

ious to give their cash registers an early-season workout. Finding the best way to communicate the benefits of these frost delays to both golfers and other golf course personnel was the topic of some recent postings on the discussion forum in the members-only portion of this site.

We are lucky enough to have a pro who understands that golfers cannot get on the course until we give them the go-ahead. We use radios to contact the pro with the information he needs. I have also seen signs describing the dangers of playing on frost posted in the pro shop and near the practice green or first tee. . . Enforcement of the frost policy is the superintendent's job, and educating and communicating with golfers and the pro shop staff is an important part of our job.

*Robert Wright
Assistant Superintendent
Tokatee GC, Blue River, Ore.
6-year GCSAA member*

Each year I post a message in the club newsletter about frost and how it impacts the turf and the golfer. This notice is also posted in the locker rooms. I have a personal meeting with the pro shop and switchboard staff to explain the policy, the rationale and the procedures for making the calls. Either I or my assistants go to the point position, which may be the first tee or the pro shop to answer questions from each and every golfer. This eliminates miscommunication and gives us a chance to interface with the golfers.

*Bruce R. Williams, CGCS
Los Angeles CC, Los Angeles
22-year GCSAA member*

One thing that I have tried is to build communication between the superintendents and the golf pros. I had the opportunity to be an instructor at a golf school, teaching golf-course management. I have seen a tremendous change in the level of respect due to this educating.

*Thomas Trammell, CGCS
Hawks Nest GC, Vero Beach, Fla.
11-year GCSAA member*

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Scenes of winter in New England? How about late winter early-early spring in Orlando. Granted these photos of Disney's Osprey Ridge GC were taken in March 1992, but frosts are a reality to be dealt with every year. Photo by Joel Jackson

GCSAA Web note

Visit the "For Your Golfers" section for information you can post on your bulletin board on frost delays.

I make sure that I or someone from my staff is around the clubhouse to keep an eye on the golfers and to address any questions that may be asked about the delay. I also make it a point to inform the pro shop staff as to why we have a delay and also point out the damage that can be

done. Golfers are always going to be impatient. The best thing to do is to be there to teach them why certain situations happen. I have found the more golfers know about maintenance, the more they appreciate the conditions they are given and the more tolerant they are when conditions aren't that great.

*Steve Cronin, superintendent
Pinecrest GC, Holliston, Mass.
5-year GCSAA member*

Using water-soluble material to create a dry environment for pvc cement
Forget the Bread

By Dale Walters, CGCS

Every once in awhile we all have an epiphany. A light bulb moment. A slap on the forehead - why didn't I think of this idea sooner? An idea that we feel might be original, brilliant, astounding, revolutionizing and ultimately really useful to our industry and to others.

I recently had such a thought. In July I had a 3-inch pipe line that was leaking at a tee fitting. After valving off the area, I cut the pipe and waited for the line to drain, and I waited, pulled some weeds, waited, wrote a To-Do list, waited, then I used a sump pump to remove the draining water flow. The drainage flow continued into a second day. I wanted to use pipe cleaner and pvc cement for the replacement fittings. But with the continuous flow I had to wait until it ceased to make a dry repair.

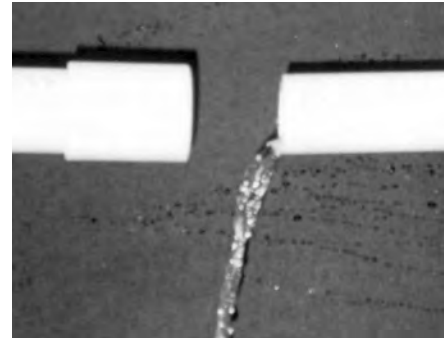
In the past, I have used bread to block the

flow but there were nearby sprinklers and I have seen them clog up from the bread. Then the heavens parted and an idea fell out of the sky. After all, I had plenty of time to think while waiting for the flow to stop. So, it was at this time that I came up with the idea of using water-soluble material to stop the flow and give me time to make a dry situation for the pvc cement.

For several years, I have been using acephate (Orthene) in a water-soluble bag. I thought about the timing it takes for the bag to break down and if I could use a similar material it would be enough time to make the repair. Using a water-soluble material would mean I would not need to be concerned about the pipe lines being clogged after the system is pressurized.

