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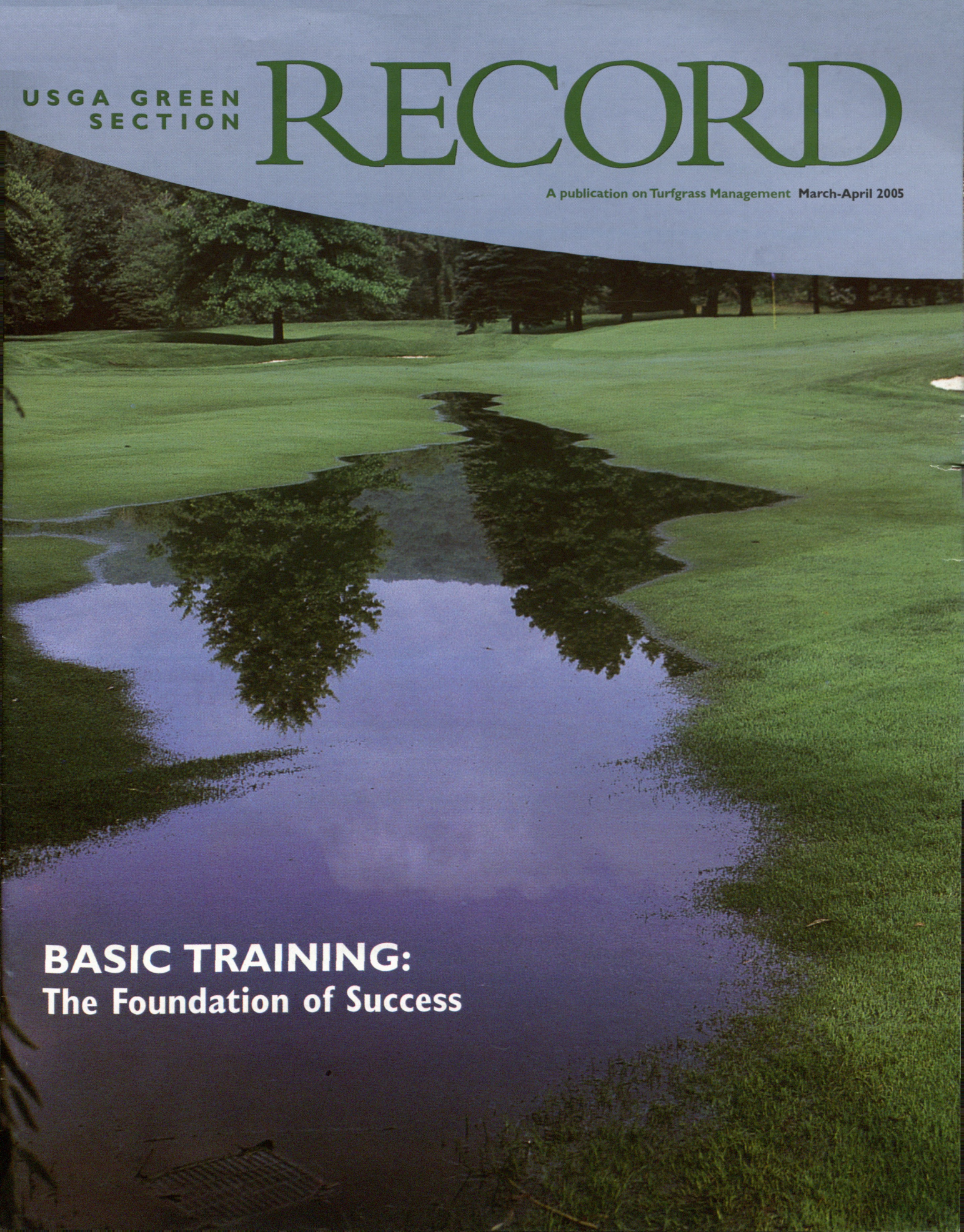

BASIC TRAINING:
The Foundation of Success

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Cover Photo
Drainage is still a fundamental factor in the success or failure of turfgrass areas, regardless of recent advances in technology.

This tee and green have an inherent disadvantage because of the excessive shade. Currently, the chainsaw is the only practical technology to overcome this problem.

BASIC TRAINING

Technology for turfgrass maintenance is more advanced than ever, but basic management programs are still the foundation of success.

BY DARIN S. BEVARD

When buying a car, the list of potential options and amenities is endless: stereo/compact-disc player, heated seats, global positioning system, traction control, anti-lock brakes, etc. Even televisions with DVD players are now common in cars, unthinkable only a few years ago. Options whose benefits are not even known to the consumer are added to the car at great expense because the salesperson convinces us that they are a must-have. Basic items such as the engine and tires are assumed to be included. We may make different choices on these basic items, but rest assured, without them you do not really have a car. The car ceases to function without these basic elements, but consumers often place more focus on amenities. However, if the engine (a necessity) fails, the car is no longer useful; if the compact-disc player (an amenity) stops working, you can still get around town.

In recent years, more amenities or technological advances in equipment, turfgrass varieties, pesticides, and other chemicals have allowed golf course superintendents to provide daily conditions that were unimaginable even 10 years ago. Unfortunately, basic agronomic programs that

Periodic light topdressing dilutes thatch accumulation between scheduled aeration events and prevents layers of thatch from developing in the soil profile.

support these advances in technology are increasingly looked upon as boring or unnecessary. Nothing could be further from the truth.

The word *basic* pertains to a *basis*. Webster defines *basis* as "a foundation upon which something rests; the chief or most stable component of anything; a fundamental ingredient." The chance for hardship and failure increases if the basics are not given proper attention in any endeavor. Basic turf management programs are often taken for granted by turf managers and golfers. New technologies supplement basic programs, but they cannot replace them. If basic turfgrass needs are neglected over time, overall golf course quality will suffer. It is only a matter of time.

The factors that contribute to success or failure in turf management are too numerous to mention. What follows is a discussion of several basic elements that are part of every golf course management program. Properly addressing these factors will prevent a breakdown in golf course conditions.

GROWING ENVIRONMENT

Growing environment is the most basic element for maintaining healthy turfgrass. Warm- and cool-season turfgrasses perform at their best when sunlight penetration and air movement are adequate. Good drainage is also critical. Do these factors sound too simple? Maybe they are. However, on virtually every golf course, old or new, poor drainage, poor sunlight penetration, and poor air movement alone and in concert with each other contribute to management challenges on the golf course. Their impacts are frequently overlooked and ignored. The best golf course superintendent will struggle to maintain desired playing conditions, especially on putting greens, if these limitations are not addressed. Shade and poor air movement promote weak turfgrasses that are less resistant to disease, insects, and traffic, necessitating greater inputs of pesticides and other resources to maintain inferior quality compared to turfgrass grown in good growing environments.

Many techniques are available to improve drainage at the time of establishment and in existing turfgrass stands. The proper technique to use will depend upon individual circumstances. Drainage problems recur in the same areas, year after year, if they are not addressed. Mechanical damage, wet wilt, disease, and poor playing conditions are common characteristics of poorly drained areas.

Improve sunlight penetration, air movement, and turf quality by removing trees that prevent quality turfgrass from being maintained. In some situations, tree removal may not be possible. In these cases, other solutions, such as fans, may need to be considered. In most instances, resistance to tree removal is strictly political. Yet, those who rail vehemently against tree removal are often the same individuals who decry poor turfgrass conditions caused by the same trees they strive to protect. Establishing good growing conditions is the first step in obtaining good grass.

GRASS SELECTION

Selection of turfgrasses suitable for maintenance in a particular environment is critical for limiting future problems. Better quality can be maintained if grasses suited for a region's weather conditions are selected. The grass will be healthier and more resistant to disease and insect problems.

The National Turfgrass Evaluation Program (NTEP) provides excellent information for comparing newer turfgrass cultivars to each other and to previous standard entries, and encompasses broad climatic regions. For example, one creeping bentgrass cultivar may perform at a high level in Georgia but may perform poorly in Maryland because of differences in climate, disease pressure, and insect populations. These important differ-

ences can often be seen in the NTEP data. Additionally, new turf-type grasses such as seashore paspalum offer options for managing quality turfgrass in southern climates with limited high-quality water or poor soil conditions.

In spite of increases in overall quality and cold tolerance of warm-season grasses, recent trends in the transition zone have seen cool-season grasses pushed further south. Maintenance of cool-season grasses in this instance can strain budgets because of greater fungicide and water requirements during the summer months compared to warm-season grasses that may provide better playing conditions during the peak season.

In the last ten years, improvement in turfgrass varieties for putting greens, in particular, and golf courses in general, have provided unprecedented options for new golf course construction projects and renovations, but there are limitations. Plant grasses that perform best in your region. Pushing the envelope with poor grass selection will lead to expensive management challenges in the future.

NITROGEN FERTILITY

Nitrogen fertilizers have significant effects on overall turfgrass quality. Unfortunately, it is difficult to accurately predict nitrogen availability from soil tests over the course of the growing season. Weather conditions, especially rainfall, affect the availability of nitrogen and other nutrients in the profile. Nitrogen generally promotes a greater growth response than any other nutrient when applied to turf. Annual nitrogen applications on golf course turf are often low, or even inadequate, for maintenance of healthy turf.

There seems to be a certain element of pride in maintaining low nitrogen fertilizer inputs. To what end is this low-nitrogen philosophy being employed? Current and long-past research indicates the importance and benefits of nitrogen in reducing disease pressure, allowing recovery from traffic damage, and competing with weeds, including moss, on putting greens. Applications of nitrogen promote uptake of other nutrients such as potassium, even when these other nutrients are present in lower than recommended amounts.

Do not confuse adequate and excessive nitrogen fertility! People who consume a healthy, balanced diet generally will be healthier than people who overeat and become overweight. Conversely, being severely underweight is equally unhealthy. The key is to avoid extremes in either direction. Excessive nitrogen fertility can promote thatch accumulation, other disease problems, and poor wear tolerance. In recent years, however, excessive nitrogen inputs are rarely seen.

Often, the goal of low nitrogen fertility is faster putting surfaces. Reducing nitrogen fertility in the short term to achieve green speed is a common management practice that can be used successfully. Inadequate nitrogen fertility for the long term on putting greens and other turf areas promotes turfgrass that lacks density, struggles to recover from traffic, and has chronic problems with diseases. Focus on growing healthy turfgrass and implementing grooming techniques to achieve desired playing conditions.

The exact quantity of nitrogen needed for a particular turf area on a given golf course will vary significantly based upon location, weather conditions, and the number of rounds played. Any specific number that may be offered here would be arbitrary. For example, most courses' heavily used middle tees should receive more nitrogen to maintain quality compared to the less used forward or back tees. At many golf courses, all tees are fertilized in the same manner, regardless of traffic levels. This may promote excessive thatch on forward and rear tees, while middle tees become thin or devoid of turf. Clearly, a golf course receiving 50,000 annual rounds will need higher nitrogen inputs on all turf areas than one receiving 12,000 annual rounds to account for traffic effects.

Excessive thatch accumulation reduces the superintendent's ability to control soil moisture, promotes certain disease and insect problems, reduces the effectiveness of many pesticide applications, and negatively impacts playing conditions.

Look for indicators to help determine nitrogen fertilizer needs for a given area of your golf course. One obvious indicator of low nitrogen fertility is dramatic growth responses to animal droppings. High populations of clover or other legumes, in particular, may indicate low nitrogen fertility. Legumes fix their own nitrogen and easily out-compete turfgrass under low nitrogen fertility. In the Mid-Atlantic Region, persistent dollar spot disease often occurs in conjunction with low nitrogen fertility. A more subtle indicator is the failure of the turfgrass to heal from traffic and other mechanical damage, such as ball marks, in a timely manner. Monitor the growth

Above: Modern irrigation systems provide unsurpassed coverage, efficiency, and control, but they still are only as effective as those who manage their use.

