(Continued from page 9)
category! That notwithstanding, it sure is nice to be in the midst of golf's boom time.

•

October 4, 5 and 6 were the dates of "GOLF COURSE EUROPE", an international exhibition and conference on golf course design, construction and maintenance. It was held in Wiesbaden, West Germany. GCE 1989 had a distinct Wisconsin connection.

The golf course design and construction session featured our own Christine Madderom Faulks. Her invitation came as a result of her work and great success with Greensmix and Waupaca Sand.

And then, on the same day, GCE participants could listen to a lecture from Peter Trenchard, owner of Cherry Hills of Door County and the Bay Ridge Golf Course in Sister Bay, Wisconsin. Peter's subject was "Assuring Profitability in the Development of Public Golf".

The GCE program, consisting of four concurrent sessions each of the three days and an equipment show, had an American flavor overall. Over 40% of the speakers were from the USA. Hurrah for us! And no Japanese were there. Pleasant surprise. They don't own golf yet.

•

Despite the 6" or so of snow in Milwaukee in the end of October, golf course superintendents are always interested in solutions to problems they have. Aquatic weeds are probably not occupying many of your thoughts these days, but some research from Vermont may bode well for controlling those nuisances.

Scientists from Middlebury College are studying some aquatic insects that attack milfoil. Eurasian milfoil is an imported weed. The insects that are feasting on it in Lake Champlain are also of European origin.

The milfoil isn't a problem in Europe because of natural controls. Pretty easy to figure out why it is bad news here — a lack of those natural enemies. No one knows how these aquatic insects — species of moths and a weevil — were imported to the U.S. But scientists do know that they have almost completely eliminated milfoil in at least one Vermont pond.

This kind of research merits support, especially since the DNR won't let Tom Harrison, Carl Grassl, Tom Schwab, et.al. raise grass carp!

•

Bulletin seen on a WGCSA member's office door:

The Occupational Safety and Health Administration has determined that the maximum safe load capacity on my butt is two persons at one time, unless I install handrails or safety straps. Since you have arrived sixth in line to ride my hind end today, please take a number and wait your turn.

Thank you.

•

It would appear that yet another name architect will leave his mark in Wisconsin. The CUNA Mutual Insurance Society and First Federal Savings and Loan, both of Madison, have hired Jack Nicklaus to design a new golf course in Middleton. The site is on land now occupied by the Pleasant View Golf Course. Construction could begin in the spring of 1991, if all goes well.

The golf course would be part of a development that would include from 1,300 to 1,600 residential sites. The price tag for the golf course is expected to exceed $5 million.

This project would be Nicklaus' first solo effort in our state. He co-designed the Americana's Briar Patch course in Lake Geneva with Pete Dye in 1971. The Middleton golf course would be open to the public.

Nicklaus has sent one of his designers to the site a couple of times already. He is Rick Jacobson, a 1980 graduate of the UW-Madison Department of Landscape Architecture.

•

Here's a joke for Dr. Worf:

A mushroom went into a tavern, sauntered up to the bar and ordered a drink. He spotted a couple of nice looking gals at the other end of the bar and asked the barkeep to serve them each a cocktail.

After the ladies had been served, the mushroom moved over next to them and asked one of them for a date.

"Why should I go out with a mushroom?", the pretty young girl asked. "You're all slimy and wrinkled and ugly and you smell bad," she added.

The mushroom replied, "Because I'm a fun guy."

•

I was beginning to wonder when (and if) the Golf Course Superintendents Association of America was going to choose a golf course superintendent to receive our highest honor — the Old Tom Morris Award. No need to wonder any longer.

Sherwood Moore is going to receive the coveted award in Orlando at the closing banquet of the Conference and Show on February 26th.

Moore holds a 50-year member pin from the GCSAA and has served as president. He was the golf course superintendent at Winged Foot from 1957 to 1967. From there, he moved on to become GCS at Woodway Country Club in Connecticut. He went back to Winged Foot in 1980 to help prepare for the Senior Open and stayed through the U.S. Open. In 1984 he joined The Captains Golf Course in Brewster, Massachusetts. The Captains is an award-winning golf course designed by Geoffrey Cornish and it's located on Cape Cod.

