

# Nature playing increasing

## *Future fairly bright for biological disease controls...*

By Peter Blais

CINCINNATI — The future looks fairly bright for biological controls of insects and disease as an alternative to pesticides, according to Dr. Hank Wilkinson, a turfgrass pathologist at the University of Illinois.

With chemicals coming under increasing fire from environmentalists, biological controls (one living organism that controls the growth of another) are being touted as an alternative in the battle to control turf diseases.

"We're not there, yet," Wilkinson said at last month's annual Ohio Turfgrass Conference and Show. "But it's coming."

Agro-chemical companies are currently testing biologics, although golf course applications are still five to 10 years away, Wilkinson said.

"If there is anything that will drive biologics into your hands faster, it's the environmentalists," he explained. "As they push on chemicals and they are gradually reduced or eliminated, that increases the interest in the dollar value and the money behind biological controls."

Biological controls are not expensive to produce, but they take a long time to develop. The reason is there are hundreds of turf diseases and many different types of turf (bluegrass, bentgrass, Bermudagrass, etc.). But each organism and each turf type must be dealt with singly.

"It may not be efficient to develop one biologic that controls many diseases. Two diseases may require two different controls. In fact, the same disease in different parts of the country may require different biological controls," Wilkinson said.

For every pathogen there exists at least one naturally occurring biological control, the Illinois researcher said. Disease occurs when one pathogen temporarily gets out of



Dr. H. Wilkinson

hand. Most diseases will eventually disappear, which is the natural biological control.

"Research tries to understand how nature does it, and then speed up the process. What we'd like to do is take the control that is naturally established in five to 10 years, and make it take hold in one or two on your course," Wilkinson said.

There are three ways to achieve a biological control system — managing a healthy turfgrass; maintaining a balanced, living biomass; or reducing the effective pathogen population.

Managing a healthy turfgrass by changing to a turf type that is better-suited to naturally occurring biological controls is the best way to develop disease resistance. But ripping up one type of grass in favor of another is often impractical.

The second option — maintaining a balanced, living biomass — is more practical, especially in the soil. The soil tries to keep all organisms in balance. This is called general suppression and is accomplished by many organisms working together. Dying or dead soil has low general suppression leading to more disease. Cultural practices like core cultivation, proper fertilization and others can make the soil more active in fighting disease.

Soil amendments with organic materials and organisms can also be added to the soil to help improve the biomass and control disease. But there are so many products on the market that it is difficult for any researcher to determine if the introduction of any one significantly reduces disease, Wilkinson said.

That leaves the third method of biological control, reducing pathogens, as the easiest to research and perhaps most promising biological control of turf disease, Wilkinson said.

Specific suppression is the technical term for one organism attacking and actually suppressing another organism. The controls work in different ways on the pathogen — directly attacking it, reducing its food supply, secreting toxins on it.

The control works best when it is present in the turf when the pathogen attacks. It is much less effective if applied after the pathogen establishes a foothold.

"They are more protective than curative," Wilkinson said.

Soils tend to keep all organisms in balance. Foliage is constantly reproduced and replaced. That means biological controls introduced at the roots rather than soil or foliage level will be most successful and will likely be the first available to the golf course market, Wilkinson predicted.

"The protection, if it needs to be there before the pathogen, has to continuously grow and respond to cover up those new tissues," Wilkinson explained of the likely success of root-level controls.

Using biologics will force superintendents to re-think how they deal with disease. While eliminating the disease-causing pathogen may seem the best response, "it's basically a better idea to suppress a disease than eliminate it," said Wilkinson.

"If you eliminate the organisms that cause disease, you create imbalances in the soil. Other things can happen. Other pathogens may fill in that niche and give you bigger problems. The goal of biological control is to reduce disease to acceptable levels and hold it without eliminating it."

Biologics (usually in the form of bacteria)

respond to diseased grass. The cycle works like this: A diseased root develops, bacteria grow on it, pathogen numbers are reduced, less disease develops and the situation eventually stabilizes.

"You get a little disease and no symptoms," Wilkinson explained of the natural cycle.

An organism must not only survive, but also grow to be successful as a biological control. Competition with other organisms that are already in the soil, plus the constant reproduction of grass foliage, make that difficult.

The control must also continue effective against constantly changing pathogens. Pythium blight and dollar spot are two diseases, for example, that can change and become resistant to a certain biological control.

Some diseases and grasses are more receptive to biological control than others. Warm-season pythium is one that has proven extremely difficult to control.