I located a distributor of water-soluble materials that are being used primarily in the medical field. After a visit with the distributor, I was given several types of product to play with. I ran several experiments in the shop to figure out which product would work best in the field.

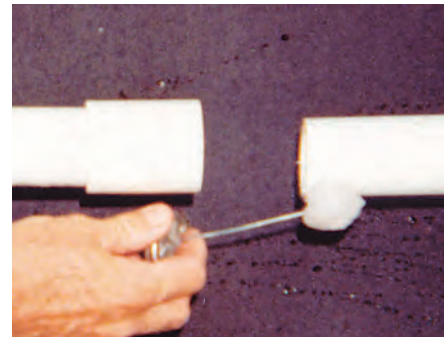
Fortunately (and unfortunately) I had several irrigation leaks shortly after receiving the material. I had one 8-inch, one 6-inch, one 4-inch, one 3-inch,



Slowly draining irrigation lines can hold up repairs to leaks at critical times.



Insert water-soluble material into pipe to block flow. The material will dissolve completely and not plug up sprinklers.



Have all fittings and materials ready-to-go. The temporary plug will provide adequate time to make a pvc cement repair.

and two 2-inch pipe leaks. Instant field testing! In each case I was successful in using the water-soluble material to stop the drainage flow which allowed me the opportunity to make the repair before the flow stopped.

The bruises on my forehead from my "Why Didn't I Think Of This Sooner" experience faded, and in September, I applied for and received a provisional patent for the use of water-soluble material to stop a flow in a pipe line. Presently, I am seeking how to market the material so that others can benefit from the time-saving method of making pvc repairs.

Editor's note: Dale submitted his innovation for irrigation repairs while he was still a superintendent at the Royal Palm C.C. in Naples. This isn't a plug for a Lesco product, but it might be some day. For current contact information, see the inside cover. Good luck, Dale!.

Junior Tips Photo Gallery

Darren J. Davis Turf Time

If you have read any of my Florida Green "Super Tip" columns, you are aware that I am strong believer of the old saying that imitation is the sincerest form of flattery. With very few exceptions, I have brought home a tip that could potentially help my operation from every golf course and superintendent I have been fortunate enough to visit in my travels.

In looking for a tip for this issue, I realized I have numerous "junior super tips that I have not written about simply because they were smaller in scale and would require minimal text to explain. Therefore, as another often-used cliché goes, "A picture is worth a thousand words." Here are some "junior super tips" that are essentially self explanatory.

Tool Time



Hanging around: Need more room in your facility, but have fertilizer spreaders taking up valuable floor space? At Reynolds Plantation in Georgia a 2 by 8 plank was anchored to the concrete wall and steel hooks were screwed into the full depth of the wood, allowing a quick, easy and inexpensive solution



One man's trash is another man's treasure: Instead of trashing some old tire rims, at Discovery Bay Golf Club in Hong Kong, these would-be discarded tire rims were cut in half with a torch and mounted on a wall to serve as one-inch hose racks.



Nature's best filter: We have been told over and over by scientists, nature's best filter to protect our ground water is turfgrass. At the Thai Country Club in Thailand, the compound of the golf course operations facility is constructed of pavers that allowed a stand of paspalum to be established in the voids of the block, therefore, filtering any potential pollutants.



Making the sell: Want a new grass variety but can't get the powers-that-be to venture to a nursery or an off-site location? At the Hong Kong Golf Club in Hong Kong, a multi-plot test area was established next to the driving range and labeled with the name of the turfgrass varieties so it can be viewed when it is convenient for the decision makers.

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BENHAM'S BEAT Envirotron Hero Must Have Died a Happy Man

By Don Benham

Jeff Hayden passed away on Friday evening Dec. 6. I was fortunate to be able to attend the funeral on Friday, Dec. 13. The reason I said I was fortunate was because Jeff and I were not close



Don Benham

friends. I would only see him and talk each year at the Envirotron Classic. We also always managed to have a conversation at several meetings we both attended during the year.

