Choose Your Bio Potting Medium With Care

Along with reduced fertilizer, an important part of biological growing methodology is for nurseries to select a potting mix that will not inhibit soil bio life.

Common bark-based potting products may have some fungicidal qualities, which is desirable when one is using a disease-prone chemistry-based approach, but not such a good idea when trying to encourage beneficial fungi on root systems.

In general, peat and sand mixtures work much better than wood-based products. Even pure sand can be used if weight is not an important factor. The sticky hyphae of AM fungi will quickly bind sand particles together into a moisture holding biomass, which will become an excellent environment for helpful bacteria.

Small amounts of gradual-release fertilizer will still be needed, but nothing compared to the continuous direct feeding required with a sterile potting medium. With the right biological activity in its root zone, a plant becomes nearly self-sufficient, making greater use of its own photosynthesis and the symbiotic relationships with nutrient-providing fungi and bacteria.

For nurseries that wish to adopt clean biological methods of growing healthier and more vigorous plants, the first step should be to experiment with various potting mixes. Through observation and microscopic exams, it will not take long to determine which mixture produces the best rate of mycorrhizal colonization.

Of course, the choice of potting mixtures is somewhat restricted by local availability and cost factors. The lucky nursery growers who have good affordable sources of bio-friendly mixes will enjoy an advantage over those with only wood-based options.

It should be noted that some wood products may work OK - it will depend on decomposition levels, presence of fungi-inhibiting resins, addition of peat and/or sand, etc.

I expect that bio assays of soil will eventually be regarded as being far more valuable to growers than chemistry tests. Mycorrhizal fungi can fix various soil chemistry problems, shield their host plants from toxins or undesirable pH levels, and regulate the uptake of nutrients to individual plants on an as-needed basis.

For a grower the tricky part is learning how to provide good habitat for these valuable living organisms. Unlike chemicals, the AM fungi, beneficial bacteria, and other biological plant-helpers have specific media requirements.

Onward and upward, friends!

Don Chapman
President, BioOrganics, Inc.
www.bio-organics.com
Jan., 2002

In Disease Suppression, Timing Is Everything

The ability of mycorrhizal fungi to ward off a wide variety of plant pathogens (such as nematodes) and diseases (Phytophthora, etc.) has been well documented. Any search will turn up dozens of studies on this topic.

However, it is not widely recognized that the beneficial fungi must have a chance to colonize the roots and surrounding soil before this important protective role can be realized. This argues for inoculating crop plants as early as possible - either at transplanting time or preferably while still in the nursery.

I am not aware of any research that indicates that mycorrhizal fungi can perform any recovery-type functions after a plant has been infected with disease or infested with harmful soil organisms. Its role in nature seems to be geared almost entirely toward the prevention of, rather than curing, plant problems.

There are at least four ways in which mycorrhizal fungi protect their host plants: 1) They create physical barriers around roots with sticky hyphae; 2) They produce antibiotic exudates that specifically target plant enemies; 3) They create positive hormonal changes in their host plant's immune system; 4) They provide greatly increased mineral uptake that leads to stronger plants better able to withstand diseases.

It is impossible to artificially replicate all the above good effects of mycorrhizal fungi with chemicals and synthetic fertilizers, which explains why crop plants tend to suffer from so many diseases and pathogen attacks as compared to non-cultivated plants. Without the normal and essential presence of their natural fungi partners on their root systems, crop plants are at a terrible disadvantage.

Moral: Give your plants the symbiotic protection they require for good health, and give it to them BEFORE they develop problems.

For good growing,

Don Chapman
BioOrganics, Inc.
www.bio-organics.com
Feb., 2002

Advisory Help Needed!

In the wonderful world of agriculture (more gamblers than Las Vegas ever sees), there is a desperate need for professional soil advisory services.

No, I don't mean more soil chemistry advisors - there's already an overabundance of them. We're all familiar with conventional soil test routines - dig a sample, check the pH plus a few macroelements, then issue a prescription for "fixing" problems or deficiencies. Very simple and easy to understand - match the soil to the plants.