Warm-season pythium can consume grass within a few hours. Bentgrass and ryegrass are very susceptible to it. Bluegrass is more resistant. As the turf's resistance increases, the biological control has less work to do. The more susceptible the grass, the more effective the biological control must be. So the integration of a resistant grass with a strong biological control is important.

How do researchers find effective controls considering there are thousands of different organisms in a single handful of soil?

It is time-consuming process that involves scraping bacteria found on foliage and smearing it on a petri dish where the pathogen is also present. In most cases, the bacteria has no effect in limiting the pathogen's spread. In the rare instances it does inhibit pathogenic growth, the bacteria is subjected to further

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# role in turf maintenance

...while biostimulants turn supers', researchers' heads

The world of biostimulants has taken the giant step from snake oil-type doubt to science-supported legitimacy.

While testimonials are still coming in, golf course superintendents are cashing in on the years of research done on biostimulants to improve or accelerate plant growth.

"It's another tool that if golf courses aren't using nowadays they'd better, or the person in charge is behind times," said Melvin B. Lucas Jr., former president of the Golf Course Superintendents Association of America.

"You can do a lot more with biostimulants than you can with just putting out fertilizer..." said Lucas, who operates Round Hill in South Dartmouth, Mass., after 25 years at two Long Island golf courses. "You have fairly good control of your growth of turf. You never seem to get a flush as you will with nitrogen fertilizers. You can maintain a nice even quality of turf with any of these biostimulants."

Superintendent Dean Graves, of Bethesda (Md.) Country Club, site of the Mazda PGA Championship, said he has used biostimulants to encourage root growth and develop a stronger plant for three years.

At the same time, Graves said, the biostimulants green up turf, making it aesthetically pleasing for the tournament cameras.

Unlike nitrogen or fertilizer, it gives a green color but not a flush of growth, he added.

Dr. Michael Goatley, an assistant professor of agronomy researching Roots biostimulant at Mississippi State University in Starkville, said golf courses where superintendents are managing sand-based greens, are a good "fit" for biostimulant use.

"In this situation, biostimulants could be a valuable management tool during stressful times of year, as in the case of severe drought, because of stronger, more developed root systems," said Goatley, who is testing Roots

Root Growth Enhancer and PGR IV.

"There are testimonials from a lot of people," said Dr. Richard E. Schmidt of Virginia Tech in Blacksburg, who has researched biostimulants for more than a decade. "I think a lot of people see what they want to see. But it's there. It's for real... It's like an insurance policy.

"We're now trying to get them into the 90th percentile, so that when you apply them, 90 percent of the time they will have positive results."

The word "biostimulant" itself has brought debate. According to Schmidt, "Biostimulators stimulate growth biologically.

"A lot of people want to call them 'growth regulators,' but growth regulators can either enhance or inhibit growth."

Schmidt said his research shows biostimulant use "can be a good insurance policy. If a turf manager gets in an adverse situation caused by moisture, heat or cold stress, the treatment might help him through."

Biostimulants are not a cure-all, Schmidt warned. "Our research has shown that these materials work well under some conditions," he said. "We know we can stimulate growth — especially roots — with some materials, and we are also getting better tillering and initiating of buds.

"However, under certain conditions results of our research infers that growth stimulation with biostimulants is not necessarily associated with nutrient uptake."

Dr. Eliot C. Roberts, director of The Lawn Institute in Pleasant Hill, Tenn., said: "We have to do something to help build more stress-resistance within the plant other than simply watering practices and trying to control the rate of nutrient release within the plant so they don't get oversucculent.

"These growth substances do this. They

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— Melvin B. Lucas Jr.  
Round Hill operator

help to regulate cell division so that it slows down growth. They also help to control cell elongation. And growth is either a function of cell division or elongation, or a combination of both. When you apply fertilizers ... more nutrients mean more cell division and cell elongation, more hydrated cells, and thus they are more sensitive to stress environment.

"If you can control this growth in a way that will make the plant hardy, you have a turf that will withstand more play on golf courses, more traffic on greens, more soil compaction, and withstand the adverse high summer temperatures. When you try to put bentgrasses in the South, anything you can do to make it more hardy during the summer the easier you're going to make it on the superintendent."

Lucas, who designed and built Round Hill, said he gained state Conservation Commission approval largely because of his promise to use biostimulants.

"The No. 1 consideration here was that the course was being built in and around wetlands," Lucas said. He said the commission was "highly receptive and openly taken by the abilities of biostimulants ... in providing many nutrients without an overuse of fertilizers.