I had the privilege of meeting Sherwood and visiting with him for a time at the last U. Mass Turfgrass Conference. He and Geoffrey Cornish are good friends and I was sitting with Geoff when Sherwood came by. It was a great experience.

Sherwood joins some classy people as Old Tom Morris Award winners — Arnold Palmer, Bob Hope, Gerald Ford, Patty Berg, Robert Trent Jones, Jr., Gene Sarazen and Chi Chi Rodriguez. And he fits right in with them. He embodies what the rest of us should strive for in our profession: competency, experience, intelligence, and respect from the industry. He's articulate, well dressed, ever friendly, and an excellent writer.

Congratulations.

•

Take a close look at the ad in *The Grass Roots* for the 1990 MID-AM Horticultural Trade Show. It's worth attending.

The 1990 edition will be held on Friday, Saturday and Sunday, January 19, 20 and 21. The show opens at 9:30 a.m. each day and closes at 5 p.m. (4 p.m. on Sunday).

Among the sponsors of the MID-AM is the Wisconsin Landscape Federation. Many Wisconsin companies have exhibits in the show.

The MID-AM show will be held in Chicago at the Hyatt Regency Chicago Hotel.

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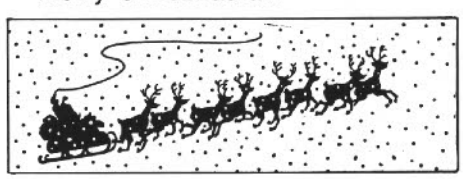
Merry Christmas all!



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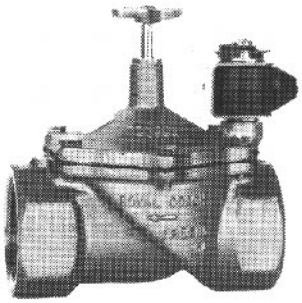

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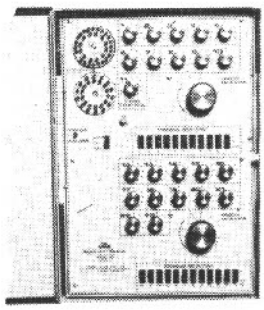

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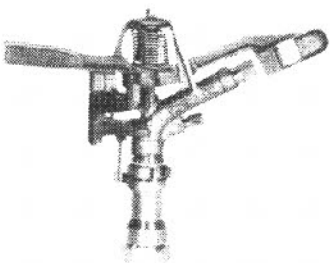

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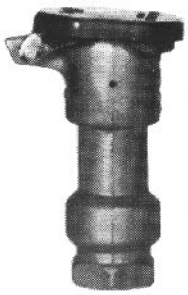

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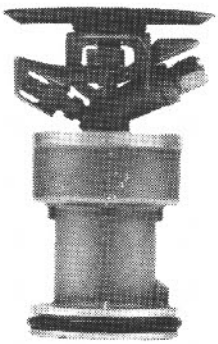

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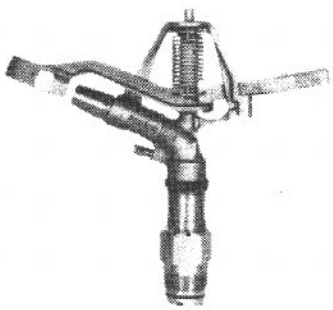

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THE PERFECT MEMBER

By Scott Hoffmann
President, Minnesota Golf Course Superintendent's Association

When the MGA suggested to me that this article be written concerning those traits composing the "Perfect Member" from the golf course superintendent's viewpoint, my first reactions were that it would not only be a somewhat delicate subject matter, but also a poor one for someone having spent the last dozen years as superintendent of a resort golf operation. However, after giving the idea further consideration, I decided who better to comment on the Perfect Member than someone viewing the situation from the outside, and with little or no risk of experiencing the unpleasant ordeal of members wishing me great success in some new line of work.

I am sure to have missed a few other good qualities, but believe those already listed are probably enough in themselves to provide for a good hanging.

I'd also like to state that these observations are purely my own and in no way reflect the opinion of the Minnesota Golf Course Superintendent's Association or any of its members. Oh, yes, all the names have been changed to protect the innocent and all events or dramatizations are purely fictional and should not be construed otherwise.

