

## *Biologicals and organic/natural products —* **Soil microbial enhancement**

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Superintendents that would like to incorporate the use of biological enhancement into their management programs will find it difficult to find empirical data to guide them. There are more companies everyday claiming that various combinations of bacteria, organic amendments, bio-stimulants and other bugs in a bottle will solve most of the problems associated with the management of fine turfgrass.

The most common claims are:

1. Thatch reduction
2. Disease suppression
3. Nematode control
4. Control of black layer
5. Sodium reduction-increased percolation
6. Increased nutrient availability, especially nitrogen
7. Improvement of irrigation water quality

The chance of these benefits without the use of chemical applications or mechanical manipulation sound too good to be true... and they are. We have all been around long enough to know that there is no easy way to manage turf at the level we maintain today. When the water injection aerifiers arrived, they were never meant to replace core cultivation, and the increased effectiveness of growth regulators is not likely to put mower manufacturers out of business soon. These new developments are tools to be used in conjunction with the tried and true methods that experience and science have proven effective over the years. The use of biological agents to improve the health and

quality of our turf should be viewed the same way.

These techniques can only be effective if they are part of a truly integrated plant management system. The difference between the use of organic materials and biological agents, and the other techniques mentioned is that they have been in use for many years. Where a plant is growing in its native environment and is not subjected to artificially induced stress, this is the normal equilibrium of the rhizosphere, and the application of fertilizer and pesticide is not necessary. In turf management, we generally give the plant the opposite conditions, subjecting it to unnatural soils and demanding quality at the expense of resistance to stress. The goal that we are pursuing at Emerald Dunes is to modify the soil environment to make it the most efficient natural growth medium for the turfgrass. The practical results of these efforts are hoped to be an increased ability of the plant to resist debilitating stress factors under normal growing conditions.

While there is not a lot of available research on the use of plant growth rhizobacteria (PGPR) on turfgrass, there has been work in this area as early as 1890 in regard to agricultural crop production. Studies were done first in Russia and Eastern Europe with inoculating seeds with cultures of bacteria to improve plant growth. Work in this area progressed into the 1970s in India and the U.K. with the introduction of bacteria into the growing medium in the greenhouse and positive results were observed on growth promotion.

In Australia however, field trials using the procedures showing success in the laboratory did not produce the same results.



### **Practical Application I – Seminole Golf Club**

HAL HICKS  
SUPERINTENDENT

**The concept behind humic acid is that it allows the bermuda plant to be more receptive to taking in needed nutrients**

As with a lot of golf course superintendents, I have been experimenting with various "materials" in hope of finding a way to reduce the need of applying various chemicals and fertilizers to the turf. Humic acid is a great example. Just ten years ago, this product was probably not used very much. Today, I know many superintendents that use humic acid in combination with topdressing or through direct spray applications. The concept behind humic acid is that it allows the bermuda plant to be more receptive to taking in needed nutrients, which in turn allows for higher efficiency.

In line with this concept, I have also been experimenting with the injection of microbial bacteria and nematode suppressing materials through our irrigation system. Again, the idea behind the

use of these "materials" is that they supposedly enhance nutrient release from fertilizers, improve soil structure and water infiltration, suppress disease and nematode activity and reduce thatch.

But in reality, what does all this mean? The bottom line is that — to date — I cannot dispute or verify any of the claims these products make. I have not witnessed any great change in our turf that I can definitely state is a result of these "natural" products. But what I do know is that we have moved into a new environmental age. As a result, probably more and more "natural" products will be introduced into the market in the near future. Time will tell what does and does not benefit the turf. But, if successful, the concept of using "natural" products to reduce chemical and fertilizer use is excellent. I hope that in time these "natural" products prove successful and reduce some of the stress on the golf course superintendent.

# Soil microbial enhancement

The theory developed from these experiments was that the inoculum which was not normally found in the rhizosphere could not compete with native bacteria.

The idea of a dynamic microbial equilibrium that is established in the root zone of the plant led to the belief that any introduced microorganism will not be able to establish itself in the soil.

Two important breakthroughs in recent years have brought the use of biological agents for plant management into practical use. The discovery of mutant strains of bacteria that lived off root exudates and altered the indigenous microbial populations of the root zone, to allow their colonization throughout the season, and techniques to measure their establishment. Selective breeding for host specific strains that process known plant pathogens or biodegrade organic matter has brought us the products being marketed today.

The area most likely to be successfully colonized by beneficial microbes is a newly constructed USGA style green. This is basically a sterilized soil medium where the inoculum can be more easily established. Along with the microbes, it is important to supply a food source until the root system becomes sufficient to support their growth. The supplier of the microbes should be able to recommend an available substrate.

If the supplier can't provide this information, you should reconsider using the inoculum he is selling. Some bacteria are inoculated onto fertilizer carriers that supply an adequate food source for a short time.

Another important consideration is that the inoculum must be delivered to the rhizosphere, as bacteria are not all mobile and must have moisture present to survive and move to the desired location. The incorporation of bacteria and a food source into the soil before planting may provide the best opportunity for establishing healthy colonies where they can do the most good.