"This was a selling point that I had to have. Indeed we have not eliminated fertilizers,

but we have indicated the continued use of biostimulants would reduce our nitrogen use on the areas near and in wetlands."

Lucas said for many years he applied iron to bentgrass greens and tees as a "dormant feed" and got "tremendous results."

"Now there are new products coming out," he said. "I've used all of them. They all produce very good end results. Coming into the spring the root density and depth are far greater than the check points (areas not treated).

"More and more people are realizing these products can enhance and make a better turf than just relying on nitrogens. They're finding these are very qualitative materials. They do what they say. They will enhance root growth, maybe help in soil formation to some extent."

Dr. Hans Helmprecht, president of Chemical Consulting of Babylon, N.Y., agrees.

"Customers (using biostimulants) report better root systems and more vigorous growth of grasses such as bentgrass and general turf mixtures of bluegrass and fescue," he said. "In terms of consistency of results, a biostimulant, when used in a uniform approach, results in vigorous growth of young plants. Once roots are stimulated by a biostimulant, the rate of fertilizer usage and nutrient uptake increases."

Dr. Graeme Berlyn of the Yale University School of Forestry and Environmental Studies in New Haven, Conn., reported that in one experiment, perennial ryegrass treated with a biostimulant had twice the chlorophyll content of untreated grass over a seven-week period.

"Even two weeks after mowing, the treated grass was much larger than the untreated. The residual effect of the biostimulant was

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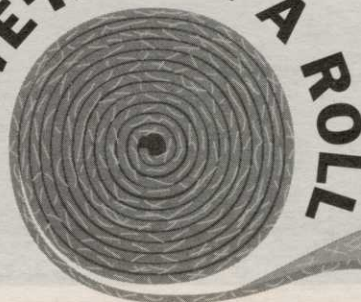
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# Biologicals: The proof is on your turfgrass

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tests on actual grass grown in the laboratory. Even if it survives this second round of lab tests, it must still test positively in the field.

"Don't buy anything that is only laboratory-tested in terms of a biological control. The proof is on your turf, not in the laboratory," Wilkinson said.

Since many of the biological controls tested on warm-season pythium have done little more than slow the growth of disease, Wilkinson predicts the first wave of

biologicals on the market will be mixed with chemical fungicides.

A successful biological control keeps 97 to 98 percent of the plant surface, according to researchers. What diseases potentially have biological controls that fit the bill?

Tests have shown many patch diseases, take-all and summer patch among them, to be successfully suppressed by certain bacteria. They are suppressed naturally, although it may take five to 10 years for the diseases to run their course.

In addition to natural suppres-

sion, the patch disease has two phases — a seedling blight phase and a mature declining phase. Biologicals work best on seeds rather than mature grass stands that are more resistant to change. Grass seeds coated with a certain bacteria have proven resistant to patch disease on grass-less soil containing patch fungi.

Tests have been less successful on mature turf where the biologic must be drenched into the ground and then journey to the plant root to attack the fungus. Many of the

bacteria don't survive the trek. Biological controls have been only half as successful on mature turf as grass-less soil.

Coating the disease-carrying fungi itself with a biological control and then placing both in the turf has yielded interesting results. Introducing the problem and the solution at the same time kills some of the plants, but also helps build resistance against future attacks, Wilkinson said.

Perhaps the biggest obstacle to full-scale development of biologicals

is the bacteria's ability to change, Wilkinson said. A researcher can give an agro-chemical company a bacteria that has proven effective in deterring disease. But if the company's method of growing the biologic is even slightly different than the researcher's, the control could change into something ineffective or even harmful to turf.

So what is the future of biological control?

"We'll probably never be able to rely completely on biologicals," Wilkinson concluded. "They're not designed to do the whole job.

"But with an integrated approach of biologicals and other combinations of chemical, managerial and fertilizer solutions, we'll probably be able to reduce the impact of pesticides into the system and gain very acceptable levels of control."

## Ohio Turfgrass Foundation gives out scholarships

CINCINNATI — OSU senior Robert King received the \$2,000 George Biddulph Memorial Scholarship from the Ohio Turfgrass Foundation at its annual show.

OSU junior Carolyn Fisk was given the \$1,000 Dick Duke Award.

The \$1,000 Glen Hudson Scholarship went to OSU junior Michael Fast. Fast worked most recently at Sycamore Hills Golf Club in Fort Wayne, Ind., and would like to become a superintendent.

