Microbes: Snake Oil or Revolutionary Product?

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One of the fastest growing technologies in the golf maintenance industry today is microbial technology. I am sure by now you've either read information about microorganisms, had discussions with other superintendents about them, or you've been contacted by someone selling the technology.

Is the use of these organisms for plant growth warranted, or are they just another snake oil?

I think before you can answer that you must have an understanding of how microorganisms actually perform in the soil rhizosphere, or root zone.

The reason most new technologies in the golf industry get thrown into the category of snake oil is that it's human nature to be skeptical. It's easy to think that if these microbial products are as good as billed, they would have been around 25 years ago.

After all, most of us old-timers were pretty well educated 25 years ago. We were never taught to incorporate and feed organisms, and we were surely never taught that our cultural practices are what cause the demise of the organisms.

A lot of the blame for superintendents' attitudes has to be credited to the companies that sell the products. Many marketing strategies promote products as the cure-all of cure-alls. This overbearing type of marketing usually breeds skepticism.

Any intelligent superintendent knows that you can't rely on one product to maintain turf. It takes a combination of many tools, and good weather conditions, to make a maintenance program successful.

The key to understanding technology is that it evolves, and with the development of the computer industry it is evolving at phenomenal rates of speed. Therefore it is only logical to assume that sooner or later there will be revolutionary products developed that will change the way we maintain our turf.

Technologies are being refined that are consolidating many of the commonly-used tools of today and making others obsolete. Many of the microbial programs being advocated today can be very effective tools, if used appropriately.

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Microbes are not new — they have been around since the beginning of time. Microbes can survive almost any atmospheric condition. Plant life and microorganisms have evolved and flourished on the earth for the past 500 million years without any help from man.

Plants have been able to do that because of natural balances and cycles that occur in nature. Plants and microorgan

isms have an interdependent relationship, and one could not survive in nature without the other. Put simply, microbes feed plants and plants feed microbes.

But how?

Plants use sunlight to execute photosynthesis. One of the processes of photosynthesis is to produce carbohydrates which the plant uses to do many metabolic functions.

What very few people understand is that 25% of all the carbohydrates produced are forced out through the roots into the root zone. This is the plant's way of enticing microorganisms. The carbohydrates provide a food source for the microorganisms.

Microorganisms feed plants in a couple of ways. When plants defoliate, microorganisms break down and decay the organic material dropped by the plant. The microbes then process in their digestive systems nutrients, acids, enzymes, coenzymes, and every other substance that make up the hemicellulose of the plant.

When the microbes age and die, they release these processed nutrients and substances. The processed nutrients create long chains of amino acids and proteins that are used as a food source by plants.

Microbes also devour elements that are in the soil. They transport them and process them for the plant. When the plant is being fed in this manner, it doesn't have to expend any energy to feed itself.

Sounds pretty simple, right? So if all this really happens why do we have to use fertilizers and chemicals to keep plants alive? Because of man! In the last few centuries man has ignored the laws of nature and started growing plants with synthetic fertilizers and chemicals.

It has become a necessity to use man-made products because we are disturbing the natural relationship between plant and microbe. The disruption of the cycle has not been done just to be malicious — it has been done to feed an overcrowded planet.

To feed mankind, we harvest plants for food instead of letting them return to the soil. Harvesting does not allow the nutrients and hemicellulose to return to the soil. Since microorganisms are not replenishing nutrients to plants, we have to do it with man-made fertilizers.

What is missing from man-made fertilizers are all the compounds that make up the hemicellulose. This deficiency causes a decline in the populations of beneficial plant-growing microorganisms.

Once the beneficial microorganisms dwindle, the root zone repopulates with organisms that are either detrimental to plant growth or do nothing except occupy space and eat carbohydrates. Many of these organisms cause disease. To control disease we use fungicides, which kill not only the disease pathogens, but even more of the beneficial organisms.

When you get an extensive extermination of microbes, which you get from fungicides, the plant will emit pheromones to attract organisms to the root zone. Then it becomes a race for the organisms to repopulate the root zone. The organisms that usually win are the pathogens. Most pathogens reproduce from spoors, and fungicides don't kill spoors.