Jeff always wanted to know what was new with the FTGA as he was a strong supporter. On the other hand I would question him about the Envirotron Classic, and thank him for the support of the FTGA and the Envirotron. That was our common thread. I did not know the Jeff Hayden that his



Jeff Hayden, left, loved the Gators. He's seen here with at a pre-Gator game gathering in 2001 with (from left) UF/IFAS Vice President Mike Martin, Gainesville CC's Buddy Keene, CGCS, Palm Beach National's Mark Jarrell, CGCS and Brian Schaeffer, superintendent of the Meadowbrook GC in Gainesville.

friends talked about. But from what they said, I came to know how much Jeff meant to his friends, the university and the industry.

David Cheesman and Don Delaney from Golf Ventures, his employer, both had special relationships with him. David worked for Jeff at Turkey Creek C.C. in Gainesville. He described Jeff as a tough and fair boss who influenced him for 23 years. Don Delaney, also a former Lake City classmate, said he never knew if he worked for Jeff or if Jeff worked for him. Don said, most of the time when they had a work disagreement, they compromised and did it the way Jeff wanted it.

Joe Conoly from Bayer talked about how excited Jeff would get about a new chemical and take Joe to different clubs so they all could try it to solve a particular problem.

Glen Oberlander, (Plantation Inn & Golf Resort) described how dedicated Jeff was to the Envirotron Classic, and as soon as it was over he was planning how to improve the next event. Glen also talked about how close they had become and that whenever Jeff wanted to go someplace he would call and talk Glen into going with him. Maybe it was fish-

ing, or golf or driving for hours to look at a boat.

I can relate to that as I have a close friend who lives down the street that I am always talking into going someplace with me even if its only for an ice cream cone at a special store five miles away. We have Christmas-shopped together for 40 years.

Buddy Keene from Gainesville Country Club described how close he had become to Jeff and his family. Buddy felt Jeff was his mentor and he would constantly come to see the condition of the club, where Jeff had also been a superintendent. Buddy said he was always anxious to hear what Jeff had to say and when he had the course really good, Jeff would tell him if anything needed improvement. Through his tears he told how much he loved Jeff.

David Hoggard of Citrus Hills did a lot of fishing with Jeff on his boat and Jeff would always let him bring his son and sometimes his son's friends also. John Piersol of Lake City Community College described Jeff as a student and as a mentor to Lake City students over the years.

Buddy was not the only one speaking through tears and it had a great impact watching these speakers talk about a man they loved. They loved being with him and stated how he had influenced their lives. He was a strong Gator fan and many of the University of Florida administrators were in attendance at the service.

Jeff was a passionate believer in getting involved with the Envirotron, the Seven Rivers Chapter of the FGCSA, the FTGA and the University of Florida. From what I heard at the funeral he must have died a happy man because he had spread happiness every day. Jeff was only 52 years old. We will miss him.

USGA GREEN SECTION REGIONAL UPDATE

Snowbird Season Poses Challenges to Proper Maintenance

By Todd Lowe

The weather has been great for most of Florida over the past month. Daytime temperatures have begun to drop into the mid-80s and most of the rain has subsided. The milder temperatures and increased sunlight have improved bermudagrass growth, which has been important for some courses that did not "weather" well with summer stress.

Bermudagrass growth slows as the temperature continues to drop, and now is the time to decrease mowing frequency, particularly on putting green perimeters and to utilize less aggressive (smooth) rollers on the mowers. A common occurrence on many of our visits during winter months is "triplex ring" syndrome on putting green perimeters caused by routine mowing. The wear patterns become obvious as the temperature drops, but recovery is more difficult at that time. Grooved rollers are excellent tools for actively growing bermudagrass, but are too aggressive for putting green perimeters as temperature decreases. Switching to smooth rollers and decreasing mowing frequency to two or three times weekly will decrease the development of these rings and improve playing conditions for the peak season.

The annual migration of snowbirds has

become apparent on our TAS visits. Conducting visits during summer months in Florida is no problem, especially during mid-afternoon, as the sweltering heat and humidity drives away most golfers and we can usually view the course hole-by-hole without disturbing too many golfers. At this time of the year, getting around the entire course with minimal disturbance is a challenge. The golf course superintendent faces this dilemma each day during the peak season with shotgun starts two to three times weekly and/or 7:30 a.m. tee times. It is important to keep in mind that every maintenance practice requires a specific amount of time, and conditions suffer if the time or



Todd Lowe
USGA Agronomist

labor is not allowed to conduct these practices.

