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Sampling For Good Results





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United States Golf Association, Golf House
P.O. Box 708, Far Hills, NJ 07931 • (908) 234-2300
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GREEN SECTION AGRONOMISTS AND OFFICES:

Northeastern Region:

United States Golf Association, Golf House
P.O. Box 4717, Easton, PA 18043 • (610) 515-1660
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500 N. Main St., Palmer, MA 01069 • (413) 283-2237
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11431 North Port Washington Rd., Suite 203
Mequon, WI 53092 • (414) 241-8742
Robert C. Vavrek, Jr., *Agronomist*

Western Region:

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22792 Centre Dr., Suite 290
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Turfgrass Information File (TGIF) • (800) 446-8443

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Cover Photo:

*Sampling properly is
important for soil mix
analysis, disease
diagnosis, and
nematode assays.*

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SAMPLING FOR RESULTS — The Methods Are Important

by **KEITH A. HAPP**

Agronomist, Mid-Atlantic Region, USGA Green Section

A PLANT requires a proper balance of water, oxygen and nutrients from the soil as well as a good growing environment to survive. Golf course superintendents' training in the basics of turfgrass, soils, physiology and pathology equip them to detect many of the problems that may cause imbalances and resultant turf loss. However, additional diagnostic tools are often employed to detect hard-to-solve turf problems.

In pursuit of healthy turf, cultural programs must first lay a strong foundation to maximize the benefits of any fine-tuning technique. One of the most basic agronomic programs is proper fertility. Balanced nutrition, for example, allows growth regulators to be much more efficacious. We know that a hungry, stressed turf is more susceptible to disease or pest problems (e.g., nematodes). Undernourished turf can succumb rapidly to pest pressures. An important component of designing and managing a fertility regime that helps meet the needs of the turf is to test and monitor the nutrient base (growing medium). Many superintendents submit soil samples for chemical and physical analysis regularly.

At times, problems can develop due to the dynamic nature of turfgrass management and changing weather patterns, even with a sound agronomic program in place. When they do, diagnostic clinics are often used to detect and identify plant pathogens and/or parasitic nematodes. When employing the services of a testing laboratory, sampling techniques are one of the keys to obtaining valid results. The purpose of this article is to provide practical guidelines for common agronomic field sampling practices. Procedures for four types of tests will be outlined: 1) physical soil analysis, 2) chemical soil



When evaluating soil test results from year to year, consistent sampling depth is a key factor in obtaining valid results.

analysis, 3) disease diagnosis, and 4) nematode assays.

The results received from a lab for disease diagnosis, chemical or physical soil analysis, or nematode assays can be no better than the samples that are sent to the laboratory. Testing laboratories pride themselves on the precision and repetition of the methods and procedures employed. This same precision needs to be utilized in the field when collecting samples and submitting them for testing. Formal sampling procedures must be established to gain accurate, reliable, and valid information from laboratory testing services.

General Guidelines

First and foremost, establish a formalized sampling procedure at your course so that the individual who collects the samples has clear guidelines to follow. The employee selected to pull soil samples may change from year to year, but the procedures followed in doing so should not. A written set of procedures will help to produce reliable results.

Knowledge of how samples were collected in the past is very important so that new information can be interpreted and reliably compared to trends of the past. Altering the sampling technique can significantly affect the results. In effect, without a formalized written sampling program, a new turf manager is starting fresh when it comes to the chemical analysis of the soil.

One of the first criteria to establish is the sampling depth. Sampling depth is very important and will vary with the testing discipline employed. Also, the height of cut

of the turf helps determine the sampling depth. For example, longer turf often has deeper roots, and root depth influences the size of the available nutrient reservoir. Accurately meeting the needs of the turf depends on accurately sampling to the depth where roots are actively growing.

After the samples are collected, they should be clearly identified and packaged. Loosely packed samples can shift in transport and become contaminated. If a few samples are to be sent, pack the voids within the box used for shipment. Use packing materials (newspaper or styrofoam) to hold the sample bags or plugs in place.

Write down as much information about the sample as possible. Do not place the written information within the sample bag; it can become wet and is then of little use. Wrap the written information in plastic and insert it in a cardboard tube. Then label the tube.

When the samples are assembled, they should be mailed to the lab the same day. If this is not possible, the samples should be stored in a freezer to help keep them from deteriorating. If at all possible, prompt shipment should remain a high priority.

The following are a few additional specific guidelines.

Soil Testing: Chemical Analysis

Many soil testing laboratories perform both chemical and physical analyses. Chemical soil analysis is a basic component of a good turf management program. It involves extracting essential elements from the soil and correlating these levels with the nutritional needs of the turfgrass plant.

Specific nutrient deficiencies can be detected and, if necessary, an appropriate corrective strategy developed and implemented.

The most common laboratory testing procedure performed in golf course maintenance is chemical soil analysis. To ensure reliable results, there are several sampling procedures that should be followed. Some details to include in a formalized program are:

- Determine whether or not to include the thatch with the sample. Some labs indicate that this material should be included, but most suggest discarding the thatch. At the lab, the samples are dried prior to analysis. The oven used to prepare the samples eliminates the green vegetation and thatch. For sampling purposes, consistency is the key. If the thatch is included in the first sample, then all of the samples should be extracted in a similar manner.

- Establish a sampling pattern. Soil samples should be indicative of the entire area. Using a soil probe, take several cores from the area. Using a cup cutter and sending in one large core or sending a collection of aerification plugs is *not* good sampling technique. Also, wet soils are difficult to handle and transport. When sampling, avoid wet areas.

- For greens, a 4-inch sample depth is most often recommended. In areas where the turf is maintained at a higher height of cut (fairways and rough), a 6-inch sampling depth is best. Placing a piece of tape on the soil probe allows for uniform sampling.

- Determine the size of the sample to send. Ten to 12 4-inch plugs, using a ¾-inch soil probe, from greens and tees will supply the proper volume of soil for analysis. This



should provide enough soil in case additional tests are needed at a later date. Most labs keep a soil sample on file for a period of time. Collect the same number of sample cores for fairways and rough areas.

- Use only waterproof soil sampling bags. These bags can be supplied by the soil testing facility.

- It is best to sample greens and tees separately. Mixing several green site samples with tee site samples to create a single sample does not provide valid information.

- Representative sampling from fairway areas (two to three adjoining holes) is a common practice. For fairways, topography is the key. Rolling terrain indicates more sampling sites are needed, and each area tested should be mapped for future reference. If the sample is lost or damaged for any reason, a second sample can be obtained.

- If representative testing is used, the same greens, tees and fairway areas should be sampled each year.

Consistency is the only way to monitor trends.

Soil Testing: Physical Analysis

Physical soil analysis pertains to the size and the distribution of the soil particles within a given profile. The short- and long-term physical characteristics (e.g., bulk density, porosity, stability, infiltration rates) of a soil are determined by physical analysis. This test is commonly performed on putting green soils. For example, knowing the physical makeup of the soil in an existing putting green is important when selecting a topdressing material. Applying the wrong topdressing material can cause significant

problems, and physical soil analysis should be conducted to help determine the proper topdressing formulation.

Physical analysis is especially important for new construction, to ensure the best possible results. The USGA method of putting green construction was developed and refined to help establish the proper blend of materials to support optimal turf growth and provide consistently good quality playing conditions. Physical soil analysis is an essential ingredient in building a USGA green.

The best way to examine the physical properties of an existing soil is by submitting an undisturbed soil core for testing. An undisturbed sample provides more valid information than soil that has been dug up and submitted in a loose state. The sample can indicate problems due to low infiltration rates or the effects of soil layers, and corrective action can sometimes be recommended after this analysis.

A preferred sampling method for submitting an undisturbed soil profile sample from a green is by using a 2-inch-diameter PVC pipe.

- First, cut the pipe into two-foot pieces. Then one edge of each sample pipe should be beveled, allowing the pipe to move more easily through the soil when it is driven into the green.

- Next, drill two holes, opposite each other, at the non-beveled end of the pipe. A metal rod can be inserted through the holes to help remove the pipe from the sample area.

- When the pipe is inserted into the green, pound it deep enough to include, if present, the intermediate layer and drainage gravel. If

these materials are not present, obtaining a 12-inch sample is sufficient. Laboratories will run particle analysis on portions of the profile, if requested. Most problems exist in the upper 3 inches of the soil profile. Significant differences in the physical characteristics within the soil profile can be detected only when an undisturbed sample is submitted.