Well, maybe TOO simple. We seem to have created an entire generation of ag advisors who believe that soil chemistry is the only factor behind crop success or failure, and "add X lbs. of ___ per acre when you're low" is giving good advice.

Actually, soil pH and availability of mineral elements are automatically regulated by natural biological processes, if the right macro (earthworms, etc.) and microbial elements are present in substantial populations. There are whole families of bacteria that efficiently produce nitrogen from the air, and other families that convert phosphorus into a form that plants can use, and then mycorrhizal fungi allow plant roots to uptake needed amounts of those now-available nutrients.

Larger organisms, especially worms, move decayed plant material from the surface of the soil down into the root zone and also transport beneficial microbes from one location to another. This is how wild plants thrive and do not deplete their surrounding soil - it's a team effort and this team of plant helpers can be utilized in agriculture if (and this is a big if) someone knows how to encourage them.

I was delighted recently when a California tomato farmer called to get information about our microbial inoculants. He told me that his local Extension Agent said his soil seemed to lack biological activity, and that could be the reason his yields were falling off! I had never before heard of an Extension Agent suggesting a non-chemical solution to a problem, even though it is well-documented that plants often struggle when their soil biology is not right. Light at the end of the tunnel!

What is really needed now to promote healthier, sustainable, and more productive crop soils is for all ag advisors to learn more about the living components of soil, and then learn how to apply that knowledge to individual fields. I've said it before and I'll keep repeating it: If the soil biology is healthy, then the chemistry for crop plants will also be right. A focus on the biological elements will lead to good soil chemistry; the opposite is not true.

By all means, let's conduct soil tests. But, instead of over-simplistic testing for just NPK and pH levels, let's train ag advisors to do bio-assays at the same time. That information will help growers really understand the living dynamics of their soil, and it should also make them question quick chemical "fixes" that do more harm than good to their soil in the long run.

Might be time to blow the dust off that old soil biology textbook.

Cheers, my friends,

Don Chapman
President, BioOrganics, Inc.
www.bio-organics.com
March, 2002

Looking For a Growth Business Venture?

Based on the many agreeing comments I received after last month's newsletter, the idea that soil advisors should analyze biological elements as well as just simple chemical elements was on target with many of you.

To continue further with that thought about advisors looking at the biological activity in soil, let's keep in mind that a bioassay requires someone trained in microbiology looking through a microscope to identify and count little critters.

Which leads to the point of this newsletter: I can pretty well count the number of well-organized and inexpensive bioassay services on my thumb and first finger!

As the interest level in using soil biology to replace chemical methods grows (and it has already grown dramatically since I started this business seven years ago), I see a great need developing for more lab testing services, especially regional ones.

Ideally, such services would not only provide bio-profiles of soil samples, but would also offer general benchmark standards. Growers need some sort of "high-low, good-poor, above-below average" interpretive commentary for bioassays to have any practical value (and those comments need to be expressed in plain words, not in scientific jargon!). I would suggest that there are wonderful opportunities in this area for soil biologists with entrepreneural ambitions and communication skills.

The existing labs do good work, but there will be a need for many, many more in the future, especially for services that become intimately familiar with their local soils and crops. There is substantial business potential developing among commercial growers, but also among home gardeners, nurseries, and landscapers.

A good bio-testing service should retain individual field or garden results for making year-to-year comparisons in addition to general standards. I expect most growers would enjoy seeing their soils measure healthier over time as they learn how to encourage beneficial fungi and bacteria instead of destroying them.

And after we get all these local bio-testing labs set up, we can get busy building lots more composting facilities - another biology-based area of opportunity!

Onward and upward, friends!
BTW, thank you for the feedback. But, if you ever wish to correspond with me, don't just hit the "reply" button - that goes to our webmaster instead of directly to me. Use don@bio-organics.com

Don Chapman
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April, 2002

Introducing Beneficial Fungi To Established Trees - Worth Doing?

