CORNELL UNIVERSITY TURFGRASS TIMES

CUTT

Fall 2000 • Volume 11 • Number 3

Core Cultivation: A Necessary Evil?

There are few practices that turf managers feel are more vital and users of turfgrass areas feel are more disruptive to play than the process of core cultivation. In fact, a 1996 golfer survey conducted by the GCSAA indicated that 77% of respondents ranked "recently aerified greens" as the most bothersome aspect of golf turf management.

Core cultivation is a preferred term to aeration in that cultivation will often improve water movement, which is as or more important than aeration. The aeration concept actually is derived from one of the first mechanical cultivation devices developed by the late Tom Mascaro.

Regardless of semantics, a perennial discussion occurs each year on golf courses throughout the country, among golfers and turf managers, on the essential nature of cultivation. "Can it be after the Labor Day tournament?", "Do we have to do it every spring?", "The golf season is short and aeration disrupts the surface for a month." Many superintendents hold firm, some are flexible, others stop altogether.

Kurt Theummel at Walnut Hills Country Club in East Lansing, MI has not aerified his greens for almost 20 years. "Why should I aerify if my greens are in good shape, I don't have thatch accumulation, and I don't have compaction?" All good questions that beg other questions regarding why as an industry we are so committed to core aerification?

Why Cultivate?

Core cultivation has been the primary means of managing the inherent traffic a turf receives and the subsequent soil compaction that is typically confined to the upper few inches. Soil compaction is defined as the pressing together of soil particles into a more dense soil mass. The degree of compaction is often determined by measuring the soil bulk density.

Bulk density is simply the dry weight of the soil particles contained in a specific volume, reported as grams per cubic centimeter (g/cc). The more particles crammed into a specific volume, the less pore space, the higher the bulk density, and consequently the less air-filled porosity (aeration).

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This Times

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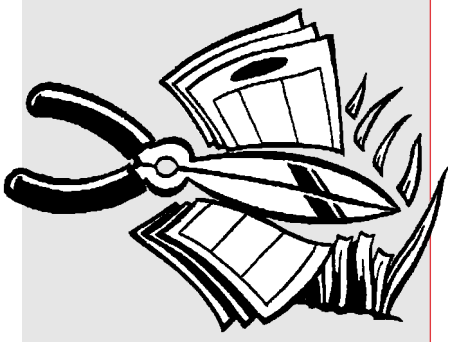
Clippings

Roughly 600 golf courses will be contacted with a letter requesting participation. If selected, your commitment of time and information would be invaluable to providing an accurate projection about how golf course management practices are aligned to meet the challenges of future.

New York State Turfgrass and Grounds Exposition, November 14–16, 2000, Syracuse, NY.



Fore! Golf Course Management Survey

Over the next few weeks, the turfgrass program at Cornell University will be hitting the links! However, rather than recovering from the sand and creating divots in your fairways, the Cornell team may be aiming for your participation in a study being conducted throughout New England and the tri-state area. Cosponsored by the New York State DEC, the fact-finding project seeks to identify current trends within the industry.

The internet and mail based questionnaire requires about one hour of time to complete and examines how golf courses and associated management practices have evolved to relate to their surrounding environments and to provide a better understanding about the relationship they maintain with surface and ground water bodies. Although some questions are asked about how pesticides are handled, this study is not concerned with pesticide use or the amounts they are used in. Roughly 600 golf courses will be contacted with a letter requesting participation. If selected, your commitment of time and information would be invaluable to providing an accurate projection about how golf course management practices are aligned to meet the challenges of future.

Managing our Natural Resources: The 2000 NYSTA Conference

The program is set for the New York State Turfgrass and Grounds Exposition scheduled for November 14 through 16, 2000 in Syracuse, NY. The theme for the 2000 conference continues NYSTA's commitment to environmental excellence: "Managing our Natural Resources."

Sessions consistent with this theme will include several basic and advanced topics on soils, water, fertilization, and wildlife management. In addition, as leaders in the area of sports turf education, we will be providing sessions on managing high traffic areas, core cultivation, and using the latest products on the market based on the science. As usual, the golf turf program continues to explore cutting edge research on environmental stress and how to identify and manage diseases such as gray leaf spot and bentgrass deadspot.

Right in the middle of the conference is the early bird session highlighting the latest research currently underway at Cornell on moss control, pesticide fate, dollar spot biology, and insect killing nematodes. The Tuesday Seminars will include grass and weed identification, as well as basic aspects of turf soil management, to help you get back to basics. As technology continues to enter the market, client expectations increase, and regulations limit our options; education is the key to maintaining a successful profession.

See you in Syracuse!

Governor's Pollution Prevention Award Goes to Colonial Acres Golf Course

Governor George E. Pataki announced that five organizations have won the 2000 Governor's Awards for Pollution Prevention for their outstanding environmental protection efforts through pollution prevention. Among the winners was Colonial Acres Golf Course in Glenmont, Albany County, and its golf course superintendent Pat Blum.

Colonial Acres Golf Course, established in 1964, is a privately owned nine-hole golf course. With 33 acres of property, of which 13 are woodlands or water areas, Colonial Acres has been a certified Audubon Cooperative Sanctuary since 1998. Working with Audubon International, Colonial Acres has been using organic and biological products for the control of pests to reduce the amount of synthetic pesticides and petroleum-based products on its fairways and greens.

"Each year, more and more New York businesses are embracing pollution prevention as a successful way of protecting the environment while increasing economic benefits and maintaining product quality," Governor Pataki said. "Colonial Acres has gone beyond regulatory requirements to make intelligent investments that are helping to identify and reduce pollution at its source, resulting in cleaner air, land and water for all New Yorkers."

The 7th Annual Governor's Awards for Pollution Prevention were presented by New York State Department of Environmental Conservation (DEC) Deputy Commissioner Carl Johnson at the 13th Annual Pollution Prevention Con-

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Scanning the Journals

Nitrogen and Amphibians: A Closer Look

The turfgrass industry, similar to most agricultural production systems has become increasingly aware of the potential for inputs such as fertilizer nutrients and pesticides to influence the environment. Millions of dollars have been invested to research the environmental fate of applied chemicals. These studies attempt to determine the role that specific management practice may play in minimizing off-site movement and often use established EPA concentrations to evaluate success. In general, these levels are established from toxicological research that determines concentrations that might cause human health concerns. But what if the levels we have been using were harmful to other species vital to aquatic ecosystems?

Environmental researchers from Canada recently published an assessment of nitrogen pollution affects on amphibians. The paper is a review of available water quality information for the Great Lakes region of the US and Canada. Of the over 8,000 water quality samples collected in areas surrounding the Great Lakes, 20% of them were found to have concentrations that cause sublethal effects in amphibians. Nitrate levels, as low as 2.5 ppm, have been shown to affect amphibians (background levels in temperate regions are assumed to be less than 3 ppm).

The nitrate in the water appears to disturb the digestive process in tadpoles in a way similar to the mechanism in humans. The nitrate is converted by the bacteria in the babies' gut and then severely restricts the blood's ability to become oxygenated. There is a significant lack of information available on the toxicity levels relative to the different amphibian species, including influence on the predators and prey.

The review did not point the finger at the turfgrass industry, but rather to understand the influence of wastewater treatment, livestock, precipitation, and fertilizers on nitrate pollution. Clearly, as major users of fertilizers for turfgrass areas, whether it is home lawns or golf courses, we must be aware of best management practices to minimize off-site movement. In addition, turf has a place as a potential vegetative buffer and biofiltration system to protect sensitive aquatic habitats. Now is the time to think about this bigger picture before another crisis occurs.

From: Rouse, J.D., C.A. Bishop, and J. Struger. 1999. Nitrogen Pollution: An assessment of its threat to amphibian survival. Environmental Health Perspectives, 107:799-803.

Copper and Turf Growth

Copper is considered a minor element in plant nutrition because it is found in relatively low concentrations in plant tissue. However, while low levels might be required, it is considered an essential element that can become toxic to plants. Recently, the interest in using fertilizers containing copper and copper-based fungicides combined with the relative immobility and potential to accumulate in the soil, has raised questions regarding toxicity.