Right: In many instances, only a small percentage of turfgrass areas on greens may suffer from drought stress. Hand-watering allows these stressed areas to be addressed in a site-specific area without applying water to areas where soil moisture is adequate.

rate of the turf and scout for potential indicators of low fertility. Apply fertilizers based on turfgrass need and response rather than an arbitrary number of pounds of nitrogen per year.

Nitrogen is not the only nutrient that may be deficient, although commonly it is limiting in turfgrass. Availability of other nutrients can be evaluated through periodic soil testing. Fertilizer programs then can be developed to supply necessary nutrients to allow for good turfgrass growth. Sufficient levels of all nutrients must be maintained for optimum turfgrass growth. There are varying theories on maintaining secondary nutrient levels (calcium, magnesium, sulfur). However, research in turfgrass indicates that maintaining sufficient levels of these nutrients may be more important than maintaining them in any specific ratio. Do not lose sight of the big picture of soil fertility by micromanaging for certain ratios when adequate nutrient levels are already present.

THATCH MANAGEMENT

Thatch accumulation cushions the turf from golfer and maintenance traffic, but undiluted, excessive thatch accumulation in fine turf areas eventually causes problems on fairways and putting greens. Certain insect and disease problems increase dramatically when excessive thatch is present. Thatch provides a good environment to harbor many turfgrass pests and provides challenges for managing soil moisture levels during dry weather. Thick thatch produces a barrier to water infiltration when it dries out, becoming water repellant, and making rehydration very difficult. Under wet conditions, excessive thatch acts as a sponge and increases moisture at the soil surface. Soft conditions contribute to scalping and negatively affect playability, especially on putting greens and fairways. Whether wet or dry, excessive thatch accumulation reduces a superintendent's ability to control soil moisture status.

Thatch accumulation can be managed via core aeration, light topdressing, and deep vertical mowing. These programs work best when used in combination with each other. The required amount and frequency of aeration and topdressing depend on many factors, including

length of growing season, fertility, and traffic levels. Research conducted by Dr. Bob Carrow in the 1990s suggests organic matter accumulation above 3-4% by weight in sand-based putting green soils begins a downward slide in overall turfgrass quality, because the potential for the problems discussed above are enhanced. The goal should be to prevent organic matter accumulation from exceeding this threshold. Patrick O'Brien and Chris Hartwiger have written two excellent articles, "Aeration by the Numbers" (*Green Section Record*, July-August 2001) and "Aeration and Topdressing for the 21st Century" (*Green Section Record*, March-April 2003), that discuss frequency and intensity of thatch management programs.

We know that too much organic matter (or thatch) in the upper portion of the soil profile can lead to management problems, and we have the tools to reduce and prevent thatch accumulation. What's the problem? Problems with thatch management are often political. The disruption caused by core aeration and subsequent sanding of greens reduces playability for varying amounts of time. Depending upon geographic location, a single aeration and topdressing procedure could impact a substantial portion of the golfing season, which means loss of ideal playing time at private facilities and loss of revenue at daily-fee golf courses. Do not be fooled. Over time, neglecting aeration programs for short-term gains will lead to problems with disease, turfgrass quality, and overall playability.

Implement thatch management programs when the turf is growing vigorously to minimize healing time. Aerating too early in the growing season leads to increased healing time and more golfer complaints. A short-term increase in nitrogen fertilizer inputs will speed healing of affected areas and lessen golfers' frustrations.

New technologies such as sand injection and smaller aeration tines have provided options for thatch management that result in less disruption to playing surfaces. In many instances, these tools are not being used frequently enough to keep up with thatch production, and problems develop incrementally over time. One may not even realize that the basis of turfgrass decline or failure is related to slow thatch accumulation that contributes to a variety of management challenges. Options are available to reduce disruption, but proper aeration and topdressing programs cannot be replaced.

IRRIGATION MANAGEMENT

Irrigation management varies widely across the country. In regions where cheap water is readily available, over-watering occurs too often. In the Mid-Atlantic Region, turfgrass areas are frequently damaged by too much water during the summer months, more so than by drought stress. Within

Below left: Indicators of low nitrogen fertility should be heeded. Goose droppings provide a dramatic growth and greening effect that indicates nitrogen inputs may be far too low.

Below right: Animal-supplied extra nitrogen on this putting green. Aside from the obvious greening response, note the lack of open aeration holes in the affected area because of increased nitrogen fertility.

reason, using less water is better for the grass, better for playability, and better for the environment. Under hot, dry conditions, there is often a tendency to put on more, rather than less, water to be sure that drought stress does not occur. This can promote soft conditions on greens and fairways, which upset golfers. It also places additional stress on the turf. When turfgrass is over-watered, soil pore space that is normally filled with air is filled with water, and root decline can occur due to lack of oxygen. Roots do not grow deeper in search of water. Rather, soils that have adequate moisture and oxygen levels promote deeper root development. Root mass rapidly decreases in saturated soils with limited oxygen. Water also conducts heat, increasing soil temperatures above air temperatures under hot, saturated conditions.

The complexity and coverage area of irrigation systems continues to expand. Systems costing in excess of $1 million and operated by computer are becoming the norm on golf courses. Regardless of how many bells and whistles are included with an irrigation system, the results will only be as good as the programs of the people who are pushing the buttons.

Fine turfgrass performs better when efforts are made to maintain drier conditions. That is, water should be applied only in amounts to prevent wilt or when wilt is occurring rather than on a repeating schedule that does not take actual soil moisture conditions into account. Over- or under-watering is often not noticed for several days because actual conditions are not being monitored closely. Focus management programs on meeting the needs of the turfgrass, and water only areas that truly need it.

Lack of fine tuning for varied growing environments is another overlooked factor. Protected and shaded areas will require less water inputs than open, full sunlight environments. Golfers must realize that hand-watering will be required at times to achieve the best turfgrass quality, even with the best new irrigation systems, and labor will be needed to hand-water greens. Proper irrigation requires a hands-on approach and constant attention to weather and turfgrass conditions. There are no shortcuts!

COMMUNICATION

One tool at the disposal of every turfgrass manager, regardless of golf course prestige or budget, is communication. Communication is the one tool that can pull all other programs together. Communication with course officials consists of education about golf course needs, management goals, and potential course problems and limitations. There are consequences to any management decision. When there is a problem, course officials want to know why it occurred, how it will be fixed and how long it will take, and what will be done to prevent future occurrences. In many instances, where controversy erupts over golf course conditioning or playability, poor communication and lack of understanding do more to promote the controversy than any single maintenance practice. Conversely, when interested parties communicate, controversy can often be avoided.

Not everyone is blessed with good face-to-face communication skills, but more avenues are available now than ever before for communicating. E-mail communication is commonplace, and the Internet provides a great source of information on just about every topic. Industry publications provide articles that can help you to get a point across or provide education on a particular topic. Consultants can be used as an independent third party to foster better communication between the superintendent and course officials.

Good communication is necessary so that basic turfgrass management programs can be explained and justified. Without it, well-designed management programs may be perceived as unnecessary or unsuccessful, regardless of the actual results. Lack of communication continues to be a significant problem at many golf courses.

More tools have been developed for turfgrass managers than ever before. Golf course superintendents have more options to provide top-quality turf because of advances in equipment, pesticides, and fertilizers, among other technologies. The Internet places information at our fingertips and fosters frequent communication among golf course industry professionals. However, if basic, fundamental practices are not employed, these technologies are far less valuable. There still is no product that can be sprayed or spread to replace basic agronomic practices. Are you overlooking the obvious? Evaluate your maintenance programs to be sure that basic needs of the turf are being met. Fine-tuning strategies then can be implemented to maximize golf course conditions.

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Research *You Can Use*

Habitat Value of Golf Course Wetlands to Waterbirds

Researchers measure which pond characteristics are important for waterbird habitat.

BY C. LEANN WHITE AND MARTIN B. MAIN

As natural wetlands decline in availability and quality, alternative habitats become increasingly important to wetland-dependent wildlife.

Urbanization, roads, and other human-induced changes to natural areas continue to alter and degrade wetlands nationwide. As natural wetlands decline in availability and quality, alternative habitats such as created wetlands may become increasingly important to wetland-dependent wildlife. Wetland-dependent birds, often referred to as waterbirds, seem well suited to use created wetlands when appropriate habitat is available.

In urban and suburban areas, golf course ponds have excellent potential to provide valuable habitat in areas that otherwise lack suitable habitat for waterbirds. Anyone who has spent time on a golf course has noticed a variety of birds such as ducks, geese, herons, and the little peeps running along pond shorelines. It seems clear that many species of waterbirds use golf course ponds. What is unclear, however, is what characteristics of golf course ponds are important for waterbird species.

STUDYING FLORIDA GOLF COURSES

A two-year study (2001 and 2002) in southwest Florida was conducted to determine the habitat value of golf course ponds to waterbirds. Our objectives were to identify the diversity and abundance of waterbirds using golf course ponds and to evaluate the effects of numerous habitat variables on waterbird use. Habitat and hydrological variables were quantified at each pond to determine the relationship between these components and waterbird abundance and species richness. Hydrological variables included trophic status, as an indicator of food availability, and avail-

able shallow water (1.3 ft.) habitat around each pond's perimeter. Habitat features included shoreline and littoral zone vegetation type and cover, and adjacent landscape features (e.g., golf course, residential housing, construction, etc.).

All species studied in this project were waterbirds and are defined as any water-dependent bird species.[14] Members from the following orders of birds were surveyed: Ciconiiformes (wading birds), Gruiformes (short-legged and other wading birds), Pelecaniformes (diving birds), Anseriformes (waterfowl), Podicipediformes (grebes), Coraciiformes (kingfishers), and Charadriiformes (shorebirds). Birds from these orders represent a variety of bird sizes, morphology, foraging techniques, and major substrate used for foraging (e.g., bare mudflat vs. open water). Because the degradation of wetland habitat has affected nearly all species of wetland-dependent birds, it is important to consider more than one species when determining the functionality of created ponds on golf courses for waterbirds. Therefore, all waterbird species observed in the ponds or within 5.5 yards of pond edges were included during surveys.

Created wetlands, such as those found on golf courses, may provide valuable habitat to waterbirds.

Species were categorized into six foraging guilds, defined by their major foraging techniques, food types, and substrates listed for each species,[3,4] as well as personal observations of foraging birds on golf course ponds. Foraging guilds were used in the analysis of waterbird site selection because there were normally too few observations to conduct separate analyses for each species. Twelve golf courses were surveyed during this study, nine owned by Bonita Bay Group and three by Watermark Communities Incorporated. All golf courses were located in Lee or Collier County in southwest Florida.

Golf courses were selected to provide a diversity of study sites within the study area without previous knowledge of the quality or nature of habitat associated with ponds on those golf courses. A total of 183 golf course ponds from these 12 courses were monitored during the study. Annual surveys were conducted during January through April. This study focused on birds that were actively using golf course ponds; therefore, only waterbirds observed in the water or within five yards of the water's edge were recorded. Birds that flew over ponds but were not obviously foraging or did not stop at the pond were not included in the analyses.