The topic of this newsletter was prompted by a note I recently received from a customer, who stated: “Three years ago I planted a small orchard of cherries using your product on all but one row -- I wanted to see if this stuff really worked. It did. The results were startling from the onset. However, I now need to get these trees up to their brothers rate of growth!!! How do I apply the product and at what rate?”

He has decided to try probing inoculant down to the root zones of the “Without” trees, and I hope the fungi will colonize them. However, as I told him, I have to wonder if it will be as effective at this later date as it was for his new transplants.

Nature does not leave things vacant for long, whether it be topsoil or the mycorrhizophere below ground. After a period of time, the root zones of all existing trees are occupied by native fungi and various other bioorganisms. I think it then becomes difficult or impossible to successfully introduce new players.

Note that this is speculation on my part, as I am not aware of any good research that has been done on this specific subject. I am aware that there are bio-supply companies that actively promote the application of expensive mycorrhizal inoculants to existing trees and claim that such applications produce wonderful results, but my sceptical side can’t help feeling that the fertilizers and biostimulants that are injected at the same time might be entirely responsible for any positive responses.

If my logic is correct, then the opportunity to establish the most effective symbiotic match between a tree and the best type of fungi for that tree may be lost if other less-beneficial fungi are allowed to become dominant in the ecosystem around the roots. (I think that native fungi and native plants are almost certainly the best and most obvious match for each other, but introduced plant types often seem to respond better to introduced fungi.)

In other words, when setting out new trees or shrubs, I think an inexpensive dusting of multi-specie fungi spores on the roots - either Endo or Ecto types, depending on the tree type - makes good economic sense. Comparison tests such as done by the grower quoted above attest to the value of such planting-time inoculations.

However, for established trees, I doubt that simply putting new mycorrhizal fungi spores in the root zone will do any good. It is difficult to see how later entries can succeed in the competition for root exudates. (But, I freely admit that I could be wrong about this).

I personally think the best possibility for helping problem orchards or vineyards is to dust new spores on cover crop seeds. Then, as the legumes, grasses, or wildflowers activate and host the new fungi, the cover crop roots may transport those better fungi species down to the roots of the target trees or vines where they may co-colonize.

Trees are certainly capable of hosting multiple species of mycorrhizal fungi at the same time, and research has even shown that, for unknown reasons, the types of fungi found on a root system change as trees mature.

Still much to be learned. In the meantime, I just hope that row of cherry trees catches up!

Cheers, my friends,

Don Chapman
President, BioOrganics, Inc.
www.bio-organics.com
May, 2002

Bio-Lawns Make Better Sense

Lawns are interesting. A nice lawn is generally considered to be an integral part of most landscaping in the U. S. and serves as both a decorative and practical feature. A lawn is a cooling, dust-free, barefoot-friendly and attractive part of most homesites.

Much advice has been written about how to successfully maintain a lawn - which is essentially a monoculture crop of grass. A huge industry has built up to produce specific chemicals for weeding and feeding lawns, along with countless service companies who will apply those chemicals on a periodic basis.

At one level, these products obviously "work", as lawns remain green and weed-free under chemical regimens. However, besides the high cost, the runoff of all that combined tonnage of lawn fertilizers is contributing to the contamination of both underground aquifers and surface water. Lawn-care chemicals are a primary source of water pollutants, including nitrates, and communities that depend on wells for their municipal water supplies are facing major decontamination problems in the future.

As an experiment, last summer I tilled under a rather average-looking lawn area that had been chemically maintained by the previous owners of this property. I then blended in compost from the local yard-waste recycling center, along with gradual-release pelleted fish fertilizer and a light dusting of mycorrhizal inoculant. After leveling, I seeded a fescue and annual ryegrass mix which is recommended for this climate.

This spring, I applied more of the fish pellets (developed at Oregon State specifically for turf grass). I water deeply about once a week (this is a high-desert zone that typically receives less than 10 inches of precipitation - mostly snow - per year). I will not fertilize again until next spring.

The new lawn is beautiful, to the point where strangers have driven in to ask what I use on it, and I feel that I am now contributing minimal amounts of runoff into the local water supply.