Researchers at Iowa State University investigated the influence of increasing copper concentrations supplied by cupric sulfate to sand rootzones of differing pH in the greenhouse. Creeping bentgrass clipping weights from plants growing in the calcareous sand (pH 7.3) was not inhibited at copper concentrations as high 600 ppm, as compared to plants growing in silica sand (pH 6.8) which were reduced 16%. Root growth decreased in both sands, but interestingly while a significant amount of copper was applied, less than 1% was taken up by the plant regardless of pH. Clearly, the inhibitory effect of copper is more evident in examining root growth as opposed to shoot growth.

The final aspect of the study was to evaluate the use of the DPTA-TEA extraction method for analyzing soil copper levels. The role of this test was to determine the amount of plant-available copper to indicate what a plant may absorb. The researchers concluded that based on the accumulation of copper in root tissue regardless of pH, the DPTA-TEA test did not provide an accurate assessment of the potential for copper availability. Therefore, as we continue to include more copper-based materials into turfgrass management, we must be aware of soil pH, root growth and root tissue content, and realize that current soil testing procedures may not accurately assess the risk for copper toxicity.

From: Faust, M.B. and N.E. Christians. 2000. Copper reduces shoot growth and root development of creeping bentgrass. Crop Sci. 40:498-502.

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Core Cultivation

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Interestingly, the increased adoption of sand based root zones originated with the thought that properly sized sands would resist compaction. In addition, the high percentage of air filled pores would allow for improved drainage and better root growth. Also, in the last decade there has been an increase in the use of straight sand topdressing.

The question remains, if we have more sand than ever in the greens, and sands are supposed to resist compaction, why are we cultivating so much? Is it from layered profiles that result from poor material specification? Is it due to organic matter accumulation? Is it because of poor quality water that brings particulate matter or possibly calcareous sands that degrade and "plug" pores pace? The answers are yes.

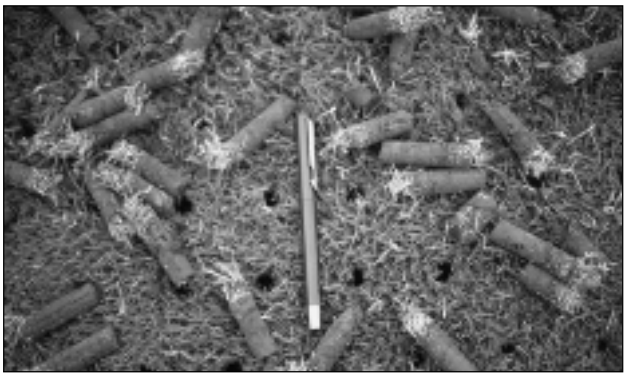
Regular core cultivation is employed to reduce organic matter (OM) accumulation at the surface. The undecomposed or partially decomposed organic matter that is referred to as thatch is thought to be reduced through regular cultivation. This would be accomplished by increasing aeration and mixing soil with OM, thereby enhancing degradation. However, very few studies bear this out.

Art or Science

The science in support of core cultivation has not been consistent. Some have found an increase in water infiltration rates and oxygen levels, others have found decreases. Several researchers have reported no effect on thatch accumulation, other have reported decreases.

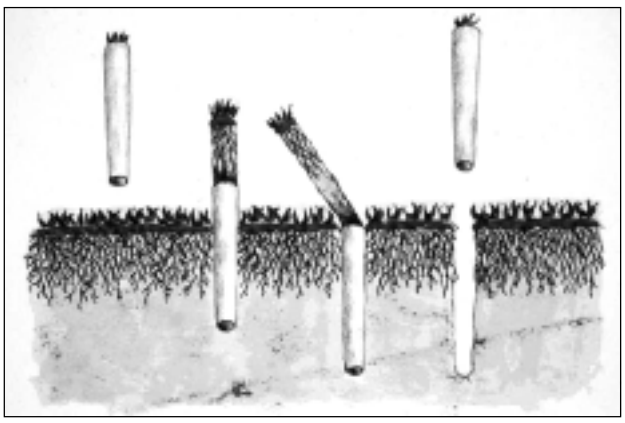
An interesting study conducted in the late 1970's by Marty Petrovic working with Paul Rieke at Michigan State University measured increased compaction around the walls of a soil recently cultivated with a hollow tine unit. They also noted increased compaction at the base of the core that persisted for 90 days. This was the first confirmed report of the development of a "cultivation pan" at the base of the coring operation. As a result of this and others' work, mechanical units that go below the normal 4" depth to break up the compacted pan layer, are more widely used.

Paul Rieke published another important study in 1993 with Jim Murphy of Rutgers University. A loamy sand soil supporting a Penneagle bentgrass putting green was subjected to seven hollow or solid tine core cultivations over a 3 year period. Cultivation had no effect on soil compaction, total porosity, and water infiltration unless significant compaction already existed. Soil strength, a measure of the resistance of the soil and thereby indirectly the compaction level, was decreased (less compact) one week following cultivation. However, three weeks after cultivation, the effect on soil strength had diminished. This point argues for increased frequency of coring operations, but concern remains for the development of a pan layer at the base of the tine depth.



While coring seems drastic, a typical operation affects less than 10% of the surface.

Core cultivation is best accomplished by the removal of a core as opposed to solid tine cultivation.



Organic matter accumulation in the Rieke and Murphy study was not reduced by core cultivation, in fact it actually increased! However, the percentage organic matter per unit of depth did decrease, suggesting a dilution of the OM with the incorporation of soil. This dilution concept

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Core cultivation has been shown to improve water infiltration.

has been enhanced recently by researchers from Penn State and Michigan State universities investigating the influence of topdressing material, frequency, and rate on thatch. While there was no significant reduction in organic matter (OM) from the 100% sand topdressing, when compared to peat and soil treatments, there was a significant reduction when compared to the non-topdressed plot. Coring was not a component of this study, however, if dilution is a primary means of managing thatch, can't we just topdress and skip the aeration?

The Deep

One consistent issue that is evident in golf turf systems is the presence of layered soil profiles. Sometimes these profiles are designed, such as the USGA Method for Putting Green Construction. Also, they occur as a result of changing materials for topdressing, or regular hollow or solid tine cultivation to a consistent depth, or even because organic matter has accumulated at the surface. More important than how they occur is where they occur.

Our research at Cornell University on a sand based putting green has shown that bentgrasses are prolific root producing grasses. In addition, over time the roots continue to be localized at the surface. Any removal of root material or reduction in rooting would be welcome. Unfortunately we have grown accustomed to enhancing root growth as means of improving turf. I wonder if more roots are always a good thing, especially if they are surface roots? Furthermore, if I would rather not core cultivate to disrupt the surface, it appears from previous research that topdressing will work to dilute surface OM accumulation.

But what can you do when the entire profile is compacted very deeply or the layering is below a 4" depth? Deep tine cultivation with the Vert-drain or other mechanical devices, such as the Floyd-Mckay drill that penetrate from 8" to 16", could be effective. There is limited research and what is available suggests that the effects of these processes diminishes from 3 to 8 months after treatment.

Un-Plugged

As long as turf receives traffic, is regularly watered and fertilized, and golf is played on it, the debate will rage on about the importance of cultivation. No reasonable agronomist would categorically eliminate the use of cultivation because each situation is different. For example, if Walnut Hills had exceptionally poor quality irrigation water, not coring would be foolish. Many management considerations must be integrated precisely for "not coring" to be successful.

In the absence of these unique conditions, many new technologies are on the market or coming. The use of high pressure water injection systems introduced by Toro and more recently by Deere and Textron, offer great potential for increased aeration and infiltration with reduced surface disruption. Quad-tine aerification units appear to be less disruptive and are widely used. But why do we always have to make holes?

If we want to get more oxygen into the root zone, why not inject it? This is the basis for the Sub-Air system that pumps various concentrations of oxygen through pipes under the ground. The jury is out on this approach, and clearly what we have to date cannot warrant the expense of retrofitting an existing green.

On the other hand, the solution to the coring controversy is to be clear about the objectives. Is it performed for reducing compaction? Is it for OM accumulation? Is it for overseeding or soil modification? Can any of these be accomplished without severe surface disruption? Should they be? In the end, we know precious little about the dynamics of the golf turf system, let alone the role of a sound cultivation program. Consequently it appears that the debate about this issue will continue.

