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Acknowledgements

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Editor's Note: Karen Delahaut is a graduate student at the University of Wisconsin-Madison where she is studying for a master's degree in IPM.

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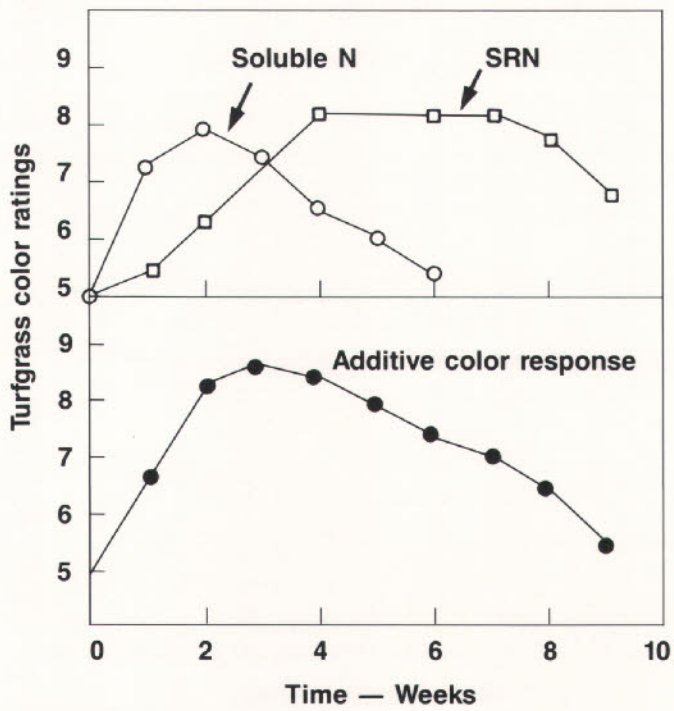
BENTGRASS RESPONSE TO SRN AND SRN - UREA COMBINATIONS

By David Guthery

Turf fertilizer manufacturers often blend a soluble N source with a slow release N (SRN) source in an attempt to provide uniform turfgrass response over an extended period of time. The inherent assumption is that the fast release soluble N provides quick response until such time that the SRN begins to release comparable amounts of N. Based on this assumption, one would expect a turfgrass color response such as that shown in the top of Figure 1.

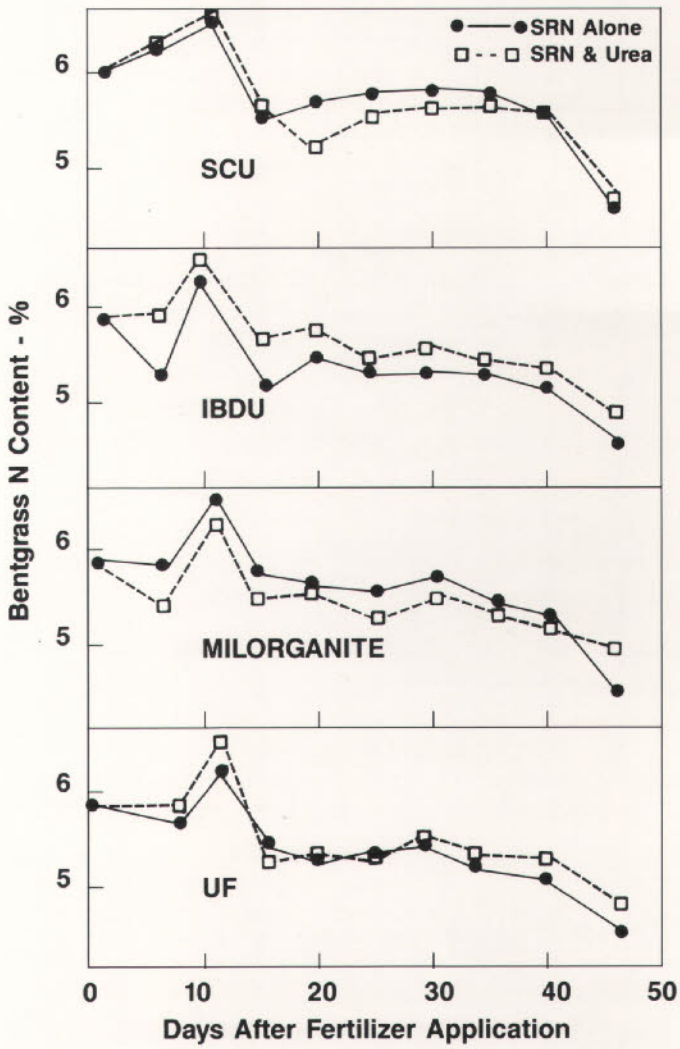
Is the assumption underlying fast release N-SRN combinations valid? From a theoretical perspective, perhaps not. As shown in the top of Figure 1, there is a considerable period of time during which the turfgrass is simultaneously receiving N from both the soluble and the SRN sources. Logic tells us that when this overlap occurs, responses of the turfgrass to the two N sources are additive. If so, then the expected turfgrass response pattern is that shown in the lower half of Figure 1.