Shoreline vegetation is important for many foraging and nesting birds, as well as for birds seeking shelter and protective cover.[14] During this study, shoreline vegetation was delineated by the pond's waterline because the centers of the ponds were generally too deep to allow growth of vegetation other than purely aquatic plants. Percent cover of shoreline and aquatic vegetation was visually estimated. Percent cover class[2] was used to quantify visual estimates of vegetative cover, which was classified into seven terrestrial and four aquatic categories.

Measurements of the landscape features adjacent to the ponds were taken simultaneously with the shoreline vegetation. The effective foraging area within the littoral zone was quantified to determine its influence on site selection of golf course ponds, particularly by wading birds (e.g., herons and egrets). Four water-chemistry parameters were measured to determine the trophic status (i.e., biological productivity) of golf course ponds: water clarity and total chlorophyll a, phosphorus, and nitrogen.

LOTS OF WATERBIRDS RECORDED

During January–April 2001 and 2002, 10,474 waterbirds were observed during surveys of 183 man-made ponds on 12 golf courses. We observed 42 species of waterbirds (30 in 2001 and 40 in 2002) over both years. The most common behaviors of all birds observed were associated with foraging, and the least common with nesting activities. Approximately 46% of all waterbirds observed used golf course ponds as foraging habitat. The remaining 54% also may have used the golf courses as foraging habitat, but they were engaged in other activities (resting, preening, etc.) during surveys.

The diving birds guild was the most commonly recorded. Anhingas (in 2001) and double-crested cormorants (in 2002) were also observed on more study ponds than any other species. The second most frequently observed guild was Open Water, with little blue herons (*Egretta caerulea*) most abundant over the two-year study period. The dense vegetation wader guild was observed least.

LARGER PONDS, MORE WATERBIRDS

The major objective of this study was to determine the influence of pond

Shoreline and adjacent landscape features of the ponds on 12 golf courses in southwest Florida were measured to determine their influence on waterbird use.

characteristics on bird use. Differences among golf courses may have been due to variables that were not easily captured by analyses, but may have included differences in human use, management practices, or location of the courses relative to other resources that were not quantified during this study (e.g., distance to nesting colonies). However, we did analyze the influence of the total pond surface area on each golf course (versus the surface area of individual ponds) on waterbird use and found a significant relationship, indicating that the total pond surface area explains some of the variation in average bird abundance among golf courses.

Several major factors appeared to influence waterbird use of golf course ponds at the landscape and individual pond scale. Golf courses with more total pond surface area had more birds on average. Greater pond surface area (in the form of larger or more numerous ponds within the same golf course) may provide advantages such as reduction of effort required of the birds when moving among ponds to find food.

At the individual pond scale, pond size influenced waterbird use by 4 of the 6 foraging guilds. Larger ponds may be able to provide more foraging opportunities and habitat types to support a greater diversity of waterbirds. This relationship has been reported for birds in other freshwater habitats.[1,6,7,11] However, the availability of food, the most crucial feature for determining foraging habitat suitability for waterbirds, includes not only density but accessibility of suitable prey.[5,9] Many waterbirds are unable to access prey in open-water areas. For example, wading birds and shorebirds are confined to water depths no greater than their leg length. Indeed, the effective foraging area was a better predictor of pond use by the majority of wading birds (open-water waders) than either surface area or perimeter.

Observed differences in bird presence among golf courses may also be related to the course location relative to other landscape features important to waterbirds, such as natural wetlands, flooded pastures, and roosting or nesting areas. Once a golf course has been selected, birds may then select from available ponds within the course based on more specific pond features such as pond size or vegetation structure and density.

Analysis of waterbird site preference for other pond features resulted in a wide range of habitat variables selected by each foraging guild. However, several similarities exist among the selected variables. For example, trees and shrubs provide roosting and resting habitat for several foraging guilds. Short vegetation in the littoral zone and along the shoreline of the ponds was selected by several foraging guilds, probably because it allowed for increased predator detection while foraging. Ponds with man-made structures such as walls and ledges around the perimeter were avoided by one foraging guild (dipping and dabbling foragers), probably because they impeded movement into and out of the water.

The large number of species of waterbirds observed during this study indicates that golf course ponds are used by many different types of waterbirds, principally as foraging habitat (46%). The extent to which waterbirds used golf course ponds in this study was primarily related to pond size, ability of the birds to access prey, and habitat features that influenced security and foraging success. The low densities also suggest there is ample opportunity to increase the value of golf course ponds to waterbirds.

OPPORTUNITIES FOR HABITAT IMPROVEMENT

The wide range of habitat variables selected by each foraging guild indicates that providing a diversity of habitat features among ponds within a golf course would provide the greatest benefits to the largest number of species. To accomplish this goal, ponds could be managed as a wetland complex, whereby different ponds or sections of ponds are enhanced or modified to meet guild-specific needs. For example, creating areas along ponds that have dense shrub cover would benefit dense-vegetation waders, trees can provide roosting sites, and the creation of shallow foraging areas will benefit wad-

The littoral zone is important to birds such as herons and egrets that wade in shallow water areas to search for food.

Table 1

Waterbird species observed during surveys of 183 golf course ponds in southwest Florida during 2001 and 2002. Total abundance, average density (average abundance/total ha for all golf course ponds), and number of ponds where species were observed in 2001 and 2002 are listed. Species are ranked by numbers observed within each guild classification.

Species	Total Abundance	Average Density (No./ha)	Occurrence (number of ponds)	
			2001	2002
Diving Birds				
Double-crested cormorant (*Phalacrocorax auritus*)	3,078	6.564	105	107
Anhinga (*Anhinga anhinga*)	943	2.011	111	119
Pied-billed grebe (*Podilymbus podiceps*)	247	0.527	38	7
Hooded merganser (*Lophodytes cucllatus*)	240	0.512	9	3
Lesser scaup (*Aythya affinis*)	78	0.166	N/A	25
Ring-necked duck (*Aythya collaris*)	1	0.002	N/A	1
Ruddy duck (*Oxyura jamaicensis*)	1	0.002	N/A	1
Open-Water Waders				
Little blue heron (*Egretta caerulea*)	677	1.444	100	21
Great egret (*Ardea albus*)	533	1.137	107	79
Snowy egret (*Egretta thula*)	530	1.130	74	79
Tricolored heron (*Egretta tricolor*)	420	0.896	73	108
Great blue heron (*Ardea herodias*)	340	0.725	85	2
Glossy ibis (*Plegadis falcinellus*)	249	0.531	24	68
White ibis (*Eudocimus albus*)	208	0.444	31	78
Wood stork (*Mycteria americana*)	76	0.162	18	29
Sandhill crane (*Grus canadensis*)	7	0.015	2	14
Dense-Vegetation Waders				
Green heron (*Butorides virescens*)	96	0.205	21	1
Black-crowned night-heron (*Nycticorax nycticorax*)	22	0.047	4	35
American bittern (*Botaurus lentiginosus*)	1	0.002	N/A	4
Dipping and Dabbling Foragers				
Common moorhen (*Gallinula chloropus*)	511	1.090	17	2
Mottled duck (*Anas fulvigula*)	475	1.013	58	8
Blue-winged teal (*Anas discors*)	130	0.277	16	28
American coot (*Fulica americana*)	48	0.102	2	1
Wood duck (*Aix sponsa*)	2	0.004	N/A	70
Hybrid (mottled duck and mallard)	1	0.002	N/A	1
Moist-Soil Foragers				
Killdeer (*Charadrius vociferous*)	497	1.060	99	2
Unidentified shorebird	362	0.772	22	2
Greater/lesser yellowlegs (*Tringa melanoleuca/flavipes*)	288	0.614	58	0
Ring-billed gull (*Larus delawarensis*)	162	0.345	19	10
Common snipe (*Gallinago gallinago*)	35	0.075	12	60
Laughing gull (*Larus atricilla*)	8	0.017	N/A	3
Willet (*Catoptrophorus semipalmatus*)	7	0.015	4	9
Black-bellied plover (*Pluvialis squatarola*)	3	0.006	N/A	36
Black-necked stilt (*Himantopus mexicanus*)	4	0.009	N/A	1
Bonaparte's gull (*Larus philadelphia*)	1	0.002	1	45
Aerial Piscivors				
Bald eagle (*Haliaeetus leucocephalus*)	4	0.009	N/A	4
Belted kingfisher (*Ceryle alcyon*)	157	0.335	33	67
Brown pelican (*Pelecanus occidentalis*)	2	0.004	2	0
Forster's tern (*Sterna forsteri*)	7	0.030	2	2
Least tern (*Sterna antillarum*)	2	0.004	N/A	1
Osprey (*Pandion haliaetus*)	16	0.034	N/A	10
Royal tern (*Sterna maxima*)	5	0.021	2	1
STUDY SUMMARY	10,474	22.337		

Table 2

Foraging guilds with general description of foraging techniques used for classification and representative species for each guild.

Foraging Guild	General Description	Species
Diving Birds	Forage in a variety of water depths, but were generally observed in open water	Grebes, cormorants, anhingas, mergansers, scaup, ruddy and ring-necked ducks
Open-Water Waders	Forage in shallow water with low-density vegetation	Herons, egrets, ibises, storks, cranes
Dense-Vegetation Waders	Forage in shallow water surrounded by dense vegetation	Night and green herons, bitterns
Dipping/Dabbling Foragers	Forage by surface dipping or dabbling in shallow water	Mottled ducks, blue-wing teal, moorhens, coots
Moist-soil Foragers	Forage in muddy or moist-soil areas along the shoreline	Sandpipers, yellowlegs, stilts, willets, killdeer, snipes, gulls
Aerial Piscivores	Generally use perches to search for prey and then dive from a height to capture prey	Terns, kingfishers, eagles, osprey, pelicans

ing birds and numerous other species. Not only would this type of management strategy benefit waterbirds, but it could also provide greater management options for the golf course.

Maintenance problems associated with wet areas along edges of ponds may be ideal for modifications to benefit waterbirds while simultaneously reducing management costs and maintenance challenges. Consequently, opportunities likely exist on many golf course ponds to improve habitat for waterbirds while providing financial savings and generating positive public relations for practices that provide benefits to wildlife.