With all bases fairly well covered, I will now attempt to characterize the golf course superintendent's Perfect Member.

1) Even after completing the local Community Ed. offering of "How to Maintain the Perfect Lawn", and regardless of whether or not his home lawn IS flawless, the Perfect Member understands the superintendent is the expert at the golf course. The Perfect Member knows in his heart, even if some of his methods at times appear contrary to the game of golf, the superintendent has only the purest and most prudent of motives and the true best interest of the course in mind.

2) The "Perfect Female Member" knows the superintendent does not lie awake nights dreaming up new and devious methods of destroying an otherwise perfect "Ladies Day" by sending out his most deafening machinery, manned by temporary help procured from the local insane asylum, and always choosing this day to test the accuracy of the sprinkler system.

3) The Perfect Member is far too intelligent to compare his club to Slick Greens CC down the road. He realizes the superintendent is managing a living, dynamic, ever-changing commodity subject to a host of variables including budgets, soils, age of facility, grass types, club demands, topography, and last but certainly not least, the whims of Mother Nature. He knows one of the superintendent's greatest challenges is to manage these variables to the point where the membership will be unaware they exist.

4) The Perfect Member understands the superintendent closes the golf course to carts only when deemed to be in the best long-term interests of the golf course and would probably do so even if the lost revenue were providing for his children's college education or, at the very least, his assistant's children's education.

5) The Perfect Member repairs his ball marks, replaces his divots, and is an excellent reader, able to understand even the most difficult golf course directional signs.

6) The Perfect Member compliments his superintendent from time to time, and provides well-meaning, constructive criticism, but at the same time ALWAYS remembers complaints toward the golf course are akin to telling the superintendent he has an ugly daughter, and he avoids them at all costs.

7) The Perfect Member believes the superintendent is grossly underpaid.

8) The Perfect Member is wonderfully understanding and always gifted with a rare sense of humor.

I am sure to have missed a few other good qualities, but believe those already listed are probably enough in themselves to provide for a good hanging.

In all seriousness and with some hopes for atonement, I would like to state that superintendents have the greatest respect for their members, most of whom are already "Perfect" and share a common bond with them in our love for the game and continuing quest and desire to enjoy and provide "Perfect Conditioning."

EDITOR'S NOTE:

Scott Hoffmann is the golf course superintendent at the Madden Inn and Golf Course, a 45 hole resort complex in Brainerd, Minnesota.

A turfgrass management graduate of Michigan State University, Scott has been at Madden since 1975. Scott has served as president of the Minnesota Golf Course Superintendents Association.

His article, "The Perfect Member", appeared in Volume 16, Number 1 Spring 1988 issue of MINNESOTA GOLFER. It is reprinted in "From Across the Country"' with Scott's permission.

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TREES UNDER STRESS: THE DROUGHT OF 1988-1989

By Dr. Edward R. Hasselkus
University of Wisconsin-Madison

The classic symptoms of water stress—wilted leaves and marginal leaf scorch—were a common sight during the 1988-89 growing seasons. In severe cases, the terminal portions of the crowns of trees died back, as that portion of the plant is most remote from the limited water supply. Recently planted trees, particularly those set out in spring or fall of 1988, suffered extreme drought stress or death.

Fall-planted conifers were nearly a complete loss. Drought sensitive trees such as sugar maple, beech, birch, arborvitae and spruce were among the most common fatalities.

Many tree losses during 1989 were due to borer infestation of drought stressed trees. Oaks, birches and pines were especially hard hit, but ashes, lindens and numerous other trees are dead or dying from this cause. Canker and vascular diseases such as Dutch elm disease and oak wilt have been more prevalent due to drought stress.

PHOTO COURTESY OF OHIO STATE UNIVERSITY.

In some cases the bronzed, irregular dead tissue of scorch disease will extend both inward from the leaf margin and in between the veins.