Fig. 1
Presumed (top) and theoretical (bottom) color responses of turfgrass to soluble N-SRN combinations.



In comparing the two situations depicted in Figure 1, we find that the SRN alone provides turfgrass color ratings of 7 to 8 for a period of six weeks. When the color response is additive, the period of acceptable but not excessive color (ratings of 7 to 8) is only about 4½ weeks. This raises some serious questions regarding the advantages of blending SRN's with soluble N sources.

Fig. 2.
Nitrogen content of bentgrass fertilized with various SRN's and SRN-Urea combinations.



The purpose of the present study was to test the hypothesis that blending of SRN's with Urea does not improve turfgrass response to fertilizer N. The study was conducted in the greenhouse with Penncross creeping bentgrass growing in pots containing an 80:20 blend of sand and peat.

OBSERVATIONS

Over short periods of time, nitrogen content of turfgrass is a much more sensitive measure of response to fertilizer N than is color. Detectable color changes often do not arise for several days after major increases in turfgrass N content. It is for these reasons that turfgrass N content was chosen as the measure of bentgrass response to SRN's and SRN-Urea combinations applied at the constant rate of 1 lb. N/1000 ft.^{2}

As shown in Figure 2, there were no readily apparent advantages of blending SCU, IBDU, Milorganite or UF (Nitroform Blue Chip) with Urea such that equal amounts of N were provided by the SRN's and the Urea. With only minor exceptions, bentgrass tissue N concentration for each of the SRN and SRN-Urea combinations was essentially the same throughout the duration of the study. For reasons that are unknown, bentgrass N content was rather consistently less when Milorganite was combined with Urea than when Milorganite alone was applied.

The patterns of bentgrass tissue N content (Fig. 2) are not exactly those expected. Tissue N concentrations in all treatments declined sharply between 11 and 14 days after fertilizer application. There are two reasons for this. First is the fact that daytime temperatures in the greenhouse rose above 85°F. for a period of about ten days. This depressed top growth and led to a pythium infestation that was eventually brought under control with two applications of Koban.

TABLE 1.
INCREASES IN BENTGRASS CLIPPING WEIGHT RESULTING FROM APPLICATION OF SRN AND SRN+UREA

	Increase in Clipping Weight*	
SRN	SRN Alone	SRN+Urea
	g/pot	
SCU	0.44	0.40
IBDU	0.33	0.26
MILORGANITE	0.50	0.52
UF	0.19	0.45
Blsd(k=50) = 0.22 g		

*As compared to the control.

Except in the case of UF, applying the SRN's alone or in combination with Urea had no effect on bentgrass clipping weights (Table 1). Blending Urea with the UF significantly increased clipping weights. Without Urea, clipping weight increases for the UF treatment were significantly less than for the SCU and Milorganite treatments.

TABLE 2.
BENTGRASS RECOVERY OF N FROM SRN AND SRN+UREA

	Fertilizer N Recovery	
SRN	SRN Alone	SRN+Urea
	%	
SCU	37.1	31.1
IBDU	21.7	24.8
MILORGANITE	40.7	36.9
UF	17.8	33.5
Blsd(k=50) = 7.2%		

Fertilizer N recovery values (Table 2) paralleled increases in bentgrass clipping weights. For the SRN's applied alone, fertilizer recovery by the bentgrass over the 46 day growth period ranged from a low of 17.8% for UF to a high of 40.7% for Milorganite. Blending Urea with UF increased fertilizer N recovery to 33.5%, a level comparable to that of SCU and Milorganite.

Recovery of N from IBDU and the IBDU-Urea combinations was notably less than recovery of N from the Milorganite treatments (Table 2). This is believed to be due to the fact that microbial release of N from Milorganite is greatly favored by greenhouse growing conditions. This was evidenced by fungal micelial growth that completely covered the Milorganite treated pots between approximately 5 and 10 days after Milorganite application.