Many Florida golf courses are busy overseeding at this time of year. The weather has a major impact on overseeding success and, while it is important to be mindful of scheduling overseeding with fall tournaments in mind, there are several agronomic factors to consider for optimum establishment. These include:

- Nighttime temperatures consistently in the 50's,
- Average midday air temperatures remain in the low 70's,
- Soil temperatures at a 4-inch depth are in the mid-70's,
- At least 20 to 30 days before the first expected killing frost.

Hopefully, with a little help from Mother Nature, the overseeding will establish uniformly and with minimal impact on the golfers. If the weather trend continues as it has, most clubs should be in good condition for the remainder of the peak season.

For information about the author, see the inside cover.

Editor's note: Early December rains have impacted some overseeding operations and cloudy days have created poor growing conditions causing varying degrees of turf stress. Best remedy is to raise the height of cut until conditions improve. So you want "slow" greens or "no" greens?

IGM/Meadowbrook's \$1 Million Shootout Nets \$10G for Foundation

International Golf Maintenance, a Meadowbrook Company, held its inaugural \$1 Million Shootout at ChampionsGate Golf Resort Nov. 16. At the event, IGM presented the GCSAA Foundation a check for \$10,000, representing proceeds raised during IGM's qualifying rounds held at every IGM-affiliated property nationwide. Fourteen finalists participated in the shootout at ChampionsGate.

Despite severe storm predictions and

rainy weather, the participants' spirits were bright. After monitoring storm activity, IGM and golf course officials moved the shootout time from mid-afternoon to mid-morning in order to take advantage of the first break in the weather. At 9:00 a.m., 13 participants took their one swing at \$1 million from 175 yards on the par-3 second hole of ChampionsGate's National Course. Unfortunately, no one was able to walk away with the prize. However, Fred Rowe from Heritage Greens in Naples did make a hole-in-one during the qualifying event to win his chance at \$1 million. He was awarded a vacation to Orlando to include:

- Two theme park tickets of choice
- Two nights' hotel accommodations
- A round of golf at ChampionsGate Resort
- A shot at the \$1 million prize

The check presentation was held in Champions Hall in the ChampionsGate clubhouse following the shootout. Scott A. Zakany CGCS, executive vice president of IGM, presented Teri Harris, director of development for the GCSAA Foundation, with the \$10,000 check. Prior to the shootout, Zakany surprised Harris with news that in the event one of the participants made the hole-in-



Scott Zakany, CGCS, IGM executive vice president, presents \$10,000 check to Teri Harris, GCSAA Foundation director of development

one, not only would the winner receive the \$1 Million, but the GCSAA Foundation would also receive an additional \$250,000 donation.

"We wanted to create an added bonus for The Foundation," said Zakany. "The whole idea behind the event was to raise money for the GCSAA Foundation. By taking out the extra insurance policy for the \$250,000, it let the participants be more involved in the cause behind the tournament."

The GCSAA Foundation enhances the game of golf through funding applied research and advanced education in golf course management. Since its inception in 1955, the GCSAA Foundation has provided more than \$2 million in support of numerous research studies and more than 1,200 student scholarships.

Plants of the Year for 2003

In a continuing effort to promote the production, sale and use of superior Florida-grown plants, the Florida Nurserymen & Growers Association has announced the 2003 selections of the Florida Plants of the Year. This program was launched to promote under-utilized, but proven Florida plant material. This effort has led to increased retail and wholesale demand since the program was launched with the 1998 selections.

These proven ornamentals are selected on an annual basis by a group of growers, horticulturists, retailers, landscape professionals and University of Florida faculty. For a plant to be considered a Plant of the Year, plants have good pest resistance, require reasonable care and be fairly easy to propagate and grow. The award-winning plants must also exhibit some superior quality, improved performance or unique characteristic that sets it apart from others in its class.

Here are the details on two; the others will be presented throughout the year.