Frank S. Rossi

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CUTT

Oxygen Injection and Bentgrass Rooting

Program Spotlight

The observation that monthly oxygen injection increased root growth at the injector indicates that the concept of oxygen injection to enhance root growth appears to be sound. The lack of improved root growth away from the injector indicates that a better system of injection is needed.

This project set out to determine if periodic oxygen injections of root zones could enhance root growth by delaying summer decline or stimulating spring and fall growth, and improve the visual quality of creeping bentgrass greens.

Materials and Methods

The site for the study was the soil amendment putting greens area of the Cornell University Turfgrass Field Research Center. The study consisted of using mini-greens 7.5' in diameter, 18" deep to simulate a typical tri-layer modern putting green profile of 4" of gravel, covered with 2" of coarse sand that is capped with 12" of a sand-organic amendment. In this study, there were 4 plots of 3 organic amendments: reed sedge peat, composted brewery waste and composted sewage sludge. Each amendment was used to modify sand at an amount equal to 1.5% organic matter, by weight, or approximately 20% by volume. Four additional plots had a native soil (Arkport fine sandy loam) as the entire 18" profile, typifying the old "pushup" style green. The site was established in the mid-1990s.

The site was mowed generally 3 times per week, clippings removed, and irrigated to prevent wilt. Disease activity was allowed to occur before a fungicide was applied. Dollar spot disease did occur on this site in July-August, however, there were not noticeable differences between treatments and the area was sprayed with a fungicide.

Treatments consisted of oxygen injection at different monthly frequencies of 1, 2 and 4 times per month. A non-injection treatment was included (just had oxygen injector installed). Each of the 4 injection treatments were applied to one of the 4 plots of each soil. The results from the sand amended plots were averaged. The oxygen injection treatment applied 5 pore volumes of oxygen of 150 cubic feet for the sandy loam soil greens and 100 cubic feet for the sand-organic amended greens. The oxygen generator produced 12 cubic feet per hour and injection times were 8 hours for the sand greens and 12.5 hours for the sandy loam greens. Injectors were constructed of 1/2" diameter schedule 40 PVC, with the first 8" being solid and the bottom 2" having slits. Four injectors were installed

Figure 1. Root growth in the sandy loam soil immediately adjacent to the oxygen injector.

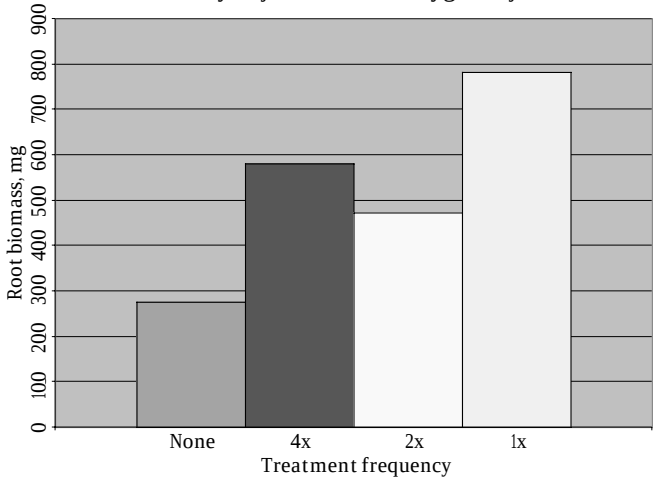
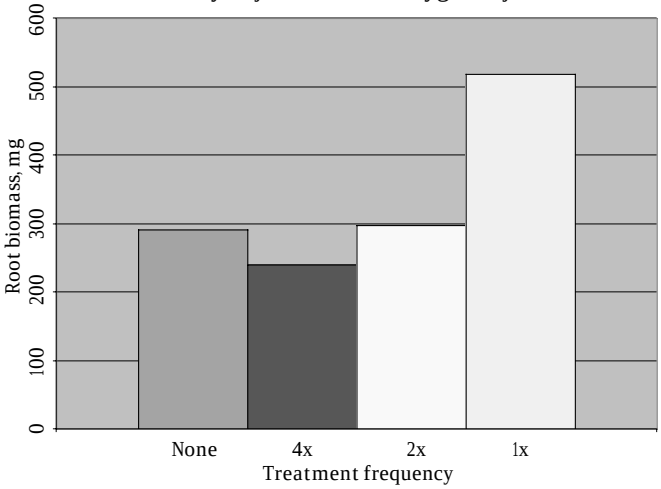


Figure 2. Root growth in straight sand immediately adjacent to the oxygen injector.



in each plot. Injection began in the first week of May 1999 and continued until the last week of October 1999.

Data collected included root biomass and length. There were not noticeable visual quality or disease occurrences between plots so data on individual plots were not recorded. Root biomass samples were collected monthly. Sampling consisted of 4 root samples per plot of 2 cm diameter, 12" deep sample taken 9" and 18" from each injector. Samples were frozen, washed to remove soil, oven dried at 55°C for at least 24 hrs., and weighed. On the last sampling date (10/25/99) a sample was taken directly next to the injector for biomass and depth of rooting.

Results

For each major soil type (sand and sandy loam) Figures 1 and 2 show root biomass at the injector (emitter) for each of the treatments at the end of the study.

The following are general comments on seasonal rooting behavior and soil differences:

- There is the typical summer seasonal decline in the root system with an increase in growth in late summer.
- There are slightly more roots in the sandy loam greens than in sand greens.

The following are results relating to oxygen injection:

Sandy loam greens: there was a substantial increase (2 to 3 fold) in root biomass directly adjacent to the injector during the late fall sampling period, most notably with one injection per month (3 times increase in biomass). Root length at the injector was greater primarily with the once per month oxygen injection. At either 9" or 18" away from the injector, the impact of oxygen injection on root growth is less evident or consistent. Oxygen injection did not stop the summer seasonal decline in root biomass. In the late fall, there was a slight increase in root biomass with the 4 times/month oxygen treatment. It must be pointed out that there were not replicate plots and therefore the data is subject to possible over interpretation.

Sand greens: there was a substantial increase in root biomass and length with one monthly oxygen injection at the injector in the late fall. Two injections per month also increase the length of roots at the injector. At 9" and 18" from the injector there was little if any impact of oxygen injection on root growth.

Summary and Recommendation for Future Research

The observation that monthly oxygen injection increased root growth at the injector indicates that the concept of oxygen injection to enhance root growth appears to be sound. The lack of improved root growth away from the injector indicates that a better system of injection is needed. The 1/2" injector inserted 10" deep with the bottom 2" perforated appears not to be adequate to distribute oxygen very far from the injector. Therefore, any future research may need to be directed at improving oxygen injection to a much greater distance from the injector to be beneficial in golf course management.

A. Martin Petrovic

Enhanced root growth was observed at the site of oxygen injection.

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CUTT

Does Milky Spore Disease Work?

IPM Corner

Milky disease is compatible with traditional grub insecticides, however, controlling grubs with an insecticide runs counter to the reliance on infected grubs for spread of the disease and may slow its dispersal.

The disease acts when Japanese beetle grubs ingest the bacterial spores as they are feeding and, provided they ingest a sufficient amount and the soil temperature is high enough, the spores reproduce within the grub.

Many factors have led to the current interest and increased demand for environmentally benign alternatives to traditional pesticides. Industry has responded with an ever-growing list of "new" materials. One category of products experiencing this upsurge in the marketplace is microbials: products based on fungi, bacteria or viruses. In general, successful use of these materials requires greater attention to environmental conditions (temperature, moisture, structure, pH, etc.) and determining results can be problematic, as they may not be obvious or immediate. Managers accustomed to the relative simplicity and convenience of synthetic pesticides can avoid frustration by becoming familiar with the limitations and performance of microbial products.

Many microbial products have only recently appeared commercially, while some have been around for quite some time. Foremost among these is *Paenibacillus (Bacillus) popillae*, milky disease (commonly referred to as milky spore disease and sold commercially as Milky Spore), the first microbial product ever registered in the US. First detected in New Jersey in 1933, USDA trials of milky spore began back in 1937. The commercial registration followed in 1948.

How Milky Spore Works

The basic mode of action is that Japanese beetle grubs ingest the bacterial spores as they are feeding and, provided they ingest a sufficient amount (5-10,000 spores) and the soil temperature is high enough, the spores reproduce within the grub. This results in the hemolymph (internal insect fluids) turning an opaque white—hence the name milky disease. Infested grubs eventually die and the spores, several billion, are dispersed into the surrounding soil. Persistence in the soil is from 2-10 years though persistence in a treated area may be as long as 30 years due to recycling through grub populations.