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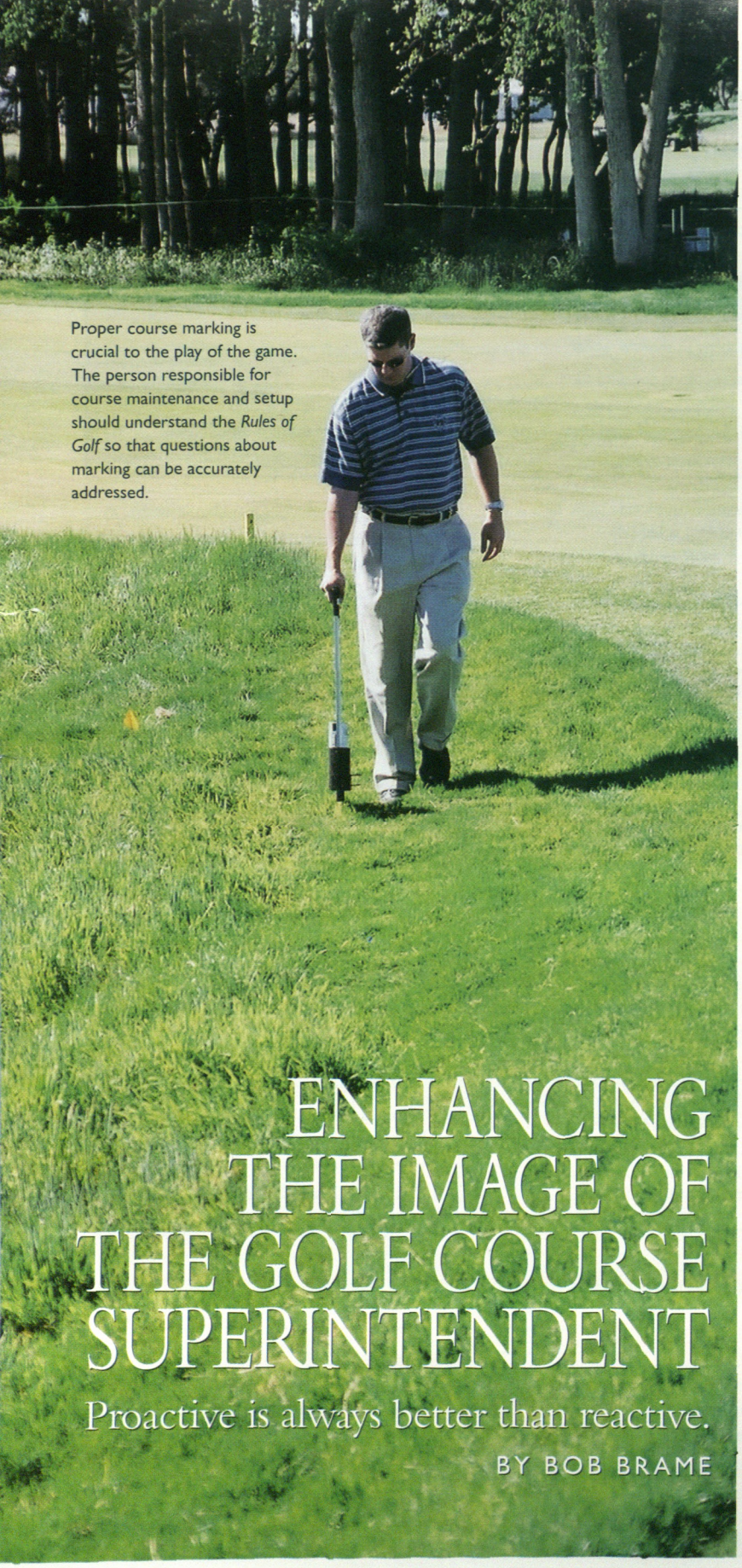
Table 3

Proportion of birds engaged in various behaviors recorded during surveys of golf course ponds in southwest Florida in 2001.

Behavior	Proportion
Foraging or associated movements	45.9
Stationary/resting	34.8
Moving but not obviously foraging	7.6
Wing drying	3.9
Flushed	2.1
Preening	5.4
Nesting activities	0.3



Proper course marking is crucial to the play of the game. The person responsible for course maintenance and setup should understand the *Rules of Golf* so that questions about marking can be accurately addressed.

ENHANCING THE IMAGE OF THE GOLF COURSE SUPERINTENDENT

Proactive is always better than reactive.

BY BOB BRAME

The topic for this article originated with a request for one of our staff to participate in a panel discussion about ways to enhance the image of golf course superintendents. The entire staff was polled on the topic and the results have been combined with my experience working with golf course superintendents for 39 years, 18 of those as a superintendent. Enhancing the superintendent's image within the golf industry and at most courses is a very real need. Hollywood's depiction of Carl in *Caddyshack* did not present today's professional superintendent in a positive light. Such images linger in the minds of golfers, who already have the perception that growing and mowing grass on a golf course is straightforward and comparable to the home lawn experience. This, of course, is neither true nor accurate. Too many superintendents have defaulted to a reactive posture with how their image is being viewed and how it affects their ability to be successful, as opposed to being proactive. The following suggestions are categorized, with the three categories building on each other, and are offered to enhance in a proactive way the golf course superintendent's image in today's industry.

1. WITH THE GROUNDS STAFF AND OTHER COURSE EMPLOYEES

- Separate yourself by how you dress. The superintendent should stand out from other grounds staff. It it's necessary to occasionally get more hands-on, have a change of clothes in your office. A razor, comb, and shower essentials should also be accessible in the maintenance complex. Do not enter the pro shop or clubhouse grubby or wearing jeans.
- Avoid wearing commercialized clothing. Display your course logo or professional associations (e.g., GCSAA, local superintendent associations, and golf associations) as opposed to companies and products.
- Budget for staff uniforms or course logo shirts. The crew's appearance and performance directly reflects on the superintendent's image.
- Avoid, or be very cautious with, your name or photo being used for product endorsements. Regardless of how good a product may be, published endorsements will be seen as a compromise in objectivity.
- Keep your office and the maintenance complex clean and well organized.

Working with outside contractors should mirror the same patience used with the grounds staff, golfers, and committees.

- Implement and maintain a consistent and professional procedure for answering the office phone and recording any subsequent messages. Whether recorded by a machine or the staff, return calls promptly (within 24 hours).
- While on the course, utilize a clean and neatly organized vehicle/cart with your name and title displayed for golfers to see.
- Have a positive attitude. Smile. Don't whine. Use humor when appropriate. Image is a character issue.
- Be clear, patient, and consistent when instructing/guiding the grounds staff. Make sure that they understand their task and have the needed training/tools to be successful.
- Know the names of all course employees. Treat them like individuals and know as much about them as possible.
- Watch and listen patiently before speaking.
- Never criticize your predecessor.
- Do not take cell phone calls when talking with someone. It's rude. Program your voice mailbox and let it work for you.
- Meet regularly (at least weekly) with other key employees like the golf professional and clubhouse manager.
- Work closely with other departments, particularly where responsibilities overlap, such as maintaining the practice range, cart usage, and starting times (routine play, outings, and shotgun starts).
- Play golf regularly with assistants, other key employees, and various groups of golfers. To the extent possible, work to lower your handicap, which may include taking lessons from the golf professional.
- Know the *Rules of Golf* and how to properly mark the course, even though this may be the golf professional's responsibility. When asked a ruling or marking question, know the answer or know how to look it up quickly.
- Avoid stringing together 12- to 16-hour days.
- Take at least one day off every week.

Other employees need the same. Delegate responsibility.

- Make sure everyone is aware that you have a life (e.g., a spouse, children, hobbies, and community interests) apart from the course.

2. WITH GOLFERS

- In addition to a smiling demeanor, wave and acknowledge golfers by name. Keeping up with names will likely be a never-ending process, but it's worth your best effort. Everyone likes to be called by name.
- Contribute regularly to the course newsletter or Web site. Carefully proof and spell-check all written documents prior to release.
- Post pertinent information about course maintenance, pesticide applications, projects, and the grounds crew. The first and/or tenth tee, along with the pro shop, locker rooms, and clubhouse are possible posting sites.
- Openly utilize tools of the trade like, but not limited to, a soil probe, soil thermometer, hand lens, and slope gauge. Be open to, and ready for, questions about such tools. The possible exception might be the Stimpmeter, for which discretion should be exercised.
- Eat at the clubhouse regularly to answer questions and address golfer concerns.
- Always have a short speech ready for anyone who asks, "What's happening on the course?" or "How are things going?" or similar queries. Don't make light of such questions — they offer opportunities.
- Solicit golfer input on key decisions when possible and appropriate.

A clean and well-organized office and maintenance facility tells everyone who visits that the superintendent cares about presentation and attention to detail.

- When problems occur on the course, it's not necessary to launch into a detailed scientific discussion. Keep your answers simple and to the point. Golfers want to know: (1) what happened, (2) can you fix it, (3) when will things be back to normal, and (4) are there any cost/financial concerns. Be honest and don't make excuses.
- Accept compliments graciously. Don't argue with or qualify compliments. Avoid responses like, "The weather's been great; anyone can grow grass with these conditions." It is more appropriate to say, "Thanks, I really appreciate your noticing what we've been able to accomplish."
- Work with the pro shop staff to teach and emphasize course etiquette.
- Make your e-mail address available and check it regularly (at least daily). If you don't have e-mail capability, it's time you did. Establish an address that reflects a positive image — machoman@-dontmesswithme.com or stimp11@fasterthan-others.org are examples of what to avoid.
- Offer to attend and speak at specialty group meetings (ladies' day, men's outings, neighborhood association, etc.).
- Offer assistance when golfers have questions about their home lawns. It's a perfect opportunity to highlight the differences between course maintenance and home lawn care.

3. WITH COMMITTEES, YOUR SUPERVISOR OR OWNER

- Know your budget and the budgeting process. Carefully monitor and compare actuals to the budget as a fiscal year progresses. Know the specifics of either black or red numbers.
- Keep accurate records and make them available for review.
- Be actively involved with long-range planning.
- Document with pictures. Nothing refreshes the memory like reviewing before, during, and after photo documentation.
- Be prepared and use PowerPoint or similar technology for meeting presentations. The use of a digital camera, laptop, and projector will enhance communication.
- Dress for meetings to look as good as, or better than, everyone else in attendance.
- At least occasionally, have committee meetings at the maintenance complex.
- Include select site visits on the course as part of committee meetings when digital images and a projector won't allow comprehensive coverage of a topic.
- If you or someone on your crew makes a mistake, disclose the specifics immediately; don't wait for any possible damage to become visible or compromise playability.
- Invite course officials to appropriate industry meetings.
- Obtain a yearly unbiased outside review of the maintenance program. This should occur in the form of an on-site agronomist presentation and a written report.

Golf course superintendents should be cognizant of, and always looking to improve, their image. It starts with candid objectivity to identify weak points. Along with a candid personal evaluation, secure input from close friends who know you and who care enough to be honest. Limitations then can be outlined, targeted, and resolved.

Author's note: Thanks to Patrick O'Brien, Director of the Green Section's Southeast Region, for surveying our staff and setting the stage for this article.

BOB BRAME *is the director of the Green Section's North Central Region. In addition to working as a superintendent for many years before joining the staff, he has worked for and continues to work with superintendents, making this topic a four-decade assemblage.*

Research *You Can Use*

Winter Survival of Seeded Bermudagrasses

The recent development of high-quality seeded bermudagrasses makes the choice of this species for fairways even more appealing.

BY MICHAEL D. RICHARDSON, DOUGLAS E. KARCHER, AND JOHN W. BOYD

Bermudagrass is a widely adapted warm-season turfgrass that is used in numerous golf course applications from transition zone to tropical regions of the world.[3] Most of the bermudagrass cultivars that have been developed for golf course fairways and tees are sterile hybrids of *C. dactylon* and *C. transvaalensis*. While these hybrids produce a uniform, dense surface, they must be planted vegetatively by either sprigs or sod, which can add significant cost to construction or renovation projects.

Seeded bermudagrass has been available for many years, but the typical "common" bermudagrass has not offered the quality or performance of the vegetative hybrids (Table 1). Although lower-quality seeded bermudagrass cultivars provided a turf adequate for home lawns and utility areas, they did not produce an acceptable turf for golf courses, sports fields, or other high-maintenance applications.

A renewed interest in seeded bermudagrass breeding since the early 1980s has yielded several new seeded cultivars that perform much better than older seeded types and also perform as well as the established vegetative hybrids (Table 1). Of the new seeded cultivars, Princess-77, Yukon, and Riviera are being widely utilized due to their high shoot density and dark green genetic color.[6] These major improvements in turf quality have stimulated considerable interest from the turfgrass industry, as a high-quality bermudagrass turf is now possible using a seeded cultivar.

A potential limitation to seeded bermudagrasses, especially in the upper transition zone, is the potential for winterkill following the establishment year. Winter survival of bermudagrass has always been an important issue in this region, with major emphasis on cultivar variability,[2,13] fertility management,[10] and the underlying physiology associated with cold tolerance.[4,12] Unfortunately, most of the research in the literature has focused on established bermudagrass turf with particular emphasis on vegetatively propagated hybrids.