Common Name: Beautyberry
Botanical Name: *Callicarpa Americana*

Hardiness: Zones 7-10

Mature Height and Spread: 4-7 feet tall and wide

Classification: Native deciduous shrub

Landscape Use: Accent or massed in partial or full shade

Characteristics: The small pinkish white flowers appear at leaf axils and are attractive to butterflies. Showier are the clusters of brilliant violet to magenta fruits that replace them and encircle the stems at 3-6-inch intervals. This deciduous native thrives in shade, but flowers and fruits abundantly in more sun. Stems with berries are good as a cut flower in arrangements.



Beautyberry.
Photo: Stephen Pategas-Hortus Oasis

Common Name: Evergreen Paspalum
Botanical Name: *Paspalum quadrifarium*

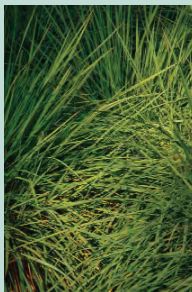
Hardiness: Zones 7-10

Mature Height and Spread: 3-4 feet tall and wide

Classification: Ornamental grass

Landscape Use: Accent, tall groundcover, masses

Characteristics: This attractive bunch grass maintains a dark green color all year and is moderately salt tolerant. Blades are broad when under irrigation and roll up when dry. If grown on the dry side foliage takes on a blue-green appearance. For best results in massing plant four feet apart.



Evergreen Paspalum.
Photo: Stephen Pategas-Hortus Oasis

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MSMA

A loaded gun to your head?

By Dr. Phil Busey

That's harsh language, but it metaphorically describes the situation of those of us who use MSMA. Monosodium methanearsonate (MSMA) is the most effective broad-spectrum postemergence grass herbicide for use in bermudagrass golf and sports turf. It's also a heavy element and Class A human carcinogen.

Each typical application of MSMA adds to the environment 1.0 kg/ha (nearly one pound per acre) of elemental arsenic. Two to four applications may be required for a single series of treatments to control grass weeds such as goosegrass.

Arsenic has only slight volatility, that is, tendency to evaporate; therefore additional applications will, for the most part, either accumulate at increasingly higher concentrations in soil, or move in water. The Florida Department of Environmental Protection's Leslie Smith said that, south of Orlando, one should be concerned about both a groundwater and soil problem. Her remarks (including the loaded-gun expression) were made at the United States Golf Association Green Section Regional Conference in Palm Beach Gardens, Nov. 14.

One attendee asked Leslie, "What's its half-life?" She correctly pointed out that as an element, arsenic never breaks down. To emphasize that in my own way, I say, "its half-life is infinity."

So you can study to no end the complex models for the transformation of arsenic compounds, some of which are more toxic than others, but the bottom line is, the majority of the arsenic stays around. (Unless the owner pays someone to excavate the golf course or sports field and move the arsenic to someone else's property.) What little leaches into the groundwater may be a serious health problem in some cases, but will not diminish greatly what is accumulated in the soil.

If a single application of MSMA were mixed thoroughly in the top 15 cm (about 6 inches) of soil, based on a bulk density of 1.5, there would be a concentration of 474 ppb elemental arsenic in the soil throughout the root zone. This exceeds the existing 400 ppb soil screening level of the US

Environmental Protection Administration. In one application. If even a small percentage of the arsenic reached the drinking water, it would also exceed the EPA limit of 10 ppb arsenic in drinking water, depending on the level of dilution.

Houston, we have a problem.

Or do we? Ironically, MSMA has a very low acute toxicity, based on a high LD50. It takes a relatively large lethal dose to kill 50 percent of laboratory animals. The acute oral LD50 is 2833 mg/kg for rats. For an 80-kilogram rat, about the weight of an adult human male, that would be equal to about 9 shot glasses, a pretty distasteful and unrealistic way to die. The chronic effects of small doses are not easily predicted, but arsenic is not good to be in contact with. If I were an 80-kilogram rat, I'd be more con-

cerned about chronic exposure to MSMA, than the unlikely shot glass. And that's why I always wear protective clothing, whatever I am spraying.

When was MSMA first used in turf in Florida?