TABLE 3.
BENTGRASS COLOR RATINGS 46 DAYS AFTER FERTILIZER APPLICATION

	Color Rating*	
SRN	SRN Alone	SRN+Urea
SCU	7.9	7.7
IBDU	8.3	7.5
MILORGANITE	7.7	7.4
UF	7.6	7.3
Blsd(k=50) = 0.4		

*Scale 1 to 9 with 9 being very dark green.

Turfgrass color ratings at the end of the study averaged less for the SRN-Urea combinations than for the SRN only treatments (Table 3). This difference, however, was significant only in the case of IBDU.

Even more striking than color differences, per se, was the uniformity of bentgrass color at the end of the study. With exception of SCU, the bentgrass color was decidedly more uniform for the SRN than the SRN+Urea treatments (Table 4). This occurred despite the fact that the Urea and SRN fertilizers were individually applied as uniformly as possible.

TABLE 4.
UNIFORMITY OF BENTGRASS COLOR 46 DAYS AFTER FERTILIZER APPLICATION

	Color Uniformity*	
SRN	SRN Alone	SRN+Urea
SCU	6.7	7.2
IBDU	8.1	5.9
MILORGANITE	7.7	6.3
UF	8.5	6.3
Blsd(k=50) = 0.6		

*Scale 1 to 9 with 9 being completely uniform throughout the pot.

CONCLUSIONS

This study failed to provide any evidence that blending SRN's with a soluble N source provides longer term or more

uniform response of bentgrass to fertilizer N. Rather, once the Urea was depleted, turfgrass color intensity and color uniformity were generally better when the SRN's were applied alone.

Because these results were obtained in a short-term greenhouse study, they require field verification. It is clear, however, that such field studies are warranted.

Editor's Note: David Guthery is a 1989 graduate of the UW-Madison Turf and Grounds Management program. His interest in the turfgrass profession stems from several summers' work at the Racine Country Club. David is currently pursuing an M.S. degree in Ornamental Horticulture under the guidance of Dr. Ed Hasselkus.

SUPPORT THE NOER CENTER

Dates Set for Turf Management Short Course at UW-Madison

The University of Wisconsin College of Agricultural and Life Sciences will offer a one week turfgrass management short course the week of January 8-12, 1990. The course will meet every day during the week from 10 a.m. to 3 p.m., and the cost will be $50.00. Professor Robert Newman of the University Horticulture Department will be teaching the course. Other faculty in CALS will be featured as guest lecturers. Housing and parking will be available for the week on the Madison campus. A registration form is enclosed for your convenience. Please note that registration forms are due by December 15, 1989. A course description is listed below.

The turfgrass management short course is both an entry level course into turfgrass management and a review course for practicing turf professionals. The course deals with cool season turf grasses including both golf and home lawn situations. The unit covers selection of grasses for various sites and purpose and management practicing including:

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MORE TRIVIA

By Monroe S. Miller

1. Who is the only **non-player** in the Wisconsin Golf Hall of Fame?

2. How many four-term presidents has the WGCSA had? Name(s) and club(s), please.

3. Has a Wisconsin resident ever presided over the United States Golf Association? If so, who was this person? Where did he/she play golf?

4. Which golf course had the last sand greens in Wisconsin?

5. Which Wisconsin golf course has the largest (regulation; not practice and not double) green in the state? How big is it (square feet)?

ANSWERS

1. O.J. NOER

2. Two. John Bone of Blackhawk Country Club (1935-1938) and Les Verhaalen of Brynwood Country Club (1942-1945).

3. Yes. Mr. Lynford Lardner, Jr. of Milwaukee Country Club was USGA president for 1972 and 1973. Mr. Lardner also served the USGA as Counsel for 1964-1965, Executive Committee member for 1966, 1967 and 1968, Treasurer in 1969 and Vice President in 1970 and 1971. His law firm — Foley and Lardner — is well known in the state yet today.

4. Viking Skyline Golf Course of Strum, Wisconsin. Their sand greens were last played on June 8, 1985.

The farewell to the sand greens that day was given through a tournament that began on their nine-hole sand green golf course and ended on a new course built around the old one. The new course was built with grass greens.

5. The 5th on the Valley Course at Blackwolf Run. It's 15,560 square feet!

1990 GCSAA Conference and Show Will Be In Orlando

The Golf Course Superintendents Association of America will hold its 1990 International Golf Course Conference and Show in Orlando, Florida on February 19-26. It will be the 61st of these annual events hosted by the GCSAA. Nearly 500 companies will exhibit a tremendous selection of supplies, products, equipment and services. The show has grown so much that it is now one of the 150 largest annual American trade shows.

