PESTS

By Monroe S. Miller

Answers to The Wisconsin Golf Course Quiz are on page 17.

The Center for Golf Course Management released a report in 1993 that took an in-depth look at golf course pests and pest controls in all regions of America, the amount of money spent and the products used.

It was an interesting study; if you haven't seen it you might want to borrow a copy of it from a GCSAA member.

The report was the basis for the questions in this issue's QUIZ.

1. Using the USGA region descriptions, which region in the U.S. spends the most (on the average or mean) on pesticides?

2. Which region spends the least?

3. Generally speaking, do older golf courses use more or less pesticide products than new courses?

4. This study identified and ranked the problem intensity of turfgrass weeds in the Great Lakes Region. Which were the five worst?

5. The same ranking was given to disease problems in the Great Lakes Region. Again, give the top five.

6. How does the ranking of the nation as a whole compare to that of the Great Lakes Region?

7. A casual perusal of the fungicide data indicates which fungicide is used most often on our country's golf courses. Which one do you think it is?

8. What are the Great Lakes Region golf courses' most serious insect problems (top five)?

9. Across the U.S., which insecticide receives the most use?

10. For contrast, name the five most serious insects on Florida golf courses.

MEET YOUR TALL FESCUE NEEDS WITH THE BEST

Lofts has three of the best-performing tall fescues available. Each one offers all the good looks and tough performance you need:

- Attractive, dark green color
- Fine-leafed texture
- Resistance to drought, disease, insects and traffic
- No thatch buildup
- Adaptability to sun or shade
- Less maintenance than bluegrasses or ryegrasses

New Rebel Jr.* even offers the added advantage of slower growth.

All of these varieties offer good looks, tough performance and low maintenance. When you need a fescue, choose one of the best!

Lofts Seed Inc.
World's largest marketer of turfgrass seed
Bound Brook, NJ 08805
(201) 356-8700 • (800) 526-3890
(800) 624-1474 (NJ)

CALL TOLL FREE
1-800-627-5495
Milwaukee (414) 276-0373
Chicago (312) 876-1172
Minneapolis (612) 522-7059
Indiana (219) 393-3553

Kellogg Inc.
Seeds and Supplies

Wondering About Winter

By Dr. Frank S. Rossi
Department of Horticulture
University of Wisconsin-Madison

The crisp fall mornings remind me of peaceful times on the golf course; play slows, expectations appear easily satisfied and our courses heal the wounds from a challenging season. Our distinguished editor begins his trek to view the brilliance of the northeastern deciduous forests and I can enjoy two weeks without a reminder of my Grass Roots deadline—HaHa! (I truly jest, as I heartily enjoy preparing my article, *because* it makes me wonder.)

The Golf Turf Symposium is upon us, and for a few days we will all be thinking winter, mindful of the devastation that many of our courses experienced, yet hopeful that answers await from our investment in education and research.

Now that I have experienced one complete season in Wisconsin and traveled the state, I can easily say that the winter poses our biggest challenges and greatest mysteries. It might have been a unique year.

Dr. Beard states in his text that "prolonged ice cover of more than 30 days rarely occurs in our country". Was it the prolonged ice cover? Several superintendents became so concerned with the ice that they proceeded onto the frozen tundra, armed with their core cultivators and removed it. Did they lose less grass?

What happens under the ice? Do toxic gases, such as cyanide, build up as a result of anaerobic conditions (lack of oxygen)? If so, I would think that these gases would not discriminate among species.

Why does annual bluegrass survive less time than bentgrass or Kentucky bluegrass?

Experiments with ice-encased forage grasses provide some insight. Researchers from Canada have shown ethanol does accumulate and most likely is responsible for inducing plant death. Interestingly, research concerned with flooding and grass growth under prolonged water (anaerobic conditions) has mostly been conducted with the warm season grasses. This work demonstrated that some of the grasses continued to grow even more under water up to 90 days.

This was suggested to be a result of ethylene (a precursor to ethanol) stimulation.

Conditions are different under low temperatures, but, the plants are still oxygen deprived as they are under ice and supposedly dormant. Dr. Beard conducted the foundation research in this area in 1968 and now 20 years later we realize we need more answers and Dr. Roberts from New Hampshire is leading the way with the turfgrasses. As I write this fall, I recall the *wet* fall of 1992. Research has shown plants that receive excessive moisture do not fully acclimate to low-temperature and are less "hardened off" than plants that experience slight moisture stress. We know moisture stress stimulates an increase in the hormone abscisic acid (ABA).