MSMA was first used publicly in 1963, and by 1967 Dr. Evert O. Burt of the University of Florida, Fort Lauderdale, reported that it was equal or slightly more effective than disodium methanearsonate (DSMA) for grassy weed control in bermudagrass.

Although that was a long time ago, both DSMA and MSMA were already late arrivals. The arsenicals as a group were the first chemicals widely tested for chemical weed control. Long before the 1942 discovery of the phenoxyacetic acid herbicides (e.g., 2,4-D), the US Army

Corps of Engineers was using sodium arsenite for control of water hyacinth in Louisiana, in 1902.

Some of the early arsenical products used in Florida turfgrass include the Florida East Coast Fertilizer Company's S.A.M.A. 70, a monosodium arsenical, possibly MSMA, and Dal-E Rad 70, a DSMA powder by Vineland Chemical Company. These products usually required four applications to give a serious chance to eliminate goosegrass, especially the more mature goosegrass. Very mature goosegrass could not be controlled.

Aware of the hazards of arsenic, scientists attempted for years to find replacements. In describing metribuzin as such a prospect in 1979, the University of Georgia's Dr. B. J. Johnson said as an afterthought, "If EPA takes MSMA off the market, we may be left with Sencor as our base material."

Rather than seeing MSMA disappear, however, Dr. Johnson made it better by developing (with others) the synergistic combination of tank mixtures with the triazine herbicide metribuzin.

Sencor was Mobay Chemical Company's formulation of metribuzin, and Dupont



had attempted to develop another formulation called Lexon. Another chemical, methazole, formulated as Probe, was being looked at along with metribuzin, but by 1993 its herbicide registration was voluntarily canceled by Sandoz Agro, Inc.

It was the MSMA + metribuzin tank mixture that proved to be very effective at selective control of goosegrass, even mature goosegrass, in bermudagrass turf. The number of sequential applications of MSMA could be reduced from four to two, and with a little bit of metribuzin as Sencor, there would be better goosegrass control than with MSMA alone.

I was present at a 1976 meeting in Arkansas when Dr. Johnson described the promise of metribuzin for goosegrass control in fairways. By 1978, Dr. Max Brown described in the South Florida Green (Volume 5 No. 3) that Sencor could be used for grass weed control. But tank mixtures with MSMA were not mentioned.

History in the Making

The big breakthrough for Florida golf course superintendents and sports turf managers came around 1979, when Dr. B. J. Johnson described metribuzin as the "best product researched and now on the market" for grass weed control in bermudagrass, and he described a 1/8-pound-per-acre active ingredient metribuzin tank-mixed with 2 pounds active ingredient MSMA. At that time he had done some three years of research on MSMA + metribuzin tank mixtures. The interview was conducted by Dave Bailey, at that time superintendent of Atlantis Country

Club, and staff writer for *The South Florida Green* which was edited by Dan Jones.

There was also a flurry of abstracts (not full scientific reports), also in 1979, by Dr. Johnson, as well as by the University of Arkansas's Dr. John King, and the University of Florida's J. A. Tucker and Dr. Wayne L. Currey. There followed a full scientific article on the subject by Dr. Johnson, in 1980. I first became aware of the MSMA+metribuzin tank mix in the summer of 1980, when my bermudagrass breeding plots were overrun with crowfootgrass. But I opted not to include the metribuzin because it was still too new, and I didn't want to take a chance of messing up my experiment.

The Lost Discovery?

One of the interesting mysteries about the MSMA + metribuzin tank mixture is that the first scientific report goes back to 1974. This synergistic mixture was reported in *Agronomy Journal*, a widely disseminated journal, by the University of Hawaii's Dr. Chuck L. Murdoch and David Ikeda. Dr. Johnson was aware of that paper in 1975, because he cited Murdoch and Ikeda's work when he published a study involving MSMA and metribuzin. But the most novel aspect of the Hawaii paper was the tank mixture, which was not a part of Johnson's studies until later.

In conclusion, MSMA appears to have been used in Florida since the mid-1960s for post-emergence goosegrass and other grassy weed control in bermudagrass turf. DSMA had formerly been used for the same purpose, but did become established.

MSMA was not very effective against mature goosegrass until 1979 or 1980, when the MSMA + metribuzin tank mixture swept the industry based largely on the research of Dr. B. J. Johnson. The same mixture was reported, and appears to have been ignored, from work in Hawaii in the early 1970s.