Preliminary studies at this location[5] and at others[8,9] have suggested that bermudagrass seeding methods will impact both the speed at which a full turfgrass stand is attained as well as the ability of the seedling turf to withstand the first critical winter. One factor that is very important is the maturation of the turf before it goes into the first dormant season. The objective of this study was

Table 1

Turfgrass quality of selected seeded and vegetative bermudagrass entries in the past three National Turfgrass Evaluation Bermudagrass Trials.

	Turfgrass Quality		
Selected Entries	**1986 Trial**	**1992 Trial**	**1997 Trial**
Vegetative			
Tifway	6.6	6.0	6.4
Midlawn	6.0	6.0	5.8
Tifsport	na	na	6.5
Seeded			
Arizona Common	4.4	4.2	4.7
Guymon	4.4	5.0	na
NuMex-Sahara	4.9	4.5	5.0
Mirage	na	5.4	5.1
Yukon	na	5.3	na
Riviera	na	na	6.4
Princess-77	na	na	6.5
LSD (0.05)	0.2	0.2	0.2
Total no. of seeded entries	8	16	18
Total no. of vegetative entries	20	10	10

na — entry not available in that trial

to assess the effects of the seeding date on the establishment and winter survival of several seeded bermudagrass cultivars in a transition-zone environment.

HOW THE STUDY WAS CONDUCTED

A field study was conducted over two growing seasons (2000 and 2001) at the University of Arkansas Research and Extension Center, in Fayetteville, Arkansas. The soil at the site is captina silt loam with an average pH of 6.2. Prior to planting, the site was fumigated with methyl bromide (67%) and chloropicrin (33%) at 350 lb. per acre.

Six bermudagrass cultivars were tested in these trials, including NuMex-Sahara, Princess-77, Mirage, Jackpot, Yukon, and Mohawk. Four seeding dates were tested each season and included April 15, May 15, June 15, and July 15. During the 2001 season, a severe storm caused the loss of the June 15 seeding date, and no data were collected for that date. All plots were seeded by hand at 1.00 lb. PLS per 1,000 sq. ft. based on a germination test.

The fungicide Subdue® (mefenoxam) was applied at planting to prevent development of any seedling diseases and pathogens such as *Pythium spp.* The site was irrigated with an automated irrigation system to provide optimum moisture conditions for germination and establishment of the seed and to minimize water stress. Plots were fertilized with phosphorus and potassium prior to planting according to soil test recommendations. Nitrogen was applied, beginning five days after first emergence, as urea (46-0-0) and reapplied every two weeks during the test at a rate of 0.5 lb. N per 1,000 sq. ft. Plots were mowed three times per week with a reel mower set to a bench height of 0.5 inch with grass clippings returned.

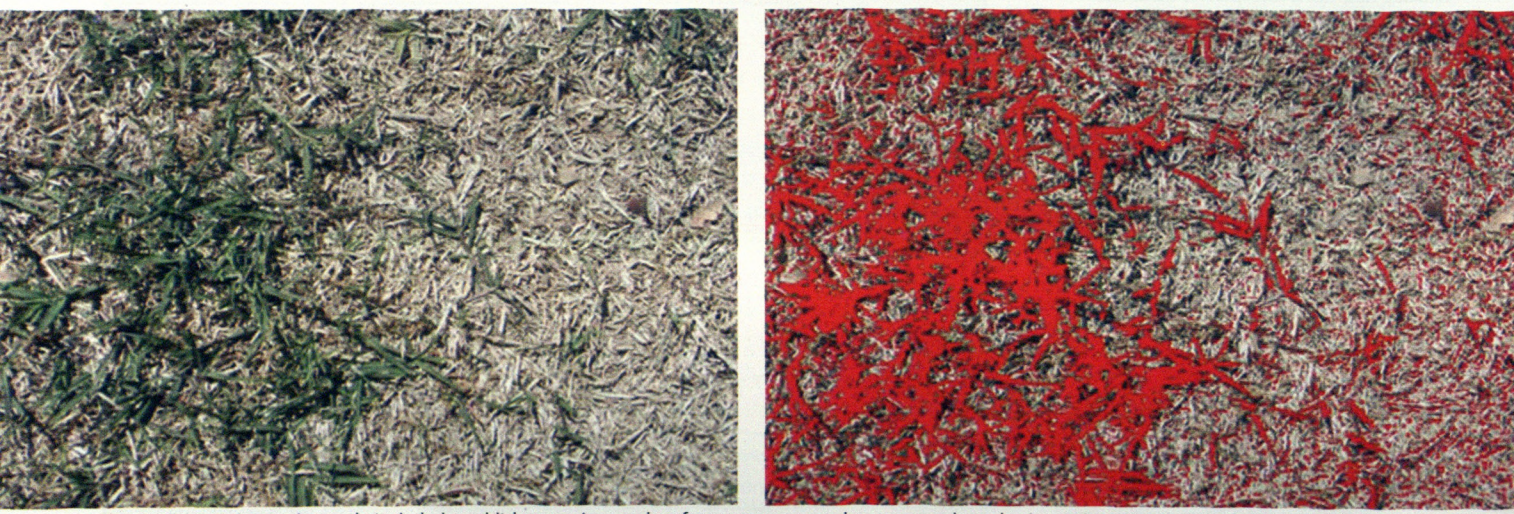
Data collected during the study included establishment vigor and turfgrass cover rates (data not shown). During the dormant season following planting, two 2.4-inch plugs were pulled from each plot and the turf was analyzed for morphological characteristics, including rhizome density, stolon density, and weight per stolon.

Turf recovery from winter dormancy was monitored on three dates during the spring using digital image analysis techniques.[11] Digital images were obtained using a digital camera and analyzed individually using SigmaScan Pro software. The color threshold feature in the SigmaScan software allows the user to search a digital image for a specific color or a range of color tones. The settings used to identify green areas in the image included a hue range from 57 to 107 and a saturation range from 0 to 100. After developing a fingerprint of the green areas of the image, the measurement tools in the software package were used to count the total number of selected green pixels. The number of green pixels in each image was then divided by the total pixel count of the image for a determination of turf coverage percentage in the image.

Each cultivar was replicated four times within each planting date for each season. The two years were considered repeats of an experiment and the data were analyzed by year as a randomized complete block design.

WHAT WE FOUND DURING THE STUDY

Cultivar and seeding date had a major effect on winter survival in both years of the trial, and there was a significant interaction between cultivar and seeding date in both years. The winter of 2000-2001 was more severe than the 2001-2002 winter, but winter injury was observed in the late-seeded plots for both growing seasons (Table 2). Yukon had the greatest winter survival among the cultivars in both 2001 and 2002, with Princess-77 exhibiting the poorest recovery in the spring following establishment (Table 2). Other cultivars were intermediate for



Data collected during the study included establishment vigor and turfgrass cover rates that were evaluated using an image analysis technique. Green cover (left) was pixelated (right) and the number of pixels in each image was then divided by the total pixel count of the image for a determination of turf coverage.

Table 2

Recovery of bermudagrass from winter injury, as affected by cultivar and seeding date. Recovery was measured near May 1 in the spring following establishment.

Seeding Date	Jackpot	Mirage	Mohawk	NuMex-Sahara	Princess-77	Yukon	*LSD (0.05)*
	% Recovery from Winter Injury						
				2000			
April 15	58	43	43	48	27	100	*17*
May 15	65	47	32	43	23	100	*11*
June 15	24	30	25	17	12	100	*8*
July 15	7	5	5	6	4	80	*6*
LSD (0.05)	*17*	*12*	*14*	*10*	*7*	*8*	
				2001			
April 15	65	61	64	73	48	81	*15*
May 15	59	63	54	67	63	63	*18*
June 15	nd†	nd	nd	nd	nd	nd	
July 15	39	33	45	41	23	83	*30*
LSD (0.05)	*25*	*20*	*ns‡*	*21*	*26*	*ns*	

† - nd — not determined for that seeding date due to a loss of stand as a result of a thunderstorm

‡ - *ns* — no significant difference due to treatment

winter survival. It should be noted that all cultivars eventually recovered to 100% turfgrass coverage, but it took several months for cultivars such as Princess-77 to reach full coverage.

Seeding date also had a significant effect on winter recovery, with April and May planting dates having significantly more recovery compared to June and July seeding dates for all cultivars except Yukon (Table 2). Yukon had good recovery at all seeding dates, even though there was a slight, significant decline in winter recovery with the July seeding date.

Another significant aspect of spring recovery of these plots was the difference in spring green-up among cultivars. Across these and other studies in this location, Yukon exhibited consistently earlier green-up than other cultivars, while Princess-77 was always the last cultivar to initiate spring growth (Table 3). This could be a significant factor if early spring activities were planned for the turf, as cultivars such as Yukon would provide much earlier spring growth than other seeded cultivars. Other cultivars were intermediate to Yukon and Princess-77 regarding spring green-up and were not different from each other (Table 3).

Table 3

Dates of initial spring green-up among seeded bermudagrass cultivars.

Cultivar	2001	2002
	Date First Green-up Was Observed	
Yukon	2 April	5 April
Mohawk	11 April	15 April
Jackpot	13 April	15 April
Mirage	13 April	14 April
NuMex-Sahara	14 April	16 April
Princess-77	22 April	24 April

True rhizomes were not produced during the first season after establishment in any of the seeded cultivars. This is in contradiction to work by Philley and Krans,[9] who reported rhizome production during the establishment of several seeded bermudagrass cultivars. However, Munshaw et al.[7] also reported no rhizome production during the establishment year and suggested that stolons were the primary over-wintering structure of new bermudagrass seedings. The differences in rhizome analysis between these studies may be a reflection of varying methodology or the actual means by which a rhizome is identified.

Stolon density (Figure 1) and weight per stolon (data not shown) were affected by both cultivar and planting date across both years of the study. Yukon had the highest stolon density in both years of the test, with Princess-77 having the lowest stolon density (Figure 1). Seeding date also had a significant effect on stolon density in the 2002 trial, with higher stolon densities observed in April and May seeded plots compared to the July seeding. Regression analysis was used to determine if stolon density was related to winter recovery, as it was observed that Yukon had both the highest recovery from winter injury and the highest stolon density. However, when regressed across all planting dates and cultivars, there was no significant relationship between stolon density

and winter recovery (data not shown).

The data from this study show conclusively that some cultivars of seeded bermudagrass will be adapted for use in transition-zone environments, where winter injury can cause a severe loss of stand. These data are corroborated by other studies from Mississippi,[9] Indiana,[8] and Kentucky,[7] where other researchers have associated increased stand fitness with first-year winter survival of seeded bermudagrasses. Munshaw et al.[7] found that stolon density and stolon diameter were enhanced by low seeding rates, and they speculated that these parameters were important in winter survival. However, they did not report winter injury in that study. Philley and Krans[9] also observed significant first-year winter injury in several seeded bermudagrass cultivars, especially from late planting dates. The exception in this study was Yukon, which survived the first winter even when planted later in the season.

