

Scare Tactics On Pesticides Mislead The Public

By C. Everett Koop

Editor's Note: Last fall, while Cheryl and I were on our annual autumn vacation in New England, we stayed one night at the Hanover Inn, located on the campus of Dartmouth College in Hanover, New Hampshire. Close friends had made arrangements for us to eat breakfast in the dining room the next morning. It was quite a treat. We went down the next morning, early, and there were guests only at one other table. I took a long look and said to Cheryl, "I recognize that gentleman at the other table." After a minute, I realized it was Dr. C. Everett Koop. Dr. Koop was surgeon general of the United States from 1981 to 1989. He probably has done more than any other single person to help millions of Americans break the smoking habit.

The thoughtful article written by Dr. Koop first appeared in the *Progressive Farmer* in January of 1992, and it deals with pesticides and our excellent food supply. But the principles he speaks to can carry over to our business. It is worthwhile reading and it appears here with permission.

Back in my former incarnation as a surgeon, I was distressed when cyclamates were taken out of soft drinks. I had found Fresca very much to my liking.

The reason these substances were banned was because of experiments on rodents. The scientists found that high doses of cyclamates cause cancer in rats.

Translating those scientific studies to someone my size, I would have had to drink four bathtubs full of Fresca daily for about eight years to have an equivalent dosage.

Those who read murder mysteries know that with poison, it is the dose that counts. With coffee, it takes 96 cups to deliver a toxic dose of caffeine, and with turkey, 3.8 tons to deliver a toxic dose of malonaldehyde.

In the days of my early surgical career, the state of the art in detecting the concentration of toxins was beginning to approach a sensitivity of one part per million. Anything below that was considered to be zero residue.

In 1965, we were able to test for parts per billion; by 1975, parts per trillion. And now, we are approaching the time when we will be able to test for parts per quadrillion.

Even parts per million is miniscule measurement. Converted to time, it is one second per two years. Parts per billion converts to one second every 32 years. And parts per trillion comes out in time to a sensitivity of one second every 32,000 years.

Americans are concerned because they are confused. They are confused because no one sorts out for them various components of what has become the food safety issue.

The public does not have a very good grasp of the relationship between the dose of a toxic substance and its risk in human beings. Their information comes from those who revel in using scare tactics instead of science to warn the public about dangers in the food supply.

These scare tactics lead us down the wrong path. We end up creating concern where it isn't necessary and ignoring concerns that are real.

For instance, some people think that all manmade substances, such as pesticides, should be removed from

our food supply, and that everything occurring in nature is beneficial.

To sell nothing except foods untreated by pesticides would not only leave storekeepers with rotting food but would also fail to protect the consumer against molds that in high enough concentration can be lethal.

People who are so worried about pesticides fail to realize that the cancer rates have dropped over the past 40 years. Stomach cancer has dropped more than 75 percent, while rectal cancer has dropped more than 65 percent.

In the food supply—as in all other public health questions—we need better understanding of the difference between risk and hypothetical risk.

There is risk in almost everything we do, so we need to concentrate on the differences. The chances of your being killed in a motor vehicle (1 in 6,000) are much more real than are threats from pesticides. Yet that doesn't keep us off the road, either as passengers or as pedestrians.

There is another concern I have. By focusing on a hypothetical risk, like that from pesticides, not only do people find their anxiety levels elevated, but by focusing on a straw man, they also feel they are doing something to improve their health.

In doing so, they often neglect all the other things that they could be doing more readily, more legitimately and with greater effect, such as paying attention to smoking, alcohol, exercise, balanced diet and so on.

Our food is not only the safest but also the most abundant in the world. Science and good sense will eventually prevail, but not until the pesticide terrorists have had another lick or two. 🍷

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Who Is She, Anyway?

by Lori Ward Bocher

Unlike Monroe Miller, Pat Norton and Bruce Worzella, I'm not a golf course superintendent. Unlike Chuck Koval, Wayne Kussow and Tom Salaz, I don't even play golf. So why am I writing a regular column in *THE GRASS ROOTS*?

I guess it's because I have a few things in common with His Honor the Editor, Monroe Miller.

Like Monroe, I grew up on a farm. My dad was a fourth generation dairyman on a farm near Fort Atkinson, Wis. I totally loved my childhood, a childhood that helped me cultivate a root-deep understanding of what it takes to nurture a crop in the same soil year after year and to depend on Mother Nature for favorable weather conditions.

If you could use only one word to describe Monroe, it would have to be "opinionated." Well, I'll never admit to being as opinionated a Monroe. That's impossible. But I do remember telling off my high school guidance counselor early in my senior year. You see, when I expressed an interest in choosing journalism as my college major, he suggested that I take advantage of my farm background and major in agricultural journalism. "No!" I adamantly stated. "I don't want to write about cows the rest of my life. Those words would come back to haunt me."

Like Monroe, there was never any doubt in my mind as to where I would attend college—the University of Wisconsin-Madison. Maybe that's because both of my parents graduated from the UW, just as Monroe's father did. In fact, our fathers even knew each other while in school.