Commercial production of milky disease remains dependent on obtaining it from infected grubs (*in vivo* production). Several years ago a technique for producing it on artificial media (*in vitro* production) was registered and the products were widely marketed. Unfortunately it turned out that a different but related bacteria was actually being produced which did not have any activity against the grubs. Disappointing results naturally followed and the products were withdrawn from the market. Current production, by a different company, is back to using the earlier method.

Temperature-Related Limitations

While spore reproduction can occur at temperatures of 16°C (61°F), ideal soil temperatures are between 19°C and 21°C (approximately 66°F to 70°F). As soil temperatures are often below this in the north during the primary grub feeding period (third instar grubs in the fall and spring), many question the efficacy of the disease in these colder areas. This question remains unresolved, partially because the nature of the organism makes determining efficacy difficult. You can check infectivity in the course of fall grub sampling by examining third instars. The normally opaque area on the rear of infected grubs will be the characteristic milky white. You can also clip off a leg from the grub and examine the droplet of hemolymph that forms at the cut for this same coloration.

Dividing the number of infected grubs by the total number of third instar Japanese beetle grubs examined will give you a rough percentage. As only a portion of the grub population will be third instar in the fall and some may have already decayed, a more accurate measure would be to sample periodically from late summer through the fall and into the spring just before pupation. However, the inconvenience of adding more tasks to the already crowded schedule most turf managers follow far outweighs the small increase in precision gained.

Application Procedure

The application procedure involves "seeding" the spores into the soil and relying on infected grubs to eventually spread it throughout the soil profile. This has several implications.

A white grub infected with milky spore disease. Regular infection can serve to increase bacteria populations and continue to suppress grubs under optimum conditions.

Results, if any, will take several seasons (3-5 years in cooler climates according to manufacturer's literature) to manifest themselves—a far different situation than the relatively "instant" results managers, and researchers, are accustomed to. The higher the Japanese beetle population in the first few seasons following application, the faster the soil will become thoroughly inoculated with spores. Milky disease is compatible with traditional grub insecticides so they can be used on turf treated with the bacteria. However, controlling grubs with an insecticide runs counter to the reliance on infected grubs for spread of the disease and may slow its dispersal.

How Effective Is It?

Where it works, the overall effect of milky disease is as a population suppressant, not as a direct control. Hopefully it keeps Japanese beetle levels below a damage threshold. If you are considering using milky disease you may want to check before applying to observe the ambient level of disease activity. In areas conducive to spore reproduction it's not unusual to find some incidence of the disease. While it is technically possible to bioassay the soil for the presence of the disease the complexity of doing so makes it impractical for field use.

Another concern is that milky spore only affects one species of "white grub" and in areas where Japanese beetle is neither the sole nor the predominant species this can be a serious issue. Knowing or checking the species composition of your grub population allows you to better gauge any possible benefit. Likewise, knowing the typical soil temperature profile during the fall and early spring will help you determine the likelihood of success. Post-application sampling in the following seasons can confirm or deny the anticipated results.

While more attention to detail is usually involved in successfully using organism-based products, the attraction, pressure and, in some instances, necessity of incorporating alternatives into your pest management program may warrant the time spent determining their viability and potential usage on your turf. More than ever, basic agronomic practices will prove their importance in raising the tolerance level of the turf as fewer products are available to compensate for deficiencies in this area. Hopefully, the ever-growing pressure to rely on materials such as milky disease will spur the research needed to advance their usefulness in pest management programs.

Gary Couch

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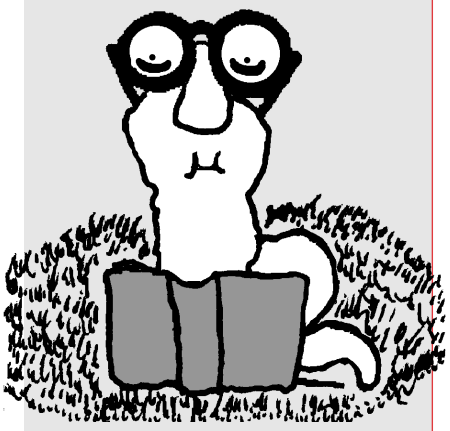
The Birds and the Trees

The Lawn Reader

Sharon Lilly and Ann Arbor Press have provided an important text, Golf Course Tree Management, *that provides easy to understand information regarding the care of trees in turf situations. This book is not just for golf course personnel, rather it is an excellent reference for those in the green industry involved in the care of turf, where trees might be involved.*



Turfgrass managers are regularly reminded to look up from the turf and observe the beauty that is found in the trees. At the same time, in those same trees, are birds that utilize the turfgrass landscape as important habitat. In the last decade through the efforts of a proactive turfgrass industry and environmental advocacy groups such as Audubon International, turf managers have been working to become environmental stewards. What's been lacking is accessible information that recognizes the uniqueness of the turfgrass habitat and how it could influence the birds and the trees.

This installment of "The Lawn Reader" features two recent books that deal with tree management and bird conservation. What follows is my personal, objective review. I have confined my comments to first provide an overview of the text, then discuss its strengths and weaknesses, and finally highlight the key aspects worthy of further investigation.

As always, reader suggestions of books to include in this column in future issues are welcome.

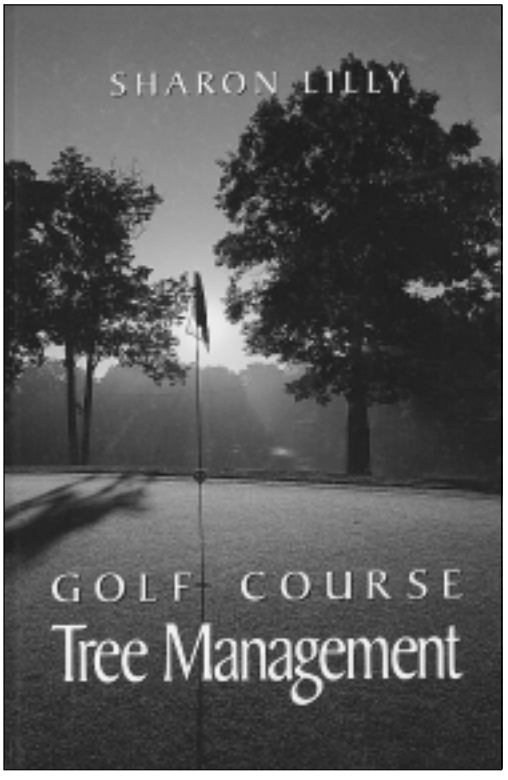
Frank S. Rossi

Golf Course Tree Management
Sharon Lilly
1999, Ann Arbor Press, Chelsea, MI
ISBN 1-57504-117-0

I must admit my bias before proceeding any further. As a passionate turfgrass manager and scientist, trees are a nuisance. I have seen many excellent golf course superintendents wage career jeopardizing battles over the removal of trees. Many of these "specimens" add no strategic benefit to the course and often little aesthetic value. In fact, in most cases the tree creates additional challenges to managing the turf that require an inordinate amount of effort with little hope of improving turf quality. Still, one cannot work in this industry and not appreciate the beauty of an old oak, or a majestic tulip tree, but my personal favorite is the palm tree (all trunk with little shade).

Industry estimates reveal that about 30% of all turf areas are maintained under some degree of tree shade. In addition, there are unique aspects of the tree-turf interaction that must be understood so that the health of both species can be maintained. Sharon Lilly and Ann Arbor Press have provided an important text, *Golf Course Tree Management,* that provides easy to understand information regarding the care of trees in turf situations. This book is not just for golf course personnel, rather it is an excellent reference for those in the green industry involved in the care of turf, where trees might be involved.