Plants that become low-temperature acclimated have high ABA levels and this has been correlated with being "hardened off" and dormant. Is it possible that our plants never properly acclimated as a result of excessive moisture?

Much of the hormonal research has been conducted with perennial fruit crops. ABA levels decline as the winter progresses until in early spring. Then temperatures rise, the hormone gibberellin is stimulated and deacclimation begins. If this process occurs during freeze-thaw cycles and the plant is not "hardened off", cells have elevated free water with a higher freezing temperature and cell membrane function, vital for cell growth, is disrupted. These elevated cellular water levels might be similar to what we call "crown hydration" and intimately involved with the deacclimation process.

Interestingly, Dr. Jiwan Palta, UW-Madison Professor of Horticulture, has shown that these cells injured by internal freezing can be recovered and growth resumed. This is an area that my research program is beginning to address.

How could a pondering of this subject exclude mention of our major winter-killed species, annual bluegrass? Is it possible to sustain annual bluegrass through the winter? Does the perennial biotype survive and the annual die as a rule?

Clearly, the majority of annual bluegrass plants do survive, but how? Is it related to reserve carbohydrate levels that reduces the amount of free water available in the cells? Is it adequate or luxury consumption of potassium (K) that also results in less free water available for freezing?

How do our fall fertility programs influence winter survival? We are conducting experiments investigating the effects of high amounts of K on reserve carbohydrate levels and will be monitoring these levels as well as crown moisture content.

Last year we tried to apply PGR's in the late fall to exploit their ability to increase carbohydrate reserves. The plants were all killed; therefore, we need to look closer at earlier applications, different rates and close monitoring of changes in carbohydrates and moisture during the winter for correlations.

Other factors worth mention include wind and traffic of frozen unprotected turf. Also, what is the role of low-temperature pathogens? Are winter injured plants more susceptible to the snow molds or do the snow molds predispose plants to more severe low-temperature kill? Dr. Meyer, Catherine Smejkal, and Steve Millett are actively investigating the snow molds for mercury alternatives, both culturally and biologically.

Certainly, we are excited about the prospects of reduced incidence of snow mold *and* it would be interesting to see if it results in less winter injury.

One thing is for sure when it comes to winter survival of the turfgrasses; many questions remain unanswered. The process of understanding this series of interactive stimuli and responses is continuing. Most likely there are several factors that ultimately occur to cause plant death.

My interest level in this area is extremely high and one of the reasons is a short visit I had this spring with Jim Hugget from Long Island Sod Farms. Jim and I looked out over his 100 acres that emerged from the spring with substantial winterkill. As we looked over the field that represents a severe economic loss, he asked what I thought was the problem.

"Well", I said, "could be this, could be that, could be the other thing, or might be all of them". He looked over at me with a sincere and genuine gaze and said, "we could sure use some answers to this problem".

I wish I had them, and it sure makes me wonder...

NATURAL ORGANIC

Milorganite®

FERTILIZER

America's Number One Natural Organic Fertilizer

- *Many of the finest golf courses in America are fertilized with Milorganite.*
- *Non-burning, cost-effective, turf fertilizer.*
- *90% Water Insoluble Nitrogen (W.I.N.), slow release nitrogen promotes vigorous growth.*
- *Rich in organic iron — 4% minimum guaranteed.*
- *Supplies humus and improves water holding capacity of soils.*

FREE LITERATURE

Mail in the coupon below for further information or call 414-225-3333

Please send me further information

☐ *Milorganite's Specialty Fertilizer Program*

☐ *Milorganite's Iron — Technical Bulletin*

NAME

ADDRESS

CITY STATE ZIP

( )

PHONE #

The ABC's of 1993

By Monroe S. Miller

One of the WGCSA hats that I wear is that of Chapter Historian. I try to execute those duties by doing a thorough job of reported the news and views of our Wisconsin group. My hope is that our successors, when wondering 40 years hence just what was going on in Wisconsin in the '80s and '90s will get their questions answered by reading the bound copies of *THE GRASS ROOTS* from these times.

In that spirit and with my Historian's hat on, I offer to you my ABCs of 1993.

Awful is the only word that could describe the weather of 1993 in most of the Badger State. Awful winter (ice, winter kill, too long), awful spring (arrived very late, too wet, too cold), awful summer (rain all the time, records set for rainfall, floods, clouds, just awful.)

Bottensek, Jeff. Congenial, capable, personalible course superintendent at Stevens Point Country Club. True practicer of the axiom "you only get as much out of an organization as you put in." The WTA and the WGCSA are far more prosperous because of his contributions given over many years. Jeff, by the way, received his 25-year plaque from the WGCSA in 1993.