- When the pipe is removed from the test site, any space at either end of the pipe should be packed with paper to prevent soil shifting. Next, cover each end with newspaper and then securely tape both ends.

- Along with the sample from the green, send a sample of the current topdressing mix, which can be tested to determine if it is compatible with the growing medium.

- If the topdressing is stockpiled on site, use a long piece of 1- or 2-inch PVC pipe and push it deeply into the center of the pile. This sample will provide a more accurate representation of the particle size distribution of the topdressing material.

Sampling to Diagnose Disease

A pest is defined as an undesirable organism. Pests can take the form of diseases, plants or insects. Some diseases are easily identified, as are some insect and weed problems. Mycelium or fruiting bodies provide clear indications of disease identification and direction as to which control strategy should be implemented. On the other hand, some pests do not provide clear visual signs or symptoms to allow proper diagnosis. This is especially true when trying to identify soil-borne pathogens and parasitic nematodes. When dealing with such problems, definitive diagnosis requires the help of a diagnostic clinic and a plant pathologist. The information gained, combined with site observations, helps to formulate a plan of attack. Again, good sampling techniques are important to help ensure accurate identification. Here are some guidelines to follow:

- Send samples that are representative of the problem area. Collect several samples that show a continuum of symptoms. Sample to a 3- to 4-inch depth to include the roots.

- In this case, a cup cutter or 8-inch plug cutter works well to sample damaged areas. Select a sample site along the outside perimeter of the damaged area. Both damaged and healthy turf should be included. If the sample is dry, lightly moisten the soil. Wrap the entire sample in newspaper or aluminum foil and place it in a box with packing material to allow the sample to arrive at the lab intact.

- The sample should be fresh. To facilitate accurate disease diagnosis, it is critical to package and ship the sample promptly.



The best way to examine a soil's physical properties is by submitting an undisturbed soil core. To aid in sampling, a metal rod can be inserted through the end of the PVC sampling tube to help remove the pipe from the soil. Clearly identify each sample with as much information as possible. Securely tape the ends of each sample tube to prevent soil shifting.

Sample decay can occur rapidly. If necessary, refrigeration can be used, but if possible, send the sample right away. Second-day air mail works very well. Also, mail the sample in the early part of the week to avoid having it sit in the post office or lab over a weekend.

- If several different problems are present, package the samples separately.

- The written information should include: type of grass, age of turf stand, date symptoms first appeared, pattern of damage in turf stand (if there is one), a description of the visual symptoms, prevalence in grass stand and severity of symptoms, and a picture of the sample site (if possible). Other written information should focus on the location (e.g., in shade, low spot, high spot, wet spot, etc.), soil conditions, weather conditions prior to symptoms and weather conditions when symptoms occurred, cultural practices (aeration, verticutting, grooming, spiking, etc.) carried out in the area prior to symptoms, and any chemical treatments that have been made to the area (fertilization, pesticides) within a month's time.

Nematode Assays

Another important laboratory diagnostic tool is the nematode assay. When diagnosing

nematode problems in turf, the above-ground symptoms are of little value. An assay supplies information via a systematic extraction process. Identification and a total count of each species is then performed to determine if control measures are necessary. Nematicides are some of the most toxic materials used in turfgrass management. The application of these materials hinges upon accurate and valid information gained from a testing laboratory. The basis for the results, once again, lies with the field sampling techniques.

Not all nematodes are plant parasites. Some are beneficial soil organisms and are necessary to maintain a good microbial balance within the soil. When nematicides are applied, the "good guys" are not spared. The only way to determine if turf damage is directly attributable to parasitic nematodes and if treatment is warranted is to have a laboratory perform a nematode assay. Field sampling in this case is critically important. To better insure accurate results, consider the following:

- Use a $\frac{3}{4}$ - to 1-inch soil probe and sample to a depth of 4 inches. When sampling for nematodes, remove the green vegetation. Assays provide only an estimate of the actual nematode populations. Nematodes are

almost always unequally distributed in the soil, both vertically and horizontally. Samples from different areas on the same green will yield different results. Nematodes will tend to clump in a horizontal plane. This further emphasizes the importance of the sampling depth. For example, a 2-inch sample may show twice the concentration of parasitic nematodes as compared to a 4-inch sample.

- If damage is suspected, 15 to 20 samples should be collected. All the samples from the affected area should then be bulked (mixed together).

- If the intent is to monitor populations from year to year or between different locations, then an area no larger than 500 square feet should be used. When monitoring a site, 20 cores is adequate.

- The soil sample (at least 2 cups) should be placed in a plastic bag to prevent drying.

- If the tests are performed to monitor nematode activity, a specific time frame for sampling should be established. Nematode populations decline in the winter. As soil temperatures increase in the spring, nematodes begin to feed and the populations increase. Reproduction can occur rapidly during the summer. However, the samples should not be collected during high temperature extremes. Due to fluctuations in the nematode population, a single sample may be misleading. Follow-up samples should be taken every three weeks to gain more accurate information. This will help to monitor populations and determine if they are at dangerous thresholds.

- The written information should include: depth of sample, grass composition, estimated depth of root system, soil texture, symptoms and extent of damage, other stresses present, and any treatments that have been applied.

Conclusion

In these times of environmental awareness, using all of the available tools to diagnose and then accurately select a control method is very important. A recent GCSAA survey of golf course superintendents found that 90% of respondents are using or plan to use an Integrated Pest Management (IPM) program. Proper sampling techniques are a part of Integrated Pest Management and help to identify only those areas of the course where treatment is needed.

Laboratory testing can provide valuable information upon which many turf management practices are based. Consistent sampling leads to reliable results. To receive the most valid information from the laboratory, formalize your sampling techniques in the field. Ask yourself if you are "sampling for results."

When submitting turf samples for disease diagnosis, the samples should include a continuum of symptoms from the area, from healthy to infected turf.





*Creating a naturalized buffer strip to separate a pond from turf areas can deter Canada geese.
Bridgehampton Golf Club, Long Island, New York.*

CANADA GEESE — Definitely No “Birdie”

by LAURA E. HENZE

USDA, Animal and Plant Health Inspection Service,
Animal Damage Control

THROUGHOUT much of the country, populations of Canada geese have been increasing exponentially on golf courses and park lands over the past 20 years. This increase has resulted in turf damage, pond eutrophication, and generally unsightly messes. The sources of these problems are what wildlife biologists have termed “resi-

dent” Canada geese. These birds have adapted to urban and suburban areas because of the availability of large expanses of well-manicured turf, interspersed with bodies of water that provide all of their basic necessities — food, water, and cover. These areas also provide protection from predators and sport hunting.

Canada geese traditionally have been a source of recreation and food to hunters and are managed by federal and state wildlife management agencies for that purpose. Before 1935, migrating geese were attracted to hunting clubs with captive live decoy geese. When this practice was no longer allowed, many of these decoy birds were

released and remained in the area to produce "resident" goose flocks.

Legal Status

Canada geese are protected by the Migratory Bird Treaty Act. Under this law, Canada geese cannot be captured, moved, or killed without a permit allowing these activities. No permit is required, however, to scare or harass geese.

Animal Damage Control (ADC) is the federal agency responsible for providing technical assistance to persons with wildlife problems, and they should be contacted before beginning any goose control program. There is an office in every state. ADC can assist in setting up a Canada goose management program specific to your property, which may include obtaining a permit from the U.S. Fish and Wildlife Service. Problems with Canada geese do not occur overnight, so be aware that solving a goose problem may take several years. Eliminating them completely from the property is probably not possible.

Control Methods

Effectively managing resident populations of Canada geese requires an integrated management approach utilizing a variety of tools. These include habitat modification, exclusion methods, harassment techniques, and population reduction. This article discusses tactics that have a scientific basis for reducing problems with geese. Any other methods should be discussed with ADC wildlife biologists to assess their legality and effectiveness.

Habitat Modification

Canada geese need grass for food, water for protection, and protected areas for nesting sites. If these basic necessities are eliminated, geese will be less likely to remain in an area.

1. Stop supplemental feeding of any waterfowl by well-intentioned golfers and the public. Human food is nutritionally unhealthy for wildlife and will concentrate birds, making them more susceptible to

disease. You may be able to work with the town in drafting ordinances that forbid wildlife feeding.

2. Develop habitat buffer strips around ponds and other plantings to break up large turf areas. These provide physical and visual barriers that make geese less comfortable in an area.