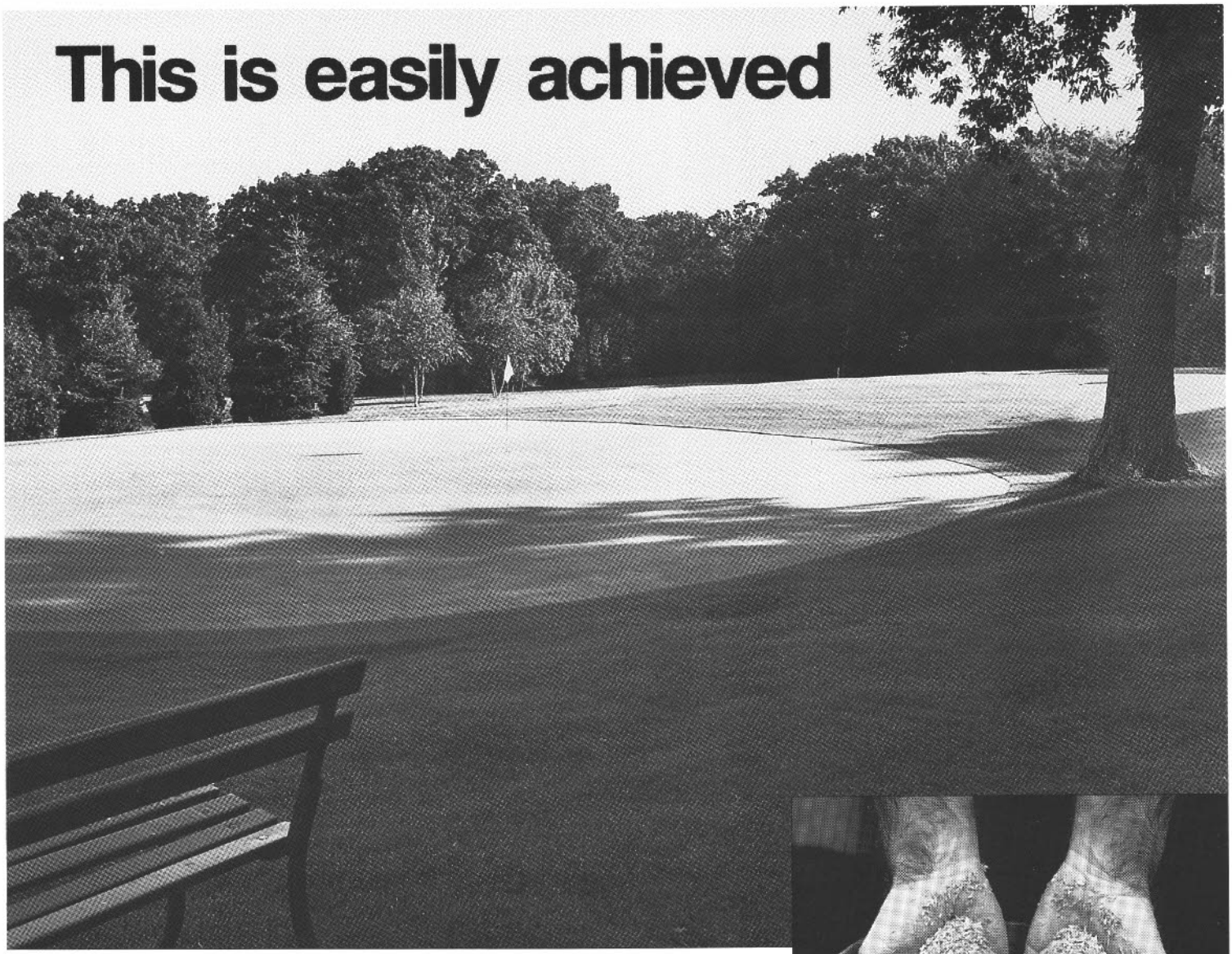
Rainfall for 1989 in Madison is at least six inches below normal and some parts of the state have received even less. If the drought persists, deep watering of the rootzone of trees before soil freeze-up is in order — especially for conifers.

In addition to irrigation, mulching young trees with shredded bark or woodchips will help conserve soil moisture and moderate soil temperature extremes. Apply three to four inches of mulch over the entire rootzone of the tree, but keep it six inches away from the trunk. Mulch in contact with the trunk may delay winter hardening of those tissues and the mulch may serve as an attractive home to mice and moles that may feed on the bark in winter. The presence of mulch will also minimize injury from mowing equipment and weed "eaters".