By using compost, natural biological agents and small amounts of dry organic fertilizers at a rate the grass can actually uptake, I think homeowners can greatly reduce the collective harmful impact of lawns on the environment.

However, as with agriculture, I have no illusions that widespread conversion to cleaner lower-input biological methods will happen overnight. As usual, soil and water problems must become severe before being dealt with - that's just human nature.

But I feel good about having a low-impact lawn.

Cheers, my friends,

Don Chapman
President, BioOrganics, Inc.
www.bio-organics.com
June, 2002

The Search For The Great Fungi

A few years ago, I had the opportunity to observe an experiment that consisted of transplanting tomatoes into large pots containing pure beach sand - unwashed and quite salty.

Each of the dozen or so groups of test plants had been inoculated with a different type of endomycorrhizal fungi - Glomus mosseae, G. intraradices, G. aggregatum, Gigaspora margarita, etc.

Very quickly it became obvious that the beach sand was a less than ideal potting medium. The non-inoculated control plants died almost immediately, followed by most of the test plants. Some test group plants survived, but were weak in appearance and bore only a few small fruits.

However, one group of test plants all thrived and produced good crops of large tomatoes. That one particular fungi, and only that one, had the ability to help its host plants deal with the extreme low-fertility/salty growing conditions.

The moral of this? With more than 150 named types of AM fungi, plus countless local adaptations that have evolved, be very sceptical of the projectability of any testing that involves only one or two types. Just because one beneficial fungus does not perform well in a lab test does not mean those results are typical of all types.

I would speculate that AM fungi that have evolved in the harshest soil and climate situations will prove to be most useful for growing crops in poor soils, and hope that researchers will devote some time to identifying, capturing, and trialing such types.

Yes, it is more convenient to conduct tests using only commonly available types, but I'm guessing that the greatest rewards will not show up there.

Cheers, my friends,

Don Chapman
President, BioOrganics, Inc.
www.bio-organics.com
July, 2002

How To Turn Good Loose Soil Into Sticky Clay

With few exceptions, farmers and gardeners alike complain when they have to deal with heavy clay soil - the type that sticks to their boots and tools. Whole industries exist to loosen such soil or to assist water in penetrating brick-solid surfaces.

But, if those frustrated growers were to step over to any nearby naturally wooded area, they would discover that the soil under those untended trees, shrubs and grasses is generally loose to the point where a person can scoop into it with bare hands.

What's going on here? Why dense sticky clay a few feet away from loose soil? Were the wooded areas just lucky enough to get better dirt?

Well, as usual, the answer is mycorrhizal fungi. Undisturbed, these beneficial organisms will completely colonize every square inch of the soil surrounding their host plants and form massive networks of interlinked hyphae (their microscopic root threads).

This hyphae network, sometimes called a "foodweb", serves many useful purposes underground: searching soil for nutrients that are brought back to the plant as needed; exchanging nutrients between established plants and seedlings; providing fodder for countless other soil organisms; preventing access to plant roots by pathogens; etc.

Indeed, it would be difficult to point to just one of these functions as being the most valuable to plants, but physically improving soils would have to rank near the top. The tiny platelets that make up clay are separated and pushed apart by exploring hyphae. This action "opens up" dense soil, which then gives water and oxygen easy access to the root zone - in effect, allowing the soil to "breathe" and quickly drain away excessive moisture.

Plants and all sorts of aerobic soil organisms thrive in such conditions, and their success then supports further growth of the beneficial fungi - a most useful and self-sustaining symbiotic cycle. When these fungi and their extensive hyphae network are destroyed by tillage and the application of high-analysis synthetic fertilizers, the clay platelets stack tightly together and the soil becomes compacted and waterlogged.

Many aerobic organisms, from worms down to friendly bacteria, cannot tolerate tight soggy soil, leaving growers on their own to deal with the stuck-together clay platelets. Tillage fluffs up such soil only temporarily, as any owner of a rototiller who then uses chemical fertilizers will verify.

The trend toward no-till agriculture makes very good sense from the standpoint of preserving and encouraging the underground community of microbial organisms (along with earthworms). Also, compost or shredded crop residues should be scratched lightly into the soil surface and only "gentle" lower-analysis, timed-release fertilizers should be applied.