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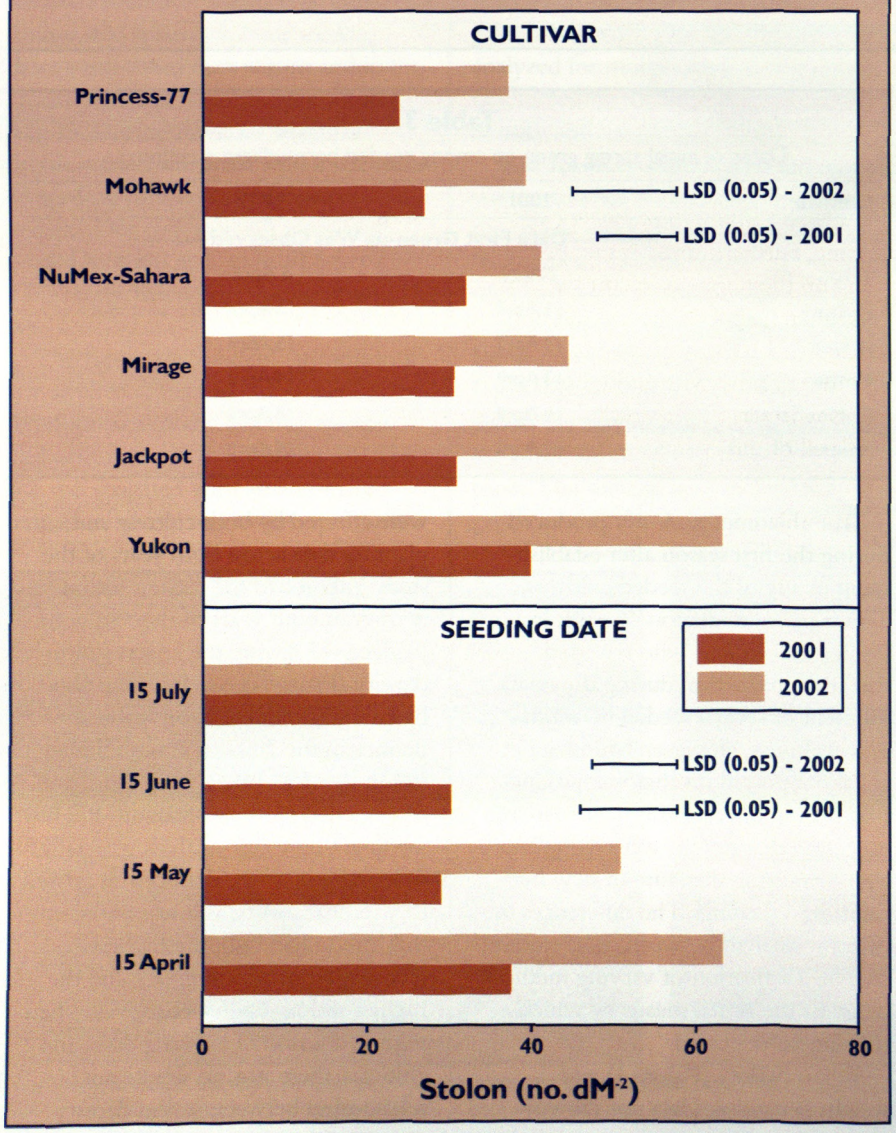
Figure 1

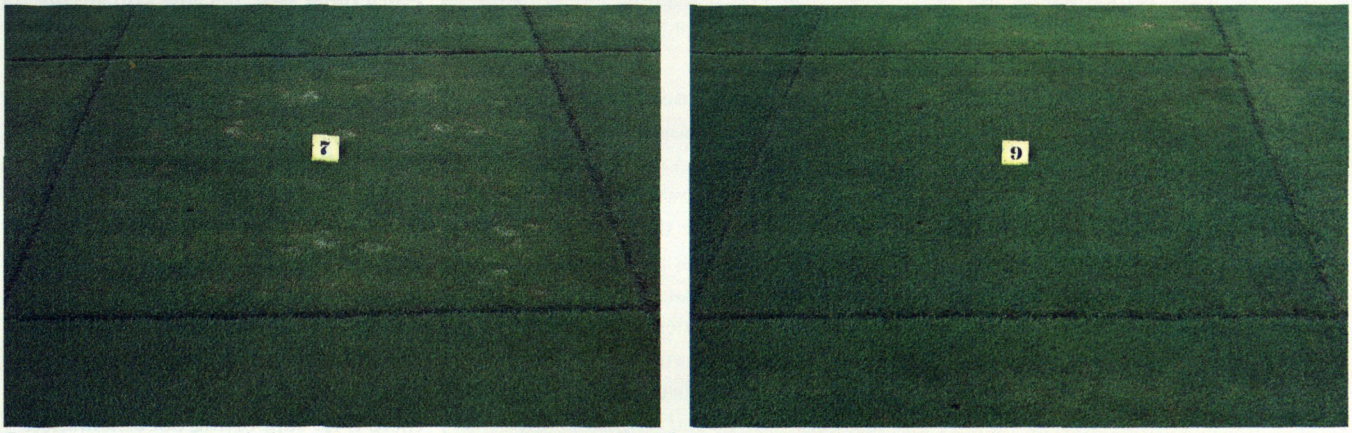
Effects of cultivar and planting date on stolon density of seeded bermudagrasses.



Ironing Out Your Fertilizer Program

Can micronutrients be used as macronutrients without consequences?

BY TOM COOK



Turfgrass vigor was impacted when sulfur rates were changed from 1.5 lbs. sulfur per 1,000 sq. ft. (left) to 3.5 lbs. sulfur per 1,000 sq. ft. (right) per year.

I can't remember how many times superintendents have told me that growing grass is the easy part; dealing with people is the hard part. I always took that as a compliment because it meant our students actually learned something about turf culture while they were in school. Unfortunately, recent events in the world of putting green fertility management make me wonder if some of our students may have been snoozing from time to time.

A recent craze here in the Northwest involves the use of high levels of micronutrients, while greatly reducing nitrogen. To be fair, most of the superintendents I have talked to have asked what I know about this program and whether I think it has any merit. This is a little frustrating because until recently I really didn't know what the program was about since it is "secret" and only available to clubs who pay a large fee and agree not to divulge any information about what they are doing. I confess, if I were a superintendent, I would be very skeptical about paying someone money for advice before I knew what I was getting. Furthermore, I would probably hang up the phone or escort the guy out when he got to the part about nondisclosure. I have been amazed at the number of otherwise good superintendents who seem to have fallen under the spell of this "magic" even before they have tried it. A scarier situation involves the clubs where the superintendent has been forced to adopt this program because it was sold to a board member or the green committee.

My purpose here is to offer my assessment of this fertilizer plan in the context of putting green turf culture as we know it in the Pacific Northwest. I believe my comments will have relevance nationwide, at least in the northern states, but I can really speak only from our limited experiences in the Pacific Northwest.

SOME HISTORY

Except for golf courses less than 20 years old, the vast majority of putting turf on Pacific Northwest golf courses ranges from 80% to 99.9% annual bluegrass. Because we have cultured annual bluegrass for so long, most courses have developed complex mixtures of perennial types that provide excellent putting surfaces and are relatively easy to maintain year 'round (Cook, 1987, 1996a, 1996b).

Fertility programs have evolved over the years, ranging from very high nitrogen levels in the 1950s and 1960s to the starvation diets of the 1990s and to the variable, course-specific levels of today. According to survey data we are currently summarizing, the average annual N-P_2O_5-K_2O rates in lbs. per 1,000 sq. ft. per year applied to mostly annual bluegrass putting greens in our area range from approximately 5-1.5-5 for areas west of the Cascade Mountains (10+-month growing season) to approximately 4-1.5-4 for areas in the snowy winter parts of the Pacific Northwest (6- to 8-month growing season). At the low end there are a few courses applying as little as 3 lbs. of N per 1,000 sq. ft. per year, but overall application rates are fairly consistent. These standard fertility programs have

generally produced healthy turf and high-quality putting surfaces throughout the region.

Some readers may remember the fertilizer research done many years ago by Dr. Roy Goss and his colleagues at Washington State University (WSU). What started out as a disease-suppression study evolved over time into a long-term study on the effects of different fertilizer rates, NPK balance, and sulfur on turf vigor, disease incidence, and the balance between bentgrass and annual bluegrass. Working with colonial bentgrass putting turf on a fine sandy loam soil, Goss found that long-term fertilization with 6+ lbs. N per 1,000 sq. ft. per year, 0 lbs. P_2O_5 per 1,000 sq. ft. per year, and 3.5 lbs. S per 1,000 sq. ft. per year resulted in pure bentgrass turf with no annual bluegrass. Potassium rates had no impact on stand composition. In the same trial, plots receiving variable levels of nitrogen, P at 4 lbs. P_2O_5 per 1,000 sq. ft. per year, and S at 1.5 lbs. S per 1,000 sq. ft. per year resulted in high levels of annual bluegrass (Goss et al., 1975). An added benefit of the high-sulfur fertilization program was a significant reduction in Fusarium patch disease on bentgrass. In the context of the times, this was a landmark study. It was clear that we could produce pure bentgrass turf on soil by using moderate nitrogen, minimal phosphorus, variable potassium, and high sulfur.

When I first saw these research plots, the transition had already occurred. One of the nagging questions left over from the study was just what happened to the annual bluegrass that was originally in the plots. The answer to that question became apparent once superintendents began to incorporate high sulfur rates into their turf management programs. People who went on low-phosphorus, high-sulfur fertility programs on annual bluegrass greens soon were struggling with severe Anthracnose problems in summer and winter, and severe Fusarium patch problems during the winter Fusarium season (Cook, 1987, 1996a).

Meanwhile, the bentgrass looked great! Perhaps this explained how the plots in Goss's trials converted to pure bentgrass. Superintendents who were expecting their annual bluegrass to simply disappear learned the hard way that it had to die first. Since club members would never stand for that, superintendents responded by using more fungicides to keep their annual bluegrass alive. This was a little like pouring gasoline on a fire while trying to put it out with water.

The lesson I learned from this experience is that you have to make sure you understand what grasses you are growing and how best to take care of them to produce the healthiest turf possible. In our region that means different fertility management for bentgrass and annual bluegrass. In other words, if you treat annual bluegrass like it was bentgrass, you will simply increase disease problems and jeopardize the quality of your putting greens and your job.

BACK TO THE PRESENT

Fast forward to 2004. Assume you are a superintendent and somebody wants you to change your fertility program to a plan that will give you the ultimate putting surfaces and reduce the need for fungicides. The catch, of course, is that you have to adopt the program without knowing what it is and have to take the seller's word for how your greens will handle it. Does it make sense to do this? Obviously, there is no way to know for sure. The prudent thing to do would be to study the ingredients, consider your greens, your grasses, and what you have to gain by buying into the program. You know changes in your fertility program will likely affect bentgrass and annual bluegrass differently. You really need to know what this program entails.

In a nutshell, what this program describes is very low nitrogen and very high sulfur. This is different from, but clearly reminiscent of, the program developed from the work of Dr. Goss at WSU. It is very clearly oriented towards growing bentgrass. The stated advantages of this program include reduced chemical, fertilizer, and water usage, leading to a more environmentally friendly golf course; reduced thatch buildup due to enhanced microbial activity; and reduced need for aerification, leading to a frequency of once every other year. Because you are no longer growing much grass, you will not have to mow as often, resulting in a 40% reduction in labor costs. Instead of mowing 7 days per week, you will only have to mow 4 days per week. The turf will be so dense that you can mow it at 0.08" with a triplex mower. Finally, the seller suggests that the program will produce quality putting surfaces reminiscent of the outstanding surfaces achieved in Australia and the British Isles. Other than the word of the seller, there is no supporting documentation for these claims.

When I first heard about this fertility program, all I knew was that it probably used less nitrogen and incorporated a soup of other ingredients. That wasn't much to go on, so it was hard to predict what might happen. I was pretty sure that the claims for reduced disease would not come true in western Oregon, at least on annual bluegrass, but I really didn't know.