The week-long program will be held at the Orange County Convention and Civic Center. There will be lots of educational opportunities — 38 continuing education seminars, six concurrent educational sessions, a state government relations forum, meetings of allied associations (architects, sports turf managers, golf course builders, et.al.) and numerous symposia.

The annual meeting will be held during the week, and the GCSAA golf championship will be held the week previous. The opening session will be keynoted by Ken Blanchard, author of *The One Minute Manager* and an avid golfer.

Orlando would be a great place to take your family. It's a reasonable drive from Wisconsin. The Walt Disney World Resort complex offers the Magic Kingdom, The EPCOT Center, and the new Disney/MGM Studios theme park. Also close by is Sea World. Silver Springs is a short drive, and Busch Gardens isn't all that far either.

Usually by February we're starting to think about golf courses again. If you'd like to see one then, there are about 60 of them within a 30-mile radius of Orlando. Then there are the beaches of the Atlantic and the Gulf. Or how about a tour of the Kennedy Space Center?

* * * * *

Better make plans. If you aren't a member (or if you are!) and you'd like more information, call 1-800-472-7878.

EBDC Fungicides Making (Unwanted) Headlines

By Dr. Gayle L. Worf
Department of Plant Pathology
University of Wisconsin-Madison

Perhaps you have noticed recent articles about EBDC fungicides. Some have already appeared. Public activist groups are promising that a whole lot more will be said in the near future. I intend with this article to bring you up to speed about the EBDC's, and also ponder the potential effects it could have upon the turf industry.

EBDC's, short for ethylenebisditihiocarbamates, are the most important of all fungicide families. Now you may not have heard of EBDC's per se, but you have heard of Fore, maneb, zineb, Dithane M-45, Tersan LSR, Manzate, and quite a few more. They were developed in the late 1940's. It was predicted then that never would there be a more useful group of compounds discovered for fungicide use. That was proven to be the case, for they have a broad spectrum of activity, very safe on plants, quite economical to produce, and was formerly considered to be extremely safe to man and the environment (LD_{50} above 10,000). And no fungal resistance has ever been reported to develop with them.

We've used them some for turf protection, especially for Helminthosporium. Fore also carries one of the very few labels for algae control. But they've not enjoyed as much popularity on turf as on other crops, mainly because they're poor against dollar spot disease. They are protective — not systemic or eradicative in activity.

I'm sure you are acquainted with Alar, the now infamous growth regulator used on the apple crop to reduce fruit drop and enhance color. Perhaps you read in a recent Wall Street Journal article about how the Alar furor was orchestrated by a public relations firm involving CBS' 60 Minutes, Meryl Streep and some surreptitious half-truths and rumor spreading that became self-feeding and supporting. That same strategy was set to occur last month for the EBDC's only to be postponed at the last minute for a later release.

If the EBDC's are so safe, you might ask, then what's the concern about them?

Well, it's an old compound that must be retested and reregistered according to present day requirements. It's very similar to Alar. Long term animal feeding tests show carcinogenic, and possibly some neurologic and teratogenic activity. One of the campus toxicologists the other day suggested the extremely safe acute toxicity level is probably its downfall, that is, it's safe enough to feed high levels long enough to laboratory animals that some problem, real or imagined, can appear. EBDC's are very active both chemically and biologically. One of the reasons they have proven to be so effective is that as the products degrade, the secondary compounds also become good fungicides. Unfortunately, one of these products, called ethylenethiourea (ETU), has shown these chronic toxicity characteristics. And the real confrontation is with the ETU's.

ETU's are transitory. They breakdown readily, they must be ingested to have possible effect, there is no dermal absorption or problems except minor skin irritation, typical of many chemicals, that may affect the occasional sensitive individual. Extensive studies of manufacturing plant workers and applicators have turned up no evidence of problems. Breadbasket surveys report the virtual non-existence of the product on grocery shelves. Toxicologists are clearly divided on the extent of this problem and how to interpret the animal laboratory data. The failure of most of them to get excited about this concern says something to me about its relatively low hazard.

Most toxicologists have come to question the concept of "zero risk" for fungicides (and other pesticides), and instead support a "negligible risk" approach, now followed by the EPA for at least some of its decision-making process. After determining what the threshold is for inducing cancer in laboratory animals, that level is included in a mathematical model that calculates a "negligible risk" for you and me, e.g., less than one in a million chance that the allowable exposure could cause cancer.