3. Construct permanent decorative walls of stone or timber to separate ponds from heavily used turf areas.

Barriers and Exclusion

During the late spring and summer, geese prefer to walk between the areas that they inhabit. The goslings are flightless at this time, as the adult geese often are during their annual molt. Temporary fencing can be installed during this period to keep geese away from areas of play.

Canada geese also have been prevented from entering even large ponds by using a wire, kevlar, or monofilament line grid over water. Stainless steel wire or heavy 80-100 lb. test monofilament line is suspended 10-18

Canada geese in great numbers affect maintenance activities and create areas that are a nuisance to play through.



inches above the water in a 10-15-foot grid pattern. The grid prevents access to the water, making the geese less likely to remain in the area.

Harassment Techniques

Harassment is a convenient and relatively inexpensive means to frighten geese off golf courses. Canada geese, like any other animal, will adapt and become accustomed to repetitious harassment programs when they realize there is no danger involved. Following are several points to remember when establishing an effective harassment program:

1. Initiate the harassment program early in the season, prior to nesting or the establishment of feeding patterns. Extra attention should be paid during periods of sunrise and sunset and during inclement weather.
2. Do not allow even one goose to remain, as it will attract other birds.
3. Be persistent, especially early in the season when birds are looking for nesting sites. Often it requires days to break long-established feeding patterns.
4. Use a variety of harassment methods to prevent acclimation. Usually, no one method will work by itself.

The use of dogs has become a popular tool for goose harassment. Specially trained herding dogs, retrievers, flushing breeds, and even energetic mongrels have proven up to the task of chasing geese, serving as a very effective deterrent. Again, harassment with dogs should start prior to nesting.

The use of pyrotechnics such as shell-crackers, whistle bombs, noise bombs, and screamer/banger rockets can also be used against depredating Canada geese. These should be fired to explode in the air just above the birds. It is a good idea to contact local authorities prior to using these devices, as special noise ordinances may exist.

Visual frightening methods also can provide some success for deterring geese, especially when used in conjunction with other harassment methods. Important components of a good visual frightening device are movement, light reflection, certain colors, and shapes that might resemble natural enemies or predators. Scarecrows, large-diameter helium balloons with eyespots, or flags of mylar or colored plastic have been somewhat effective. Both real and artificial swans have also been used but often provide only short-term deterrence to geese.

Another interesting and apparently successful method of deterrence utilizes a radio-controlled boat that chases the birds on the water. Other superintendents have reported success in startling the birds with the automatic irrigation system. It is obvious that a



A German shepherd is used successfully to harass geese at Gnome Hollow Golf Course in New Jersey.

good imagination and persistence is required to outwit the Canada goose.

Repellents

One of the most recent developments for deterring geese involves the use of the feeding deterrent methyl anthranilate (ReJex-iT AG-36). This product is a feeding deterrent that is sprayed onto vulnerable turf areas. The geese show an immediate response to the treated grass and quickly move to another feeding site. The effectiveness of any repellent depends on its residual life. Stickers can be added to extend the life of the repellent, but repeat application will be required for heavily irrigated and frequently mowed turf.

Population Control

The Canada goose is a migratory game bird and as such is managed through careful population assessment and hunting seasons set by waterfowl biologists. Hunting and removal of Canada geese is a very effective means of reducing the resident geese problem. Your local state conservation department can provide information regarding licensing season dates and bag limits. Several states have requested and obtained extensions to the regular hunting season to better target resident populations. These seasons are opened prior to and following the dates when truly migratory birds move through the area. The extended seasons have been most effective in managing resident goose numbers.

Depredation Permits

Together with the State Conservation Department, the U.S. Fish and Wildlife Service issues depredation permits when geese are not responding to harassment measures or any other methods. The two types of permits most commonly issued are for adding eggs in nests or shooting adults outside of hunting season. A permit also would be required for relocating geese, but this is seldom approved as locations where the birds will be accepted are rare. Permits are issued only when other methods are not possible and only as a reinforcement to harassment techniques. These permits are not issued for population control.

Summary

Canada geese are and will continue to be a common bird species on golf courses and park lands that provide suitable and safe habitat. However, an integrated management approach, utilizing cultural practices, habitat modification, harassment, and population control, can reduce the numbers of geese to levels that do not create a nuisance or damage turf. Work with your regional ADC staff and State Conservation Department to help with this problem. Finally, educate golfers about Canada goose biology, natural history, and available control strategies. Communicate your plans to your golfers, and be realistic about your expectations. It is possible to strike a balance between resident Canada geese and golf.



A light rate of topdressing material applied every two to three weeks throughout the season is a very effective way to modify a root zone. The topdressing is worked into the putting surface with a brush or dragmat.

A Successful Topdressing Program Requires Consistency, Commitment, and Communication

by **ROBERT C. VAVREK, JR.**

Agronomist, North-Central Region, USGA Green Section

ONE MIGHT ASSUME that the practice of making light, frequent applications of topdressing to greens is a relatively recent technique that was developed to maintain modern sand-based greens. The practice of topdressing greens with sand, a sand/peat mix, or a soil/compost,

however, is about as old as the game itself. Historians record a quote (“mair saund, Honeyman”) from Old Tom Morris, who is considered to be the first formal greenkeeper at the Old Course in St. Andrews, Scotland. The interpretation of the quote is “more sand, Honeyman,” which was a request made by

Old Tom Morris to his assistant, Honeyman, to apply more sand to the greens.

Today, the maintenance programs at nearly all of the elite golf courses include topdressing greens frequently throughout the season with either straight sand or a sand/organic material. Superintendents at

these courses customarily make a light application of topdressing every two to three weeks from early spring through fall, trying to match the amount and frequency of sand with the growth rate of turf.

On the other hand, there are some excellent courses that still provide consistent, high-quality putting surfaces with little more than an occasional topdressing to fill open holes after core cultivation. Similarly, the standard practice at many courses that have modest operating budgets and limited labor for maintenance is to do little more than mechanically break up the cores after aerification, drag the greens, and remove the organic debris. Yes, some of these courses have high-quality greens, too.

What, if any, topdressing program is right for you? Each superintendent must make that decision based on the condition of the greens, the available resources, and the golfers' expectations. To aid in the decision-making process, this article reviews the advantages and potential pitfalls of the program.

Advantages

The most basic benefit of topdressing greens is to provide a smoother, more consistent putting surface. Topdressing continually fills in ball marks and other minor imperfections in the playing surface. In fact, relatively heavy topdressing applications are

routinely used to smooth and level the surface of new seeded greens during grow-in and on new sodded greens.

One of the overlooked benefits of topdressing greens is the improvement of playing consistency among greens on an older course that has been renovated and possesses a variety of greens built from different construction materials. From the golfer's perspective, this helps minimize the "hard green / soft green" effect associated with new construction projects.

The primary reason for building a high-sand-content green is to provide a compaction-resistant and well-drained growing medium that is suited to accommodating heavy traffic under a variety of climatic conditions. Timely applications of topdressing also help prevent an undesirable accumulation of thatch in the root zone that can limit drainage and root growth. Sand topdressing does not actually prevent organic matter accumulation; instead, it dilutes the thatch as it accumulates and prevents the development of a dense layer. Topdressing is also an important practice on older greens that already have a thick thatch layer. The combination of core cultivation and topdressing is the most effective way of correcting the adverse effects of excessive organic matter in the root zone. Removing the cores and filling the holes with sand removes thatch and modifies the upper soil profile. Coring followed by heavy topdress-

ing, along with a light/frequent topdressing schedule, is the standard way to build a new, more desirable growing medium above an old native soil profile. A high-sand-content root zone is the necessary compromise associated with the increased play at most courses and the golfers' demands for faster, more consistent playing surfaces, which can be very difficult to provide on older native soil greens.

Finally, a relatively heavy topdressing application also can be used to provide a degree of protection from desiccation during an open winter. The cover of sand is applied during late fall or early winter after the greens are treated for snow mold.

Disadvantages

Unlike some other maintenance practices, topdressing is not a program to be tried for a year or two and then discontinued. A one-year trial of frequent, light topdressing deposits a discrete sand layer in the upper soil profile that will become covered with thatch within a few years unless the program is continued. Layers in the upper root zone can limit root growth and slow the movement of water through the green. Alternating layers of sand and organic matter are often associated with the development of black layer during wet weather or when greens are irrigated frequently for prolonged periods of time.



