allow the excess to enter the roots. This is also true for salts or heavy metals. Any amount of an element beyond what the plants require will be blocked by the mycorrhizal fungi. (Mycorrhizal inoculants are commonly used to establish plants in toxic mine tailings.)

The other side of the coin is that the foraging fungi cannot manufacture elements that are not in the soil, creating the need for growers to occasionally add broad-spectrum minerals (along with much-reduced amounts of fertilizer - perhaps only ten percent as much).

If there is "some of everything" present in the soil, then the fungi can pick and choose whatever their host plants need at any given moment in their development. The difference in health, vigor, and yields from perfectly-nourished plants can be dramatic.

It's the grower's choice: try to create the ideal recipe of all essential soil nutrients for the plants, or grow mycorrhizal plants that can adapt to just about any soil they find themselves in. Dealing with the uptake of plant nutrients is the beneficial fungi's role in nature. They've been practicing the role now for many millions of years, and will be happy to take that difficult job away from humans if given the chance.

Cheers and good growing, my friends,

Don Chapman
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www.bio-organics.com
Aug., 2003

The Bio-Inoculant Marketplace: Who's Trying, Who's Buying, and Who's Lying?

When I first got involved with beneficial mycorrhizal fungi several years ago and realized what these microorganisms could do for agriculture, I was wildly enthusiastic about the marketing prospects. After all, here was a natural method that promised to grow high-yielding, disease-resistant plants without contaminating water supplies, without having to apply heavy doses of expensive fertilizer, and without depleting our food-producing soils. At the time, I thought, "Wow - If just 5% of the corn farmers in Kansas convert to biology-based methods, it will be a billion-dollar market! How will suppliers ever be able to propagate enough of the fungi to satisfy the demand once the word gets out?"

Well, seven years later, with the added wisdom of actual experience, I now see that nothing short of major yield failures or government restrictions on excessive fertilizing will move large farmers away from chemistry-based practices. The cost and complexity of restoring biological activity to huge acreages of croplands makes for a pretty overwhelming task, no matter how great the long-term soil and yield improvements might be.

Yes, the interest level in biological practices is increasing; Many growers around the world are now routinely applying bio-inoculants to crop plants and ornamentals. Dozens of university and USDA researchers have published thousands of articles to describe favorable test results...But we're a long way from getting even one-half of 1% of those Kansas corn farmers on board.

So, if the large acreage, lower value crop farmers are not great prospects (yet), then where is the market for bio-products? Based on our general experience, two distinct factors produce orders - poor soils and higher value plants.

For growers with sand who are having problems holding moisture and nutrients in the root zone, the mycorrhizal fungi can perform miracles by clumping together sand particles and promoting the development of an underground biomass. Also, soils that are too salty, overloaded with some element, or with pH levels that are outside the acceptable range for plants are all excellent candidates for using biological rather than chemical methods.

Grain crops can certainly benefit from having mycorrhizal fungi in the soil; but grapes, citrus, avocados, melons, stone fruit, tomatoes, peppers, and other market vegetables are better candidates from an economic standpoint. A one-time inoculation of seeds or transplants can produce a quick and significant monetary payback.

Of course, landscape plants and turfgrass (especially on golf courses or in stadiums) also fall into the higher-value category and we have many customers in those areas. For example, check out the grass in the Baltimore Raven's stadium next time they are on TV.

Combining the above factors, you can see that valuable plants being grown in problem soils represents the most immediate market for inoculants. I could add another consideration as well: The larger the acreage, the more difficult it will be to get off the chemical treadmill. But it can be done.

So, home gardeners, landscapers, market growers, and orchards/vineyards will probably be the "early adapters" of soil-biology methods. Actually, I see absolutely no reason why any home gardener or landscaper should ever rely on chemistry when it is so simple for them to create wonderful soil conditions with beneficial organisms. These are not, repeat, not places to copy chem-farmers.

The Bio-Inoculant Marketplace: Who's Trying, Who's Buying, and Who's Lying? continues

There have recently been good articles about mycorrhizae in "Mother Earth News" and "The American Gardener" (the publication of the American Horticultural Society), and I expect there will be many more in coming months. Hopefully, all this favorable publicity will not bring fast-buck artists out of the woodwork, making exaggerated claims for the fungi and turning off potential users. Read the small print on the labels folks. Look for guarantees of species and spore counts - and don't pay Endo prices for Ecto spores! (Those of you who know one from the other will understand.)

Good growing, friends,

Don Chapman
President, BioOrganics, Inc.
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Sept., 2003

Soil Biology - Nothing But Normal and Natural

I find that many of our customers believe that the introduction of mycorrhizal fungi to their plant root systems is adding an “extra” benefit - something like a new and improved fertilizer. It’s not. Actually, a biological approach to growing healthy and productive plants is simply trying to copy normal and natural methods that have evolved over millions of years.

Mycorrhizal fungi are a key element in an overall ecosystem, as described in earlier newsletters (see the Archive section at our website - www.bio-organics.com). Most notably the fungi greatly enhance and regulate the uptake of nutrient and moisture by plant roots, along with protecting their host plants from pathogens and diseases.