Step lightly - there are valuable little critters under your foot!

Cheers, my friends,

Don Chapman
President, BioOrganics, Inc.
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Aug., 2002

And The Desert Shall Bloom...

As a companion piece to my earlier article about mycorrhizal fungi, tomatoes and salty beach sand, an agricultural advisor who lives near Yuma, Arizona, told me an interesting story about creating cropland from desert sand.

A farmer in his area set out to create a large field of alfalfa to be watered by circle irrigation - a long motorized pivoting pipe. The area to be converted was basically pure sand with a few widely scattered greasewood bushes.

Growing conditions were not the best that first season - there were some water supply problems, the seeding was not done quite early enough, etc., so the alfalfa didn't perform well...except in a few spots where the difference was obvious from a quarter-mile away. In those spots, the plants were tall and beautiful compared to the rest of the new field.

This was puzzling until my friend, who had been involved with conversion of desert into cropland during Egypt's "Green Revolution", pointed out that the good-growth spots were where the greasewood bushes had been located.

His analysis, which I agree with, was that there had been mycorrhizal fungi and beneficial bacteria colonizing the greasewood roots and that dormant spores in those spots were activated by the exudates from the alfalfa roots.

The alfalfa plants that had been lucky enough to gain the symbiotic assist of these powerful biological agents thrived under the extremely difficult growing conditions, while those that lacked the nutrient-uptaking fungi had trouble even surviving.

Using this observation, it seems to me that any desert conversion project might benefit from dusting mycorrhizal spores on the roots of transplants, or by simply adding spores to seed coatings.

Of course, the ideal approach would be to use the fungi types that are best adapted to the local plant/soil/climate conditions. (There is often more than one type colonizing a plant's root system, perhaps performing differing functions for their host plants?). I would wager that excellent candidates for controlled propagation could be easily found by digging up roots of the nearest greasewood, cactus, or acacia tree.

Two related ideas: The mycorrhizal fungi are not as plant-specific as many people seem to think - they seem to attach quite happily to nearly any new roots that come nearby - and the mature fungi spores are extremely durable. One microbioogist told me he thought some spores from inside the pyramids would probably still activate with exposure to root exudates.

These are some very determined (and useful) survivalist organisms, folks!

Good growing to you, my friends,

Don Chapman
President, BioOrganics, Inc.
www.bio-organics.com
Sept. 2002

Lessons From The Garden ... Again!

For those of you who have been reading these newsletters for a while, you know that I often use my vegetable garden as an example of biological growing methods.

Several years ago, when I first began experimenting with mycorrhizal fungi, I stopped my old ways of rototilling and putting synthetic fertilizer in the soil every spring, with added sidedressings and cultivation during the season. While this routine served me reasonably well for more than 45 years, my research into beneficial microbial organisms indicated that tillage and abnormally high fertility are harmful to mycorrhizal fungi.

Having an ultra-productive vegetable garden that is based on biological, rather than chemical, principles has now become such a routine thing to me that I hardly take notice of the big yields except when a neighbor visits and makes a fuss over the plants. “What fertilizer are you using?” is their usual question.

I’ve gotten used to seeing their puzzled looks when I explain that I never dig the soil and use hardly any fertilizer - just a very light scattering of compost, dry fish pellets and some volcanic trace minerals scratched into the top couple inches of soil early in the spring.

I think the most important lessons I’ve learned from my garden are:

1. Tillage, especially “fluffing up” clay soils with rototilling, is counter-productive. It makes the beds nice and loose for a few days, but if there is limited biological activity in the soil, they quickly revert to a hard-packed condition. I’ve found that the no-till concept - just lightly scratching nutritional materials into the surface - is gentler on the valuable living organisms that keep the soil loose without human help.

2. Replicating nature’s own “from the top down” method of replenishing nutrients works better than blending fertilizer deeper into the root zone. Artificially enriching the soil several inches deep might seem helpful to plants, but letting earthworms, bacteria and fungi do the job of transporting the nutrients down lower in the soil seems to be the better strategy.