Heavy topdressing after core cultivation is an effective way to modify the upper soil profile of a poorly constructed green.

Black layer may occur where layers have developed in the profile. Layers slow the movement of water through the green and limit root growth.



The cost of topdressing equipment and the cost of high-quality sand can be concerns at a course that has a modest operating budget. A light sand application over 18 average-sized greens and a practice putting green usually requires between 10 and 20 tons of topdressing. Shipping costs can double or triple the costs for high-quality topdressing. Some type of storage structure for stockpiles of topdressing is also highly recommended. A waterproof floor and a structure with rigid walls and a roof, instead of a parking lot and a tarp or sheet of plastic, is an excellent investment. Spreaders, brushes, dragmats, labor, and the interruption of play must also be considered in the cost of the program.

The amount of time required to topdress 19 greens depends on the available equipment, labor, and the weather. Even when equipment and labor are not concerns, the combination of moist topdressing applied to wet or dew-covered greens and humid or rainy weather can transform a simple maintenance operation into a several-day ordeal for the crew and the golfers. Hours or days may be needed before wet sand dries and can be worked into the putting surface. Consequently, superintendents strive to apply dry sand to a relatively dry green, which usually interferes with the use of the course.

Unlike many private clubs, most public courses do not have the luxury of half a day without play to set aside for maintenance of

the course. It can be nearly impossible to work a topdressing application into the maintenance program every 2 to 3 weeks at a busy course. A number of heavily played public courses, though, have managed to maintain routine topdressing applications throughout the season by blocking out an hour or two of tee times at regular intervals.

Although the long-term effects of topdressing are positive, there can be temporary, but significant, injury to the grass blades if sand is brushed into the surface when the turf is under stress or if coarse, angular sand is used. And damage to the turf is usually minor compared to the wear and tear on reels and bedknives that occurs when recently sanded greens are mowed. Superintendents who utilize thinner tournament bedknives expect to wear out a set of bedknives after every two or three topdressing applications. Some courses use an old set of dull reels to mow greens for a day or two after topdressing, until the sand on the surface disappears into the turf. Not all courses have this luxury; furthermore, mowing a sanded green with a dull mower can take its toll on turf quality as well. The amount of injury to the turf caused by this practice has not been well documented.

Plant pathologists and soil scientists have raised other questions regarding topdressing applications, too. Does an upper soil profile composed of sharp, angular sand particles have an adverse effect on roots when the surface shifts under foot traffic or when

heavy maintenance equipment is used? How much more fertilizer is required to maintain high-quality turf that, once growing in a soil base, now is growing almost entirely in the layer of topdressing near the surface?

There is general agreement that the best combination of moisture-holding capacity and drainage is achieved when a medium (0.5mm to 0.25mm) sand is used for topdressing. What are the consequences, if any, of changing to a coarser or finer material, or from a sand/peat mix to a straight sand? What is an objective, reproducible definition of a "finer" sand, and when does changing topdressing materials produce a perched water table effect in the root zone?

The bottom line — topdressing greens is a practice that is here to stay. The popularity of golf and the expectations for higher quality and consistent putting surfaces mean that more play will be crowded onto older courses. Reconstruction, renovation, and new greens will require topdressing during grow-in and for general maintenance of the playing surface afterwards. A considerable amount of research will be required to separate the legitimate concerns associated with topdressing from the old wives' tales. The next step is to define maintenance practices that minimize the documented adverse effects of topdressing. Through sound research and, perhaps, the development of new equipment, the challenging task of this practice can be made easier for all golf course superintendents.

Pinehurst Provides Habitat for Cavity-Nesting Species

by SCOTT A. LAVIS, CGCS

Former Superintendent, Golf Course Number 2,
Pinehurst Resort & Country Club, Pinehurst, North Carolina

ALL BIRDS and mammals have specific nesting requirements that are necessary to complete their life cycle. One category of birds includes the cavity nesters. Species such as the common flicker, great crested flycatcher, downy and red-headed woodpecker, barn and screech owl, nuthatch, and kestrel all require cavity trees to reproduce and raise their offspring. Unfortunately, these birds have not reproduced well in "managed" landscapes that are often void of cavity trees.

We became particularly aware of this fact at Pinehurst four years ago after finding a common flicker nesting in a small dead pine tree near the 18th tee on Course No. 2. Surprisingly, the flicker excavated a cavity in a dead tree that we didn't know existed. Normally, if we located a dead tree, we removed it as soon as possible. As we observed the bird over the next few months, we wondered where the young would go after they fledged. To our knowledge, there were no other cavity trees on our golf course, especially since we continued to remove them as they died.

At about the same time, two pine trees were struck by lightning and died. As was standard practice, the trees were set for removal as soon as the equipment and time could be scheduled. However, because of our concern for the birds and our desire to create habitat for them, we decided to test another theory. Instead of the usual practice of complete tree removal, we cut out the top portion of the tree and left a 14-foot-high stump. Our hope was that the birds would excavate cavities in these stumps and accept them as suitable living quarters.

Cavity-nesting birds require tree cavities to reproduce and raise their offspring.

At Pinehurst, artificial cavities are excavated in dead trees to provide nesting sites for cavity-nesting birds such as the common flicker, great crested flycatcher, and the red-headed woodpecker. The designated cavity trees blend into the surroundings.



This project was not without risks. Obviously, our first concern was creating a potential liability for the resort. After consideration, we realized we had three factors in our favor that significantly reduced the chances of a lawsuit. First, the two trees we tried this experiment on were located deep in the woods. They were completely out of the normal traffic patterns and posed no threat to golfers. Second, because only a 14-foot stump remained, we felt the chances of the wind blowing it over were practically zero. Finally, we were closely monitoring these cavity trees and planned to remove the trees before they became too unstable. (It should also be noted that when removal becomes necessary, it is scheduled prior to or after the nesting season.)

Since this project was in the experimental stages, we were anxious to see if new habitat for birds could be successfully created. Finally, after eight long months, a red-headed woodpecker was discovered excavating a cavity in one of the trees. We are proud to say it has made its residence there for the past two summers. Fourteen months

after cutting the second tree, an American flicker excavated a cavity and used the nest site for one season.

Currently, 16 14-foot stumps are found around the golf course. Aesthetically, these trees are not displeasing. In fact, if you are not specifically looking for the trees, you do not notice them. It is estimated these trees will last between 5 and 10 years, depending on their age, size, and structural soundness. Due to the success of our program and the stability of the cavity trees, we have begun to apply the same practice closer to cart paths. Recently, Pinehurst experienced a tremendous wind storm, with winds clocked at over 100 mph. This storm blew over 125 trees, *none of them cavity trees*. We now feel more confident in the stability of these newly created cavity trees and are convinced they have minimal liability potential.

The process for creating cavity trees is simple and inexpensive. To reduce the length of time it takes for a cavity to be created, we took the initiative to create a cavity ourselves. First, we removed a 4-inch slab off the top of the tree. This was accomplished

using a chain saw. We then drilled an entrance hole according to dimensions for the targeted species.

The cavity was more difficult to create. A combination of an adjustable wood bit and several chisel types was used. Specific information on cavity sizes for species in your region can be obtained from your local U.S. Fish and Wildlife office or Audubon Society. The cavity sites not only benefit the intended species, but provide nesting sites for secondary birds as well. It is important to drill the entrance hole at a slight upward angle to prevent water from entering the cavity. Finally, we siliconed the slab and used wood screws to secure it back in place on top of the tree. Obviously, since we have just begun this program, we have not had time to evaluate the effectiveness of this procedure. We will continue to monitor the program over the next few years to determine its success.