Research by Dr. Gary Watson at the Morton Arboretum has demonstrated that grass growing over feeder roots of trees causes severe competition for moisture and nutrients. The addition of mulch over tree roots increased total root surface area of trees up to 195%.

When applying turf herbicides, keep them away from the rootzones of trees. Dicamba can kill broad-leaved trees as well as broadleaved weeds!

This is easily achieved



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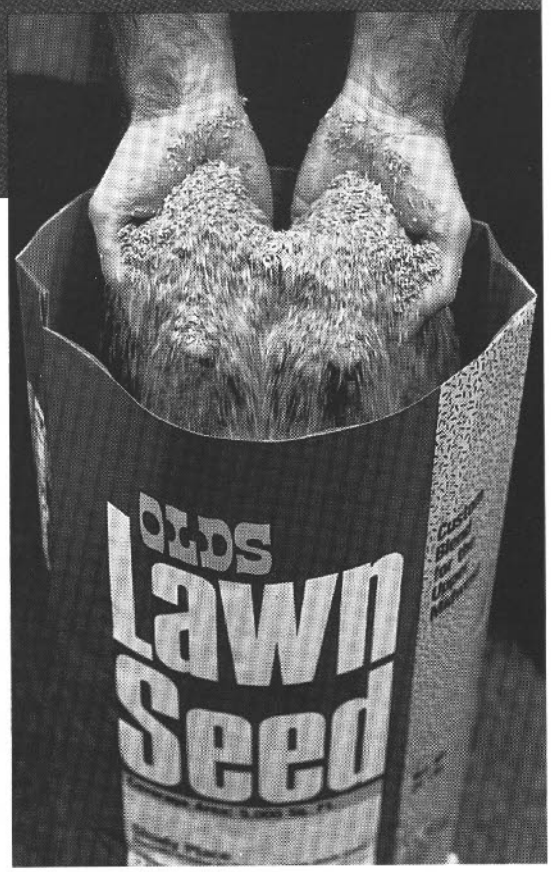

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EARTHWORMS: *Beneficials or Pests?*

By Karen Delahaut and C.F. Koval
Department of Entomology
University of Wisconsin-Madison

Earthworms are found in a wide range of habitats throughout the world, having adapted to many different soil types as well as to lakes and streams. Earthworms — often called nightcrawlers, garden worms, red worms or, simply, worms — are a valuable resource to many people. They provide bait for fishing, a source of protein for food, and most importantly, they play a unique and important role in conditioning the soil.

With the advent of chemical pest control, however, earthworms have become non-target recipients of many pesticides. Some of the most effective pesticides are broad spectrum in action, and they may inadvertently harm earthworms and other beneficial soil organisms.

Earthworms belong to the phylum Annelida and the class Oligochaeta, which consists of over 7000 species. Their bodies are long and tube-like, tapering at both ends and ranging in length from one to six inches. Another characteristic of the phylum Annelida is a segmented body, including an enlargement of several segments to produce the clitellum, a glandular organ used for reproduction. Earthworms are hermaphroditic and homosexual, and thus they may function as either a male or a female during reproduction. Self-fertilization does not occur.

Although one acre of soil may hold up to eight million earthworms, most people pay little attention to these productive and beneficial animals. They mostly go unnoticed from day to day, unless a heavy rain forces them to the surface of the soil, an angler needs some bait, or their casts disrupt a game of golf.

Builders of Soil

Earthworms benefit the soil in many ways, primarily due to the physical and chemical effects of their casts and burrows. Earthworm casts, consisting of waste excreted after feeding, are composed mostly of soil mixed with digested plant residues. Casts modify soil structure by breaking larger soil particles into finer granules. As plant material and soil passes through an earthworm's digestive system, its gizzard breaks down the particles into smaller fragments. These fragments, once excreted, are further decomposed by other worms and microorganisms. Earthworm casts can contribute up to 50 percent of the soil aggregates in some soils.

Cast production is most abundant in spring and fall when earthworms inhabit surface layers of the soil. During this time, 20 casts per square foot of soil surface are not uncommon, and as much as 40 pounds of casts per 1000 square feet per year have been recorded. Under conditions of extreme temperatures or moisture stress during summer and winter, earthworms migrate downward into subsoil horizons. In irrigated areas, such as golf course greens, fairways, and tees, this behavior may be altered and earthworms may not migrate during the summer months. Thus, their activity may be regarded as a problem requiring management.