I was a student a decade later than Monroe, from 1973-1977. A funny thing happened in my junior year. After a summer internship at a daily newspaper, I began to realize that I really didn't like the daily grind of straight news reporting. I began to realize that agriculture really *was* my first love, that maybe it *wouldn't* be so bad to write about cows the rest of my life.



Lori Bocher, husband Luke, daughter Sarah and son Andrew.

Upon graduation, I went to work for a publishing company that specialized in magazines, newsletters and direct mail pieces for agricultural companies. In less than two years I visited more than 200 farms and ranches in 33 states gathering information for testimonial articles.

Unlike Monroe, I did not become a "lifer" at my first place of employment. Although I could talk "farmer language" and write about farms, I felt that my basic agricultural knowledge and experience was shallow. So I returned to my father's farm to gain some first-hand experience. I was no longer writing about cows; I was milking them, feeding them, cleaning up after them, doctoring them and delivering their calves. After a year on the farm, my quest for more knowledge drew me back to the UW. This time I majored in Dairy Science. Now I was *studying* about cows. My second time around at the UW took me to the college of Agriculture and Life Sciences. Like Monroe, I gained a deep and lasting love and respect for the college and many of its professors.

While working on my Dairy Science degree, I began to do some part-time writing for a Fort Atkinson-based publication called *Hoard's Dairyman*, the national dairy farm magazine. Four months before I was to graduate, they

offered me a full-time position as an associate editor. I began my new career in January of 1982—a career that combined my skill for writing with my knowledge of cows and agriculture. And I spent the next seven years of my life—you guessed it—writing about cows!

Like Monroe, I developed a love for editing, writing and creating a publication during my years at *Hoard's Dairyman*. But my love for a young minister who worked a block down the street proved to be stronger. So when Luke asked me to marry him in 1988, I accepted even though I knew he would be leaving his church in Fort Atkinson shortly before the wedding.

Luke's new church was in New London, 20 miles northwest of Appleton. Because we were both in our early 30's when we married, we knew we wouldn't be waiting too long to start a family. So I decided to become a freelance writer instead of looking for a full-time job. That way, I'd have flexible working hours and could work as much, or as little, as I wanted.

Then, in 1989, it finally happened: I had the privilege of meeting Monroe Miller. He was elected to his first term on the board of directors for WALSAA — Wisconsin Agricultural and Life Sciences Alumni Association. It was our mutual love for the UW College of Agriculture that brought us together.

At the same time, I was asked to supply feature articles from Wisconsin for a trade magazine called *TURF*. This was my first venture into the turf-grass arena. I was a little apprehensive because I'd never written about turf before. But I figured my agricultural education would help.

However, I didn't know any people in the turf industry—except Monroe. So I began to seek his advice on *TURF* articles. As I jogged Monroe's memory about people in Wisconsin's turf industry, the wheels in his head began to turn. He had always wanted to include a "Personality Profile" in *THE GRASS ROOTS*, but he didn't know who would write it. Now he knew. And that is how I began to write a regular column in your newsletter.

I'll admit, before I started writing for *TURF* and *THE GRASS ROOTS*, I'd only been on golf courses in the dead of winter with cross country skis attached to my feet. But I wasn't a total stranger to turf.

Many of my childhood hours were spent riding or pushing a lawn mower. I was the chief mower for our various farm yards. I also mowed a 1.5-acre cemetery for three years. I always enjoyed hopping on the lawn mower; it gave me time to meditate, solve problems and daydream.

In my first job out of college, I did a lot of traveling in a small company airplane. Since we usually were going to rural farming areas, we landed on a lot of grass strips. "I bet you hate it when we make you land on these small grass runways," I said to the pilot one day. "Actually, I'd take a good grass strip over a paved runway any day," he replied. "The turf absorbs the shock of the landing. It's easier on the plane." I gained a little respect for turf with that knowledge.

I gained even more respect for grass after walking on the artificial turf at the UW's Camp Randall on a hot August day. I couldn't believe the amount of heat radiating from that field; **real** grass has a cooling effect. I'd also seen Camp Randall on rainy days when the turf was as wet as a sponge; **real** turf, with **real** soil, would absorb so much more rain and drain it away.

And while working at *Hoard's Dairyman*, I did some articles on an intensive form of grass management called "rotational grazing." You see, cows aren't very competent lawn mowers. If put out on one large pasture, they'll keep going back to where they've already grazed because the grass is young, tender and full of protein. The rest of the pasture is wasted as the grass matures and the cows refuse to eat it. But if you divide the pasture into several small paddocks, and move the cows every day or so, they'll make efficient use of all the pasture and always be eating the most nutritious kind of grass. I just couldn't resist saying something about cows!

Even though cows are my first love, I've really enjoyed writing for the turf industry because it's given me a new challenge. Learning your lingo has been especially interesting. The word "turfgrass" doesn't even appear in *Webster's Dictionary*. Neither do "aerify" and its derivatives, "aerification" and "aerifier." My computer spell-check has had fun with those words!