The opening chapter on the value and importance of trees was an excellent approach for the cynic in me who lacked the ability to understand the myriad of reasons trees are vital for the overall appeal of a landscape. Although, I will admit I have always preferred the prairie landscape. Nevertheless, the chapters build on each other, first laying a foundation in the understanding of how trees grow and the relationship between trees and turf. From there for-



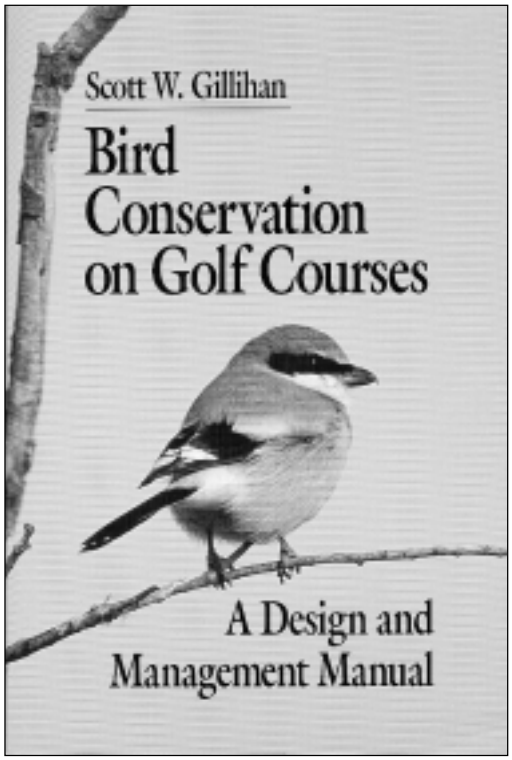
ward, lest a few comments about design and placement on the golf course, the text is an easy to follow entry level guide to tree care. It is filled with excellent illustrations that compensate for the modest photographs (color photos would have been an improvement).

The chapter on hazards and liability is a must read for anyone involved in managing turf areas that receive regular traffic. The author outlines the importance of recognizing the hazard, how to use signs that indicate trouble, and then the legal aspects of liability. In my mind, the next step would be to utilize the closing chapters on how to train your crew to understand tree care and then hiring a tree care professional. These chapters are easy to read and well organized, so that a busy professional could spend an evening and understand the key points, then access more in-depth information from other sources, including a competent tree care professional.

I highly recommend this book for anyone involved in turf management where trees are their responsibility and for those who may not care for trees but would like to know the basics. This book is available to *CUTT* subscribers at a 30% discount from Ann Arbor Press. Contact Sherry Sawyer at (800) 487-2323 or sawyers@sleepingbearpress.com and mention *CUTT* for the discount.

Bird Conservation on Golf Courses: A Design and Management Manual
Scott W. Gillihan
2000, Ann Arbor Press, Chelsea, MI
ISBN 1-57504-113-8

Birds have always been used by humans as an environmental indicator. The landmark text from Rachel Carson, *Silent Spring*, that energized the modern environmental movement was written about the awareness of birds in our lives. The discussion of birds in the turfgrass industry up until the last decade was generally centered around nuisance issues with water fowl and the well-publicized kills that occurred as the result of pesticide applications. The establishment of wildlife enhancement programs such as the Cooperative Sanctuary System from Audubon International, has raised the awareness of the turfgrass industry. Many turfgrass managers now understand the important habitat that the turfgrass landscape provides for many bird species, yet few texts are available to aid their efforts that recognize the turf-bird relationship.



Scott W. Gillihan is Program Coordinator at the Colorado Bird Observatory in Brighton, CO and the author of a new text from Ann Arbor Press, *Bird Conservation on Golf Courses.* This is the first book to my knowledge that attempts to address the relationship between our managed landscape and birds. There are many excellent aspects of this book such as it providing an entry into turfgrass areas as habitat for birds. Also, many of the chapters are easy to follow providing a good overview of the issues without exploring more basic aspects of birds.

Bird Conservation on Golf Courses is not just for golf turf managers, but for anyone interested in designing and managing their landscape to preserve habitat for wildlife. It is essentially an 80 page book and a 255 page reference manual filled with lists of breeder birds, plants and habitat care for specific birds. As a result, I did not find the book easy to read and many times found myself needing a more thorough explanation of some issues that are raised then only briefly addressed, especially in the basic bird biology chapter that amounts to four pages. Clearly, this could have been expanded to address unique habitat aspects that turf areas provide. While the relationship between biology and management is addressed in other chapters, it would have been more useful to discuss these examples in a biological context.

The course maintenance chapter was the

continued on page 16

Many turfgrass managers now understand the important habitat that the turfgrass landscape provides for many bird species, yet few texts are available to aid their efforts that recognize the turf-bird relationship.

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CUTT

Does Your Business Have the Right Culture? Are You Positive?

The Human Dimension

Three keys to creating a positive culture in your golf course or turf business:

- *Commit to shared organizational philosophy.*
- *Create a people-oriented culture.*
- *Align your organizational structure with your organizational philosophy and your culture.*

A few weeks ago I was shopping for a new sports coat. The following are my observations from two of the stores I visited:

Store 1: I observed three sales clerks. Two appeared to be having an argument while the third leaned lazily against a wall. Without moving, the third asked in a disinterested tone "Can I help you?" After I indicated I was looking for a sport coat, he pointed me to the racks and hovered over me as I looked for and tried a couple sports coats. He provided little assistance although he was knowledgeable when I asked questions and urged me to purchase every coat.

Store 2: As I entered, a nicely dressed man approached and asked with a smile "How can I help you today?" When I indicated I was looking for a sports coat, he asked questions to better understand what I wanted, measured me for size and then escorted me to the racks were the coats were located. As I tried on jackets, he was completely focused on assisting me in finding the perfect jacket; he was truly enjoying what he was doing. As I looked around the store, every customer was receiving the same service.

You may be thinking that this is an interesting story but how does it apply to a golf course or turf business where we are may not be selling directly to the customer. Let me suggest that this story is more about the culture of the two stores than it is about customer service. Note that the man at the first store also knew about coats; the difference was attitude. The culture of a business dramatically influences attitudes and consequently performance.

The critical questions are what did the owner of Store 2 do that the owner of Store 1 did not do? How did the Store 2 owner create a positive culture? In this article, I will suggest three keys to creating a positive culture in your golf course or turf business:

- Commit to shared organizational philosophy.
- Create a people-oriented culture.
- Align your organizational structure with your organizational philosophy and your culture.

Commit to Shared Organizational Philosophy

In a positive business culture everyone feels they are a part of a winning team. What does it mean to be part of a winning team? We know that in sports the winning team is the one that better completes the desired outcomes of the sport: scores more points, scores more runs, scores more goals.

What does it mean to be part of a turf team that is "winning?" Let me suggest that again it means successfully completing the desired outcomes. In this case the comparison is not with the opposing team or teams but with the expected or desired performance level or with the goal.

What does it mean for a winning business team to complete the desired outcomes? Let me suggest the answer has three parts:

1. Selecting desired outcomes.
2. Insuring that these outcomes are meaningful to everyone on the team. This means superintendents, owners, managers and employees.
3. Gaining all team members' commitment to these outcomes.

Let's look at some examples of successful winning business teams:

- Southwest Airlines: Despite becoming a major airline, Southwest has maintained the intense desire to succeed derived from its beginnings as a small airline overcoming all attempts by the established airlines to put it out of business.
- Ben and Jerry's Ice Cream: In addition to the usual focus on quality and profitability, Ben and Jerry's has been committed to setting an example of social responsibility for a large company.
- Federal Express: Although most of us think of speed when we think of Federal Express, their success has come largely from their commitment to reliability.

You are probably asking, what does this mean for my golf course or turf business? A business—your business—must begin by establishing its organizational philosophy. You are

probably familiar with mission statements. An organizational philosophy includes mission but is much more. If you review the examples above, much of the commitment was to more than mission, also vision and core values. As you look at the material below, consider the following generalization: the mission is for the owners; the vision and core value are what motivate the employees.

The organizational philosophy provides both the focus for owners, managers and employees being passionate about the business and the framework necessary for all personnel to become empowered to make decisions. The organizational philosophy contains mission, vision and core values as described in the outline below:

Mission or Purpose:

- The answer to "Why the business exists?"
- A broad statement of business scope and operations that distinguishes one landscape or nursery business from others.
- What we get paid for.

Vision:

- The picture of the future to be strived for.
- A motivational tool. An example: Doing our part for a more beautiful community.
- One might be motivated in life to climb a ladder, but without vision, one might get to the wrong roof and thus have to start over.