## Practical Application II Banyan Golf Club

DAN JONES, SUPERINTENDENT

At Banyan Golf Club we have been working on biological control agents for many years. We started with the white amur fish in our lakes to reduce the undesirable aquatic vegetation. We have not had to conduct mechanical removal or herbicide applications for 15 years and our lakes remain weed free.

We have introduced the red eye fly and the *steinernema scapterisci* nematode for mole cricket control. The results are inconclusive at this point.

A strict IPM program has reduced our pesticide usage by 40%. We spray for curative control only.

We are currently in the process of setting up a program to control diseases and parasitic nematodes with microorganisms.

The future of biological and organic control of pests is exciting, and Banyan Golf Club plans to stay on the cutting edge.

The application of products through irrigation systems is an efficient method for moving the microbes into the soil, however may not be cost efficient due to application in non target areas. If the entire course is to be treated, this is probably the best way available to move the bacteria into thatch or the root zone.

Core cultivation before inoculation should greatly improve their ability to reach the intended destination. It is important to know the part of the plant the microbes are designed to work, as applying them incorrectly or without a sufficient food source will ensure their failure to establish and compete.

Once the colonies become established, there are products available to be applied in granular form or through fertigation that will aid in their survival and efficient growth.

There are additional factors that directly affect the life processes of the microbes and their ability to perform the task they were applied for. Extended wet periods or very compacted soils can rob the bacteria of oxygen necessary to remain in an anaerobic state and some re-inoculation may be necessary after the poor conditions are alleviated. There is conflicting data on the effects of chemical pesticide on non target microorganisms, so the manufacturer of the bacteria should be consulted as to when re-inoculation can safely take place. These factors indicate that the most efficient way of en-

couraging the establishment of beneficial microbes would be a system that provides a constant source of inoculum, with the proper food source, through a well-designed irrigation system.

The ability to do this is available today, but the cost is high and the results are difficult to quantify and cannot be expected to give rewards for two or more years. There are also products that can be applied with spray equipment on specific areas like greens or trouble spots and watered in.

At Emerald Dunes, we feel that we are receiving benefits from our management program that justifies its continuance. The use of chemical pesticides and amount of fertilizer applied has decreased gradually over the past three years. There has not been a significant cost reduction in the fertilizer budget since the nutrient sources used are more expensive per pound, however less frequent applications provide for some labor saving and less disruption of play.

The course seems to recover more quickly from poor weather conditions and stand up better to heavy traffic. Overall, we feel the quality of the turf above and below the ground has continued to improve with no corresponding budget increase since our biological enhancement programs were begun. Our knowledge of the symbiotic relationship of the plant, soil and microbial populations is

*Continued on Page 59*



## Fiddlesticks

From Page 58

have seen some low pressure injection systems which may be a good option for applications.

Nematodes are environmentally safe. No protective clothing is needed for applications. They do not harm humans, fish, or any other animals. Hopefully we will be using many effective products in the future that have absolutely no negative affect on the environment.

Scouting and mapping can be an effective cost saving procedure for nematode applications. Mole crickets seem to congregate in the same areas year after year. Limiting treatment to these specific areas can provide acceptable control and be cost effective.

Beneficial nematodes have proven to reduce mole cricket populations while being completely safe to the environment. As we fine tune application methods and find a way to insure contact between nematodes and mole crickets, this will become a more popular method of control.

## Soil microbial enhancement

From Page 56

increasing as we continue to research this exciting aspect of our profession.

Finding reliable information to assist you can be obtained by asking sales personnel to provide you with studies that support the effectiveness of their products. If you have access to the Internet, there are papers available through the Turfgrass Information File at 20676POC@MSU.EDU. Or, use a go-pher to find topics under agronomy, sustainable agriculture, biological research, or any other catch work you think might work.

### Two additional sources are:

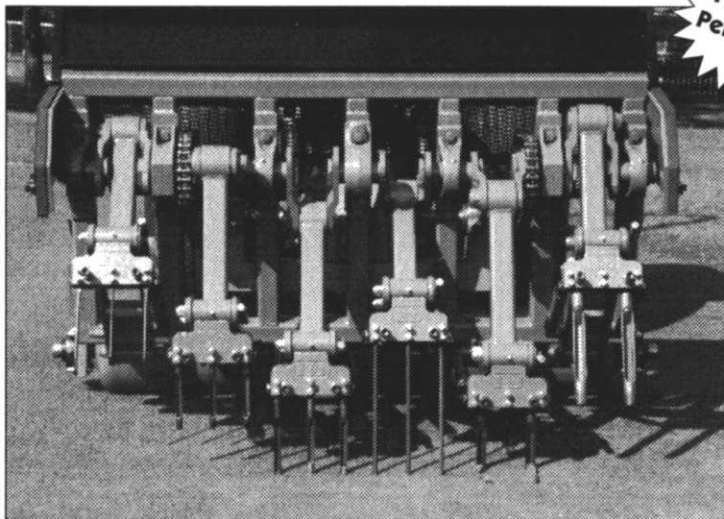
Turf Grass Trends 1775 T. St. NW  
Washington, DC 20009-7124

Many good book titles are available through:

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