Then there's "verticut." The first time I heard this word I was completely lost. How can you make a vertical cut on a lawn? So I swallowed my pride and asked for an explanation.

At least I knew what "topdressing" meant, or so I thought. I took it to mean scattering fertilizer on top of grass. Wrong. When I first heard a superintendent tell me that he topdressed with 80 percent sand and 20 percent peat, I was dumbfounded. The last I had heard, sand isn't a fertilizer. So I quietly wrote his answer in my notes and waited until I could consult with Monroe.

Then there's my favorite, "bentgrass." Before writing for *TURF* I had never heard of it. Then, six months later, I spent a day and a half learning all about it at the 1990 Wisconsin Golf Turf Symposium, "Bentgrasses: New, Old, Right or Wrong?" I had never imagined that a whole symposium could be structured around one grass variety.

Blackwolf Run Golf Course and University Ridge are the two golf courses that Monroe has steered me to so far for *TURF* articles. Many thanks to Marc Davison and Jeff Parks for giving me complete tours of their gorgeous and meticulous courses.

I also had a chance to meet several superintendents when I covered the 1990 Wisconsin Golf Turf Symposium for *TURF*. And later I had detailed discussions with five of them who agreed to participate in a round table discussion for *TURF*. A special thank-you to Dan Barrett, Roger Bell, Rodney Johnson, Pat Norton and Randy Smith. Their comments gave me a deeper appreciation of what it takes to be a golf course superintendent.

Then there are all of the people I've met while doing "Personality Profile" interviews. Most of the interviews were done over the telephone, but I always felt that I was able to get to know the person quite well after an hour or so of conversation. Going over the list is like reading a "Who's Who" in Wisconsin turf and golf: Lee Bruce, Eugene Haas, Egon Herrmann, Lois Latham,

Leo Walsh, Christine Faulks, Gayle Wolf, Russ Weisensel, Bob Newman, Bill Roberts, Jerry O'Donnell, Jim Love, Curtis Larson, Ed Devinger, John Mortimer, Bob Lohmann.

Know what else I've learned? First, people in the turf industry have a tremendous amount of enthusiasm for their careers and a great love for the industry. I didn't think anyone could be as excited about his job as Monroe is, but I was wrong!

Second, turf people are very flattered when I call to get their story. Not many people pay much attention to grass or how it grows, so the interviewees are very excited to tell about their contribution to the turf industry.

I was very excited, too, when Monroe asked me to write about myself for *THE GRASS ROOTS*. Journalists don't get to tell their own story very often; we're always writing about someone or something else.

As confusing and challenging as it has been to write about your industry, nothing was as confusing or challenging as when I became a mother—to a 2-pound, 2-month premature daughter on November 5, 1990. Suddenly, I had another lingo to learn—that of doctors, nurses, geneticists and therapists.

Being mother to a special needs child (mild cerebral palsy and a rare genetic condition) takes extra time, effort and emotional stamina. But Sarah is the most precious thing that every happened to me. She adds joy and delight to every day. And on January 26th she was joined by an equally special brother named Andrew. Luckily, he came into the world at a normal weight and time and had no medical problems.

With the birth of each child I've had less and less time to write. But I hope to be able to feature more "personalities" in upcoming issues of *THE GRASS ROOTS*. ♣



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NEW READS

(All with a Wisconsin Connection!)

By Monroe S. Miller

The book I have been waiting for hit the shelves at the University Bookstore on April 10th. Within minutes of seeing it, I had purchased my copy.

Its appearance was long awaited by many of us here in Wisconsin because so many have met the authors. Both have been speakers at the Wisconsin Golf Turf Symposium, and a number of us have attended a GCSAA seminar instructed by one of the authors.

I am speaking, of course, of Geoffrey Cornish and Ron Whitten and their new book *"THE ARCHITECTS OF GOLF"*.

The book, successor to their eminently successful first effort—*"THE GOLF COURSE"*—is a monumental work. I thought the same about the first book; it was packed with information never before gathered in one

place. The authors used 319 pages to share this lode of golf information they had collected.

The new book is almost exactly twice the size—648 pages. There is so much material that the printer used a lighter weight paper for the new book. Had the same paper used in *"THE GOLF COURSE"* been used in *"THE ARCHITECTS"*, it would have been difficult if not unmanageable to comfortably read.

The new book is a little less showy—no color photos, for example—but more readable, in my opinion. The new book has a larger type with fewer characters per inch in the narrative sections. It is lots more readable with this type (which may, as I think about it, be a major reflection of my age).

Take this advice: don't sit down with *"THE ARCHITECTS"* unless you have time to read the first couple of hundred pages. I found it to be one of those books I literally couldn't put down.

