Microbes: The Real Millennium Bugs

Microbes! Those little microscopic links in the chain of life. We all know that they're out there in the soil, water, air and in our bodies. What we don't know exactly is how they really work, what affects their populations the most, and how we can harness them to maximize turfgrass management.

Just like many of you, I have anecdotal experience that would suggest that this product or that product did indeed produce some sort of positive results. The challenge comes in finding reams of peer-reviewed scientific studies that give us a better idea of what's going on and how predictable a product or its results might be. We may soon find ourselves on a path that separates the snake oil from salvation.

Synthetic chemicals and fertilizers are under constant attack these days. They have been quick, effective tools to solve turf problems for about 50 years. Now the politically correct and environmentally conscious activists are waging a holy war to eliminate as many pesticides and fertilizers whether or not they are truly harmful. We can fight back, but it is a constant battle and the end users are at the mercy of too many things they can't control like the media, and politics and the manufacturers' bottom lines.

So, what if we could find more natural, benign ways of producing strong, healthy turf in a very active, healthy, growing medium? Maybe we can reduce our dependence on synthetic products, which are likely to start disappearing anyhow. Maybe we can find less expensive ways to enhance the natural systems at work and eventually produce stronger, healthier playing surfaces. The following articles provide information, insight, caution and hope for microbial solutions, and we are poised to start funding more research on these millennium bugs.

Former Sales Rep is Sold on the Products, Not the Sales Pitch

Since I tried to sell this technology to most of you for two years, I felt obligated to respond to this Hands On topic, "Microbes – The Real Millennium Bugs." I'm not going to waste my time or yours continuing to sell you on this concept. By now you either believe that using microbial products is good science or you think it is a deception.

Now as a superintendent once again, I use the Green Releaf products that I sold, but not exactly in the way I sold them. I tried to sell programs that incorporated small amounts of all the products that Green Releaf sold on a 7- to 14-day schedule. Green Releaf trained us to sell the products that way, because if you bought into the program you would not have room to use other people's products. The program I use incorporates several different brands of products.

I basically spray my greens every week with a mixture of nutrients. I determine which nutrients to use and the amount of nutrient needed by tissue sampling. In that mixture I incorporate two gallons of Green Releaf 5-10-5 plasma per acre. I use the plasma because of the carbohydrates, amino acids, and humates that are in the product. The nutrients in the plasma are just a bonus.

The theory is that if you increase the amount of food source for the microbes in the soil, you will increase their population. The more microbes that are in the soil the more efficient the plants will become.

I'm pretty sure that all the so-called biological products are based on this theory. In my mixture, I add one gallon of fulvic acid per acre to help hold the nutrients in the soil. My own personal theory is that by using plasma and fulvic acid, I can get by with using the lower-priced liquid nutrients and get the same results as if I used the high-priced ones.

When I was selling microbes for Green Releaf, most microbiologist were skeptical of the validity of the products. Every researcher I spoke with said that, in a laboratory setting ,the microbes did all the wonderful things that Green Releaf claimed. However, only a few scientist felt the microbes could live long enough to get down into the root zone.

Even the most discriminating skeptics felt that if you could get the microbes into the root zone they would be notably beneficial. Because of this, I use the living microbes in two ways. I use them when I aerify, and I inject them with a hydroject.

When I aerify, I spray 5 gallons of Bio A and Bio B+ per acre after the cores are removed and before I topdress. I immediately flush the "bugs" into the soil with 10 to 15 minutes of irrigation. I then add 300 lb. per acre of Green Releaf 15-4-7 organic granular (to feed the microbes), then drag it into the holes with the topdressing.

What I see by doing this process is rapid recovery from the aerification, and a flush of root growth even in the summer months.

During the winter I inject microbes into the greens monthly. Last May going into the rainy season, the roots on my greens were 6 to 8 inches deep and dense (I'm not just blowing smoke, several people can attest to this). During the heaviest part of the rainy season the roots shrunk to 2 to 3 inches, but new root growth was always occurring.

So here is the question: Can I attribute the success that I have had to microbial products? I don't know! It could be the microbes and carbohydrates. Or it could be that the weather was good last year, or my water management was

better this year, or my nutrient management is better than when I used granular fertilizers.

I honestly don't think there is any way to tell for sure if the microbes and carbohydrates have made a difference without conducting a lot of expensive research. However, I am not willing at this time to take the microbial products out of the program. Not until someone proves to me that using microbial products is not good science.

Do I think there should be money laid aside to research microbial products? Absolutely! In my opinion, with all the radical environmental groups trying to get us shut down, anything we can do that is environmentally responsible is worth researching..