Core Values:

- "How do we want to act, consistent with our mission and vision, along the path toward achieving our vision?"
- How individuals or the organization wants life to be day-to-day.
- Small number (3-5) and ranked. An example: Disney
  1. Safety
  2. Customers
  3. "The Show"
  4. Efficiency

Mission, vision and core values are pretty abstract concepts. To make them more real, let's look back at our examples of winning business teams:

- Southwest Airlines: The intense desire to succeed derived from its beginnings as a small airline overcoming all attempts by the established airlines to put it out of business is an example of a part of Southwest's vision of being the airline everyone can afford to fly and a core value of excellence and customer service.
- Ben and Jerry's Ice Cream: The commitment to setting an example of social responsibility for a large company reflects the vision of all companies being committed to social responsibility.
- Federal Express: Reliability is a core value.

Simply defining the organizational philosophy is not sufficient to developing a positive culture. The final two steps in establishing expectations for a winning business team are to focus on that those outcomes are most meaningful to everyone on the team and then to gain the commitment of all team members to the key components of mission, vision and core values.

Create a People-Oriented Culture

In this section we focus on business culture. The contention is that a positive culture is encouraged when business personnel are central to the culture.

Business culture consists of an organization's widely shared values, symbols, behaviors and assumptions. It can be thought of as "The way things get done around here." It is not easy to develop a positive culture. A positive culture, therefore, creates a great competitive advantage for any business. This competitive advantage is the nature of relationships within the organization—the way people act toward each other; the "social capital" of the organization. It can be thought of as the organization's underlying social architecture.

Think about the attributes of the culture in Store 2 in the introduction to this article: please the customer, enjoy your work, empathize with and relate to the customer. Think about how hard this culture must have been to establish! Think about how difficult it would be to compete with this store!

Now think about your own community. What business would you like to shop at or work for? What is the culture in that business? What are its attributes?

Culture is the intersection of the two conceptual categories of how people relate: sociability and solidarity. Sociability is a measure of friendliness among members of a community. In a highly sociable culture people do things for each other because they want to; there are no strings attached. It means people relate to

continued on page 14

Simply defining the organizational philosophy is not sufficient to developing a positive culture. The final two steps in establishing expectations for a winning business team are to focus on that those outcomes are most meaningful to everyone on the team and then to gain the commitment of all team members to the key components of mission, vision and core values.

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Creating Positive Culture

continued from page 13

Culture is the intersection of the two conceptual categories of how people relate: sociability and solidarity. Sociability is a measure of friendliness among members of a community. Solidarity is based in the mind rather than the heart. These relationships are strong whether or not the individuals personally like each other.

Now that your business is committed to its organizational philosophy and has defined its culture, everything *must be focused to accomplish the mission, vision and core values, and maintaining the culture.*

each other in a friendly caring way. Solidarity is based in the mind rather than the heart. In high solidarity cultures relationships are based on common tasks, mutual interests, and clearly understood shared goals that benefit all of the involved parties. These relationships are strong whether or not the individuals personally like each other.

The diagram at the end of this article illustrates four types of cultures based on the levels of sociability and solidarity. Even though all four types of culture are feasible, I think you'll agree that few of us seek a business that is low on sociability. Most of us will seek to have a high solidarity business. Our success in defining a unique and clear organizational philosophy and our success in gaining commitment will determine whether we seek to establish a communal or a networked culture. The US Women's National Soccer team that won both the last World Cup and the last Olympic gold medal is an example of a communal culture. The team members are incredibly focused on their goal and really like each other and their personal relationships.

Align Organizational Structure with Philosophy and Culture

Now that your business is committed to its organizational philosophy and has defined its culture, *everything* must be focused to accomplish the mission, vision and core values, and maintaining the culture. All organizational structures, business systems and policies must be aligned with the organizational philosophy and the culture. All supervisory relationships must focus on the mission, vision, core values, and culture. Anytime this is not true, damage to the positive culture will occur.

Perhaps this is best understood by looking at the following examples of businesses not in alignment:

- A business has a core value of innovation but the culture is such that new ideas are unwelcome and immediately challenged.
- A business has a core value of honesty but there are no policies for dealing with dishonesty.
- A business has a desire to be the best in its community but supervisors are expected to be very conservative in compensating employees.
- A business has being environmentally friendly in its mission statement but implements environmentally questionable practices whenever the alternative would cost more.
- The business leaders state that they encourage everyone to increase their responsibility but require a supervisor's approval for every decision.

Think about how you would react to each of these situations. Every time a business is not in alignment, someone will experience frustration and the culture will be damaged. Are there ways you can increase the alignment of your business?

Create a Positive Culture

The following are the three keys to creating a positive culture in your business:

- Commit to shared organizational philosophy.
- Create a people-oriented culture.
- Align your organizational structure with your organizational philosophy and your culture.

I conclude with the following suggestions for implementing these three keys:

- Organizational philosophy: Develop the mission, vision and core values for your business.
- Commitment: Gain the commitment of everyone associated with the business to the mission, vision and core values. Continually reinforce the mission, vision and core values especially focusing on those that you know have the most meaning to business team members.
- Motivation: Understand that each individual must be self-motivated. Your role as the owner or manager is to provide the culture where each individual chooses to be motivated.
- Herzberg: There are many theories of motivation but Herzberg's maintenance and motivational factors are perhaps the most useful. This theory holds that maintenance factors like wages, fringe benefits, security, fair work rules, parties, work breaks, working conditions, and status are important to maintain motivation. If one does not feel these are fair, he or she will lose motiva-

tion. These factors, however, do not create motivation. The motivational factors are challenging work, feelings of personal accomplishment, recognition for achievement, achievement of increasing responsibility, a sense of importance to the business, and access to information.

• Feedback: A positive culture is always characterized by frequent feedback, especially kudos.

• Trust: Good interpersonal relationships, including supervisor-employee relationships, are characterized by high levels of trust. Trust is increased when owners and managers are unquestionably trustworthy.

• Positive Attitude: The owners and managers set the tone for the business'culture. A positive culture is unlikely if each owner or manager does not have a positive view of the business and his or her role in it.

