of captan and Phaltan. It has a broad spectrum of activity and possesses unusual retention and redistribution potential. Unfortunately, a small percentage of people are allergic to it, so the company chose to restrict its development to certain horticultural crops, and prohibited its labeling for turf and ornamentals. For the crops that it is labeled, it properly identifies the skin allergy potential for the user's safety.

In our experience, thiram is inferior to most labeled fungicides for snow mold, dollar spot and leaf spot disease control. Brown patch has never occurred in our trials, so we have no information on its effectiveness against that disease, which is what several superintendents have in mind for its use.

GYPSY INVASION

Since the turn of the century, gypsy moths have been marching their way toward Wisconsin. . .

By Monroe S. Miller

A violent summer storm hit Medford, Massachusetts one evening in 1869 and blew over a cage of caterpillars. If they had been those of native swallowtails or monarch butterflies, that escape wouldn't have caused any disturbance. Unfortunately, those Medford caterpillars weren't ordinary. They were the larvae of the destructive gypsy moth.

It is each year at this time that Julie Nara, an entomologist from the Wisconsin Department of Agriculture, Trade and Consumer Protection, and I visit. Sometimes it's over the phone. Other times she takes the two minute walk from her office to mine. We are always discussing gypsy moths and the trapping and monitoring program she runs for the state of Wisconsin. Each year we publish her request for cooperators in the trapping program. I finally decided to do a little homework on the gypsy moth and share it with GRASS ROOTS readers. Golf courses are good sites for traps - mixtures of open and wooded areas located in urban scenes - and I hope more WGCSA members will help out this year. It really is quite easy and the monitoring of this terrible pest is important to the well being of our golf courses.

The caterpillars that got loose on that summer evening in Medford had been imported from Europe by Leopold Trouvelot, a French naturalist, who intended to cross them with oriental silkworms in hope of producing a hardier species of silkworm. Trouvelot's plans to lay claim to fame and fortune in the silk industry faded when his caterpillars escaped into the surrounding hillsides and forests.

No one saw much of the escaped moths or their descendants for about twenty years. Then, all of a sudden, Medford was overrun by them. They were unchecked by natural predators that kept them under control in Europe and their population exploded. The state of Massachusetts organized a campaign against the moths and in ten years nearly had them eradicated. Unfortunately, their success halted any further efforts to control the moths. Hindsight tells us that was a serious mistake.

Since the turn of the century the gypsy moths have extended their range of infestation beyond New England and into several southern and midwestern states, including Wisconsin. Entomologists estimate that the moths are advancing west and south at the rate of five to fifteen miles each year.

"They aren't a serious problem yet," says Julie Nara. "But they weren't very serious in Pennsylvania a dozen years ago, either." Aggressive control measures such as the use of chemical insecticides and a bacterial insecticide and mass trappings during the early stages of infestations in Wisconsin have been very beneficial. Fewer moths have been trapped in each of the last several years, a good sign although the numbers seem to follow cycles. The trapping program is important and we need to offer our golf courses as sites for this program.

Despite numerous efforts to control gypsy moths in other parts of the country, they continue to cause extensive damage to our environment. In 1981, the damage amounted to $764 million nationwide. Lost forest resources amounted to $72 million, recreational area damage was estimated at $6 million, and the rest, almost 90% of all losses, was in residential areas.

The moths themselves do not do the damage. The caterpillars, which hatch in the late spring, quickly begin eating decidious leaves. They are very partial to oaks, one reason Blackhawk Country Club is very glad to be part of the trapping program, but will consume the leaves from over 400 species of trees and shrubs. They will even eat from pine and hemlocks. The caterpillars feed until early July. At this time they are between two and three inches long and search out a protective place to spin a cocoon. From the cocoon they metamorphose into moths. But by now the damage has been done. The trees whose leaves they have stripped are weakened and disease prone. Referring to 1981 again, the gypsy moth caterpillars defoliated more than 12.5 million acres of forests, an area more than six times the area affected in 1979.

The moths emerge from the cocoons several weeks after they were spun. Their life span is about one week, and in this time they mate. The females are flightless and attract males by emitting a chemical sex attractant called pheromone. Entomologists have learned to manufacture pheromones and use them to trap males to estimate populations of moths in an area. These are the traps Julie Nara would like many of us to place on our golf courses.