Many species of earthworms deposit their casts beneath the soil surface within their burrows, where casts contribute to pedogenesis. Species that excavate permanent, vertical burrows, however, deposit their casts on the soil surface, where they play a greater role in soil profile development. In addition to benefitting soil structure, casts also provide nitrogen in a useable form for other organisms that decompose organic matter on the soil surface. This interaction stimulates an accelerated decomposition rate, which helps reduce thatch buildup.

Soil Fertility Enhanced

Earthworms are also important to nutrient availability of the soil. As they feed, they deposit digested organic matter and minerals along their burrows in the form of casts, a rich source of nutrients placed in close proximity to the plant roots growing through the burrows.

Comparative analyses of casts and surrounding soil have shown that casts contain five times more nitrogen, seven times more phosphorus, 11 times more potassium, three times more exchangeable magnesium, and one-and one-half times more calcium. One explanation for this dramatic increase is that earthworms liberate nutrients from the mineral soils that would otherwise remain unavailable to plants. Another factor is soil microbial activity within the casts, which promotes rapid transformation of soluble nitrogen into microbial proteins, thereby reducing the leaching of available nitrogen.

In soils populated by earthworms, accelerated decomposition of organic matter and an increase in available nitrogen results in greater numbers of nitrogen-fixing bacteria. Phosphorus availability also increases, due to earthworms' ingestion of phosphate rock particles and the consequent movement down burrows of phosphorus-containing casts. Furthermore, an abundance of earthworms means an abundance of decomposed organic matter — decomposition is limited only by the amount of material available, not by earthworms' capacity to ingest plant material.

Aeration and Drainage

Earthworm burrows, too, exert both physical and chemical effects on soil. Burrows are of two types. Temporary burrows are made by earthworms moving from one feeding site to another. Permanent burrows are homes to individual worms, are usually more extensive, and are open to the surface, allowing the resident earthworm to select the most favorable microclimate for feeding. Permanent burrows are fastidiously kept clean by earthworms removing casts, organic matter and soil that have washed in.

As they burrow, earthworms excavate networks of passageways throughout the soil, which improves the soil's porosity. Up to two-thirds of all soil pore space is estimated to be the result of earthworm burrows, which can increase a soil's moisture-holding

capacity — in some cases by as much as 400 percent. Because of the large diameter and low surface-tension of most burrows, they also serve as drainage systems during irrigation and heavy rainfall. This may account for better mixing of soluble nutrients throughout the soil profile.

Earthworms also act as effective agents of soil aeration. As they penetrate the topsoil and proceed downward into the subsoil, they may increase the soil-to-air ratio by eight to thirty percent.

Earthworm Attrition

With so many benefits to the soil accrued from the activity of earthworms, why are they given so little consideration when pesticides are selected, pesticides that ultimately bring them harm?

Pesticide registration guidelines initially placed little importance on the potential impact of pesticides on non-target species. This has changed dramatically in recent years, and the Environmental Protection Agency now gives considerable attention to the impact of pesticides on earthworms and other non-target species during the registration process. Use patterns that negatively impact non-target species are unlikely to obtain registration; in fact, at present there are no pesticides registered by the EPA specifically for earthworm control.

Lack of knowledge is another problem — the applicator is often unaware of the detrimental effects that various pesticides have on earthworms. To be sure, the acute effects of various pesticides on earthworm distribution and abundance have been the topic of very little research in this country. Even less is known about pesticides' chronic effects on earthworms.

Another explanation may be linked to the increasing popularity of the game of golf during recent years. To meet the demands of greater use, more sophisticated means of pest control — and more advanced chemicals — are needed to maintain tees, fairways and greens under heavy use.

Finally, early chemicals with broad-spectrum pesticidal activity and long-term residual effects, such as chlordane, resulted in the chronic reduction of earthworm activity. A single treatment could hold earthworm numbers in check for multiple seasons, depending on soil type and climatic conditions. By comparison, pesticides in use today are generally less toxic to earthworms; consequently, earthworm activity is more noticeable.