Construction—golf course type—was nearly impossible this year due to terrible weather. It delayed opening of some of our new golf courses for a year.

Disgust and Disrespect, the two emotions we should express to the CMAA and the highly unprofessional article that appeared in Club Management magazine for July/August 1993.

Echo—the "new" fungicide that was available this year as a result of the patent expiration of chlorothalanil. Seems to be working just as well as the old reliable 2787 product.

Field Day '93 showed everybody that this event is headed for the stratosphere. Big crowd, fabulous facility, lots to see and do and study. Just great!

Green speed—was it talked about more this year or am I imagining things? My sense is that it is on the rise again—contrary to common sense and good agronomy. If you want to blame something for it, try those blessed rollers.

Harrison, as in Tom. As in 25-year member of the WGCSA. Few have done more for the turf industry than this guy. I may be the only one who really knows how much he cares and how much he has given. Hope you're here for another 25, T.H.

Irrigation—something we did little of in most areas of Wisconsin in 1993. At our course, it wasn't until the third week of July that we actually watered a full program at night!

Johnson, Rodney. Led the way in the WGCSA's entry into the GCSAA Platinum Tee Club by way of $10,000 collected in the pesticide signage program. Distinguished Service Award winner for him in 1993. It will be a tough year for him to top, but count on it—he'll try!

Karel, Larry. A quiet man we got to know better in 1993 because he received his 25-year plaque. It was my pleasure!

Lots of new golf courses built in America in 1993. Seems staggering, but the NGF says we needed and indeed built one a day this year. Amazing!

Mini-bulks came into quick and surprising use this year. It is a tremendous packaging concept and an environmental plus. Hopefully, next year we'll see more of this innovation.

Norton, WGCSA Director Pat. I prefer to think of him as GRASS ROOTS author Pat. His writing for us this year sparkled with humor and realism, wit and wisdom. I'm especially proud since he worked for me when he was an undergrad at the UW-Madison and was my assistant for a couple of

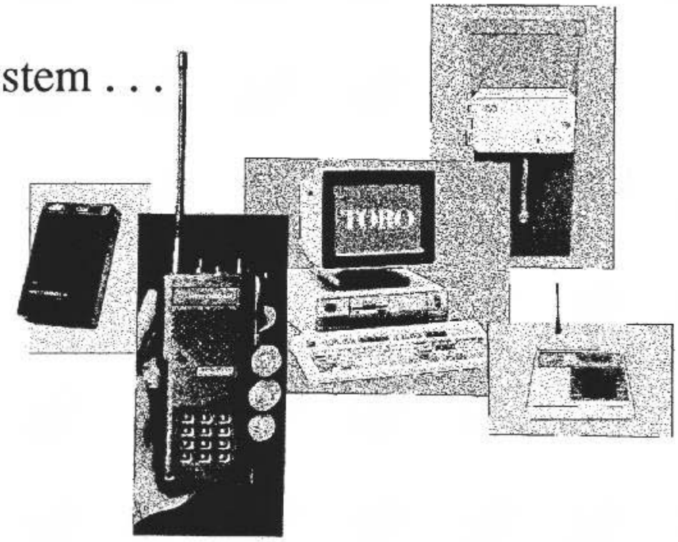
(Continued on page 17)

Attention Golf Superintendent:

Here's the Single Solution to Your Irrigation Control Problems . . .

The *OSMAC* Radio Paging Based System . . .

consisting of:



One or more RDR radio data receiver field units attached to your existing or new pedestals and connected to your existing or new field wires. The RDR field unit allows independent scheduling of each station. And since each RDR field unit can control up to 48 stations, it is possible to replace multiple controller sites with one RDR.

A standard IBM compatible computer for easy yet precise, flexible and powerful centralized control, using the OSMAC PC Timer Software.

The Central Control Station. A small, desk-top paging encoder that includes a built in radio frequency tranceiver to provide local-area signalling to the field satellites, radio paging, two-way communications or telephone interconnect.

One or more Portable Radios for remote control of valves, initiating pages, two-way communications, and telephone interconnect.

Optional pagers for signalling staff or other personnel.

An optional centralized rain gauge interface is available.

The Leaders of the Industry are Your Assurance of Quality

OSMAC is manufactured by Motorola. The radio frequencies are selected by Motorola. The components are serviced by Motorola. You get the expertise and experience of the world leader in high-technology radio communications. You get the assurance of a Malcolm Baldrige Quality Award winning company.