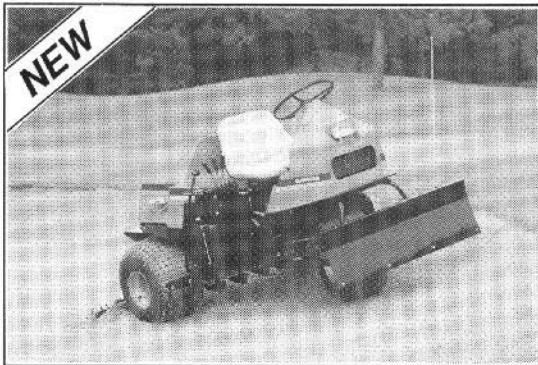
Frankly, even though *"THE GOLF COURSE"* has an excellent collection of photos, I like those in *"THE ARCHITECTS"* better. They are nicely integrated into the copy and accent the narrative perfectly.

Best pictures for me were of Old Tom Morris (p. 10), A.W. Tillinghast (p. 59), early construction equipment (p. 65), and the John Deere tractor with R.B. Harris aboard (p. 129).

The authors, writing in the preface, draw an analogy between this book and its predecessor, and golf courses. With golf courses and their natural aging processes, one can choose from three options—reconstruct, restore or renovate.

They felt the same about *"THE GOLF COURSE"*. It first appeared in 1981. Change has taken place; details have emerged; new information has come to light. What to do—recon-

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Choosing a gift for birthdays and Christmas this year will be a lot easier now. Or, if you are looking to treat yourself to something special, get a copy of *"THE ARCHITECTS OF GOLF"*. It's a great book and deserves a place in your library.

Chad Eberhardt's articles in *THE SPORTING GREEN* feature of *THE GRASS ROOTS* has garnered lots of comment, both from our Wisconsin members and those from beyond our borders. In fact, as Rod Johnson noted recently, Chad's articles have been reprinted in other chapter newsletters more than any other of our columns in the past year.

Eberhardt hit a responsive chord for a lot of golf course superintendents and students. Derek Van Damme's close examination as to the reasons why, as written in the last issue of *THE GRASS ROOTS*, merits rereading.

You can imagine why, then, I thought Chad had authored a new book when I saw a copy of *"THE CORPORATE COACH: How to Build a Team of Loyal Customers and Happy Employees"*. A close look showed it was written by Jim Miller—no relation.

There is a Wisconsin connection in this book, too. Miller is a Milwaukee native who graduated from Marquette High School and attended Marquette University (although he never graduated from MU). He also got his start in business in Wisconsin.

He bought a bankrupt Texas office supply business in 1967 and since then has lived there. In the 25 years he has owned the company, it has grown from 3 employees to 600 and from \$50,000 in sales to over \$150 million.

In his book, Miller credits his employees and his management style. He treats workers like family, encouraging camaraderie and sense of common mission. Put another way, Miller (and Eberhardt) views that group as his team.

He espouses a philosophy of listening to customers (players for us) and working to meet their expectations for success.

At his company, Miller has a teamwork style to both training and working. Teams compete with each other on quality issues, productivity goals and general welfare of everyone in the business.

Like Eberhardt, his goal is enthusiasm and a positive working atmosphere. He keeps goals and competition at reasonable levels to prevent an excessive amount of job pressure.

His business, like ours, is mainly a service business where a feeling of importance among employees is often transferred to customers (golfers, for us).

The book is organized logically and is easy to pick up, read a bit and set down again. I like the "Coach's Checklist" at the end of chapters.

Some fairly impressive people have endorsed the book. From our own state come kudos from Ray Nitschke, Bart Starr, Merle Harmon and Lindy Infante. The CEO from Northwestern Life Mutual Insurance Company liked the book. So did Roger Staubach.

And who wouldn't be impressed by the fact that any and all profits are going to charity?

So, for any who doubted or questioned whether Eberhardt's system works (it does), here is evidence that others share Chad's teamwork philosophy. The ideas work for a crew of a few to a staff of thousands.

So head to your favorite bookstore and get a copy of this book, Coach. It should be in your professional library.

It hardly seems almost a quarter of a century has gone by since *"TURFGRASS SCIENCE"* was first available. It was a source of a tremendous amount of information and some valuable references.

But as with other sciences, those in turfgrass have grown enormously in the past two decades. Some of the information in that book is outdated. It seemed time for a new edition.

A new book, simply and appropriately titled *"TURFGRASS"*, has been available for almost a year now. Like its predecessor, it also is an Agronomy Monograph, published by the American Society of Agronomy, Soil Science Society of America and the Crop Science Society of America, located in Madison.

The book is not just an update of the 1969 book. It offers a lot of new information on old topics, and it offers up a lot of new topics. It's divided into five sections: The Turfgrass Industry, Turfgrass Physiology, Soils and Water, Management, and Research Methods.

Those who have attended recent GCSAA conferences have likely heard lectures from the book's co-authors—Dr. D.V. Waddington, Dr. R.N. Carrow, and Dr. R. C. Shearman.