3. The amounts of fertilizer commonly recommended by manufacturers and “soil experts” are excessive and harmful to beneficial soil organisms. Small amounts of slow-release materials that contain a very broad spectrum of major, minor, and trace elements are preferable when following a biological approach to growing plants.

4. A covering layer of mulch conserves moisture and discourages weeds. This step completes all my fertilizing and cultivating for the whole season. Almost too easy!

Some of these same procedures are catching on in agriculture - especially no-till or limited-till, although from what I read, the practitioners are mostly unaware of the biological reason these methods work so well. They are unintentionally encouraging beneficial organisms!

But we must always keep in mind that it is a mistake to think of gardens as just little farms, or of farms as just big gardens. The differing scale of operations call for differing methods, plus farms have profit considerations which are absent from home gardens.

However, both gardens and farms can benefit greatly from the “cheap and clean” low-input assistance of living soil organisms, and I think there is a role-reversal of sorts happening as ag researchers look at successful biology-based gardens for new ideas.

Motto for the day: Take care of your fungi, and they will take care of you.

Cheers, my friends,

Don Chapman
President, BioOrganics, Inc.
www.bio-organics.com
Oct. 2002

Saving Our Valuable Croplands...While We Still Can

I've just finished reading about inoculating wheat seed in some Nebraska test plots with mycorrhizal spores. A very small amount of inoculant produced good yield increases over comparable control plots during a drought year.

The results came as no surprise to me - most areas of the midwest have been so intensely tilled and synthetically fertilized that the once-abundant beneficial bio-life in the soil has been nearly eliminated. Restoring these important biological elements to plant root systems almost has to produce observable benefits.

I think it is inevitable that soil scientists will all someday come around to the realization that soil biology is at least as important to plant performance as are NPK levels, and I'd make a strong argument that the microbial life in crop soils is actually far more important.

In general, most of us have trouble really and truly grasping big abstract ideas such as "sustainable agriculture". Such long-term concepts, no matter how important, always tend to get overshadowed by immediate issues. (It's hard to remember that your game plan was to drain the swamp when you're up to your rear in alligators!)

If a soil sample shows that the soil pH is on the low side, or so many units of N per acre has always produced good yields in the past, then it would be the rare modern farmer who hesitates to use the recommended chemical inputs for each season's plantings. I would wager that not one out of a thousand of them thinks about harmful effects on soil biology.

At a glacial rate of progress, this may be changing. The USDA is actually beginning to notice that soil problems may be linked to the destruction of beneficial organisms. True!

To quote from an ARS News Service release, "When you think of endangered species, you never think of soil fungi. Yet the fungi that make plants hardier have had their numbers greatly reduced by the intensive agriculture practiced in the United States since the 1950s. Agricultural Research Service scientists are trying to figure out how to put these beneficial soil fungi back, as farmers make the transition to using less chemicals... Farmers today have to rely on whichever of these native fungi survived years of chemical use…"

I don't know whether to feel good or feel nervous when government bureaucrats agree with me, but even if this idea goes nowhere fast within the USDA, as I would expect, someone there seems to be actually concerned about restoring soil fungi. If interested, you can read more about this research at http://www.ars.usda.gov/is/AR/archive/may01/fungi0501.htm

As I mentioned in an earlier newletter, an internationally-respected soil scientist told me that he was worried that massive crop failures in the U. S. would begin occurring by the year 2025, if not sooner. He felt that our rich soils were being burned out by too much nitrogen fertilizer in a push for higher and higher annual yields. His theory was that there are very specific critical lines in soil for such things as living organisms, trace elements, and humic matter. Above the lines, plants will survive and below them they cannot. Consequently, he thinks there will probably be sudden dropoffs from one season to the next, rather than gradual yield declines, as lines are crossed.

Now, I'm not saying he's right and I'm not saying he's wrong. Time will tell. I will say that his dire prediction does tie into the USDA idea that we are not taking very good care of our precious food-

producing resource - soil. As we kill off its bio-life, soil becomes compacted and salt levels increase, eventually leading to decreased yields if not sudden disasters.