Pesticides and Earthworms

Toxicity to earthworms varies widely among types of pesticides classified by use — insecticides and related compounds, fungicides, herbicides, fumigants, and vermicides. Two groups of pesticides are extremely toxic to earthworms and most other soil organisms — fumigants, such as chloropicrin, dichloropropane, and methyl bromide, and vermicides (designed intentionally to kill worms), such as ammonium sulphate, lead arsenate, and mercuric chloride.

Herbicides, at the other extreme, pose relatively little threat of earthworm toxicity. Their modes of action are directed toward plant regulation, and physiological processes of plants differ significantly from those of animals. This leaves fungicides and insecticides responsible for the most extensive pesticide impact on earthworms.

Insects, like earthworms, may be beneficial inhabitants of the soil in that they decompose organic matter; they may also act as predators or parasites to harmful insects. However, they can also be serious pests and must be maintained below damaging levels. Root- and shoot-feeding insects, which

pose the greatest threat to golf course turf, are presently managed with organophosphate and carbamate insecticides to reduce their populations to non-injurious levels. However, a determination of non-injurious population densities is purely arbitrary.

As illustrated in Table 1, many of these compounds present a toxic threat to earthworms.

Insecticide Toxicity

Earthworms are generally susceptible to carbamate compounds, which will significantly reduce their populations. Carbaryl, a carbamate pesticide often used for insect control, acts as a cholinesterase inhibitor, thereby producing long-lasting immobility and rigidity. Bendiocarb (Turcam) and propoxure (Baygon) are two other carbamate insecticides that cause paralysis in earthworms at normal dose rates. Carbofuran, another carbamate, is also very toxic to earthworms. Moreover, a sublethal response, characterized by weight loss, delayed clitellum development, and absence of cocoon production, has also been observed at recommended rates of carbofuran application.

Organophosphates are the most widely used class of turf insecticides. They have been successful in controlling white grubs, mole crickets, chinch bugs, and sod webworms, to name a few. Of the organophosphates, ethoprop is the most toxic to earthworms. In contrast, chlorpyrifos, isofenphos, and trichlorfon are considered nontoxic to earthworms when applied at normal dose rates.

Understanding how particular classes of biocides act upon target species may yield insights as to their effects on other living organisms. Organophosphates, as well as carbamates, mimic the structure of the acetylcholine molecule, an important component in the transmission of nerve impulses across synaptic gaps in many animals. Cholinesterase, an important enzyme in the nervous system, is responsible for the destruction of acetylcholine once a nerve impulse has crossed the synapse, thus preparing the synapse for another impulse. The presence of organophosphates or carbamates results in the phosphorylation of cholinesterase, thereby suppressing the destruction of acetylcholine. This results in a continuous firing of nerve impulses across the synapse, which is manifested as tetany.

Because the axillary neuromuscular junctions of insects and other lower animals do not contain acetylcholine or cholinesterase, organophosphate and carbamate insecticides act instead on the central nervous system. The result is hyperexcitability, tremors, convulsions, paralysis, and eventually death. Experimental evidence shows that long-term disruptions of the nervous system, such as excision of the brain, indicates that respiration in earthworms is not dependent on muscular contraction as in insects. Rather, it is the circulation of blood by rhythmic peristaltic muscle contractions that is affected. Thus, organophosphate and carbamate insecticides are believed to cause death by anoxia, not as a function of respiration but as a function of reduced blood circulation.

Fungicide Toxicity

Of the numerous fungicides registered for use on turf, only those in the benzimidazole class have demonstrated any remarkable toxicity to earthworms. This class includes benomyl, thiabendazole, thiophonate-methyl, and carbendazim, which is a metabolite of benomyl, and thiophonate-methyl. These compounds are used as broad-spectrum protectants. Their mode of action is primarily systemic; the ester metabolites of these com-

pounds interfere with DNA synthesis by disrupting microtubule formation, which results in delayed mitosis.

In addition to the acute toxicity of the benzimidazoles, other, sublethal effects, have been noted in treated worms, including reduced feeding, retarded growth rates, reduced cocoon production, and reduced nerve conduction velocity.