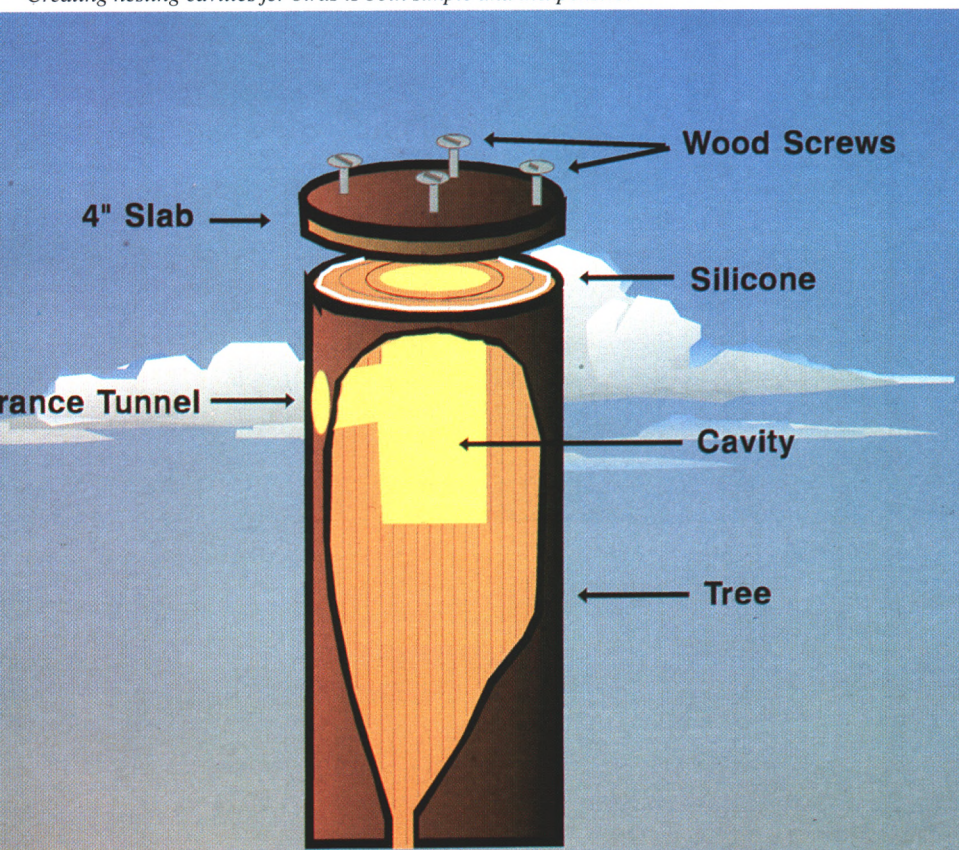
The potential for creating habitat for these species and others that are not present on your golf course is significant. For example, there are no commercially available nest boxes targeting the majority of cavity-nesting species. Someone with a creative marketing flair could produce a structure similar to a dead cavity tree. These could be pre-drilled to the correct dimensions and height and made to resemble tree bark. These structures could be permanently set in the ground and erected in the woods in ideal locations. This would be one more step in creating habitat diversity instead of waiting for trees to perish.

The program that we have implemented is a long-term commitment. Over time, as our sites increase and the excavation of existing areas creates larger cavities, we will attract a larger diversity of species. Although we have seen only two cavity-nesting species use the trees, the other trees are beginning to decay and show signs of excavation activity.

If enhancing the environment on your golf course is important, this operation can play a part in improving wildlife habitat. It is very rewarding to observe new species inhabiting an area after habitat enhancement work has been done. The program is inexpensive, allowing most golf courses a means to incorporate these practices into their plans. If your course takes a proactive role in habitat creation, you and your organization will reap the environmental benefits of living in harmony with nature and encouraging the proliferation of these species.

Scott Lavis became the golf course superintendent at Fiddlesticks Golf Club, Fort Myers, Florida, in August 1995.

Creating nesting cavities for birds is both simple and inexpensive.





All yard wastes from Old Westbury Golf and Country Club are composted on-site. The material is ground, blended, and screened before being used as a topdressing material on the fairways. The topdressing material provides nutrients that are recycled back to the turf.

The Old Westbury Code of Environmental Conduct

by **ARTHUR P. WEBER**
USGA Green Section Committee

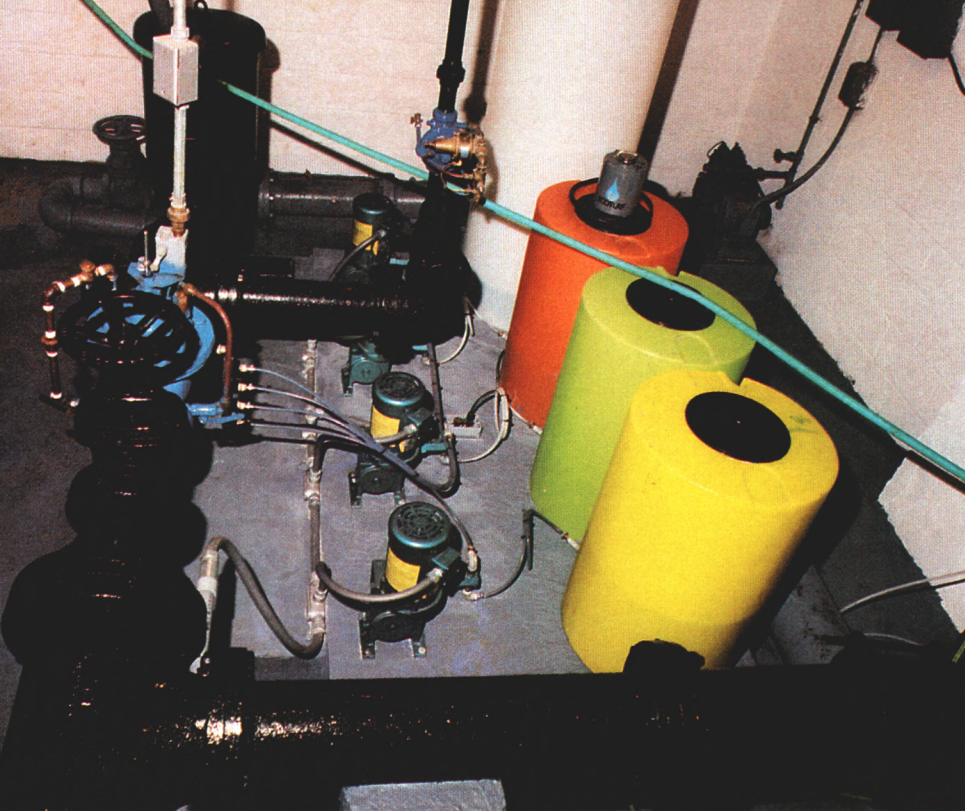
EFFECTIVE April 1, 1994, the Old Westbury Golf and Country Club, Old Westbury, Long Island, New York, became the first club in the United States to adopt a formal program of environmental awareness in the maintenance of its golf course, called the "Code of Environmental Conduct." The Code documents, for both the membership and the community, the club's positive environmental commitment and details the procedures to be followed. Its genesis derives from a set of environmental

guidelines promulgated one year earlier by the Royal Canadian Golf Association. On July 5, 1995, the club was designated a certified Audubon Cooperative Sanctuary, as promulgated by the Audubon Society of New York State with the support of the USGA.

It is not the intention here to include a verbatim recitation of the Code, but rather to highlight its content, describe how it is being implemented and report on its impact, a year and a half subsequent to its adoption. Although techniques are embraced within

the Code, such as Integrated Pest Management, which when out of context stands alone as a defensive or reactive concept, the Code in its entirety presents an aggressive or proactive Integrated Response Management protocol. A copy of the Code can be made available upon request to the club.

Superintendent Phil Anderson, realizing that golfers have been bedazzled by television tournament conditioning and driven by peer competition, has managed nonetheless to successfully live by the Code, albeit



A fertigation system is utilized to apply fertilizers through the irrigation system, providing small amounts of nutrients that the turf can readily use.

requiring a hard-fought balancing act to survive while maintaining responsible environmental stewardship. The results have been positive and without budgetary pressure. To the contrary, expenditures were reduced for chemicals, fertilizers, and for the maintenance of natural areas. Environmentally compatible biological controls and organics are employed in lieu of some previously used chemicals.

In summary, the Preamble of the Code avers:

- The club be committed to take every practical precaution toward ensuring that the products and techniques used in the maintenance of the golf course present the lowest possible risk to the environment.
- The golf course is to provide for the preservation and creation of areas useful to wildlife.
- The goal is to develop programs and utilize practices that sustain an equilibrium between maintaining good quality playing conditions and a healthy environment.
- The Club recognizes that all regulations and plans should be based upon scientifically corroborated data and, to this end, shall support turfgrass research.
- The Members be rallied to support the Club's efforts to balance conditioning with environmental enhancement and conservation strategies.

The Code provides for the establishment of an Environmental Committee to develop programs, foster staff and member support,

and maintain an evaluation process to assess the Club's performance. Employees are invited to participate in the development, implementation, and review of health and safety programs. Policies and objectives are to be disseminated to all levels in the Club organization. A system of planned audits is scheduled to verify compliance with stated objectives, the results of which are to be brought to the attention of management personnel for appropriate consideration.