These dates are approximate, but based on written documentation. If anyone has a better memory of the history of MSMA use, I would appreciate hearing from you.

Peter Harrison responds on Organic Arsenicals (MSMA question)

I have no issue with the question mark over using, and the soil accumulation data regarding the organic arsenicals. However, the arsenic while it remains in the soil is an unlikely problem for workers and users, and I also support your comments regarding sprayer user and protection, where chronic problems may occur, although I am not aware of reported problems. Movement from soil is a medium-term problem and of increasing interest.

Arsenic in soil and water, esp. mobile forms is an ongoing issue in a number of areas including widespread problems in at least one country (Bangladesh, where well water can be serious health problem if drunk), old precious-metal mining areas, older tanneries (where arsenic compounds were used at times) even soil in old animal yards and quite a lot of work is being done and some has been published about converting this to nonmobile forms in the soil/water. Some soil microbial solutions are being

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It will not “go away” as you point out, but it may be made a minor issue for those areas where transfer to groundwater, etc. is a problem. Solutions to the issue may arise from left field in areas of bioremediation and phytoremediation sciences... but there is no doubt that these products do an excellent job with weeds... including many sedges, notwithstanding newer products that have become available. Often their use can be moderated by practicing some rotational use among products, a sound ecological practice anyway, although immediate costs are sure to rise.

Similar issues and concepts over the arsenicals are receiving thoughts in Australia, so Florida is not alone. I am looking forward to the balance of the articles.

*Peter G Harrison
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**MSMA vs. other sources of Arsenic:
Phil Busey replies to Peter Harrison**

Peter correctly points out the global aspects of arsenic pollution arising from many sources. In Florida and other warm U.S. states, we have leftover CDVs (Cattle Dipping Vats) used by government mandate from 1917 to 1944 to dunk cattle in an arsenic solution (probably arsenic trioxide) to successfully eradicate Cattle Fever Ticks that were causing 50 percent mortality. This nice brew was aug-

mented later with DDT, toxaphene, and chlordane, and the arsenic was later dropped. Cattle could only be moved short distances; therefore Florida has a legacy of 3200 CDVs with a high concentration of arsenic in the soil.

Since then, many “safer” acaricides and insecticides and anthelmintics have been developed for veterinary use in the tropics, subtropics, and warm areas where animal husbandry people have so many difficulties with worms, bots, ticks, etc. Unfortunately, the narrow-spectrum “safer” pesticides are often prone to break down due to evolution of resistance in the target pest, whereas the legacy products of arsenic are dependable poisons.

Today most of the concern and press coverage on arsenic in the U.S. is about CCA (chromated copper arsenate) used to treat lumber for outdoor use, such as playgrounds. I had trouble understanding this, considering the seemingly small areas affected, and the fact that I didn’t eat playground equipment when I was a kid. However, as I point out below, CCA-treated wood accounts for about 60 percent of the import of arsenic to Florida. But the story is never simple.

In one instance in Broward County, after a playground was remediated by replacing soil and play equipment, the sampling extended into adjacent areas of bermudagrass turf maintained with MSMA, and, no surprise, there was arsenic there also.

Natural background levels of arsenic vary tremendously around the world. While the geometric mean of 441 near-pristine Florida soils was reported by the University of Florida’s Dr. Lena Q. Ma and co-

workers as 0.42 mg/kg (420 parts per billion), marl soils such as in Everglades National Park average around 5 mg/kg (around 500 ppb) which exceeds the Florida Department of Environmental Protection (FDEP) industrial soil cleanup goal of 370 ppb, and far exceeds the residential soil cleanup goal of 80 ppb.

No one is talking about excavating the Everglades to remediate a natural background arsenic level exceeding the environmental guidelines. Much of the arsenic there is tied up pretty well by calcite, organic matter, and with oxides of iron and aluminum, depending on pH, and the labyrinth of transformations that arsenic can undergo. The point is to use different background levels appropriate to different soils. And it is extremely difficult to predict what will cause arsenic to show up in drinking water.