Fast also received a \$1,000 Central Ohio District Golf Scholarship, as did fellow OSU students Dawson Thombs, Gary Posey and David Zahniser. The \$1,000 NorAm Award went to Thombs.

Recipients of \$1,000 OTF scholarships were ATI seniors Ron Swing and James Kracker as well as sophomore Monty Hale; Clark State University sophomores Mark Seitz and Joseph Wichie; and OSU seniors Zahniser and Donna Barlow along with junior Timothy Kelley.

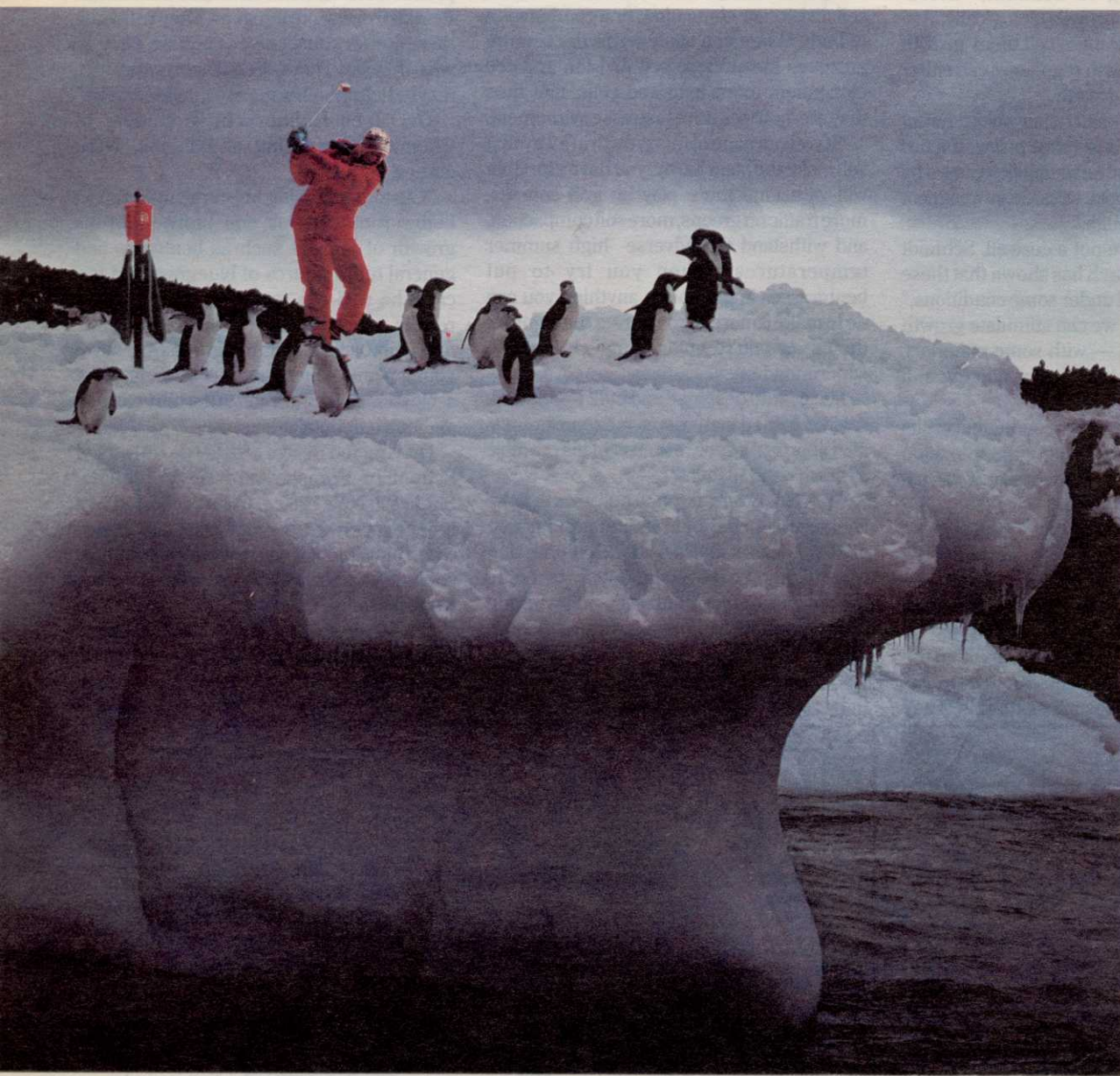
Kelley also received a \$1,000 scholarship from the Trans-Mississippi Golf Association.