Practices

All yard wastes from the course are mixed and recycled, employing on-site composting and soil blending, utilizing rototillers, a front-end loader, soil blender, and tub-grinder. Such recycling eliminates the disposal problem of organic wastes in landfills. Grass clippings, leaf cleanups, chipped brush, and thatch from turfgrass renovation projects are used in soil mixes to refurbish or enlarge tees, frame bunkers, stabilize pond banks, and create mounding for burrowing animals, and are finely ground and screened as a topdressing to biologically treat and organically fertilize fairways, tee boxes, embankments, and greens.

Organic materials are disposed of on site for use by wildlife. Scattered dead trees are pruned to remove lateral branches, leaving the main trunks standing as shelter and food sources for birds and wildlife. Aerification plugs are ground up, composted, and used as soil amendments or topdressing, thereby

enhancing turfgrass quality and the uniformity of seed germination while significantly reducing the need for water and fertilizer. Landscaped beds and the surrounds of recent plantings and young trees are mulched to reduce water requirements.

In cooperation with the Village of Old Westbury, the Club serves as a centralized depository for organic debris and leaf cleanup collected by Village road sweepers and landscape gardeners. The materials are processed to renew and enrich hardpan and sandy areas. More than 12,000 cubic yards of organic debris have been collected and processed to date. The operation now serves as a model for neighboring villages and towns.

All irrigation water is derived from the Club's two deep-well sites. The runoff of all rainwater, irrigation water, and snowmelt is directed to collection ponds and perimeter pits improved with inversion wells. Water usage has been reduced significantly by monitoring irrigation output, regulating spray patterns, and watering on an as-needed basis, supplemented by organic wetting agents, all computer-optimized. Using fertigation techniques at the pumping stations allows wetting agents, biological controls, and trace nutrients to be proportioned and selectively diluted into irrigation water. Irrigation efficiency is augmented by a scheduled nozzle inspection and replacement program.

Pesticides are shipped to the club on an as-needed basis to minimize storage and handling requirements. Only those chemicals that are biologically degradable, with short environmental half-lives and known fate in the ecosystem, are used. As a control, a "cap" is imposed upon the total quantity of pesticides in storage at the Club at any one time. Fairways are spot-sprayed as needed, rather than blanket-treated systematically. The pesticide storage area is state of the art, utilizing a rinse-and-recycle program for pesticide containers. A modern closed-loop wash area is under development for mower reels, greens rollers, aerators, blowers, and other turf maintenance machinery, vehicles, and tools. The system will prevent the potential for fertilizer, pesticide, oil, grease, and fuel contamination of ground and surface water that can result from the pressure or steam cleaning of such equipment and vehicles. The contaminants are removed and the purified water recycled.

The most prevalent disease targets have been dollar spot and pythium. An Integrated Pest Management (IPM) program is followed for insect control, applying pesticides only when a problem has exceeded an established damage threshold. Spot spray

treatments are applied at curative rates in lieu of preventive systemic treatments. The program is enhanced by the use of lightweight mowing equipment, turf rollers on greens, and judicious irrigation. Weather forecasts, soil moisture, relative humidity, and air temperature, correlated on a degree-day basis, are monitored to predict disease damage, complemented by leaf tissue microscopy. Pesticide products are varied to avoid the development of resistant disease strains. Again, composts are applied as biostimulants to maintain healthy growth on greens and less dependence on fertilizers. Biocontrol agents and aeration serve in lieu of chemical algicides in ponds.

Thatch layers are regulated by verticutting to optimize their effectiveness in maintaining a dynamic balance between water, nutrient and pesticide retention, and pesticide degradation. Turf samples are subjected, in-house, to near-infrared spectral (NIRS) analysis, measuring how much of 12 essential elements are in the plants' leaf tissue. From this fertility profile, we identify deficiencies, feed the turf only what it

needs, avoid unnecessary fertilizer applications, and reduce the susceptibility of the turf to pest damage. Only slow-release fertilizers are used, and none are applied on slopes with runoff to ponds. Even where runoff is not a concern, fertilizers are not applied within 25 feet of pond levels to maintain a buffer zone. Vegetative buffers also are preserved around ponds to filter runoff and to mitigate erosion. Baseline data have been established for pond water quality, including clarity, dissolved oxygen, and pH.

Only those parts of the golf course that are in play are maintained. *Poa annua*, which otherwise requires heavier doses of fertilizers, pesticides, and water, is controlled by overseeding with more desirable species like creeping bentgrass and perennial ryegrass.

Natural areas have been reestablished. To attract butterflies and hummingbirds, a perennial garden has been established, augmented by strategically located tree saplings and flowering shrubs. Twenty-six nesting boxes have been erected for bluebird fledglings and other cavity-nesting species.

Six bat boxes are located on the property for insect control. Habitats are maintained for wildlife, such as foxes, raccoons, rabbits, quail, pheasant, turtles, frogs, chipmunks, opossum, and red-tailed hawks.

Not to overlook other environmental concerns, the combustion engines of all turf maintenance machinery are fine-tuned and their moving parts well lubricated and overhauled as necessary to mitigate polluting fugitive emissions.

Much to the gratification of our members, the adoption of these practices, so beneficial to the symbiotic relationship between groomed golf play areas and their natural surrounds, has had a positive corollary effect upon the conditioning, playability, and aesthetic appeal of the golf course. Our members take pride in their commitment to environmentally responsible behavior and the leadership role the Old Westbury Golf and Country Club has assumed. Hopefully, as this behavior becomes commonplace, a universally adopted Code of Environmental Conduct will evolve as an adjunct to the Rules of Golf.

The Old Westbury Golf and Country Club uses in-house near-infrared spectral (NIRS) analysis to measure essential nutrients in leaf tissue. The results are used to modify the turf fertilization program.



FLORATEX® — A Low-Maintenance Bermudagrass for the South

by A. E. DUDECK, Ph.D.
Professor of Turfgrass Science,
University of Florida

FLoraTeX® bermudagrass, *Cynodon dactylon* (L.) Pers., is a joint release of the Florida and Texas Agricultural Experiment Stations (1). It is a low-maintenance turfgrass for cemeteries, golf courses, lawns, parks, and sports turfs in warm-humid and warm-semiarid climatic regions of the United States.

Origin

FLoraTeX® bermudagrass is thought to have been introduced into the United States in 1954 as a plant introduction from South Africa. Its true origin, however, was lost over time due to vegetative contamination. During the 1980s, FLoraTeX® was tested extensively

under its experimental number FB-119 in Florida and Texas and throughout the South.

Characteristics

FLoraTeX® bermudagrass is a deep-rooted, warm-season turfgrass with excellent dehydration avoidance (Table 1), low nitrogen requirement (Table 2, Figure 1), excel-

MERITS

- Widely adapted and produces acceptable turf quality throughout the warm-humid and warm-semiarid regions of the southern United States, especially under low-maintenance inputs.
- Widely adapted to soil pH, especially on alkaline soils.
- Very low nitrogen requirement due to superior nitrogen stress tolerance.
- Excellent drought resistance and dehydration avoidance.
- Superior rooting depth and mass.
- Excellent fall low-temperature color retention.
- Very early spring greenup.
- Good wear tolerance, similar to Tifgreen and Arizona Common.
- Resistant to bermudagrass stunt mite.
- Tolerant to the short-winged mole cricket.
- Tolerant to lance and spiral nematodes.
- Least affected by dollar spot under low-nitrogen stress.
- Can be identified by its starch gel electrophoresis banding pattern for aconitase.

LIMITATIONS

- Prolific seedhead producer at certain times of the year.
- Produces viable seed which may contaminate turf with off-types.
- Must be vegetatively propagated by plugs, sod, or sprigs.
- Lacks cold hardiness.
- Poor shade adaptation, which is a characteristic of all bermudagrass cultivars.



lent fall low-temperature color retention (Figure 2), and early spring greenup. It is resistant to bermudagrass stunt mite, *Eriophyes cynodoniensis* Sayed. It is tolerant of short-winged mole cricket, *Scapteriscus abbreviatus* Scudder, and of lance, *Hoplolaimus galeatus* Cobb, and spiral, *Helicotylenchus pseudorobustus* Steiner, nematodes. It is least affected by dollar spot, *Sclerotinia homoeocarpa* F. T. Bennett, under low-nitrogen stress. It is widely adapted and produces an acceptable turf throughout the southern United States (Table 3). It can be identified by means of starch gel electrophoresis for its aconitase "fingerprint." FLoraTeX® bermudagrass is an environmentally acceptable grass for low-maintenance turfs on golf course fairways and roughs, as well as on athletic fields, other recreational sports turfs, roadsides, and home lawns.