Even more likely is that we've all heard lectures from one of the chapter authors, a list which reads (as it should) like a "Who's Who" in the turfgrass sciences.

"TURFGRASS" isn't entertaining, in the sense that the two previous books reviewed here are. But it is a premier reference book, running 800 pages, that you absolutely should have immediate access to; it should be on a shelf in your professional library.

The interesting thing about all three volumes reviewed here is that each has a Wisconsin connection. That tells one, especially if you are a WGCSA member, something. Lots, even. 🙌

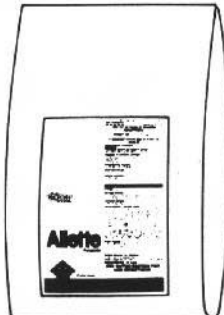

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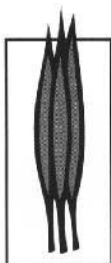
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“You’re Gonna Like This Guy”

UW-Madison Hires Scott Mackintosh to Manage the Noer Facility

By Dr. Frank S. Rossi

It is with great pleasure and excitement that I introduce to you the new Station Manager of the O.J. Noer Turfgrass Research and Education Facility, Scott Mackintosh. Scott received the offer as a result of a rigorous national search and interview process conducted by the UW-Turfgrass Group (Dr.'s Meyer, Koval, Kussow, & Rossi) with Dr. Marsh Finner and Tom Harrison presiding. As I write, Scott is completing his M.S. in Turfgrass Science at the University of Massachusetts under the guidance of Dr. Richard Cooper (himself the former Research Station Manager at Ohio State). We expect Scott to officially join us by June 15th.

Scott Allen Mackintosh was literally born on a golf course in the Berkshire Mountains of Western Massachusetts in October of 1966. Scott's father, A. Roy Mackintosh, is a golf course superintendent and has clearly had a significant impact on Scott's professional as well as personal life. Scott's interview was filled with references to learning experiences from his years with his Dad, who Scott describes as a “working superintendent, hardworking and dedicated, committed to enhancing the professionalism of the industry.” Additionally, as a result of Scott's enormous exposure to the golf course, he enjoys both recreational and competitive golf—hey, Rod, you got your wallet handy!!

Scott is happily married and his spouse, Diane, is excited and supportive about the move to Madison. They are expecting twins this July!! So, Scott will make the trip to Madison on his own at first, return to Massachusetts for the birth of the children and rejoin us in time to aid with Field Day activities. Diane will venture out sometime after she and the twins recover and the Grandparents give them a few months of lovin'. With the twins in July and Julie Meyer and her husband Wayne expecting their child in August, we will be renaming the facility the



Scott and Diane Mackintosh

O.J. Noer Turfgrass Research and Daycare Facility!!

Scott speaks fondly of his experience with Dr. Rich Cooper, describing Rich as “easy going, with an open-door policy that made for an excellent learning experience.” Scott's M.S. research investigates the fertilizer potential and environmental impact of sewage sludge applied to the turfgrass system. He evaluated some experimental material and used Milorganite as the standard treatment by which to compare performance. I had the opportunity to attend Scott's presentation at the Annual Meeting of the American Society of Agronomy last November in Minneapolis, Minnesota. At the time I was thoroughly impressed by his command of the material, never thinking he would be joining us. Also, I remember thinking that I finally met someone

who could talk as fast as me while making a presentation!

One of the recurrent themes in my conversations with Scott has been his soft-spoken enthusiasm for the position. He indicated how impressed he was with the open and friendly, team-based relationship among members of the Turfgrass Group. Additionally, having been working out of a mobile home trailer with used equipment for the U Mass Research Facility, he stated that the O.J. Noer Facility was the best in the country—“equipment heaven”. He feels challenged by the opportunity to work with both experienced and new turfgrass researchers, as well as regular interaction with the turfgrass industry.

Help me in giving a warm Wisconsin welcome to Scott and his family, marking a new phase in the growth of the UW-Turfgrass Program! 🍷



CROSSWORDS and PUZZLES

By Kevin Dushane

Answers can
be found on
page 50.

Editor's Note: Our good friend Kevin Dushane again provides us with some fun with this feature. Kevin has designed yet another crossword puzzle and a seek and find puzzle for you to solve. Although you may see an occasional reference to Michigan (overlook them!), the overwhelming emphasis is on our business of turf-grass management.

Kevin, of course, is the golf course superintendent at Bloomfield Hills Country Club in suburban Detroit. Along with frequent attendance at our Wisconsin Golf Turf Symposium, Kevin has served as a speaker.