## Michigan State adds specialist

Frank S. Rossi has been appointed to the new position of environmental specialist in turf at Michigan State University.

Rossi will be responsible for developing and teaching material concerning safe pesticide use, and concepts of integrated pest management. He also will develop and coordinate seminars dealing with environmental stewardship and turf management.

He holds bachelor's and master's degrees from the University of Rhode Island. He is finishing his Ph.D dissertation at Cornell University.



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## Biostimulants

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very impressive," Berlyn said.

He added that the material seems to work best in sandier soils because they are so permeable.

"The biostimulant promotes rapid uptake of nutrients and other beneficial compounds before they have a chance to leach out of the soil," he said.

Goatley found different responses to biostimulants between warm- and cool-season grasses.

He said warm-season varieties respond most under stress conditions. Cool-season grasses, he said, have a measurable response regardless of growing conditions.

Goatley recommended applications for warm-season grasses in early fall, "as turf begins to prepare for winter dormancy. In this situation, we see more enhanced root development late in the growing season, which could result in better carbohydrate storage and preparation of plants for winter. There is also evidence that biostimulants could enhance spring green-up as temperatures warm up and spring dormancy breaks."

"When a biostimulant ... has iron added to it, the biggest advantage would be an immediate color response that wouldn't be associated with a resulting flush of shoot growth. This could be very advantageous to turf managers in the spring when everyone is trying to get their grass to green up without promoting shoot growth at the expense of root growth.

"The lush growth of turf following an early-season nitrogen application is very susceptible to injury from late frosts."

Graves applies biostimulants in March, April and September.

And Lucas agreed they should be applied "from mid-fall to spring, when the roots are growing like crazy — March, April, May. If you've got these materials available, you create and enhance a root system that is tenfold better than your normal dormant feeding of milorganites or sulfur-coated ureas, which are somewhat of a norm these days."

He added current research has revealed that minute amounts of the sulfur-coated ureas are getting "somewhat of a flushing effect" in dormant feeding. "You're losing a very small percentage, but a percentage that could basically be used by the plant at a more optimum growing period," he said.

Virginia Tech's Schmidt added that biostimulant use might improve salt tolerance.

He said in one experiment he irrigated a turfgrass plot heavily with salt water trying to create an artificial drought.

"Salts hold back turf," Schmidt said, "but we're offsetting it. We're actually stimulating these roots with biostimulants whether we're irrigating with salt water or not."

Schmidt said he believes enzymes in biostimulants "are doing something to the plant so that it can take water up that is normally not available to it. Normally when the water gets that low, the plant wilts.

But we are still seeing it grow.

"We think it has something to do with the fatty acids and we're investigating that; but it's a story that will have to be told later."

Among the biostimulants on the market are Roots and ironRoots, made by Roots, Inc., 25 Science Park, New Haven, Conn. 06511, telephone 203-786-5295; Panacea, produced by Emerald Isle, Ltd., 2153 Newport Road, of Ann Arbor, Mich. 48103, telephone 313-662-2727; and Bovamura, made by PBI/Gordon Corp., 1217 W. 12th St., Kansas City, Mo. 64101, telephone 816-421-4070. *This story was prepared with assistance from the people at Roots, Inc., of New Haven, Conn.*

## Danger ahead without organization — Roberts

Legitimate biostimulant manufacturers must address ways to regulate the industry or see charlatans enter the marketplace, according to The Lawn Institute director.

"Research interest in biostimulants is keen and will continue, and will be competitive. But the bottom line is, ultimately, this industry is going to have to look at policing itself through regulation and controls, just like the seed and fertilizer and pesticide industries," said Dr. Eliot C. Roberts.

"The companies that really have legitimate products have to agree

among themselves on procedures they can follow for analytical purposes so they can label products and then advertise based on the label," he said.

Roberts said the fledgling biostimulant industry is not regulated, posing a threat to companies financing university research.

"A company forms and advertises its product. How do you know what's in that product?" Roberts asked. "There's not much information on the label that helps you know if it contains cytokinin, or gibberellin, or some other growth substance.

And there's not much that tells you how much there is of these.

"In time ... there will be a better means of identifying and describing contents, just as we now have procedures to identify pesticides, their active ingredient, amount, et cetera.

"In the long haul we are going to have to have state and federal agencies involved. Of course, any industry hates to be controlled. But there isn't enough (law) at the present time so that any company has to meet any criteria in the marketing process."



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