After mating, the female lays anywhere from 75 to 1,000 eggs. The spring hatch of these eggs depends on the severity of the winter. When they emerge from the egg cluster, the new caterpillars climb the nearest tree and hang from the upper branches from fine silken threads. They are easily carried by the wind and can end up as much as half a mile away by this method. They are also moved by vehicles - moths are known to lay eggs on cars and trucks and campers that are driving through an infested area at laying time. This is how the pest is moved great distances.

Widespread chemical spraying is not common today. DDT was an effective insecticide against the gypsy moth, but it was banned by the EPA in the 1960s. Sevin was then used to control them. Like DDT, it must be sprayed every year because it provides short-term relief. Enough of the caterpillars seem to survive to ensure a lot of moths during the following season. The biological pesticides are beginning to see some use, but they are two or three times as costly as Sevin. It is interesting that even without chemical control, gypsy moth populations are themselves somewhat unstable. Usually after two or three years of infesting an area their peak numbers "crash", falling victim to starvation or disease or weather. Most current research is directed at finding other biological alternatives that will limit the growth in the gypsy moth populations and their range. For the sake of our beautiful forests and urban trees, let's hope for success. In the meantime, we can do our part by filling out the WDATC form and sending it to Julie Nara.

Cooperators Requested for Gypsy Moth Trapping

By Julie Nara

The Wisconsin Department of Agriculture, Trade and Consumer Protection is seeking cooperators to conduct local trapping for gypsy moths.

The gypsy moth, which was introduced and accidentally released in the state of Massachusetts in 1869, has for many years attained outbreak populations in the northeastern United States. In the northcentral states, Michigan and Ohio had visible defoliation or generally infested counties during 1986.

In Wisconsin, there have been no identified infestations since 1985. During 1986, 33 moths were captured in Wisconsin, compared to 13 in 1985. While the gypsy moth situation in Wisconsin has been stable during the last few years, there is a possibility of an upswing in the future, and continued vigilance is necessary.

Gypsy moth trapping requires adherence to the following timetable in the southern part of the state.

July 14	• All traps should be in place.
July 20	• First moths expected to emerge.
Last week of July	• First check of traps. If possible, check at weekly intervals afterwards.
End of August	• Remove and check traps again.
September	• Send us a map or sketch with trap locations indicated and trapping results.

Gypsy moth trap density is 1 - 4 traps per square mile. Location of traps, placement date, dates and results of checks should be recorded.

If you are a golf course superintendent or just interested in cooperating, please fill out the following form and send to: Wisconsin Dept. of Agriculture, Trade and Consumer Protection, Agricultural Resource Management Division, P.O. Box 7883, 4702 University Ave., Madison, WI 53707.

1987 Gypsy Moth Trapping Cooperator

267-7727

Name ______________________________

Address ______________________________

Telephone number ______________________________

I would like to cooperate in gypsy moth trapping in: ______________________________

County, ____________________ Township, Section ____________________

The trapping area measures approximately __________ square miles and is ☐ residential, ☐ parkland, ☐ golf course, ☐ nursery, ☐ cemetery, ☐ other ______________________________

The number of traps I can take care of is ______________________________

1987 WTA FIELD DAY SET

WGCSA member Red Roskopf will, for the third consecutive year, host the annual Wisconsin Turfgrass Association Field Day. The 1987 event is scheduled for August 25th at Red's Camelot Golf Course. This has become an extremely popular day in the Wisconsin golf turf industry since it provides opportunities to operate equipment in the field. It has grown considerably in size since the first one that was held at the Arlington Experiment Station.

WTA board members are working on a site for the 1988, 1989 and 1990 Field Days, and have received tentative approval from City of Madison Park Department officials to use Yahara Hills Golf Course on the east side of Madison. Ron Schara and Irv Graf, both long time WGCSA members, are working through the details with UW faculty, city officials and WTA committee people. Yahara would be a good location because it offers ample room, proximity to the University, easy access to I-90 and I-94, a good shop facility with plenty of parking.

But that is the future. Currently, we are most interested in making the 1987 Field Day the best ever. Please set aside the 25th of August and travel to Lomira.

The Final Chapter To A Miserable Story

By Monroe S. Miller

"Scientific Evidence indicates little or no connection between amyotrophic lateral sclerosis and exposure to the metals found in Milorganite." So said Dr. Henry Anderson, state environmental epidemiologist on Tuesday, April 14. He recommended that further study of Milorganite as a possible cause of ALS, which is also known as Lou Gehrig's disease, NOT receive a high priority from the state of Wisconsin.