The puzzle and crossword below are reprinted with the permission of their designer and architect, Kevin Dushane. To him, our thanks again! 🍷

SEEK AND FIND

A K Z E N I B S U R A V E S A E S I
L E P A V E Q U M E E L B A U L O S
K Z V A X P P Z Q L H R I Y E D E C
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W I N S A C E P W L M H G R U S R I
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T Y E S A G R A W T S O N S S E T W

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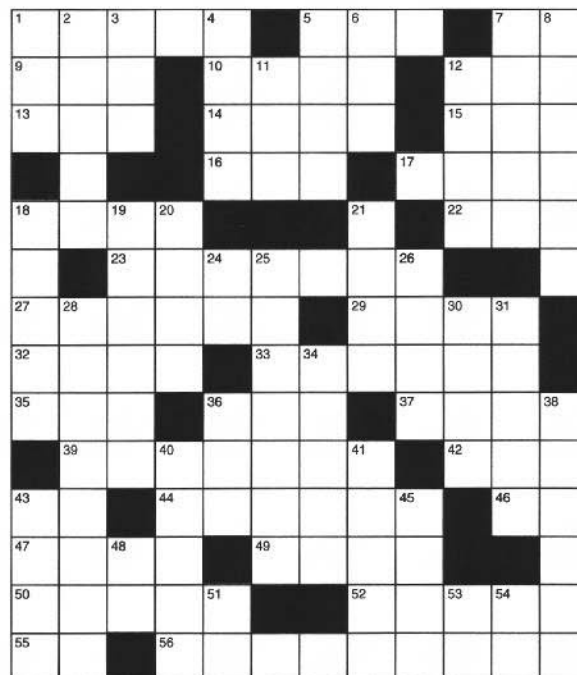
Elements
Cation
Nitrogen
Iron
Nutrients
Leach
Copper
Soluble
Phosphorus
Crum
Potassium
Rieke
Inorganic
Sulfur
Fertilize

Across

1. Cut grass too low
5. ___ Knife
7. Magnesium symbol
9. A unit of electrical resistance
10. Scent
12. Variety of bean
13. A brief immersion
14. Carbonated water
15. Pinch
16. Wooden peg
17. Controls a political party
18. Capital of Norway
22. A measurement of heat
23. A type of fertilizer
27. Used to increase green speed
29. Director of Communications for GCSAA
32. A Great Lake
33. Free Press golf writer
35. Vietnamese measurement
36. 1st editor of P.O.G.
37. Type of irrigation
39. NH+4
42. Snake-like fish
43. Initials of Superintendent at Great Oaks
44. To, or for each one
49. Mows
50. Son of Abraham
52. Indian _____
55. Initials of *Fall Guy* star
56. Loads to capacity

Down

1. Instant grass
2. Tiny silicon electrical circuits found in computers
3. A unit of electric current
4. What must be done before applying pesticides on golf courses
5. Foretell
6. Baseball statistic
7. Damp
8. Mineral used to correct soil salinity
11. Female deer
12. Supercilious person
18. Superintendent at Royal Scot in Lansing
19. Ryegrass genus
20. Heraldic bearing
21. Crafty
24. Maker of small appliances
25. Herbicide used years ago
26. Relative lack of warmth
28. Any living being
30. Time long past
31. A substance that accelerates drying
34. Farewell
36. The highest point
38. Jimmy Carter's hometown
40. Member of a group of Indians living in Mexico
41. Performer
43. Prison
45. Grape-vine disease



48. Initials of Superintendent at Bogie Lake C.C.
51. Calcium symbol
53. He's supposed to call home
54. digraph



Phosphorus In Sand Putting Greens

By Paul G. Drugan

EDITOR'S NOTE: Paul Drugan is a 1993 graduate of the University of Wisconsin-Madison Turf and Grounds Management Program and a member of the UW varsity rugby team. He grew up working at the Castle Mound Golf Course near Holmen. The club is a family business and Paul's brother Mike—a WGCSA member and UW-Madison Turf and Grounds Management alum—is the golf course superintendent. Paul has also been employed at Blackhawk Country Club in Madison. In July he is moving to Vail, Colorado to work on a new golf course there. Paul was a student of Dr. Wayne R. Kussow in the Department of Soil Science and completed this research project under Dr. Kussow's supervision.

Indications are that there is a discrepancy between what many soil testing laboratories perceive to be the optimum soil test P level in sand putting greens and the actual requirement. Christians, Martin and Karnok (1981) did not find a response to P applications made to a calcareous sand green containing 24 lb P/acre nor did Calclough and Canaway (1989) on a sand green containing approximately 18 lb P/acre. These seemingly optimum soil P levels are but 1/8 to 1/4 those deemed optimum by several U.S. soil testing laboratories (Miller, 1971; Turner and Waddington, 1978).

The most likely reason for this major difference is that soil testing laboratory interpretations of soil tests are based upon research conducted with native soils rather than USGA specification rootzone mixes. When soluble fertilizer P is applied to soil, the bulk of the P is adsorbed on surfaces of hydrous aluminum and iron oxides, on aluminosilicate clay minerals, and if present, on carbonates. Only a very small portions of the P remains in solution in equilibrium with the surface adsorbed P. As the amount of surface adsorbed P is increased through fertil-

ization, the solution concentration of P increases, eventually reaching the level where plants are supplied with all of the P they can use. The soil is then at its optimum soil test P level (Sample, Soper and Racz, 1981). Soil P tests associated with the optimum solution P concentrations.