Plants have their function in a healthy soil system, too. They are uniquely equipped to perform photosynthesis - gather and transform sunlight into nutrients (photosynthates). The plant roots then serve as a “give and take” nutrient exchange site - some of the plant’s photosynthates directly and indirectly nourish beneficial soil organisms; while in return those organisms gather, digest and deliver essential nutrients to the plants.

The details and components of this complex nutrient producing-and-exchanging system can be found in any modern soil biology textbook, but for our purposes it is enough to recognize the interdependence of plants and living things in the soil. Because of the way they are linked together in nature, neither can enjoy full health without the presence of the other.

When a plant is set into lifeless soil, or into soil that lacks the correct microorganisms to match up with that type of plant, the plant suffers from, essentially, starvation. On their own, many plants lack the ability to effectively uptake nutrients. Foraging is not what plant roots are designed to do - they are like anchoring pipelines that have limited surface contact with soil (as compared to fungi with millions of root-threads that make contact with huge amounts of soil).

Humans have learned to deal with fungi-lacking starving plants: Feed them fertilizers, placing abnormal amounts of NPK in the root zone, so even inefficient root systems uptake enough macronutrients to perform adequately - but not optimally. No amount of synthetic limited-ingredient fertilizer can substitute for the ideal bio-origin nutrients.

Again as noted in earlier newsletters, this direct-feeding of plants has some serious downsides which are becoming obvious after a few decades. For homeowners, chemically-dependent lawns are the worst problem,as such lawns need near-continuous applications of “plant food” to keep inefficient grass green. For farms, heavy fertilization and the resulting loss of soil bio-life causes compaction and salt buildups. Plus, the growing contamination of water supplies with nitrates and phosphates from this heavy fertilization should be a concern to all.

The general solution is to have a goal of increasing beneficial life in soil. The old phrase, “Feed the soil, not the plant” has perhaps more truth than even most “expert” growers realize. I suspect because it is difficult to measure the soil biota. It’s much simpler to recommend chemical tests (which invariably lead people to “fix” and damage their soil).

Let’s be clear, putting a big handful of 10-10-10 in a planting hole is NOT what’s meant by feeding the soil! And 10-10-10 fertilizer is NOT “complete”, nor is it in any way “balanced”. Those are marketing terms that I see in print over and over again as accepted facts.(My teeth would be a bit longer if not for the grinding that those two words have caused.)

Soil Biology - Nothing But Normal and Natural continues

Feeding soil means adding composted material and using organic mulches, plus occasionally scattering trace minerals and small amounts of dry low-analysis fertilizer (such as fish pellets). Ideally, it means adopting no-till or limited-till practices to avoid disrupting the underground networks of beneficial living organisms that plants link into.

It may seem self-serving, but I do believe that the use of biological inoculants is also a key part of any soil enhancement project. A one-time addition of mycorrhizal fungi spores (that also carry beneficial bacteria with them)ensures the presence of perhaps the single most important soil organism - the one that bonds all the plants and soil life together. Please note that this is all normal and natural - NOT some miraculous new additive - and promises the ultimate sustainability. A biological orientation builds up the soil's production capacity, instead of depleting it.

And speaking from personal experience with my vegetable gardens over the years (too many years), seeing my robust plants now perform closer to their full genetic potential with minimal input is exciting stuff. My investment in soil life is paying off in stronger plants with bigger yields than I ever had under chemically-oriented methods. Anyone who would now try to drench liquid fertilizer on my garden beds would quickly gain some hoe-handle marks on their rump!

Cheers, my friends!

Don Chapman
President, BioOrganics, Inc.
www.bio-organics.com
Oct., 2003

Plant Roots:
Are Some Slow on the Uptake?

The mycorrhizae linkage between plants and soil fungi varies greatly. Some types of plants do not use the fungi for nutrient uptake while other plants have trouble even surviving without mycorrhizae. Clearly, the evolutionary process over millions of years has led different plants down differing paths, and bio-growers should be aware of their plants' needs.

Based on our company's experiments, grower feedback and published research, some of the most dependent plants are (in no particular order): Grapes, roses, melons, potatoes, beans, squash, cherries, plums, peaches, alfalfa, oaks, pines, blackberries, onions, garlic, citrus, chrysanthemums, lilies, asparagus, bananas, strawberries, turf grass, eggplant, peppers, and tomatoes.

Some plants that seem to be in the "only somewhat" category of fungi-dependence. We have observed or heard of only minor differences between inoculated and non-inoculated plants are apples, pears, rice, and somewhat surprisingly, peas.

Members of the cabbage and mustard families apparently do not use mycorrhizal fungi, although there are reports of the opportunistic fungi attaching to Brassicaceae roots when the plants go into decline - most likely to scavenge nutrients!

As with every issue involving soil biology, the sorting of plant types into fungi-dependence categories is not as simple as it might seem, particularly with plants that have been subjected to "improvement".