TORO MOTOROLA

OSMAC is distributed by The Toro Company. With Toro, you get the expertise and experience of the world leader in irrigation control systems. With Toro, you get the people who, for so long, have provided the irrigation industry the most effective and efficient products available. You get the assurance of all the people who are thoroughly committed to meeting your requirements.

OSMAC

is the Solution!

- Easy retrofit to existing systems or as new stand alone
- Affordable computerized central control
- Expandable RDR50 satellite from 8 to 48 stations
- Serviceable, modular design allows easy access and service
- 100% radio communications - no communications cable
- 2-way radio communications between base and portable radios
- Make and receive telephone calls from portable radio on site
- Remote control of system from portable radio
- Remote control of system from touch tone telephone
- Pagers (optional) may be added to the system
- Two year warrranty with "over the counter" board replacement
- Financing packages available
- Proven technology, reliable, high quality product

1-800-782-3300
414-786-3301
13400 Watertown Plank Rd.
Elm Grove, WI 53122

Reinders
Irrigation Supply Co.

1-414-788-0200
900 Randolph Dr.
Appleton, WI 54915

(Continued from page 15)
years. He (and many others) make me feel like a proud father!

Otto, Wayne. Who else? The sage of the WGCSA, a guy we are all glad to know. His reputation as a quality golf course superintendent extends way beyond our borders. He received his 25-year award this year. Why does it seem he's been with us longer than that?!

Pre-emption issue finally reached the legislature in 1993 and was settled. Thank goodness. Thanks to Russ Weisensel for bulldog determination on this matter.

Questions, lots of questions I've asked in *THE GRASS ROOTS* in 1993 (and I didn't get all that many answers, sad to say). But I'm going to keep asking.

Roberts, Bill. Stood by his convictions and, sadly, ended his GCSAA career by resigning from the board in 1993. Most of us wish it had ended better, for him. But our friendship and respect are steadfast.

Symposium reached a zenith this year. A great topic handled beautifully by a stable of qualified speakers at our "new" site.

Turnaround, a good word to describe what is happening with the WTA Winter Conference this year. Here's hoping you all attend.

Unprofessional, shamelessly unprofessional, which best describes the CMAA as a result of the article on pp.90—97 in the July/August 1993 issue of their official publication *CLUB MANAGEMENT*. These guys aren't professionals; they are amateurs all the way.

Victory for *THE GRASS ROOTS* at the GCSAA Conference in Anaheim where our journal was peer judged and awarded "Best Editorial Content" in the Chapter Editors' contest.

Worzella, Bruce. He wrapped up two years as WGCSA president in 1993. Lost too often is the remarkable fact that he was on the board or held an office for nine consecutive years. We'll miss this capable guy. Job well done!

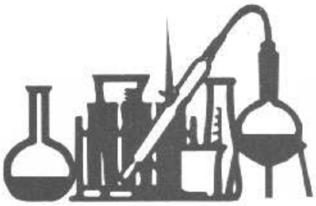
X (ex)cellsior mats. Do they offer some help in grass survival of Wisconsin winters? Experiences of '92/'93 indicate a "maybe".

Yellow tufts—many Wisconsin golf courses had more of it in 1993 than ever before. It's irritating stuff.

Zinnias—a lousy year for this normally colorful and easy to grow and trouble-free annual. Full sun plant, you know. We only had sun 50% of the time this summer, you know. Powdery milder, few blossoms, you know. Oh well, there's next year.

ANSWERS to The Wisconsin Golf Course Quiz on page 11.

1. Mid-Atlantic.
2. Western.
3. Less
4. In order, dandelion, white clover, crabgrass, broadleaf plantain and clover.
5. In order, dollar spot, brown patch, pink snow mold, gray snow mold and pythium.
6. In order, dollar spot, brown patch, pythium, helminthosporium and pink snow mold.
7. Daconil 2787.
8. In order, cutworms, white grubs, black turfgrass beetle grubs, sod webworms and Japanese beetle grubs.
9. Dursban.
10. In order, mole crickets, fire ants, nematodes, sod webworms and armyworms.



Soil Acidification

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

Soil acidification, the process whereby soil pH is reduced, has taken on renewed interest in Wisconsin. The reason has nothing to do with matters such as nutrient availability or *Poa annua* control. Rather, the concern is with the growing incidence of take- all patch. The single most effective means for controlling the disease is to reduce soil pH.

The incidence of take-all patch increases substantially when the pH of soil immediately surrounding turfgrass roots increases above 5.5. When the predominant form of nitrogen being taken up by the grass is in the form of ammonium ions, the pH of soil surrounding the roots is typically about one-half pH unit lower than the bulk of the soil. Thus, what we're really concerned with are soil pH values above 6.0. This is the ideal goal when using soil pH modification as a control measure for take-all patch. In reality, any significant reduction in soil pH values above about 6.5 will aid in control of the disease.