His report was the latest clean bill of health experts have given Milorganite after its use on the San Francisco 49ers practice field in the 1960s was described as a possible factor in the ALS deaths of a couple of former players for that team that died from ALS. Milorganite has been used safely on the nation's golf courses for sixty years.

Dr. Benjamin Brooks, director of the ALS clinical-research center at the University of Wisconsin-Madison Hospitals created much of the unnecessary furor when he said that the possibility existed that Milorganite did indeed cause ALS and heavily promoted that idea in the media. His gross mistake created a lot of unfounded fear among the hundreds of thousands that have used Milorganite during its history.

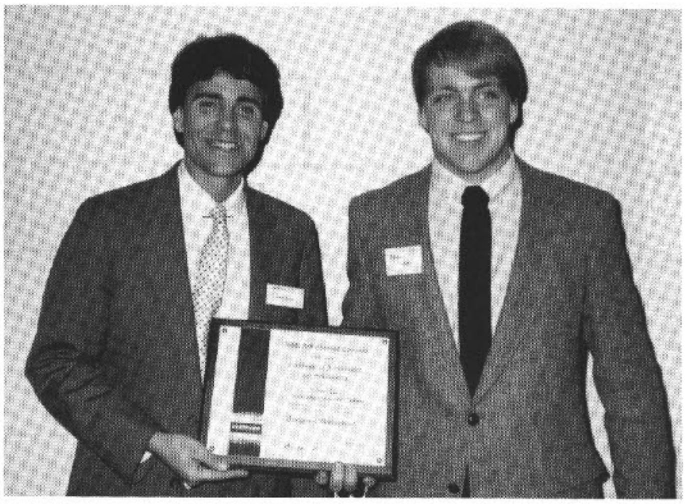
"Exposure to heavy metals has been suggested as a cause of ALS based on a 1983 British study which found that leather workers suspected to be exposed to heavy metals were at an increased risk for ALS," Anderson said. "Subsequent studies have failed to support this association, and other studies have failed to demonstrate elevated heavy metal levels in ALS patients."

Anderson went on to observe that current scientific literature suggests that genetic factors, immune deficiencies, metabolic disturbances, infectious agents, trauma, dietary factors and electric shock may be related to ALS. Anderson also said that the state would continue to provide technical assistance to the City Health Department in Milwaukee, the UW-Madison and others investigating causes of the disease.

Raymond Nashold, state vital statistics registrar, said there were no significant differences between Milwaukee County, southeastern Wisconsin or state levels of ALS cases from 1980 to 1984 and the rates for Minnesota or the nation generally.

Hopefully, this will end the hassles experienced by the MMSD staff so that they will be able to go distributing one of the finest turfgrass fertilizers ever marketed. One also has to believe that some powerful lessons in the scientific and environmental communities have been learned. They started the whole thing in the first place.

NORAM PRESENTS SCHOLARSHIP



John Turner (L) presents UW-Madison student Mike Lee (R) with a scholarship from NorAm.

John Turner, Sales Representative for the NorAm Chemical Company, used the 1987 Wisconsin Turfgrass Association Winter Conference to present a NorAm Scholarship to Mike Lee, a senior in the University of Wisconsin — Madison Turfgrass Management program. NorAm acquired the Tuco Division of the Upjohn Company a couple of years ago and decided to continue the scholarship awards that had been a significant contribution by Tuco for many years.

Mike has many years of golf course experience at Blackhawk Country Club and Cherokee Country Club. Last year he worked as a technical assistant to Dr. Gayle Worf and plans to do so again in 1987.

Thanks are due NorAm for their considerable contribution to the education of future golf turf managers. Congratulations to Michael Lee for the honor he has earned.

United States Golf Association® Regional Affairs Mid-Continent Region

Manager JAMES A. FARRELL

USGA®

FRANK HANNIGAN
Senior Executive Director

P.O. Box 616
Crystal Lake, Illinois 60014
(815) 459-5590

April 13, 1987

An Open Letter To WGCSA Members:

On behalf of myself, Jim and Lois Latham, and the USGA committee members from the region, I would like to thank all of you who attended the USGA Regional Conference at Westmoor on April 9th. I know it was tempting to do something else on such a beautiful spring day - that made your presence even more meaningful. Hopefully you found the conference worthwhile.

The Wisconsin GCSA has a tradition of supporting USGA programs and we are grateful for that. Hopefully we will have an opportunity to see many of you as the 1987 golf season unfolds.