In comparison to native soil, sand rootzone mixes likely have very low P adsorption capacities because of the lack of clay minerals and hydrous iron and aluminum oxides. This being the case, then the amount of surface adsorbed P needed to provide adequate solution concentrations of P will be correspondingly low. It follows that optimum soil test P levels will be considerably lower in sand greens than in native soil.

Phosphate ions are relatively immobile in soil due to their low solution concentrations and constant adsorption-desorption as they migrate through soil. This has led to the recommendation that phosphate be incorporated into rootzone mixes prior to green construction (Hummel, 1993). But if current soil test recommendations are followed, the P application rate may well be 4 to 8 times higher than the optimum level for sand greens. In this case, solution concentrations of P will be high enough to allow for substantial downward migration of P into the turfgrass rootzone. The practice of blending fertilizer P into the rootzone mix may then be unnecessary.

The objectives of the present study were to determine the optimum soil test P level for bentgrass establishment in a USGA specification rootzone mix and to observe the mobility of fertilizer P in the mix.

METHODS

The rootzone mix used was a 90:10 (v/v) blend of Greensmix 2340 sand and Dakota reed sedge peat. Lots of the mix were equilibrated with P to provide soil test P (Bray-1) levels of 2,

10, 16, 37, and 72 ppm P (approximately 5,25,40,92, and 180 lb P/acre). Four pots were filled with 2.65 kg (oven-dry basis) of each mix. Two of the four pots were fertilized with a 19-26-5 starter fertilizer at the rate of 1.0 lb N/M. The other two pots were fertilized with Nutralene (40-0-0) and potassium sulfate to provide the same rates of N and K as in the starter fertilizer. The pots were seeded with 'Penncross' creeping bentgrass at the rate of 5.0 lb/M and watered to their pre-determined water holding capacity of 12.1 % by weight. All pots were daily adjusted to this moisture level for the duration of the study.

To observe the mobility of P in this rootzone mix, miniature USGA greens were established in 6-inch diameter PVC pipe. In two of the greens the top inch of mix was that containing 72 ppm P. Two other greens had mix containing 16 ppm P to a 4-inch depth. The last two greens had 10 ppm P to an 8-inch depth. All columns received starter fertilizer prior to seeding.

Starting 14 days after seeding, all experimental units were clipped every 3 to 4 days at a height of 0.5 inch. After 5 mowings (28 days after seeding), tillers / cm² were determined and a 1.5-inch diameter plug removed from the P rate study pots. Maximum rooting depth was noted and the weight of roots in the plug determined.

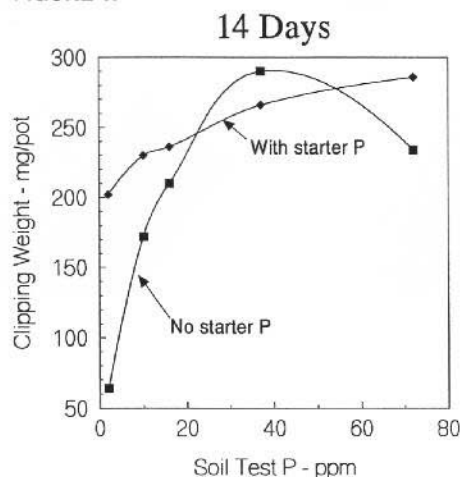
Thirty days after seeding of the miniature greens, soil cores were removed from the 6 columns and cut into 1-inch segments for P analysis. Clipping weights were recorded for a single 4-day growth period just prior to dismantling of the columns.

RESULTS

Optimum Soil Test P

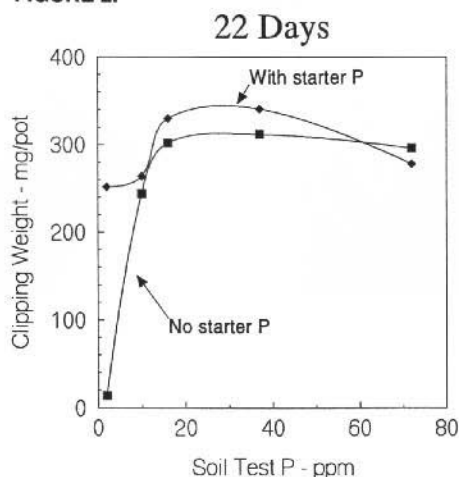
The first clipping weights recorded indicated that the optimum soil test P early in the establishment phase was about 37 ppm (Fig. 1) and at this soil test level there was no advantage to applying additional P in the form of

FIGURE 1.