Robert A. Milligan

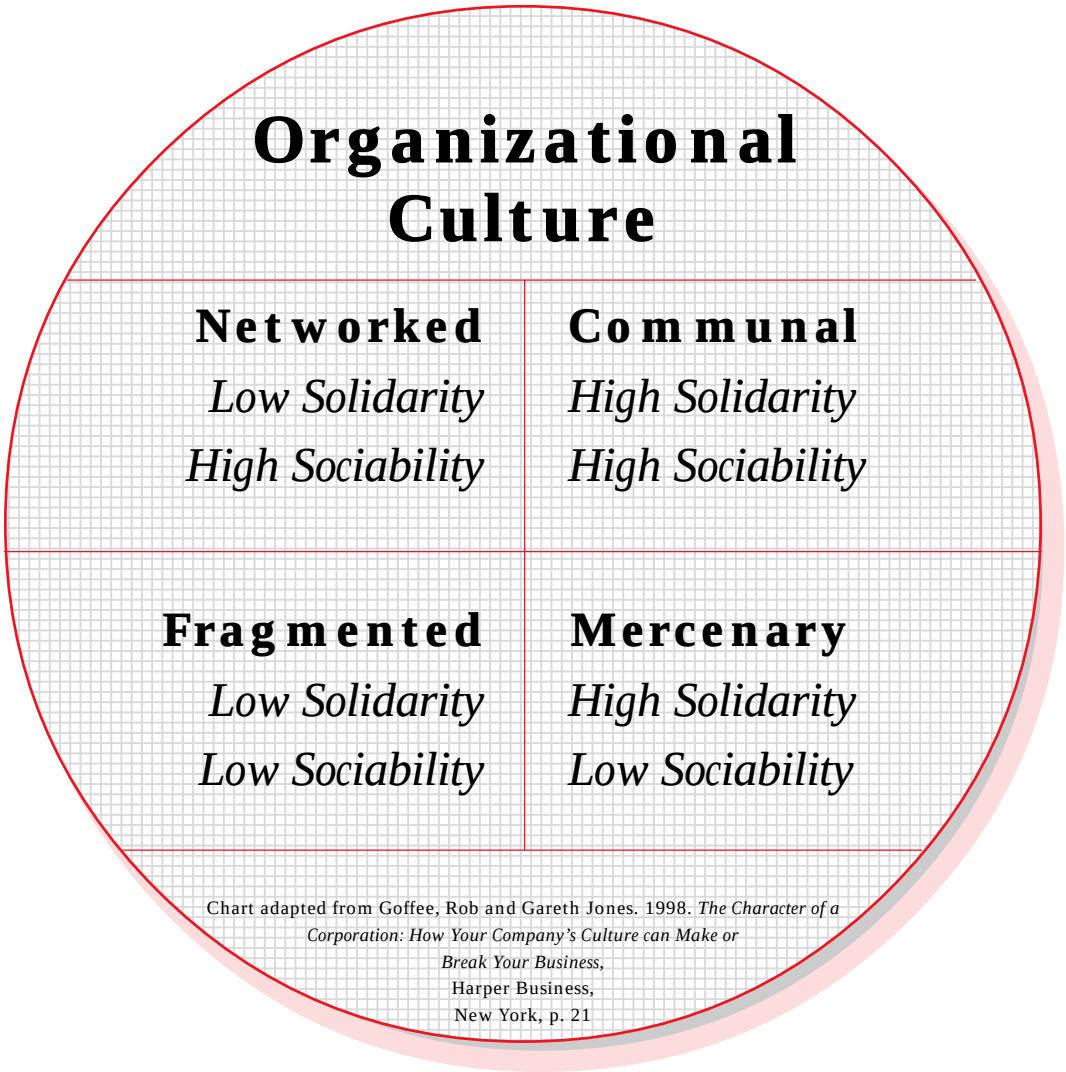

Chart adapted from Goffee, Rob and Gareth Jones. 1998. *The Character of a Corporation: How Your Company's Culture can Make or Break Your Business,* Harper Business, New York, p. 21

Implementing the three keys to creating a positive business culture involves emphasizing:

- *Feedback: A positive culture is always characterized by frequent feedback, especially kudos.*
- *Trust: Good interpersonal relationships, including supervisor-employee relationships, are characterized by high levels of trust.*
- *Positive Attitude: The owners and managers set the tone for the business'culture.*

Motivational factors include: challenging work, feelings of personal accomplishment, recognition for achievement, achievement of increasing responsibility, a sense of importance to the business, and access to information.

continued from page 11

most disappointing at only nine pages. In fact, most of the chapter focused on the negative aspects of pesticide use. There was only scant reference to the other aspects of a turf management system that could benefit birds. For example, there is a discussion of insecticide use and how it reduces insect populations that birds need to feed on. The author suggests letting outbreaks occur so that a superabundant food supply is available for birds to make their long migratory journeys. While I completely understand the ecological aspect of this recommendation, it does not recognize the situation that many turf managers are faced with regarding turf loss. A better way to address this would have been to work with some entomologists to develop a strategy for "controlled outbreaks" that serve the bird population and allows the playable areas to survive.

Bird Conservation on Golf Courses is a good first effort and an excellent reference book, but could have gone much further. Much of what is addressed in a general sense is available in the Ron Dodson book, *Managing Wildlife on the Golf Course* (reviewed in *CUTT* Spring 2000). Plus, Dodson's book takes a more holistic approach that allows for an integrated approach for all wildlife, not just birds.

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It's Short Course Time Soon!

Register Now!!

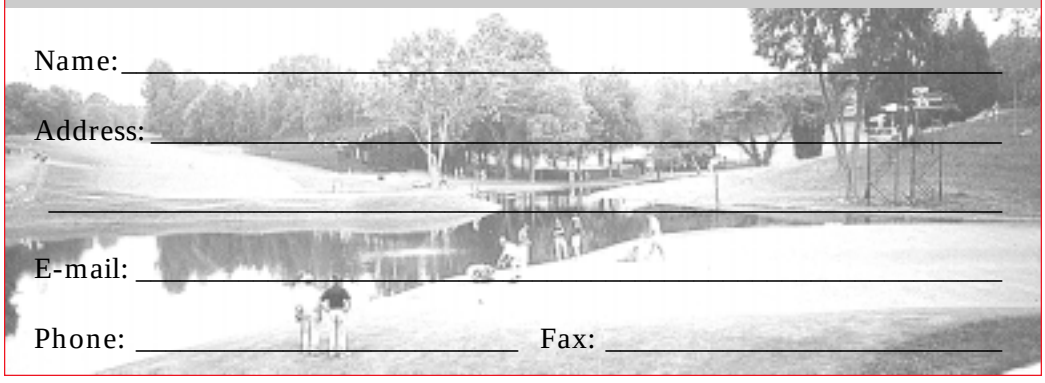
For more information on the 2001 Short Courses:

Fax the completed form to: Cornell Turfgrass Program, (607) 255-9998, or

Mail to: Cornell Turfgrass Program, Cornell University, 20 Plant Science, Ithaca, New York 14853

I would like a registration packet sent to me for the following course(s):

- ❍ *Cornell Turfgrass Management Short Course*
  The Original One Week Course
  January 8-12, 2001, Cornell Campus, Ithaca, New York
- ❍ *Cornell Turf Short Course Advanced Seminar Series*
  Attend one, two, three, or all four sessions
  Cornell Campus, Ithaca, New York
  - Soil Management: January 15
  - Nutrient Management: January 16
  - Water Management: January 17
  - Pest Management: January 18
- ❍ *Cornell Turfgrass Management Short Course*
  The Original One Week Course…*On the Road*
  February 19-23, Westchester County, New York



Name: _____

Address: _____

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E-mail: _____

Phone: _____ Fax: _____

Clippings

continued from page 2

ference in Syracuse, which is conducted by DEC's Pollution Prevention Unit.

The Governor's Awards recognize pollution prevention practices that exceed the legal requirements of environmental protection and successfully reduce or eliminate the generation of pollution at its source. The awards are given each year to organizations representing small, midsize and large businesses; federal, state and local governments and educational institutions; and trade associations or other business and industry groups.

Applications for the awards were judged by a panel from business, environmental and government organizations. Criteria included a project's success at reducing toxic and hazardous pollution, as well as the overall environmental record of the applicant, the economic benefits of the project, the extent of employee participation, management commitment, and the applicability of the project to others.

"Overall releases of pollutants in New York State have decreased dramatically over the last decade as businesses and organizations continue to recognize the benefits of pollution prevention," Commissioner Cahill said. "The Governor's Awards for Pollution Prevention and the Annual Pollution Prevention Conference play a vital role in this process by bringing together the field's best minds to share ideas and successes."

The 2001 Short Course Season is Set

The Cornell Turfgrass Short Courses are set for the 2001 educational season. This year we will offer the original course in a one week format at Cornell and in Westchester County, as well as the Advanced Seminar Series at Cornell. The Original Turfgrass Management Short Course is scheduled for January 8 through 12, 2001 on the Cornell campus. This course will be filled with lectures and the hands-on learning you've come to expect from the Cornell Turf Team. This course offers everything a turfgrass professional needs to know to get started or refresh their education with the latest research based information.

The week of January 15 through 19 is the Short Course Advanced Seminar Series. This series will offer individual full day seminars on topics such as soil management (1/15), nutrient management (1/16), water management (1/17), and pest management (1/18). The full day seminars can be attended individually or as a full week training session and will build on the basics established in the Original Short Course. The Advanced Series will be ideal for lawn and landscape, golf course and sports turf managers who are looking for the latest research-based information that may change the way you manage your turf.

Finally, 2001 marks the fifth year we have offered the Short Course "on the road." During the first three years we trained over 150 professionals on Long Island; our first year in the Hudson Valley in 2000 was a resounding success. This year we are moving south again to Westchester County, sponsored in part by the New York Turfgrass and Landscape Association and Cornell Cooperative Extension Associations in the Hudson Valley. We will be "on the road" the week of February 19–23.

If you'd like information on any of these courses, contact our Director of Turfgrass Education, Joann Gruttadaurio, at (607) 255-1792 or jg17@cornell.edu, or return the coupon on page 16.

Five organizations won the 2000 Governor's Awards for Pollution Prevention for outstanding environmental protection efforts through pollution prevention. Among the winners was Colonial Acres Golf Course in Glenmont, Albany County, and its golf course superintendent Pat Blum.