I hope there will be many more soil scientists conducting in-field trials involving biological methods. I would think there is greater potential value to be found there than comparing the effects of one NPK fertilizer to another. If any of you are aware of such bio-trials, please let me know. (I'm aware that there are thousands of lab test results available, and they are useful, but I'm far more interested in learning about real-world applications.)

Cheers,

Don Chapman
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Nov. 2003

The Inoculation Didn't Work - Why not?

We occasionally receive word from a customer that our inoculant failed to develop any infectivity on plant roots in trials, usually in nursery situations. When dealing with living organisms, it can be difficult to specifically determine why the fungi perform so well in one situation and not in another, but there are some "usual suspects" to consider.

Here are are the primary reasons why inoculations fail:

1. Improper potting mixes. Easily the leading reason. The mycorrhizal fungi are adapted to earth-type soils, not to partially-composted wood. Even kitty litter or pure sand would be better for fungi than bark or sawdust-based media, some of which retain fungicidal qualities. A wood-products growing medium might work for chemistry-based growing methods, but is not a good choice for biology-based methods. This, of course, pertains to plants being propagated in nurseries. The blend of species in our products should be suited to nearly any in-ground planting situation, and we see fewer performance problems in fields.

2. Over-fertilization and over-watering. Nurseries in particular are reluctant to change any of their traditional routines and often try to use our inoculants as "add-ons" to their regular chemistry-based procedures. The effects of the beneficial fungi will diminish as soil fertility (especially the presence of P) increases. The fungi perform best in low-fertility soil, at least what we humans consider low-fertility. In natural settings, plant nutrients come from decomposed leaf litter, bird droppings, and microbial conversion of mineral elements. Drenching seedlings with liquid fast-acting fertilizer can make the soil unsuited to biological elements. Actually, the most powerful biostimulant in the world is a "help!" signal to the fungi from the roots of a stressed plant. The fungi "go into a higher gear" when a plant's root exudates signal that it is stressed, either from lack of water, lack of some necessary nutrient, or pathogen attack. A nursery that puts inoculant spores in a proper low-fertility potting mix and then briefly withholds water from sprouted seedlings will see great results fairly quickly - but how many would dare do this?

3. Incorrect species of fungi for the particular plant/soil situation. Some types of fungi will do well in a given environment while others will fail. Experimentation by the grower is the only real way to find the best inoculant to use in their particular soil. (We have 15 different types of Endo and Ecto fungi spores in our Landscape Inoculant, but a rare situation might need #16.)

4. Inadequate application dosages. With eight types of AM fungi in our blends, a given dosage per crop plant might call for a minimum of 25-50 spores to ensure that at least a few of the right type are included in each dose. I know for a fact that many laboratory researchers apply as many as 500-1000 spores per plant when conducting their studies, which would be economically impossible for real-world growers to duplicate.

5. Poor inoculant. Hopefully, never ours, but as more supplier companies enter the marketplace, there will predictably be a very wide range of quality between inoculants. I suggest a careful reading of the labels. What species are included - just the easy-to-propagate Glomus intraradices or several other types? (Multiple species improve the odds of infectivity.) What is the guaranteed spore count, and does the count refer to only Endo-types or is it inflated with inexpensive Ecto types? Is the specific word "spores" used, or do you see the word "propagules"? Endo spores are relatively expensive and very durable, while propagules are generally nothing more than shorter-lived hyphae fragments. (We do not even count the many thousands of hyphae pieces in our products.)

I could probably come up with more possibilities, but the above - individually or in some combination - are the most likely reason(s) why a grower might have problems getting the fungi to perform.

There can be a huge potential benefit in growing plants with the powerful mycorrhizal fungi on the root systems, both for nursery propagation and after outplanting. The nurseries, farmers, landscapers, and soil reclamation people who manage to figure out how to create hospitible soil environments for the fungi will be well rewarded. We'll do our best to help them.

Happy Holidays, my friends,

Don Chapman
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Dec. 2002