Soil acidification requires two things. First, we have to introduce hydrogen ions or substances from which the ions can be produced through microbial action. Secondly, we need to reduce the levels of the dominant exchangeable cations, calcium and magnesium, by way of leaching. The presence of divalent anions such as sulfate hastens the leaching process.

Although one could actually use acid to reduce soil pH, from the standpoint of safety and cost, the most practical soil acidifiers are elemental sulfur, ammonium sulfate fertilizer and materials such as ammonium thiosulfate. Among these, elemental sulfur has been most widely used.

The acidifying action of elemental sulfur is totally dependent on microbial oxidation of the sulfur to sulfate ions and, in the process, release of hydrogen ions. Herein lies some of the limitations in the use of sulfur as an acidifying agent. For one, the soil needs to be well populated with a rather select group of microorganisms. This is not always the case. Even under ideal environmental conditions for microbial activity, the rate at which sulfur is oxidized varies greatly from one soil to another, presumably because of variation in the populations of sulfur oxidizing organisms that are present. The other issue is that of the conditions required for rapid microbial oxidation of sulfur. To function well, soil microorganisms require a continuously moist environment and temperatures in the range of 75˚F to 90˚F. When elemental sulfur is applied to established turf, these conditions are often not met, at least not on a continuous basis. Even when incorporated into soil, complete oxidation of sulfur may require six months or more. On turf, this period of time is often even greater. The bottom line here is that the rate of soil acidification by elemental sulfur applied on turf often varies considerably from one location to another and can be painfully slow. Another factor one has to deal with when acidifying soil with surface applications of sulfur is the time required to achieve acidification to some depth in the soil. It may take years to significantly alter soil pH to a depth of even two inches. In the meantime, the soil within a fraction of an inch of the surface may be at a pH of 4.0 or less for a long period of time. This why monitoring the change in soil pH change with sulfur requires sampling the soil in one-half inch increments or less.

On a pound-for-pound basis, elemental sulfur has considerably more acidifying capacity than does ammonium sulfate fertilizer. But the advantages of using ammonium sulfate are numerous. The reaction time is much shorter, there is much less soil-to-soil variabilty in terms of the microbial action required, and the acidifying action extends more rapidly into the soil.

This brings us to the question of how much sulfur or ammonium sulfate is required to bring about a desired reduction in soil pH. There are ways of estimating the quantities that may be required, but they are rather crude. I much prefer a monitor as you go approach. There are limits as to how much of either of these materials you can or want to apply at any one time and the rates are far less that the total amounts required. In the case of sulfur, the recommendation is 0.5 lb sulfur/M in a single application on putting greens and tees at intervals of at least two weeks and no more than 10 lb total/season. The rate per application on fairways can be as high as 5 lb/M, providing the applications are made in the cooler parts of the season. Sulfur applications should be followed by sufficient irrigation to remove all sulfur from the turfgrass leaf surfaces. At least once a year soil samples need be taken at one-half inch soil depth increments and pH measured to show the progress of the acidification process.

In order to have a reasonable rate of microbial oxidation, sulfur must be in the form of very fine particles. You can find on the market sulfur that is so finely divided that its possible to form a suspension with the material and apply it with a sprayer. This is perhaps the most convenient method of application.

Ammonium sulfate application rates and frequency of application are governed by your N fertilization program. The acidifying action of ammonium sulfate is determined by the amount applied and not the frequency of application. Merely substituting ammonium sulfate once or twice a season into your normal fertilization program is not a very effective way of acidifying soil. In using ammonium sulfate, you have to keep in mind that this fertilizer has moderate to high burn potential. Application should only be to dry turf and irrigation shortly after application is essential.

For all of you that live in the "hard water" region of the state, soil acidification is virtually an unending process. Even after you've achieved the soil pH you want, you're going to find it necessary to either apply an acidifying agent one or twice annually or repeat the process every few years.

There are some of you for which soil acidification is impractical. If your soil pH is at or above 8.3, your soil likely contains calcium carbonate. To reduce the pH of such soils, the carbonate must first be destroyed by reaction with hydrogen ions. To illustrate what this means, let me use the example of a green constructed with sand containing 2% calcium carbonate. In order to acidify this green to 2-inch depth, you would first have to apply a minimum of 93 lb sulfur/M **before** the pH would begin to decline throughout this 2-inch depth. At 0.5 lb sulfur per application, that's 186 applications!