The Cornell Turfgrass Short Courses are coming:

- *Original Turfgrass Management Short Course, Jan. 8–12, 2001, Ithaca*
- *Short Course Advanced Seminar Series, Jan. 15–19, 2001, Ithaca*
- *Turfgrass Management Short Course "On the Road", Feb.19-23, 2001, Hudson Valley*

Energy Crisis?

continued from page 20

Electric mowers use half the energy of gas powered. Dull-bladed mowers use 22% more energy than a well-sharpened mower. A reel mower is three times more efficient than a rotary mower. How would we rethink our mowing practices if energy costs forced us to look at these issues?

In fact, on a per unit area basis, the maintenance of edges and borders is more energy intensive than mowing large areas. A 1983 study conducted in Utah demonstrated how almost 50% of the labor spent on mowing was for edging and trimming, in spite of the fact that it performed only half as much.

times per day. Petroleum-based synthetic pesticides and fertilizers as well as plastic irrigation equipment are commonplace and enable us to have higher quality turf.

A Florida study from 1974, published in the "Journal of Environmental Systems" found that compared to all other managed turfgrass areas (sports fields, home lawns, corporate parks, airports), golf courses have the highest costs per unit area from both an economic and energy perspective. This was confirmed in a California study published in the journal "Ecology" where energy costs were determined. In that study, the total energy use was similar to the Florida study, however, almost 70% of all the energy used for turf management was for irrigation.

Interestingly, in both studies, home lawns had the next highest energy and economic costs per unit area. Still, most scientists who study this area agree that completely eliminating turf is not likely to reduce overall energy consumption as result of the important benefits of a turf area.

Mowing Energy

The Florida energy study indicated that mowing accounts for 50% of the energy used in turfgrass management. Interestingly, only 2-14% of the energy is used for cutting the grass leaf. The remainder goes to throwing the leaf and to engine inefficiency. Nearly 25% of the energy cost of mowing is associated with the manufacture and purchase of the equipment, with the remaining 75% attributed to motor and drive train losses and moving air. Energy use is increased when the grass is mowed wet rather than dry.

Electric mowers use half the energy of gas powered. Dull-bladed mowers use 22% more energy than a well-sharpened mower. A reel mower is three times more efficient than a rotary mower. How would we rethink our mowing practices if energy costs forced us to look at these issues? Would we mow less area? When we use plant growth regulators (PGR) to reduce top growth and mowing, is the energy saved in mowing used up to produce the PGR?

The old saying the "devil is in the details" is very true when considering energy costs for detailing (edging) turf areas. In fact, on a per unit area basis, the maintenance of edges and borders is more energy intensive than mowing large areas. A 1983 study conducted in Utah demonstrated how almost 50% of the labor spent on mowing was for edging and trimming, in spite of the fact that it performed only half as much.

I can remember being "attached" to a gas-powered line trimmer for weeks at a time, trimming around trees, ball washers, sand traps and difficult to mow areas such as hillsides. Given the energy inefficiency of this cutting, substantial savings could be realized if superintendents simply reduced the need for such edging. Planting ground cover and removing trees would help. So, too, would adopting a scruffier, more classical look.

Food, Water and Pests

During the mid-1970s, the price of ammonia used for fertilization more than doubled. As a result, fertilizer prices also increased. In fact, fertilizers have twice the energy per dollar value as the equipment used to manage turf. Even though much less is spent on fertilizers compared to a $25,000 mower, the energy needed to produce the fertilizer based on what you pay for it is considerable higher than the

Battery-operated mowers may offer substantial reductions in the pollution associated with mowing, especially if the power used to charge the mower does not come from coal burning facilities.

Pesticide application is an extremely energy intensive process, however, the activity of the chemicals at low rates does compensate for high energy production costs.

energy that the equipment consumes. Clearly, reducing the use of fertilizer has direct energy savings, but also indirect savings by reducing turf growth that would require additional mowing. Also, proper timing of application to promote color and turf health without stimulating top growth is an important energy saving measure that would also include the use of iron for improved turf color.

The California energy study found that 70% of all the energy used for turfgrass maintenance was used for irrigation—more than in Florida. This was related to the energy intensive nature of using municipal water. Even in Florida, energy for irrigation exceeded that expended for fertilization. There are a variety of other factors that influence energy consumption for irrigation including the use of variable frequency drive motor control and low pressure heads that have been shown to reduce energy requirements significantly. Application uniformity is often overlooked as an element of design. It might cost more up front to add irrigation heads, but the result might well be greater energy efficiency in the long term. The increased use of effluent water has not been evaluated from an energy perspective, but is likely to add some energy efficiency to our irrigation practices, provided it is not pumped great distances.

Pesticide manufacturing is the highest energy consuming practice on a weight basis of all agricultural inputs. In fact, the energy for production is 2 to 4 times greater than that for fertilizers. This includes the production of the active ingredient and the energy used for formulating the product, often with a petroleum based formulant. However, the high level of activity at low amounts of pesticides and selectivity provide other benefits that could reduce energy use, such as for weed control that would require enormous amounts of labor and energy.

Crucial in the pesticide and energy use discussion are intensive preventive strategies, especially for insecticide use. This argues strongly for a more Integrated Pest Management approach to soil insect control, one that emphasizes prevention rather than cure. This effort alone could save substantial energy on many courses with the increased use of preventive materials such as imidacloprid (Merit).

Energy Conservation

Very little research has been conducted on energy conserving turfgrass management. We are generally concerned with pest control and other measures which produce improved turfgrass quality and aesthetics. In the industry, how many turf managers take the time to review annual maintenance for energy use? Records like this might reveal how much energy use has increased over the years as use has increased. At this point in time, in real dollars the additional cost for energy may not be prohibitive. But at some point it might be.

Audubon International includes energy efficiency as a component of its Cooperative Sanctuary and Signature Programs. These programs not only look at the turfgrass area, but also at the entire facility management—an important clarification when viewing energy costs and evaluating efficiency. Nevertheless, we have significant challenges and opportunities ahead of us in the area of energy efficiency.

Frank S. Rossi

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CUTT

A Healthy Ecosystem

Recent concerns with fuel reserves, production, price, and availability are reminiscent of the fuel crisis of the 1970's. How do increased prices and decreased availability of fuel influence the turf industry?

Energy Crisis? It's Déjà Vu All Over Again

A strong economy has lead to significant increases in disposable income in the US. In turn, the turf industry has benefited with new construction and enhanced budgets at existing facilities. However, recent concerns with fuel reserves, production, and the influence on price and availability are reminiscent of the fuel crisis and sluggish economy of the 1970's. How would increased prices and decreased availability of fuel influence the turf industry?

Turfgrass management requires a significant amount of fuel (nonrenewable energy) for the production of fertilizers and pesticides, equipment use, and irrigation. A 1980 National Academy of Science Committee Report suggests that world production of oil and gas was expected to peak by the end of the 20th century, followed by increased prices and strained reserves. It appears that based on the current situation, their prediction was correct.

Environmentally, there are additional costs associated with carbon emissions from gas powered equipment. Ten years ago scientists from around the world gathered at the Intergovernmental Panel on Climate Change and concluded that as a result of human activities the earth's temperature will increase a few degrees in the next decade. This point of view was initially considered controversial without significant scientific support. However, a host of recent measurements have supported the exact conclusion that the earth is warming.

Presidential candidate Al Gore has raised the public discussion of the issue of global warming in his book, *Earth in the Balance*. This book has been attacked in the turfgrass trade literature for being extremist. Consequently, many in our industry oppose a Gore Administration, fearing an increase in environmental regulation. Regardless of who becomes president, the turf industry should be aware of the economic and environmental aspects of nonrenewable energy consumption.

An Energy Sink

A chapter in the *1992 Turfgrass Monograph* from the American Society of Agronomy reviewed the issue of energy use and turfgrass maintenance. The authors suggest that the portrayal of the excesses of turfgrasses and its ultimate futility are only one side of the energy issue. They contend that there is a great need for the industry to always strive to reduce the use of nonrenewable energy, improve the public's understanding of the benefits of turf, and recognize that little information exists on the costs and benefits of turf.

Technological advances in the areas of mowing, fertilization, irrigation, and pest control have been emphasized, though without recognizing the energy associated with each practice. In the last several decades, mowing equipment has been used more extensively and more frequently, including mowing areas several times a week, sometimes twice or three

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