Most of the beneficial organisms reproduce sexually. The bad thing about using man-made products is that the more you use them, the more you have to, because you kill the antagonistic organisms that are preventing the pathogens from occupying the root zone.

We create even more of a deficiency in golf course maintenance by cutting the turf much lower than it is genetically designed to grow. When turf is cut low, the amount of photosynthesis is decreased because the leaf area has been reduced.

A reduction in leaf area means carbohydrate production is diminished. A diminished carbohydrate source means there is not substantial food to sustain a sufficient population of microorganisms.

When you begin understanding this relationship you begin to understand that it is truly magical that plants can survive man. Like all living things plants are survivors. If there are not enough microbes to feed the plant, the plant will initiate its energy to process its own food.

The plant will begin sending out negatively-charged electrical impulses. These impulses attract positively-charged elements that are in the soil. This process requires energy. The plant uses energy to pull the elements into the exchange zone of the plant.

It also requires energy for the plant to turn the elements into amino acids and proteins. All this extra energy the plant is using is being directed away from other metabolic processes. This energy drain causes stress and imbalances in the plant.

When the plant has to feed itself it is not selective of the elements that it takes up. This can drastically affect balances in the plant. The uptake is simple electricity. The plant takes up the first available positively-charged element in the soil. Unless you have perfectly balanced soil, deficiencies will occur in the plant.

However, when microbes feed plants, they are selective—they can break chemical bonds that tie up elements. When you have sufficient populations of beneficial microbes, the nutritional balances inside the plant will be much greater than the balance in the soil. This can be detected by tissue testing on a regular basis.

Many years ago microbiologists began to study plants that flourished in nature. Through these studies the scientists discovered that several different species of organisms occupied the root zone. These beneficial species performed many different functions to help the plant grow. Some processed nutrients, some affected gas and water exchange, some were antagonistic and defended the root zone from pathogens. Scientists also found that when everything was in balance, the plants became selective of the organisms that occupied the root zone. In the last few decades microbiologists have learned how to isolate and culture the beneficial species of organisms. The problem that arose was getting living organisms from the laboratories to the field. In the last ten years breakthroughs have been made that enable us to get the organisms into the soil alive. Solutions and other carriers have been developed that hold the organisms in a hibernative state. When these solutions and carriers are added to water the organisms slowly rejuvenate and migrate to the root zone.

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One of the early mistakes made with microbial technology was to think that merely incorporating the organisms into the soil would solve the imbalance and deficiencies. Something that you have to understand is that the number of organisms is directly proportionate to the amount of carbohydrates in the soil.

So to achieve the goal of sustaining a sufficient population of beneficial organisms you must supplement a carbohydrate source. You also have to replace the hemicellulose that you remove when you remove clippings.

There are hundreds of compounds that make up the hemicellulose in plants. A plant must have all the components in hemicellulose reprocessed, so that it can achieve natural balances.

When the plant gets into balance, the energy is then directed to its metabolism instead of using it for food production or a number of other stress factors. When the plant achieves these balances it will allow the plant to grow to its genetic potential. When the plant is in balance the beneficial microorganisms will thrive, and an interdependent relationship exists.

There are still skeptics who say you cannot incorporate non-indigenous species of organisms in specific areas. However, most of the organisms that are being used by the microbe companies are indigenous to most areas of the United States.

There may be a few that are not indigenous but they are being fed a pure food source before they enter the root zone. Because they are strong going into the battle they have a very good chance of surviving and establishing in that specific area.

Soil microbiology is much more complex than I just explained. I tried to make this abstract as condensed and simple as I could so that you would understand it without hundreds of hours of studying and years of research.

Repopulating the root zone with an adequate amount of microorganism that will be beneficial to the plant can be achieved in a very short period of time. There are long-term effects from using microbes that I did not discuss that are even more astonishing.

So is the use of microorganisms a snake oil approach? No chance. Is the use of microorganisms revolutionary? I would say so. Any product that can minimize the use of pesticides and fertilizers, and enable you to grow turf as good as or better than you are doing now, has a place in every maintenance operation.

Is the use of microorganisms a cure-all?

No, but it is a tool that you can use in conjunction with other proven cultural practices, to give insurance against plant stress and, even more important, personal stress.