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Editor's Note: *At its fall board meeting the FGCSA agreed to submit a proposal from Dr. Monica Elliott on microbes to the GCSAA for research funding. The purpose of the project will be to determine if* Bacillus *microbes applied to bermudagrass putting greens do survive and establish on either the turf or in the soil. The project will also determine the effect of frequent, multiple applications on the* Bacillus *populations. The research will be conducted on a portion of the FGCSA's Otto Schmeisser Research Green at the University of Florida's Research and Education Center in Ft. Lauderdale*

Microbes Play Varied Roles in All Facets of Human Existence

If champagne, a loaf of freshly baked bread and a fragrant cheese will figure prominently in your Year 2000 celebration, then you can thank your local microbe. Human beings are dependent on microbes for many foods such as yogurt, sauerkraut, sour cream, beer and other fermented drinks.

There is also a type of bacterium that lives in the human intestine that makes vitamin K, a factor needed to clot blood.

In addition we take advantage of bacteria for their ability to protect us from microbial invaders. Human beings have their own special bacteria that have adapted to life in a salty, ocean of sweat on our skin. These bacteria keep out pathogenic fungi and bacteria. We also have a host of bacteria living in our throats, noses, intestines and other areas of the body. These friendly bacteria are tremendously effective at keeping the disease-causing bacteria away from their homes, our bodies!

A diversity of bacteria that associate with plant roots serve the same purpose of holding pathogenic microbes at bay.

Biological control agents, such as bacteria and fungi, work through a variety of mechanisms. These mechanisms include the production of antibiotics and other inhibitors; simple competition for food, water and space; stimulation of the plant's own system of defenses; and an environment around the plant roots that encourages growth of beneficial microbes.

Beneficial bacteria and fungi can form a barrier against pathogen invasion of plant roots. Because turfgrass's roots are surrounded by a host of friendly bacteria, it is much more difficult for *Gaeumannomyces* (take all disease organism) to reach its intended target.

In laboratory testing, conclusive tests have shown that *Gaeumannomyces* is sensitive to substances produced by several different species of bacteria. When a diverse group of microbes exists in the soil in the plant root zone, many reciprocal benefits are derived from that relationship. When bacteria and fungi colonize the rhizosphere, they are fed a steady diet of plant sugars. The plants in turn benefit from colonization of non-pathogenic microbes.

What happens if friendly plant bacteria are not available to protect plants? Soil that has been treated with harsh chemicals may deplete soil of the beneficial bacteria and fungi. When fungi and bacteria are no longer available as a shield pathogenic microbes may then be able to invade plants.

Within the past 50 years, the public has been taught that the only good microbe is a dead microbe. Nothing could be further from the truth. Without beneficial microbes, our plants would die and our own existence would be in jeopardy. And yet we continue to douse microbes with bactericides and fungicides in an effort to exterminate the pathogens, but in doing so many beneficial are also depleted in numbers.

Some helpful bacterial species include *Pseudomonas, Bacillus, Cellumonas, Corynebacterium, Rhodococcus,* and other member of the *pseudomonads actinomycetes.* Some species of *Pseudomonas* help break down urea-based fertilizers enzymatically and convert urea to ammonia. Ammonia is then converted by nitrifying soil bacteria to nitrates, a form of nitrogen readily available for plant utilization

Certain species of *Bacillus* produce insect toxins as well as antibiotics that inhibit fungal growth. *Bacillus* is an extremely hardy microbe. These bacteria form endospores under adverse conditions, enabling the microbe to withstand drought, high heat and adverse pH conditions. *Cellumonas* is extremely helpful in producing substances that break down dead plant material in the soil, thus helping remove thatch buildup. *Rhodococcus, Bacillus* and *Pseudomonas* are proven pesticide and herbicide degraders; therefore much of the excess biodegradable pesticides are devoured by microbes.

One important factor to remember is that just one bacterial type cannot do a job alone.

This is the reason why it is important to maintain a highly diverse population of microbes. What one bacterium can break down in the soil may not be an available food source for another microbe. As mentioned above, several different bacteria are needed in the first step of converting urea to ammonia. Without a team of urea-degrading organisms, the nitrifiers would be powerless to use urea-based fertilizers as a nutrient and thus produce nitrates for plants.

Without many different bacteria and fungi in the soil, a healthy environmnent cannot be maintained. In the decomposition of dead plants and animals, certain inorganic elements such as phosphates are released and made available for plant nutrition. Many different bacteria utilize common organic wastes and produce carbon dioxide and water.

Without microbial diversity, nutrient