Best personal regards,

Jim

James A. Farrell
Mid-Continent Manager
USGA Regional Affairs

APPLICATION FOR MEMBERSHIP

Join the Wisconsin Agri-Business Council!

Wisconsin Agri-Business Council, Inc.
1400 E. Washington Avenue, Suite 185
Madison, Wisconsin 53703

Russell R. Weisensel, Executive Director

Dues by Number of Regular Employees

- ☐ $ 75: up to 12
- ☐ $150: 13 to 49
- ☐ $350: 50 to 149
- ☐ $ 550: 150 to 249
- ☐ $ 750: 250 to 499
- ☐ $1,000: 500 and up

☐ Russ, here's my contribution toward the fine work you are doing for the Wisconsin golf course industry $ ____________.

☐ YES, also enroll me in your Forestry/Rights-of-Way/Turf Coalition.

☐ Please send me a Wisconsin "AG #1" pin, a gift for new members of WA-BC.

Name of Applicant ____________

Name and Title of Person Signing ____________

Mailing Address ____________

City ____________ State ____________ Zip ____________

Telephone ____________ County ____________

Signature ____________ Date ____________

DAIHATSU

Hanley

(608) 837-5111

REINDERS HOSTS ANOTHER SUCCESSFUL TURF CONFERENCE

Reinders Brothers recently hosted their 8th Turf Conference on March 18-19, 1987. It is Wisconsin's largest turf show and has been held on an every other year basis since 1973. It was held at the Waukesha County Expo Center in Waukesha, Wisconsin. The two day attendance exceeded 1450 people from all areas of turf management.

The attendees had the opportunity to view over one-half million dollars of the newest, state of the art equipment in the industry. They were also able to discuss current trends with the leading industry representatives.

The irrigation seminars presented the latest innovations in computer controlled irrigation systems.

At the same time, there was a two-day service clinic to update those who attended in the latest methods of equipment repair and maintenance.

Educational sessions were presented by such well known specialists as: Dr. Gayle Worf, University of Wisconsin; Dr. Robert Newman, University of Wisconsin; Dr. Joe Vargas, Michigan State University; Dr. John Street, Ohio State University; Dr. Jerry Pepin, Pickseed West.

The next edition is being planned for March, 1989.

Host Bob Reinders visited with Wausau C.C.'s Walt Stepanik.

Dick Reinders talks to Pat Norton about the Reinders Watertronics pumping stations.

The Arena floor was packed with the latest equipment used in turf maintenance.

ORGANIC MATTER IN TURF

By Dr. Wayne R. Kussow

Whether we are constructing a sand-based green, preparing a topdressing mix, trying to establish organically grown sod, fighting thatch accumulation or trying to destroy black layer, we're all concerned about the same thing — organic matter. Understanding the properties of organic matter is one of the keys to better turf production and management.

Properties of Organic Matter

Several properties of peat, muck and thatch are presented in Table 1. In the turf world, many people fail to distinguish between peat and muck. Peat contains readily identifiable plant fibers, is considerably less decomposed than muck, and is often physically similar to thatch. Muck is so highly decomposed that no plant remains are identifiable. It is dark brown to black in color and is essentially the same as what we know as humus in soil.

Table 1. Properties of three general types of organic matter.

	Type of organic matter		
Property	**Peat**	**Muck**	**Thatch**
Water holding capacity, %	100-400	90-150	30-60
1/3 Available water, %	10-80	20-60	5-10
Bulk density, g/cc	0.05-0.15	0.17-0.52	0.10-0.25
Ash content, %	1-50	10-60	15-25
Carbon/nitrogen ratio	15-40	13-20	30-60
pH	3.1-7.6	4.5-8.0	5.6-6.5
Cation exchange capacity	70-140	120-210	40-100
Biological stability, half-life in years	1-3	4-5	1.5-2.5

The relevance of each of the properties shown in Table 1 is as follows:

1. Water holding capacity is the amount by weight of water held by the material after having been saturated and then allowed to drain until no more water drains out. The significance of the values shown in Table 1 lies in the fact that mineral soil water holding capacities range from about 10% for sand to 35% for clay soil.
2. One-third available water is the percentage of water held by the material that plants can readily use. When more than one-third of available water is used up, plants begin to suffer from moisture stress on warm sunny days.
3. Bulk density is the dry weight of the material that occupies a cube whose dimensions are one centimeter (0.39 inch) on each side. Bulk densities of peat, muck and thatch, being in the range of 0.05 to 0.52 g/cc, are much less dense than mineral soils and do not inhibit plant root development as can a soil with a bulk density of 1.6 g/cc or more.
4. Ash content is the percent by weight of inorganic material that remains when all of the organic carbon is burned off. Ash content signifies the degree of contamination of the organic matter with mineral soil particles.
5. The carbon/nitrogen ratio of biological decomposition. Organic materials with carbon/nitrogen ratios greater than 30 will not readily decompose unless microorganisms can obtain nitrogen from some other source such as the soil or fertilizer.
6. pH reflects the acidity in the organic matter. Microbial activity is low in highly acidic material and the cation exchange capacity of organic matter is entirely pH dependent. The higher the pH, the higher the cation exchange capacity of organic matter.
7. Cation exchange capacity refers to the quantities of calcium, magnesium and potassium ions that loosely bond to the organic matter in a manner that greatly reduces their leaching rate but also makes them available to plants.
8. Biological stability, expressed in terms of half-life, refers to how many years it takes under optimum growth conditions for microorganisms to decompose one-half of the organic matter present at any given time.

To see how these various properties of organic matter relate to turf and its management, let's examine several specific instances where organic matter is of major concern.

Sand-based Greens

The USGA specification sand-based greens and sand topdressing mixes rely upon organic matter in several different ways. Organic matter is needed to:

1. Increase moisture holding capacity.
2. Reduce bulk density.
3. Provide cation exchange capacity.

Thus, we need to look for material that has these properties. At first glance at Table 1, we might decide that some type of peat is the material of choice. However, we also want a material that has as high a biological stability as possible and our attention then turns to muck. Among the mucks, we would then seek out one that has a pH near 7.0 to give not only a favorable pH, but also high cation exchange capacity. Finally, we want the lowest ash content possible. High ash peats and mucks contain a lot of clay-sized particles that, over time, clog up pores in the greens mix, thereby reducing water infiltration and impeding drainage. Perhaps this is one of several factors leading to black layer formation?

With regard to the cation exchange properties of peat or muck, there is one thing that is well to keep in mind. The negatively charged sites on organic matter that attract and hold cations in an exchangeable form have a strong preference for the divalent cations Ca^{2+} and Mg^{2+}. This means that a monovalent cation such as potassium (K^+) remains largely in solution and leaches very readily from sand-peat mixtures. The problem is particularly acute when the irrigation water used is "hard"; i.e. contains large amounts of Ca^{2+} and Mg^{2+} ions.

Potassium leaching in sand-peat greens is one of the strongest arguments I know of for using an 8:1:1 sand-peat-silt loam soil mix for greens. The silt loam soil possess cation exchange sites that do not show the strong preference of organic sites for divalent cations. Hence, potassium leaching is considerably less from an 8:1:1 mix than an 8:2 sand-peat mix. Extensive use of the 8:2 mix is what has led to the idea that nitrogen and potassium have to be annually applied in nearly equal amounts to USGA greens.

Organic Sod

Sod is traditionally grown on organic soil and on muck in particular for numerous reasons, two of which are the relatively low weight of the rolls of sod and less tendency to tear during handling. However, some concerns or questions arise regarding organic sod when it comes to the time of rooting and management during the period of establishment. When it occurs, slow rooting is a product of two things. One, is the fact the roots penetrating soil exert a backward force that has to be counteracted by weight from above and root hairs anchored into the soil beneath the sod. Organic sod, because of its relatively low bulk density, can be at a disadvantage in comparison to sod established on mineral soil. Secondly, laying organic sod over a mineral soil creates a textural discontinuity. Water moves faster through the organic layer than the mineral soil below. The result can be accumulation of excessive moisture at the sod-soil interface. This is not a very hospitable environment for new root growth and favors pathogen growth and development.

Recent research has shown that organic sod roots as rapidly and extensively as mineral sod as long as both are being laid over properly prepared mineral soil. Neither type of sod performs well when laid over compacted, structureless mineral soil or a scanty two inches of topsoil overlying a dense subsoil that has been pulverized and scraped to provide a firm, smooth base. Both types of sod will root rapidly if laid on loose, friable and well granulated topsoil that drains well into the subsoil below. Irrigation scheduling and rate then become important considerations. They need to be such that sufficient time occurs between irrigations for water to infiltrate into the mineral soil beneath the sod layer.