In 2004 several golf courses in Oregon bought into this program for the first time. I predicted it could take two to three years to find out what the longer-term effects would be. I believe I was wrong in my assessment. At least two courses with annual bluegrass greens reported serious turf decline as summer progressed. The turf damage at these courses was blamed on everything from anthracnose to nematodes, and chemical use went up considerably in an attempt to control these problems. At least one course dropped the program shortly after experiencing problems. Courses with sand-based greens and predominantly bentgrass turf have reported few problems so far.

Assuming the sample program I received is typical of the basic program golf courses are being asked to commit to, I will modify my predictions as follows:

- Golf courses that are predominantly annual bluegrass will eventually see serious problems with anthracnose, Fusarium patch, nematodes, and any other diseases that affect annual bluegrass in our region. This may even happen during the first year of use and will become increasingly severe as time passes.
- Golf courses that are predominantly bentgrass on sand-based rootzones may be okay, at least until the nitrogen reserves in the rootzone are depleted to the point where growth is seriously impaired. At some point, dollar spot may become a serious issue, requiring increased use of fungicides. Turf in cold winter areas will go dormant earlier in fall and be late to green up in spring. Turf damage from wear on greens with limited hole locations will be slow to recover, resulting in very thin turf. I suspect there will be other problems, but I don't know yet what they will be.

Bentgrass in Corvallis, Oregon, growing slowly under low nitrogen fertility is more prone to dollar-spot disease than vigorous turf. Dollar-spot control requires regular fungicide applications.

CONCLUSIONS AND RECOMMENDATIONS

One truism I have always believed in is that when you make major changes in cultural practices or grasses, you simply trade one set of problems for another. The key is to decide which set of problems you can live with. For example, frequent sand topdressing has provided us with firm, smooth putting surfaces and surfaces that are playable even during wet weather, but it also has increased wear on mowing machinery, increased labor costs, made irrigation more difficult, and at times inconvenienced golfers who object to sand everywhere. For most superintendents, the advantages outweigh the disadvantages.

Based on information at hand, this fertilizer program is clearly a bentgrass program geared, in my mind, to sand-based greens that are relatively free of annual bluegrass. In the short run, at least, it is likely that users could see promising results. There is no way of knowing what to expect long term. It is even harder to know what results to expect long term on push-up soil-based greens or greens using salty water for irrigation. Annual bluegrass greens should not be fertilized with this program unless you can tolerate increased disease and potential loss of turf.

I encourage all to think long and hard before mortgaging the health of your putting greens on any program that promises to solve all of your problems. This is particularly true for people with predominantly annual bluegrass greens. In the end, you are the ones who have to live with the results of your choices. Usually, the one who takes the hit is the superintendent. Before you launch off on something radically different from your current tried-and-true program, test it out thoroughly on your nursery green. If you don't have a nursery green, wait until the local guinea pigs have either proved the program or lost their jobs. Finally, rely on common sense and research before you engage in faith-based turf culture.

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Research *You Can Use*

Spring Transition: Going, Going, Gone

Removal of overseeded perennial ryegrass from bermudagrass is a must.

BY FRED YELVERTON

Few discussions regarding turfgrass management on golf courses get more emotional than discussions on whether or not to overseed fairways, roughs, etc., with perennial ryegrass. This discussion will not wander into those waters. However, one fact about overseeding is indisputable: Overseeding with perennial ryegrass can, and often does, have an adverse effect on bermudagrass. Nevertheless, management practices can be implemented that significantly reduce the impact of overseeding on bermudagrass health. The most important of those practices is ***getting rid of the perennial ryegrass by late spring!***

One of the troubling trends occurring on golf courses is the increasing practice of overseeding too early in the fall and keeping the ryegrass too late in spring/summer. If bermudagrass does not have sufficient time to grow during the summer without competition from perennial ryegrass, the bermudagrass will decline over time. This may occur in one year, but more often it occurs gradually over a period of several years. Why does this happen? A brief discussion of plant competition will provide insight.

A fundamental principle in weed science is that plants compete with one another for four basic resources: 1) water, 2) nutrients, 3) carbon dioxide, and 4) light.[4] When bermudagrass and perennial ryegrass grow together in spring, which of these resources would be limiting?

1) Water? No, golf courses provide ample water.

2) Nutrients? No, same as water.

3) Carbon dioxide? No, this should never be limiting.

4) Light? Yes, this is the main culprit.

Beard[1] describes bermudagrass adaptability to shade as very poor. Duble[2] states that at low light intensities (less than 60% full sunlight), bermudagrass develops narrow, elongated leaves; thin upright stems; elongated internodes; and weak rhizomes. Any golf course superintendent who has managed bermudagrass knows it does not perform well in shade. In overseeded environments, when bermudagrass begins to come out of dormancy in spring, perennial ryegrass growth is at its maximum. As a result, the perennial ryegrass provides significant shade to the bermudagrass. An indication of this can be seen by comparing bermudagrass growth in the fairway vs. the rough.

In most climates, bermudagrass needs about 100 days of growth without ryegrass competition. We know this because, on golf courses, bermudagrass tends to disappear gradually over time if ryegrass is allowed to remain in the summer and bermudagrass has less than 100 days of growth. Typically, bermudagrass thinning is a culmination of several years of overseeding where the perennial ryegrass is allowed to remain too long. This is exacerbated by the fact that many of the newer perennial ryegrass cultivars appear to be more heat tolerant and tend to persist longer if not chemically removed.

METHODS OF PERENNIAL RYEGRASS REMOVAL

It is an understatement to say that the typical golfer doesn't understand the dynamics of overseeding and the potential problems it can cause. A vast majority just see green grass and may not be very understanding when a herbicide has been applied to remove the perennial ryegrass. I once heard from a golf club member, "Now, I do not know much about growing grass, but the grass is dying and that is typically a bad thing." No, actually, that is a good thing. In a vast majority of environments in the United States where bermudagrass is overseeded, a herbicide should be used to remove the perennial ryegrass in late spring/early summer. With the possible exception of very warm climates like South Florida and South Texas, perennial ryegrass will not die out on its own early enough to provide sufficient recovery and growth of the bermudagrass.

Cultural methods of ryegrass removal have been extensively tested. A former graduate student at N.C. State University (Dr. Brian Horgan, now at the University of Minnesota) tested a number of such methods. His overall objective was to initiate management practices that favored the bermudagrass and disfavored the ryegrass as temperatures began to warm in spring. Treatments included nitrogen fertilization,

scalping, vertical mowing, aerification, and combinations of each of these. None of the treatments or combination of treatments would consistently remove the perennial ryegrass in a timely manner.[3] Furthermore, one of the worst things that can happen is that only about 90% of the perennial ryegrass dies. This will result in the remaining ryegrass becoming *clumpy*. Once perennial ryegrass becomes clumpy, it will not die out on its own. Clumpy ryegrass is fast becoming one of the worst golf course weed problems in areas that overseed bermudagrass with perennial ryegrass.

In recent years, several new herbicides have been introduced that are highly effective in the removal of perennial ryegrass from bermudagrass. These newer herbicides include Revolver (foramsulfuron), Tranxit (rimsulfuron), and Monument (trifloxysulfuron). Prior to these products, Kerb (pronamide) or Manor (metsulfuron) were used effectively for perennial ryegrass removal. While Kerb was effective, it removed perennial ryegrass very slowly. Typically, six weeks were needed to get good control. In addition, Kerb is highly mobile, so extreme care was needed when it was used in close proximity to cool-season grasses. Manor (first released in turf as DMC Weed Control) was used for several years with much success. It is still utilized and is highly effective. One of the complaints about Manor is that it occasionally needs to be reapplied because of an incomplete kill. In addition, it has no activity on annual bluegrass (*Poa annua*). It is common to have annual bluegrass in perennial ryegrass at time of transition.

Tranxit, Revolver, and Monument have all been released in the past few years. Not only are these products highly effective in removing ryegrass, but they also will kill annual bluegrass. Furthermore, these herbicides tend to kill ryegrass very quickly (2 to 4 weeks). Because these products kill ryegrass rapidly, they should be used as a late

Perennial ryegrass growing in low densities becomes clumpy. This occurs when ryegrass is tracked from overseeded areas or when overseeded ryegrass does not completely die in spring/summer.

transition aid. To state it another way, the underlying bermudagrass must be actively growing before these herbicides should be applied. If they are applied too early (before the bermuda is actively growing), then the ryegrass will die before the bermudagrass is able to fill in the voids from the perennial ryegrass, and the resulting overall turf quality will be poor. However, that they work very quickly allows turfgrass managers to leave the ryegrass in until later in the spring. A fast kill still allows about 100 days of bermudagrass growth without ryegrass competition.

The mobility and tracking potential of these new herbicides also have been issues. Because cool-season grasses are sensitive, use around bentgrass putting greens or overseeded bermudagrass greens is a concern. Several studies to investigate lateral movement have shown the potential for this to occur. However, they appear to be less mobile than Kerb. In terms of tracking, these herbicides should not be applied immediately prior to equipment or golfers tracking through the treated area and onto a putting green. It is advisable to apply these products after golfers have left for the day, followed by a light irrigation prior to equipment or golf traffic being allowed back on the greens.

Field trials tested the effectiveness of these products on the removal of perennial ryegrass. By four weeks after treatment, the perennial ryegrass had been removed.

In summary, any decision to overseed bermudagrass with perennial ryegrass should include a plan to remove the ryegrass. Failure to have a removal plan will lead to a decline in the overall health of the bermudagrass over time. Several new herbicides are available that are effective in removing ryegrass.

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FRED YELVERTON, PH.D., *a weed scientist at North Carolina State University, tackles tough problems throughout North Carolina.*

On Course *With Nature*

Make a Statement in Support of Golf's Wilder Side

Inventory the wildlife on your course and let people know about golf's benefits to the environment.

BY JEAN MACKAY

Biltmore Country Club in Illinois boasts 89 species of birds, 16 different mammals, and 9 reptiles and amphibians. Vail Golf Club in Colorado provides habitat for 26 species of mammals, including the pine marten, red fox, and long-tailed weasel. During last year's North American Birdwatching Open, Gull Lake View Golf Club in Michigan counted 79 bird species in *just one day.*

Those kinds of numbers are good for golf. They help to demonstrate that golf courses offer more than lush playing fields; their woods, wetlands, prairies, streams, and ponds provide sanctuary to a great variety of wildlife. Imagine if every course kept an inventory of wildlife, just as they keep a record of chemicals and equipment. What great documentation that would be of golf's environmental benefits for skeptical reporters, regulators, critics, and the general public.

TAKE A CLOSER LOOK

How many species of birds and mammals inhabit your course? Which wildlife species breed there and which come for part of the year only? Which ones are common? Which are unique in your area? Which species wouldn't be on your course if you weren't providing good habitat for them?

If you're not sure or haven't kept track, it's time to develop a wildlife inventory. Recording the birds, mammals, amphibians, and other wildlife species you see is an excellent way to learn more about the wildlife value of your golf course, gauge the success of your habitat improvement efforts, and contribute to more positive perceptions of golf courses.

A wildlife inventory is so much more than a list. It's a statement. Read between the lines and you'll find that a basic wildlife inventory communicates, "We're learning." A well-developed inventory says, "We know about wildlife, we keep track of what's going on here, and we're doing things to enhance wildlife habitats." An inventory with unusual species says, "This golf course is providing good habitat." It's fine to tell people that you care about wildlife, but it is much more impressive to document it with an inventory of 40, 60, or 100 species.