Our experience with tomatoes is a good example. We were puzzled at first when we observed major differences between some varieties of test and control plants and nearly no differences between others. In time, we figured out that heirloom types and early hybrids were the most responsive, leading to the speculation that fungi-dependence has been largely bred out of newer varieties. Through careful selection, "modern" tomatoes have been developed for direct-feeding of synthetic fertilizers and can therefore be successfully grown in lifeless soils, while older varieties still retain their need for beneficial soil organisms, particularly mycorrhizal fungi.

One of the tomato varieties that we have found most responsive to inoculations is the old Beefmaster, which sets nearly every blossom when grown in good biologically active soil. It's quite a sight to see big beefsteak tomatoes growing in crowded clusters. I also have a letter from a Master Gardener (who had been chemically-oriented) who tried a little test-versus-control experiment in his garden with two Roma tomato plants. The non-inoculated plant produced 48 full-size tomatoes - a decent yield and typical of what he had harvested in previous years. His non-fertilized inoculated plant produced 183 tomatoes. To me, this illustrated the principle that bio-dependent plants show their full genetic-potential yields only when grown in "living" soils.

For those of you who might be interested, Clear Pink Early, Pineapple, Big Girl, Lemon Boy, Burpee's Supersteak and Park's Whopper are others that perform much better in bio-active soils. (From a flavor perspective, I suggest any of these for your personal gardens. We look mostly at growth, yields and disease-resistance in our tests, but unscientific taste-testing does occur from time to time.) To grow fungi-dependent plants, inoculation with dormant spores at planting time and avoidance of high-analysis fertilizers are both important.

Plant Roots - Are Some Slow on the Uptake? continues

I would like to invite any of you who may have made your own observations about differences in fungi dependence to send them to me for possible inclusion in future newsletters. I think we have barely scratched the soil surface of this topic.

Cheers, my friends,

Don Chapman
President, BioOrganics, Inc.
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As we enter the Age of Biology...

These are exciting times for soil microbiologists. The value of their research on soil-dwelling microbes is beginning to be recognized. The potential usefulness of the tiny critters they have been studying for decades is finally starting to be appreciated by people outside of laboratories, plus the "Age of Soil Chemistry" from the 1950's is no longer looking like such a great concept.

It is also a confusing time for bio-scientists, who are more geared toward writing up study results with the elegant precision appropriate for publication in academic journals (motto: "eschew common words") than toward explaining product-usage details to dirt farmers.

I believe it was Tom Peters who said it is relatively easy to describe something using 500 words - just about anyone can do that. It is far more difficult to boil a product description down to 50 (or ideally 5) common words that capture the essence of the subject. Brevity and simplicity are not the usual writing orientations of the science folks, nor should they be.

This is where I believe a company such as BioOrganics fills a needed role: translating the specialized jargon and findings of academic researchers into simple terms that users can easily understand and, of course, setting up manufacturing, packaging, marketing and distribution processes that can convert scientific findings into a business.

A common misconception is that viable product ideas are rare and valuable. Actually, wonderful ideas are pretty much a dime a dozen. In our field, any halfway competent soil biologist can identify some beneficial organism or bio-stimulant that would benefit plants. As an established bio-products company, we regularly receive inquiries about introducing new biological concepts to the ag market, many of which probably have some real potential. But the hard part is finding the manpower and resources required to turn great ideas into profits. That's really, really, tough to do.

Classic marketing theory calls for identifying a problem, developing a product that solves that problem, calling the attention of potential customers tothe product, persuading those potential customers to buy (or at least try) the product, and then following through with good customer service.

I often see respected scientists spending goodly amounts of their own money to present their great product ideas to growers who do not believe they have problems, or think that a verbose brochure filled with "big plant - little plant" lab results is a complete marketing program, or neglect to set up a decent product order fulfillment system. These are bright people, but out of their normal environment. When their great-new-bio-product sales fail to materialize, they invariably seem to link up with the sort of "sales pros" that make you count your fingers after shaking hands. Great schemes are hatched (generally involving wildly-optimistic public stock offers), outside investors are milked,large sums are spent on advertising,and when still no substantial orders flow in, the parties involvedsue each other.

Growers, meanwhile, see these exciting new bio-products enter and depart the marketplace, and most simply continue to use easier-to-understand chemicals. Familiar products and trusted brand names have a strong appeal when one's livelihood is involved.

Biological methods will eventually replace the currently pre-dominant chemistry orientation for growing crops. I think that change in approach is inevitable, given soil degradation and water contamination projections. But the ag and hort marketplaces definitely need more bio-supply companies with staying power, not just wonderful new product ideas.

As we enter the Age of Biology...
continues

There are attractive business opportunities developing in the field of agricultural/ horticultural biology, and it's tempting to go chase some of them. However, I'm nearing retirement age with the battle scars of seductive great ideas all over my back. It's probably time to begin looking for younger business people with vision and energy to take BioOrganics onward and upward while I continue my search for the perfect tomato in the greenhouse.

Cheers, and good growing, my friends,

Don Chapman
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