Another management concern with organic sod is how much nitrogen is being released from the organic layer. This is a legitimate concern because, during the establishment period, excessive N stimulates grass top growth to the detriment of root growth and places a high demand for water on a very limited root system. Studies in Wisconsin on the rate of release of nitrogen from muck soils provide some basis for answering this question. For 9 muck soils, the average amount of N released per one-inch depth of soil was 0.23 lb N/1000 ft^2 in the first month. In the next two succeeding months, the N released amounted to 0.36 lb/1000 ft^2, and between months 3 and 6, an additional 0.37 lb N was released. Hence, in a 6-month period, the average total amount of N released from a 1-inch layer of muck soil was 0.96 lb/1000 ft^2. This is a significant amount of N that should not be ignored when fertilizing newly sodded areas.

Thatch

The final type of organic matter to be considered here is thatch. As shown in Table 1, even under optimal conditions, biological decomposition of thatch occurs at about the same rate as for peat. The biological stability of thatch and, hence, its tendency to accumulate, arises for several reasons. One is the low available water content of thatch that limits microbial activity. This is a major reason why topdressing and/or core aeration are fairly effective thatch control measures. Mixing soil in with the thatch increases moisture retention and permits more microbial activity.

Another reason why thatch decomposes slowly is its relatively high carbon/nitrogen ratio (Table 1). Rapid microbial decomposition of thatch requires an outside source of nitrogen. One possible means for meeting this need is to incorporate a slow release N fertilizer into the thatch along with topdressing mix or soil brought up during core aeration.

Research results shown in Table 2 provide some insight into the role that cultural practices can play in thatch control. The first thing to note is the relatively small changes in thatch depth that occurred over the seven year period. This points up the fact that in turf areas prone to thatch accumulation, cultural practices such as those listed in Table 2 will seldom resolve the problem without assistance in the form of frequent and light dethatching of the turf.

As for the effects of various cultural practices, combinations are the rule rather than the exception. The objective one is attempting to achieve to provide the best environment possible for biological decomposition of the thatch layer. This means incorporating some soil to improve the moisture status of the layer, adding nitrogen to off-set the high carbon/nitrogen ratio of the thatch and providing an optimum pH of near 7.0.

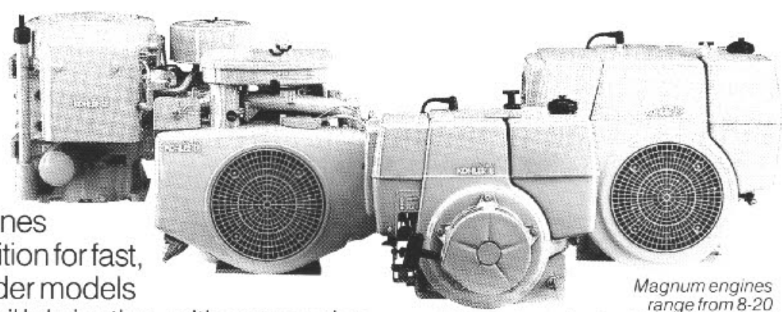
Note particularly in Table 2 the effect of a wetting agent on thatch accumulation. This is one of the enigmas in turf management. Thatchiness often leads to localized dry spots where the manager's normal response is to apply a wetting agent. This gets water to penetrate the thatch layer, but leaves it drier than normal. The result is more thatch, not less. This can quickly lead to an unending cycle of dry spots-wetting agents-dethatching that can only be broken with regular core aeration and incorporation of core material into the thatch layer or periodic topdressing with a mix of the same or very nearly the same composition as the soil beneath the thatch layer.

Table 2

	Thatch	
Treatment	**Depth**	**Change**
	Inches	
1. None	0.35	—
2. Spoon aerifying	0.35	0%
3. Spike aerifying	0.31	-11%
4. Wetting agent	0.44	+26%
5. Annual liming	0.28	-20%
6. Slow release N	0.43	+23%
7. Topdressing	0.28	-20%
8. 5 + 6 + 7	0.30	-14%

Adapted from Engel and Alderfer (1967).

In summary, organic matter plays numerous roles in turf production and management. Some are desirable, some are not. In either instance, knowing the properties of organic matter and the factors controlling its persistence in turf provides the basis for making wise management decisions.



Magnum engines range from 8-20 H.P. in horizontal and vertical shaft designs.