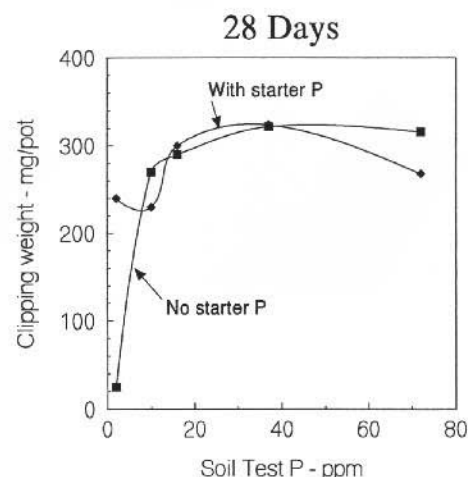
Effects of rootzone mix and starter fertilizer P on the shoot growth of creeping bentgrass the first 14 days after seeding.

FIGURE 2.



Effects of rootzone mix and starter fertilizer P on the shoot growth of creeping bentgrass at 22 days after seeding.

FIGURE 3.



Effects of rootzone mix and starter fertilizer P on the shoot growth of creeping bentgrass at 28 days after seeding.

started fertilizer. During the following week, the optimum soil test P level declined to 16 ppm (Fig. 2). Turner and Waddington (1983) have noted similar declines in the optimum soil P level once turfgrass has become established. Thus, the decline in the optimum soil test P was anticipated, but not as soon as 22 days after seeding.

Between 22 and 28 days after seeding, there were no further changes in the relationship between clipping weight and soil test P level (Fig. 3). The optimum soil test P remained in the range of 16 ppm or about 40 lb P/acre and there was no response to starter P at this soil test P level.

Between 14 and 17 days after seeding, the bentgrass growing in the pots to which no P had been added began to exhibit typical P deficiency symptoms. The grass was unusually dark green, the leaf blades narrow, and the grass virtually stopped growing. By 22 days after seeding, more severe deficiency symptoms in the form of yellowish-orange leaf tips began to appear. Application of 10 ppm P to the greens mix or starter fertilizer prevented development of P deficiency symptoms. There were no discernible color differences among any of the pots where P had been applied.

Clippings collected during the study were combined to provide sufficient tissue for analysis for P. When no P was applied and visual P deficiency symptoms were evident, the tissue P concentration was 0.16 % (Fig. 4). Increasing the rootzone mix P level from 2 to 10 ppm resulted in a tissue P concentration of 0.4 %. This is well above the concentration of 0.3% often

considered to be satisfactory for turfgrass growth. However, it was not until the clippings contained 0.57 % that dry matter yield was optimized.

Even when the rootzone mix contained only 2 ppm P, application of starter fertilizer elevated tissue P concentrations above 0.6 % (Fig. 4). However, clipping weights were no greater than when the tissue contained 0.57 % P. This suggests that an adequate or sufficient level of P in bentgrass clippings is approximately 0.6 %. Applying starter P to the rootzone mix containing 37 ppm P resulted in a tissue P concentration of 0.88%. Given that there was a tendency for clipping weights to decline when starter P was applied at soil P levels above 37 ppm, it seems reasonable to suggest that clipping P concentrations above 0.9 % should be considered to be excessive.

There were no differences among the P treatments with regard to tiller density. The pots receiving P appeared to have higher turf density, but this apparently was solely the result of wider leaf blades.

The bentgrass root weights did not support the common belief that application of P to a P-deficient soil stimulates root growth (Fig. 5). There did appear to be some stimulation of root growth when starter P was applied to rootzone mix containing 16 ppm soil test P, but not at any other level of soil test P. If inverted, the root weight responses (Fig. 5) appear to correspond quite well to the clipping responses observed after 22 days into the study (Fig. 2 and 3). This prompted examination of the relationship between total clipping weights and root weights. The relationship calculated

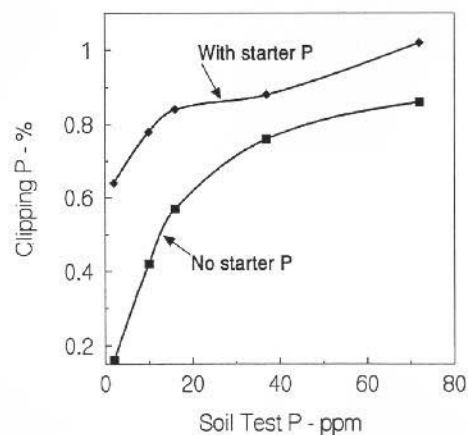
clearly showed an inverse relationship and indicated that clipping weight accounted for 98% of the variation in root weights. Thus, shoot growth rate and its influence on carbon partitioning between roots and shoots seemed to be the dominant factor as far as root growth was concerned.

Bentgrass rooting depth responses (Fig. 6) displayed some of the same features as the root weight responses (Fig. 5). With the sole exception of starter P applied at 10 ppm soil test P, increasing the P supply reduced rooting depth in all instances where increasing the P supply increased clipping weights.

Phosphorous Mobility

Clippings were collected from the miniature putting greens on just one occasion. The clipping weights tended to decline as the depth to which P was

FIGURE 4.



Effects of rootzone mix and starter fertilizer P on the average P concentration in creeping bentgrass clippings.