The mathematics at present suggests risks with EBDC's are much higher, at about one in 10,000. But the formula assumes that all crops listed on the label are treated, at maximum rates and as often as legally permitted. Because these products have been around for so long, virtually every known crop is listed. Quite obviously, for anyone familiar with crop production, this is recognized to be a profound exaggeration of actual use.

It also assumes a very low presence of the chemical in our foods. In order to comply with the EPA guidelines, the industry announced in September a voluntary withdrawal of most food and feed crops from the label, so that the mathematics are believed to be acceptable. They also made some other changes, such as extending the period after last application before harvest. The EPA has publicly applauded the changes. Turf and ornamental use, by the way, remain on the label. Though they haven't said this will save the remaining uses, the agency seems to recognize the EBDC's need within a benefit/risk model. The EPA is also calling for a more intensive bread basket survey, with results due sometime next year to support earlier evidence of negligible residues in our food.

But activists are not satisfied with this process. They are condemning the EPA for its sluggishness and calling for an immediate and outright ban.

If they carry out their plans, 60 Minutes will once again parade their scientific charade. (Remember how they vilified Daconil three years ago because of alleged poisoning of a navy golfer? To my knowledge they never did confess their error after a virus was found to be the cause of his unfortunate illness and death.) The next day four simultaneous meetings are scheduled to follow, at which such eminent toxicologists as Meryl Streep (again) and Robert Redford are reportedly expected to lend their voices in calling for the ban.

"Use alternative chemicals," they say. But according to a recent National Research Council report, 90% of all alternative fungicides have similar car-

cinogenic potential! Virtually all of the fungicides introduced more than ten years ago can be faulted in a similar fashion, so it becomes a question of "divide and conquer", e.g., pick on and destroy them, one at a time. In other words, there really is no effective alternative that eliminates the risk as these people apparently would have it.

"So use biological control, resistant varieties and other forms of alternative agriculture." There is indeed some reason for hope and optimism here, but if they really believe this is possible right now, then as the song goes, "I've got some ocean-side property in Arizona" to sell you!

We have been counseled recently that, as educators, it is not our job to persuade people to any one position. We are to present facts, information and alternatives, and allow an enlightened public to make its own choice.

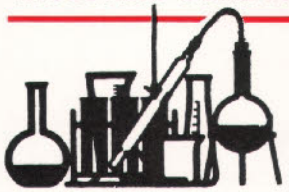
I agree with this philosophy. But it's obvious that many people have no ideas about disease, insect or other pest problems. They apparently fantasize a continuation of unlimited access to the abundant array of cheap, high quality, nutritious fresh fruits and vegetables that we see every day in our grocery stores without the use of some form of chemical protection. And they apparently don't fathom system of production, harvest, transportation and presentation of food as a miracle that this country enjoys, much to the envy of most of the rest of the world. It's been too many generations away from agriculture and the struggle to produce food for most of our society to understand this!

I see two big problems in educating the public: 1) they haven't the slightest appreciation for what benefit/risk is all about. "One in a million" talk is too much for them to fathom; and 2) they can't tell when they are being sold a bill of goods. The latter is understandable to some extent with some of the bureaucratic bungling that takes place sometimes. But in the main, isn't it better to trust the toxicologists who have access to **all** the facts, (EPA, FDA, National Academy of Sciences) rather than those who pick and choose according to their hidden agenda?

Golf courses will not operate in a vacuum over this. If the EBDC's fall, other chemicals will follow. Chlorothalonil (Daconil) and captan are already under review. I'm not sure of the current status of PCNB, but I believe it is, too. One strategy reportedly being considered by the EPA is to place a cap on the amount industry can sell of any one product — for all purposes. Chlorothalonil (Daconil) is really the only alternative for EBDC's in most instances. Can you imagine what could happen to its future availability for golf courses under this proposal?

One news release used the broad brush approach, claiming serious exposures are occurring to the public every day through the wide use of EBDC's on turf. What do they think we're doing — eating the grass!?! It doesn't seem to bother them that there's no evidence — or history — that suggests any problem has ever occurred when applied to grass. Anyway to achieve their goal of a pesticide-free world appears to be their motto.

Interestingly, I have been an advocate for some time of integrated pest management, pesticide applicator training, biological control, research and other approaches that can help to reduce our use and exposures to chemicals. It seems like a goal worth striving for, through a reasoned and orderly process. But experiences with Alar, 2,4-D, EBDC's — and you name it — can harden one's attitude, and force an overly defensive posture **for** chemicals. Is it possible that backlash may occur one of these times to all the hysteria and hype we're being exposed to? When does phobia become more dangerous than fungicides?