Fall low-temperature color retention of FLoraTeX® (center) compared to NuMex Sahara (right) and to an experimental bermudagrass selection (left) at Gainesville, Florida, in December.



TABLE 1

Comparative dehydration avoidance, as assessed by percent leaf firing, of selected bermudagrass cultivars observed after 158 days of drought stress during the summer of 1988 and after 48 days of drought stress during the summer of 1989 at College Station, Texas (3)

Relative Ranking	Year	
	1988	1989
Very High	FLoraTeX® NuMex Sahara Ormond	— NuMex Sahara Ormond
High	— Midiron Midlawn Texturf 10 —	FLoraTeX® Midiron — Texturf 10 Tifway
Medium	— Bayshore	Arizona Common —
Low	Arizona Common — Everglades Guymon — Tifway Tufcote Vamont	— Bayshore Everglades Guymon Midlawn — Tufcote Vamont

TABLE 2

Influence of nitrogen fertilization on ground cover estimates of selected bermudagrasses† after 3.5 years at Fort Lauderdale, Florida (A. E. Dudeck, Unpub. Data)

Cultivar	N Level‡	
	Low	Medium
	Percent	
FLoraTeX®	70 a*	91 a
Tiflawn	46 a-c	79 ab
Ormond	24 b-d	74 ab
Tifway	17 cd	47 cd
Bayshore	0 d	41 d
Everglades	0 d	13 e
Arizona Common §	—	—

†A total of 145 bermudagrasses were involved in this trial.

‡Low-N plots received only one pound of N per 1,000 square feet from a complete N-P-K fertilizer plus minor elements in March of an 8-month growing season. Thus, the average rate was 0.1 pound of N per 1,000 square feet per growing month. Medium-N plots also received a complete N-P-K fertilizer in March, but N was reapplied during the following seven months at the rate of 0.5 pound of N per 1,000 square feet. Thus, the average rate was 0.6 pound of N per 1,000 square feet per growing month.

§Arizona Common did not survive at both N rates and, therefore, was not included in the statistical analysis.

*Means followed by the same letter are not significantly different ($P=0.05$) using Waller-Duncan k-ratio t test.



FLoraTeX® (left foreground) and Tifway (right foreground) bermudagrass after three years in the field at Gainesville, Florida. Plots received one pound of N per 1,000 square feet from a complete N-P-K with minor elements in March of each year.

TABLE 3

Comparative average turfgrass quality of selected cultivars when tested in Florida and Texas with other experimental and commercially available cultivars in an NTEP National Bermudagrass Test that totaled 21 locations in 14 southern states from 1986 to 1991 (2)

Cultivar	Florida	Texas	NTEP
	Rating†		
MS-Pride	6.7	7.7	6.7
Tifway	6.6	7.5	6.6
MS-Express	6.2	8.0	6.6
MS-Choice	6.1	7.3	6.4
Tufcote	6.3	5.7	6.1
Midfield	5.8	5.0	6.1
Midlawn	5.7	6.0	6.0
Texturf 10	5.9	5.2	6.0
FLoraTeX®	6.2	5.8	5.7
Midiron	5.8	5.5	5.7
Vamont	5.7	5.2	5.5
Sonesta	5.7	5.2	5.4
NuMex Sahara	5.3	4.5	4.9
Guymon	5.3	3.2	4.4
Arizona Common	5.0	3.5	4.4
LSD‡	0.7	0.9	0.2

†Quality rated 1 to 9 where 9 = best.

‡Fisher's protected least significant differences at $P=0.05$.

Source of Grass

Foundation stock of FLoraTeX® bermudagrass has been released to licensed growers in Florida. FLoraTeX® is being grown under strict certification standards to maintain its genetic purity. Information regarding availability of certified plant stock may be obtained from Florida Foundation Seed Producers, Inc., P.O. Box 309, Greenwood, FL 42443.

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ON COURSE WITH NATURE

Inventorying Your Resources

by RONALD G. DODSON

President, Audubon Society of New York State, Inc.

ONE OF THE first steps necessary in reaching a goal is to take stock of the beginning point. For example, if we wanted to fly to Indianapolis, the first question a travel agent would ask is where we are beginning the trip. If we were driving, we would grab a map, look for our present location, and plan the shortest route with the best roads.

So it is with environmental and natural resource planning. It is critical that we take stock of the natural resources presently associated with our property. We need to know the ecological region in which the property is located, the size of the property, the acres of various types of general habitats found on the property, and a listing of the types of plants and animals presently found there. Starting the environmental planning process with natural resource information will result in a more successful implementation of the plan and provide a way to document the results. For example, if a plan is put in place to increase the population of purple martins, and it is not known if purple martins have ever been found in that part of the country or if adequate habitat exists for them, the conservation efforts *may* succeed, but it's not likely. On the other hand, if purple martins already exist on the property and we don't know it, or we don't know how many are there, how will we document the results of our plans to increase their population?

But, you may ask, how do I get started inventorying golf course resources when I am not a wildlife expert and I already have a full-time job?

First of all, you need a form on which you can list questions and answers. Questions and answers about the ecological region, habitat types, and kinds of birds, plants, and animals on the property will prove to be a useful reference point. Membership in the Audubon Cooperative Sanctuary Program for Golf Courses includes a Resource Inventory form that has been designed for golf courses across the country. Or you can



Survey your golfers through the course newsletter or post a notice in the pro shop to ask for volunteers in conducting a wildlife inventory.

design one yourself based on what you already know about the natural resources of your property.

After you are clear about what questions to ask and a form has been developed, how do you find the correct information? Some golf courses have hired consultants or other experts to do this work. Although that's not a bad idea, there are many other approaches that may be even more beneficial.

1. Begin your efforts by starting a Natural Resource Reference Library. Some good books to start with include: *Landscape Restoration Handbook*; Peterson Field

Guides: trees, plants, mammals, etc.; *National Geographic Society Birds of North America*.

2. Contact your state Fish and Wildlife office. They are usually located in the state capital and have regional offices throughout the state. They can provide lists of fish, wildlife, and plants of the state and possibly information about your specific location through their Natural Heritage database.

3. Through either a written or oral survey, find out if any of your own staff are birders or amateur naturalists. They may surprise you.



Eagles & Birdies at Kapalua

Just as birdies and eagles are
prized by all golfers,
Kapalua, too, places great
value on the bird species
that call our golf
courses home.

Kapalua's Bay, Village
and Plantation Courses are registered with the presti-
gious New York Audubon Cooperative Sanctuary
System, a program coordinated by the New York
Audubon Society in cooperation with the United States
Golf Association.

In order to preserve the wildlife species on and surround-
ing Kapalua's golf courses, conserving water, providing
food for wildlife species, and limiting pesticides are a few
of the ambitious projects currently being implemented.

If you would like to help us with our ongoing preserva-
tion efforts, please keep this card next to your scorecard.
As you track your birdies, keep track of ours also. On the
back of this card, circle the birds you see today and return
this card to our guest service staff.

We thank you in advance for your assistance, and have a
great game!

Have you seen me today?

Please circle species seen & return to our
guest service staff at
any golf course...



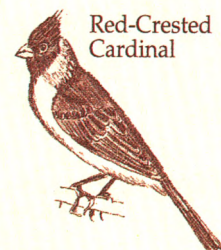
Great
Frigatebird

Lesser Golden
Plover



Black-Crowned
Night Heron

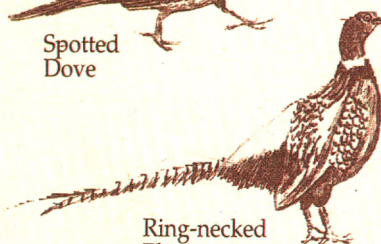
Erckel's
Francolin



Red-Crested
Cardinal



Spotted
Dove



Ring-necked
Pheasant



Japanese
White Eye

Other Species _____

Golf Course _____

Mahalo!