Worldwide the major problem with arsenic involves entirely natural origins in well water used by people. The longest-term unintended experiments involving human consumption of arsenic in water have involved skin cancers in Taiwan, and internal cancers in Taiwan, Chile, and Argentina. Many of the natural sources exceeded 500 micrograms per liter (parts per billion), which is associated with approximately a 1-in-10 lifetime chance of internal cancer. The U.S. Environmental Protection Agency threshold is now 10 ppb.

The arsenic crisis in West Bengal and Bangladesh was due to the well-intentioned efforts to provide a safe drinking water supply, free from the problem of gastrointestinal microbes. For example, UNICEF and the Bangladesh Department of Public

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Health Engineering, and later private partners, installed some 3 million tube-wells, mostly since the 1980s, and unknowingly at the time the majority of wells were contaminated with horrendous levels of arsenic which was released from natural arsenic-bearing aquifer sediments.

Since the "safe" drinking water was not tested, the problem was discovered only in 1983 after people, eventually thousands, were diagnosed with arsenic poisoning symptoms, such as gross skin lesions in children. The confirmation of the problem as arsenic contamination of well water was confirmed in 1993, but by 1997, UNICEF was still patting itself on the back for surpassing its 2000 goal of "safe" drinking water.

Bangladesh is now grappling with the largest mass poisoning of a population in history, and if the estimated 200,000 victims of arsenicosis in West Bengal is any indication, the number affected in Bangladesh is far greater, based on 20 million people estimated to have been exposed. The British Geological Survey reported that among 9037 wells tested, 22 percent have arsenic concentrations above 100 micrograms per Liter (ppb).

Arsenic bioaccumulation by lowland plants and aquatic organisms contributes to elevated arsenic in some lowland soils, and bioaccumulation may also be a remedy. The University of Florida's Lena Q. Ma and coworkers showed in *Nature* magazine in 2002 that the brake fern *Pteris vittata* can accumulate up to 126-fold enrichment of arsenic, and the highest concentration was 22,630 ppm arsenic in the

plant. The fern naturally grows better in alkaline environments where arsenic is more available, and grows better in arsenic-contaminated soil than in uncontaminated soil.

As the FDEP's Leslie Smith pointed out on Nov. 14, turf fertilizer cannot be ignored as a possible source of elevated levels of arsenic in golf courses. But the most complete report that would shed light on arsenic in Florida is an extensive draft report, "Quantities of arsenic within the state of Florida, by University of Miami's Dr. Helena Solo-Gabriele and others such as UF's Dr. Timothy Townsend. The bottom line is that about 2500 metric tons of arsenic moved into Florida in the year 2000, 60 percent associated with CCA-treated wood, 20 percent from herbicides, 15 percent from geologic sources such as phosphate mining, and 4 percent from coal.

Although Florida has about 50,000 tons of "accessible" natural arsenic reservoirs, including geological reserves, roughly 50 percent is associated with CCA-treated wood, and between 7 and 20 percent is associated with arsenical pesticides. MSMA (and DSMA) were described as a "difficult dilemma since these chemicals are applied in liquid form directly on crops and golf courses. Contamination from these arsenical herbicides is immediate, quick to disperse, and thus difficult to control. Given these observations, efforts in Florida should focus on reducing the use of arsenical herbicides for controlling weed growth on crops and golf courses," and properly dealing with CCA-treated wood and wood waste.

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Editor's Note: While not disputing the obvious import of arsenic into Florida soils through chemical use, I do question some of the figures in the report by Dr. Helena Solo-Gabriele referenced above. In the report they used the generally accepted figure of 150 acres per golf course times 1400 golf courses in Florida to estimate the amount of arsenic applied annually.

When you break down the actual acreage per golf course that might logically receive MSMA treatments combined with the fact that many of the 1400 courses don't treat wall to wall or even use MSMA other than some spot treatments, their figures need to be adjusted downward significantly. However, that factor does not relieve superintendents of the responsibility of reducing the use of a product whose final impact to the environment is under scrutiny.

ADA Guidelines Target Golf and Recreational Facilities

If your club is planning to expand or renovate its course or other facilities, you should be aware that the federal government has issued new ADA guidelines that specifically deal with golf courses and

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