Questions From The Floor

By Dr. Wayne R. Kussow
Department of Soil Science
University of Wisconsin-Madison

Q. I recently looked over a soils map of Wisconsin and could not help notice that we have significant acreage of organic soils. Why is it we seem to have to go out of state for a peat to use as a top dressing component for our greens and tees? TREMPEALEAU COUNTY

A. Wisconsin does have significant acreage of organic soils — about 1.7 million acres. Despite that, you are going out of state for peat. There are several reasons for this.

1. Quality: A very high percentage of our organic soils are mucks rather than peats. Muck soil contains little or no plant fiber and have unacceptably high ash, silt and clay contents, low moisture holding capacities and relatively high bulk densities.

2. Variability in Composition: Peat bogs in Wisconsin are noted for having highly variable composition, both laterally and vertically. It is not at all uncommon to encounter layers or lenses of material that are totally unsuitable for golf course use.

3. Bog Size: Many of our bogs with good quality peat are too small to be considered for commercial exploitation. Unlike in places like Michigan, our bogs formed in pot holes resulting from glacial activity rather than along the margins of large ancient lakes.

4. Government Restrictions: Unless a bog is on privately owned land and is hydrologically isolated from nearby lakes or streams, chances of obtaining a permit for commercial exploitation of the bog are virtually zero.

Q. Not long ago I read about some changes in the way the Wisconsin State Soils Lab will report results of soil samples tested there. How will this change the way I interpret my fairway samples I just sent? WAUPACA COUNTY

A. The changes you read about pertain only to agronomic crops. Soil test interpretations and reporting procedures for turfgrass are not being changed at this time. My personal view is that evaluation of the turfgrass soil testing program is overdue. Clients often have a difficult time understanding the recommendations and we need to look at the recommendations themselves and ask how good they really are.

Q. Within the past six months I have listened to some very convincing information about products containing seaweed extracts and animal manure extract. Do you feel these and similar products have merit or are they merely golf course "snake oils"? WASHINGTON COUNTY

A. Compared to agriculture, the influx of products such as those mentioned into the turfgrass industry has just begun. Researchers from 12 north-central universities annually meet to share information and experiences on what they call "nonconventional soil additives". Their 1986 listing of such additives names 340 products being sold in the region and nearly 10 percent of these contain extracts of fish or animal waste, marine algae, kelp or seaweed.

The universities do not begin to have the resources to test all the nonconventional soil additives being marketed. Approximately 20% have been tested in field experiments. To date, none have been found to consistently live up to their claims.

When you are confronted with new and somewhat unusual products, I suggest you seek the answers to several questions.

1. **What are the ingredients?** Be wary of any products whose composition has to be kept shrouded in secrecy or non-sensical terms in order to "protect the interests of the manufacturer". Several years ago the sales representative of such a product showed up in the department requesting inclusion of the product in field trials. When pressured to reveal the composition of the product, the answer was "Only God knows and He ain't talking." That was the end of the conversation.

2. **Are the claims reasonable?** If they sound too good to be true, then most likely they are not. Beware of products such as one claiming to be a "Biocatalytic agent" that "digests and/or emulsifies the molecular shrouds which encapsulate elements locked in an otherwise dormant soil." As a general rule, I am very leery of any product whose mode of action is stimulation or modification of the microbial population of soils. Supplying an energy source will always stimulate microbial activity, but the effect is always short-lived and non-lasting.

For years soil microbiologists have sought without much success to introduce and maintain populations of new and beneficial microbes in soil. Failure to do so relates to a very fundamental ecological principal. The organisms in soil are there because of natural selection processes. Foreign organisms rarely have the competitive ability to survive among the native population of microbes already present.

A significant number of nonconventional products claim to contain algae that fix nitrogen from the atmosphere, excrete substances that improve soil structure, etc. Always keep in mind that algae are photosynthetic plants. They can only thrive in the presence of sunlight at the soil surface and in a continuously moist environment. As we all know, maintaining good quality turf in soil with excess moisture is a losing battle. Hence, the bottom line here is that algae and turfgrass are not ecologically compatible.

3. **Are the claims backed by research data from replicated, long-term experiments conducted by an independent research group?** Beware of testimonials or research conducted at a single location for a single growing season. Testimonials are generally given in good faith, but are normally based on site-specific, non-quantitative observations made without comparison to a suitable control area. To illustrate the problem with these types of testimonials and with short-term research or non-replicated observations let me cite