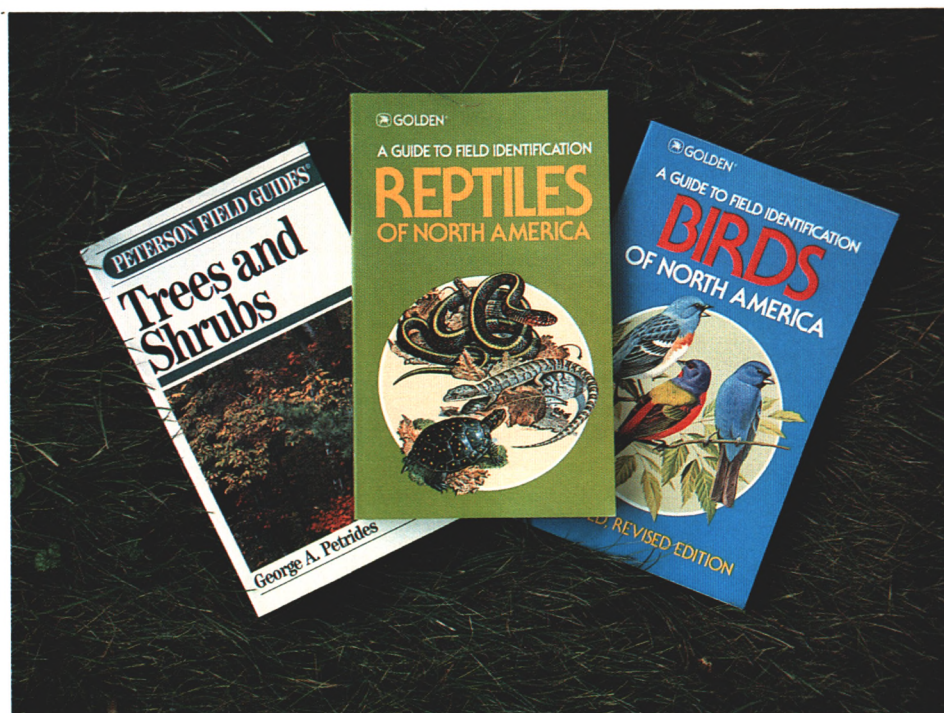
4. Survey your membership or course users, through a newsletter or notice in the clubhouse, asking for volunteer "Resource Surveyors."

5. Contact a local bird club, Audubon Society, or natural history group and ask for help.

6. Contact local high schools or colleges for names of teachers in the science area. They may be interested and they may have students who can help.

7. Local garden clubs, native plant groups, and nurseries can be good sources for help with plants.

By looking for and using volunteers, you will not only find out about the resources of the golf course, but lay the foundation for partnerships that will be valuable when you begin to implement your conservation plans. In addition, golf courses across the country are searching for ways to let people know that courses are valuable assets for wildlife and the environment. Involving others in your efforts to inventory your resources and establish a baseline of information helps all of us discover just how valuable golf course habitat is.



(Top) Completing a wildlife inventory on the golf course can be accomplished many different ways. Kapalua's golf courses (Kapalua, Hawaii) use an inventory card to involve golfers in the process. (Above) Begin your efforts to inventory resources on the golf course by starting a natural resource reference library.

ALL THINGS CONSIDERED

“You’ve Gotta Know Your Limits”

by DAVID A. OATIS

Director, Northeastern Region, USGA Green Section

THE ISSUE of putting green speed never seems to go away, does it? Golfers won't mention it for a week or a month, or possibly even for an entire season. Sooner or later, though, golfers are reminded of the green speed issue and the topic rears its ugly head once again. Of course, there is also the issue of hole locations. Golfers rarely complain about hole locations when greens are slow to medium in pace, but the faster the greens are, the more frequently golfers cry foul! I think some superintendents can probably gauge the speed of their greens by the number of hole location complaints they are receiving. It is every superintendent's nightmare that, on the day when the greens are a little faster, a hole gets placed in a more contoured area. Play is slowed by three- and four-putt (or more) greens and the golfers leave frustrated and angry!

Golfers often remember having been able to use certain portions of greens for hole locations years ago, and “settling” is frequently blamed for the severe contours that now leave some areas unusable. However, the truth is that most of today's putting greens are being managed at speeds significantly faster than was the practice 15, 20, or more years ago, and today's speeds are far in excess of what the greens were originally designed for. In many cases, this results in poor playability and severe agronomic problems.

I believe that the original architectural design should be carefully studied before a desired green speed range is decided upon. You see, most greens have an architectural limit for green speed, but often it is ignored. This refers to the speed above which a significant number of hole locations become unfair and cannot be used. Often these are some of the most challenging ones. For example, a severely contoured green would have a much lower architectural limit than a more level green would.

Exceeding the architectural speed limit shrinks the amount of usable cupping area on a green, and it robs golfers of playing to challenging hole locations that the golf course architect designed into the green. If



Identify the architectural speed limit of a green and establish a policy of obeying that limit.

the limit is exceeded infrequently, the agronomic impact is likely to be negligible. However, exceeding the limit on a regular basis can cause a number of problems, such as increased disease, wear, compaction, weed invasion pressure, etc. It also reduces course setup options. Despite the best efforts of a turf manager, poor playability usually results, since increased traffic leads to thin, worn turf and bumpier putting surfaces. In fact, it is often easy to identify the usable cupping areas on a green because the wear is obvious and these areas usually have a greater percentage population of annual bluegrass. The lesser-used portions are almost always smoother and have more creeping bentgrass in them.

The solution, then, is to identify the architectural speed limit for your course and possibly even for each individual green on it. Inherent agronomic problems should also be considered, as should the desires of the majority of the golfers. A policy for green speed based on agronomics, architecture, and golfer desires should then be developed. Though not recommended from the stand-

point of maintaining consistency, it is acceptable to maintain one or two greens a bit slower than the others if they are unplayable at the higher speeds demanded for the other greens. Putting green reconstruction for the sake of green speed is not advised in most instances.

I firmly believe that *the architectural speed limit of a green should not be exceeded on a regular basis*. When the limit is surpassed, the more contoured areas of greens obviously cannot be used. Conversely, I believe it is essential to *make a point of using the more precarious hole locations when the limit is not being exceeded*. This will provide the challenge and enjoyment envisioned by the golf course architect, and it will provide interesting new variations in course setup for the golfers. It will even make slower greens seem faster.

Both committee members and golf course superintendents need to know their courses' limitations when determining green speed guidelines. These guidelines, along with the rationale behind their development, should then be communicated to the golfers.

TURF TWISTERS

FREQUENT INTERVALS OF

Question: I occasionally hear the term *spoon feeding*; what does this refer to? (Indiana)

Answer: *Spoon feeding* is the use of readily available nutrients applied at light rates and frequent intervals. Normally, it is a strategy used in putting green maintenance. It will often involve the use of a complete (N, P, and K) analysis soluble fertilizer that can be tank mixed with pesticides. It is very important to check the label of each material being tank mixed to ensure compatibility. Application rates often are in the range of $\frac{1}{10}$ th pound of nitrogen per 1,000 square feet, every seven to 10 days. Obviously, this can vary slightly to fit the specific needs of a maintenance program. The idea behind *spoon feeding* is not to push additional growth, but simply to maintain the plant's immediate needs.

EDUCATION

Question: It's becoming more difficult for me to convince the Green Committee that annual attendance at regional conferences as well as the national conference is worth the expense. What can I do to assure them it is time and money well spent? (Florida)

Answer: First of all, invite your Green Committee Chairman, or any committee person for that matter, to attend a meeting or two with you. Let them see firsthand the wealth of information that is available at these important events. Another good idea is to always follow up any conference where significant expenses were incurred with a brief synopsis of the information gained while attending. This informative letter can be distributed to the Green Committee to assist in your efforts of ensuring attendance at future conferences.

PROVIDE LONG-TERM BENEFITS

Question: The golfers on my course always complain about putting green aeration. They always say that the holes affect the roll of the ball, knocking it away from the hole. How much of the playing surface is actually disturbed by traditional core aeration? (Pennsylvania)

Answer: The information we have suggests that when using $\frac{1}{4}$ -inch tines on 2-inch centers, only about 1% of the surface is removed. A $\frac{1}{2}$ -inch tine affects 7% of the putting surface, and a $\frac{3}{4}$ -inch tine affects 12%. As for the notion that these holes deflect balls away from the hole, we might suggest that they deflect the balls toward the hole in about the same percentage. However, golfers are always quick to criticize the aeration process, perhaps not realizing the overall benefits.