Carbamate fungicides will exert the same toxic effect on earthworms as do their insecticide counterparts, though their mode of action on the target pathogen may be entirely different. The thiocarbamates most often applied include various thiram products — Bromosan WP, Bromosan F, Lesco Thiram, Spotrete, and Thiramad, to name a few.

Although the abundance of earthworms may be affected by relatively few turf pesticides, earthworm distribution and behaviour may be altered to a greater degree. Litter and surface soils treated with certain pesticides have a repellent effect on earthworms, and this reduces the breakdown and incorporation of organic matter into the subsurface horizons. Benomyl and carbendazim are particularly lethal to earthworms and also exhibit this repellent effect, which results in the avoidance of feeding in treated soils. Consequences include reduction in the amount of available nutrients in the root zone, decreased porosity and aeration of the soil, decreased water-holding capacity, and poor drainage.

Managing Earthworms

Earthworms, though often regarded as an annoyance by golfers and golf course superintendents, also provide several benefits to turf, as we have just seen. Reduction in the number of earthworms, whether intentional or not, can have a detrimental effect on both the physical and the chemical properties of the soil. Therefore, to maintain good soil structure capable of sustaining optimum plant growth, it would appear that attempts should be made to reduce the application of biocides known to adversely affect earthworm populations.

Clearly, the earthworm and its presence on the golf course raises many more questions than there are answers. Earthworms are generally thought to be beneficial; however, as with any other species, populations which are too high or out of place may warrant control actions. Currently there is insufficient data to determine at what levels earthworms become pests. In addition, a scientifically based benefit: pest ratio has yet to be determined.

Alternative management options need to be devised and the feasibility of such options evaluated. Chemical compounds can be developed specifically for earthworm control, but they may have a greater adverse effect on non-target organisms than pesticides registered for insect or pathogen control. All of these issues should be addressed and research carried out to answer the many questions that have arisen over the understanding of earthworm ecology.

TABLE 1
Relative Toxicities to Earthworms of Some Common Pesticides.

PESTICIDE	TOXICITY LEVEL
I. Vermicides	
Ammonium sulfate	Very toxic on acid soils only
Mowrah meal	Toxic with low environmental hazards
II. Fumigants	
Chloropicrin	Very toxic at normal rates
Methyl bromide	Very toxic at normal rates
Metham sodium	Very toxic at normal rates
Dichloropropane/ Dichloropropene	Very toxic at normal rates
III. Insecticides & Acaracides	
Organochlorines:	
Chlordane	Very toxic, used for earthworm control
Toxaphene	Very toxic, used for earthworm control
Heptachlor	Very toxic, used for earthworm control
Aldrin	Toxic at high rates only
Dieldrin	Toxic at high rates only
Endrin	Variable toxicity at dose rate
Isobenzan	Variable toxicity
Organophosphates:	
Ethoprop	Very toxic at normal rates
Fensulfothion	Very toxic to some species
Phorate	Very toxic at normal rates
Fonofos	Moderately toxic at normal rates
Karathion	Moderately toxic
Methyl parathion	Moderately toxic
Thiomazin	Moderately toxic
Isofos	Slightly toxic at normal rates
Disulfoton	Slightly toxic at normal rates
Fenamiphos	Slightly toxic at normal rates
Chlorpyrifos	Relatively non-toxic at normal rates
Isofenphos	Relatively non-toxic
Malathion	Relatively non-toxic
Menazon	Relatively non-toxic
Phosalone	Relatively non-toxic
Terbufos	Relatively non-toxic
Trichlorfon	Relatively non-toxic
Carbamates:	
Aldicarb	Very toxic at normal rates
Bufencarb	Very toxic at normal rates
Carbaryl	Very toxic, used for earthworm control
Carbofuran	Very toxic
Dithiocarbamate	Highly toxic at normal dose rates
Methomyl	Highly toxic at normal dose rates
Oxamyl	Highly toxic at normal dose rates
Tirpate	Highly toxic at normal dose rates
IV. Fungicides	
Benomyl	Very toxic at normal rates
Carbenzadim	Very toxic at normal rates
Thiophanate methyl	Very toxic at normal rates
V. Herbicides	All are relatively non-toxic at normal rates but some may be toxic at rates used to completely suppress plant growth.