GETTING STARTED

You don't need to be an expert to begin an inventory, but you may become one as you record the species you see over time. Start by listing common species, such as the birds that visit feeders or use nest boxes on the course. Consult field guides to help you identify new species and expand your knowledge and skill. By recording species throughout the year, you'll note seasonal variations, including which species spend the winter, which ones migrate through, and which are year-round residents.

A helpful way to organize your list is to group the different species of wildlife you see according to general categories. Begin with familiar wildlife, such as mammals or birds. Later, expand your list to include species such as amphibians and reptiles, and butterflies or other insects. Your inventory can also include the date of the sighting (or the date of the first sighting of the year) and any relevant comments, such as breeding activity or interesting behaviors. This information will tell you more about how your property is being used by wildlife and whether changes in wildlife populations are occurring from year to year.

EQUIPMENT

When it comes to identifying wildlife, your own eyes and ears are the best equipment to rely upon. With practice and heightened awareness, you can train yourself to identify birds and mammals by sound, tracks, scat, and other wildlife signs alone. The actual sighting may be the icing on the cake.

At the same time, a couple of field guides and a good pair of binoculars are most useful to have on hand. Field guides are available for all major groups of wildlife. Check out regional guides if you are a newcomer to wildlife identification, since they limit information to specific areas of the country.

ASK FOR HELP

If you're too busy (and who isn't?) to take on a project like this, delegate it to someone else. Most courses have staff, club members, or guests with knowledge and skills who can help. Developing an inventory is also a great way to reach out to community groups. Why not invite someone from a local bird club, nature center, or college biology department to record wildlife species for you? Seasoned birders are always

looking for new places to ply their skills and most will be glad to help.

Case in point: When Dave Ward, former superintendent at Olympia Fields Country Club in Illinois, contacted a local Audubon Chapter four years ago looking for someone to help him participate in the North American Birdwatching Open, expert birders Marianne Hahn, Linda Radtke, Marlys Oosting, and Penny Kneister enthusiastically volunteered. The birding team has returned each year to participate, recording upwards of 90 birds during the one-day event held each May. When Dave moved to Coyote Run Golf Course last year, the birding team continued at Olympia Fields *and* went to Coyote Run to inventory birds there.

Tom Atol, assistant superintendent at Braemar Golf Course in Minnesota, reached out to Karen Shragg, director of Wood Lake Nature Center, for help with a bird inventory. Karen was so impressed with what she saw on the course that she went on to assist Braemar with achieving Audubon certification. She even helped to host an event promoting the course's good stewardship to other environmental and community groups.

MAKE THE MOST OF YOUR INVENTORY

Once you have an inventory, don't hide it in a file drawer. At the very least, type the list and post it or frame it for people to see. Take the next step and turn it into a simple field guide for your golf course or post it with other environmental information on the course's Web site. Audubon Cooperative Sanctuary and Signature Program members have used wildlife inventories as the basis for educational signage, displays, posters, published articles, and promotional and education guides.

Use your inventory to make a statement. Document what you have and then share it with others to let people know that you treat your golf course as the sanctuary it is.

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Superintendent David Bailey combined his interest in photography with his bird inventory to create an attractive educational guide for guests at Turnberry Isle Resort and Club in Aventura, Florida. Similarly, naturalist Dusty Durden created *A Field Guide to Oldfield* to educate residents at Oldfield residential community and golf course in Okatie, South Carolina, about the property's plants and wildlife.

A Great Man of Turfgrass Remembered

An appreciation of Dr. Marvin H. Ferguson

BY HOLMAN M. GRIFFIN

Few men had more influence on the agronomic aspects of the game of golf than Dr. Marvin Ferguson. He was instrumental in introducing the USGA's "Method of Putting Green Construction" in 1960.

In considering agronomists who played important roles in the development of the turfgrass industry, Dr. Marvin H. Ferguson was one of the greats. This article is an attempt to introduce personal information about Dr. Ferguson for those who may not have known him and to refresh his memory for his many friends and colleagues.

Born in Buda, Texas, on June 16, 1918, Marvin often rode a horse or mule to the local school, about a mile and a quarter from his home. During high school, he lettered in all sports (baseball, football, basketball, and track), for a total of 16 letters. Following graduation from high school, Marvin attended Texas Agricultural and Mechanical College and received a B.S. degree in Agronomy, accumulating enough hours to continue, after spending a year at manual labor, straight to a Ph.D. from the University of Maryland in 1950.

Marvin married Floy Bugg on April 3, 1941, and two children, Judith and Mark, were born of that union. Both children followed their father's interest in agriculture, as did his grandson Eddie Hodnett. In 1943 Marvin served in the U.S. Navy as a Medical Corpsman and was stationed in Carona, California. He served mainly in the burn ward and participated in some of the earliest attempts at plastic surgery.

Following military service, a young Marvin Ferguson began work for the United States Department of Agriculture at the turf plots in Beltsville, Maryland, where he evaluated many strains of zoysiagrass and was instrumental in the release of Z52, later known as Meyer zoysiagrass.

Being so close to Washington, D.C., he became acquainted with people in the Military Air Transport Service and became a consultant for that organization from 1951 into 1952 and traveled to many foreign places such as Tripoli, Libya, and the exotic island of Hawaii. In Hawaii, Marvin obtained a sample of a phyxotrophic soil, which has the properties of a solid until shaken and then becomes a liquid. This unique soil caught his interest and may have been the root of the techniques he advanced in later life along with his observations of the military bombers landing on airstrips with stabilized soils disguised as grassy fields.

In 1953, Marvin began work with the USGA Green Section and continued working from his home in Bryan, Texas, until 1968, when he left the USGA and founded AgriSystems of Texas. During his 15 years with the USGA, his office was housed in the Agronomy building at Texas A&M at College Station, where Marvin served part time as a teacher and graduate student counselor.

Few men had more influence on the agronomic aspects of the game of golf than Dr. Ferguson, who was instrumental in introducing the USGA's "Method of Putting Green Construction" while he was Mid-Continent director and national research coordinator for the United States Golf Association in 1960. He is rightfully

Dr. Marvin Ferguson received the 1973 USGA Green Section Award for his contributions to golf through his work with turfgrass. The award was presented by Edward C. Meister, Green Section Committee Chairman (left), and Lynford Lardner, USGA President (right).

Dr. Ferguson traveled to San Francisco to speak at the 1965 USGA regional meeting with Al Radko, director of the Green Section's Eastern Region. The picture shows them during a visit to Yosemite National Park.

known as the father of the USGA green construction method.

Dr. Ferguson collaborated with Leon Howard, then a graduate student at Texas Agricultural and Mechanical College, to build the first USGA green at Texarkana Country Club in 1959. The procedure was much disputed, but the basic principles, which are not subject to change because they are physical laws of nature, have stood the test of time and have become the foundation for modern turf management's use of modified soils as a growth medium. Marvin was among the first to note the importance of sand particle size, angulation, and silica content, as well as its worth as a major component of soil mixes.

Physical measurements of soil characteristics were little used until Dr. Ferguson and Leon Howard advanced their technical description in 1959 and 1960. This method of physical analysis was to revolutionize the industry and allow turf managers a chance to examine the acceptability of soil materials in advance of their use in practice.

Dr. Ferguson was a quiet man who could politely disagree, but to my knowledge never argued. He told people once, maybe twice, and then left them to their own devices. One example of his wit and wisdom came when he was visiting with a pathologist on a golf course. The pathologist said, "Hey, Marvin, look at the Septoria on that fescue." Marvin never missed a beat when he came back with, "You may be right about that being Septoria, but that is not fescue."

Dr. Ferguson authored hundreds of articles on turf management and was in great demand as a speaker. He received many awards, including the USGA Green Section Award, and he was a Fellow of the National Association for the Advancement of Science and received the first Blade of Grass Award from the Southern Turfgrass Association.

Marvin passed away on January 10, 1985, from a massive heart attack while picking up the mail at the post office. This is just a brief glimpse of such a great man's life, but there is no doubt that his contribution to golf turf will live forever.

HOLMAN M. GRIFFIN *was a Green Section agronomist from 1962 to 1976. He now resides in McKinney, Texas.*

All Things *Considered*

Putting the Cart Before the Horse

The folly of rebuilding a clubhouse before upgrading an old irrigation system.

BY BOB VAVREK

Extensive renovation or complete reconstruction of old clubhouses has been the trend among many private and public courses across the region over the past 10 to 15 years. No doubt, plumbing, kitchen, bathroom, and other antiquated facilities need to be updated to compete with nearby modern courses built during the recent golf boom.

The hope is that a new clubhouse will keep current members content and attract additional members. New members maintain cash flow provided by monthly dues and initiation fees. However, the $5-million to $15-million price tag that accompanies a major building reconstruction sometimes leaves the membership mired in a financial quagmire for many years. New clubhouses that are intended to attract new members may initially cause the club to lose some of the older members who believe they will not receive adequate long-term benefits from what will likely be a considerable assessment. The unfortunate side effect from many clubhouse construction projects is a five-year, or longer, freeze on funding for important golf course improvements.

Unfortunately, most courses that have neglected the clubhouse over the years have also neglected other costly, but important, items such as the maintenance facility and irrigation system. You can bet that most of the new members who join a club during the membership drives that follow clubhouse reconstruction will have expectations regarding course conditioning about as high as the price tag of the clubhouse. Reasonable as well as unreasonable expectations for firm, fast greens for day-to-day play; firm, uniform fairways; and firm, consistent bunker conditions will be nearly impossible to provide using a 30- to 40-year-old irrigation system that is sorely in need of replacement. Single-row patterns of high-output sprinklers along fairways and irrigation around greens provided by five or six sprinklers that cannot be controlled individually result in overwatered turf. Old controllers that have been refurbished umpteen times and old, leaky pipes make it difficult, if not impossible, to apply precise, uniform amounts of water to playing surfaces. The bottom line is that golfer expectations and demands increase, while the ability of an old watering system to keep the turf firm and dry decreases.

It may be possible to consolidate clubhouse renovation and irrigation into a single project, but then you risk the proposal being voted down due to the high cost of the clubhouse. Furthermore, estimating the cost of a new irrigation system is a relatively straightforward and accurate procedure. On the other hand, clubhouse renovations are notorious for going over budget. In fact, a number of courses across the region could have easily installed state-of-the-art irrigation systems with no more than the amount of money that exceeded the original anticipated cost of a complete clubhouse renovation.

It makes little sense to undertake significant clubhouse renovation first and then place long-overdue irrigation system upgrades on the back burner for another five to ten years. Arguments will always be made that it is much easier to sell a new clubhouse to a membership than a new irrigation system, despite the greater cost of the former. You cannot sit on, walk through, or have your daughter's wedding on a new irrigation system. Some members, particularly non-golfers, will find it difficult to comprehend the considerable long-term benefits of burying a million dollars or so into the ground. On the other hand, a crystal chandelier and sterling silver candelabra won't make the greens any firmer. New Persian carpets won't stop major irrigation leaks from occurring the night before the club championship. You won't realize an extra five or ten yards of roll down firm fairways because of a fieldstone fireplace.

When all is said and done, the golf club exists because of the golf course. Face it, without the golf course the clubhouse is little more than an expensive restaurant and party center that quite often operates in the red. Few, if any, avid golfers make their decision regarding which facility to join based on the square footage of the clubhouse. The irrigation system has a major impact on the quality of playing conditions — so much of an impact that it never makes sense to put the cart before the horse.

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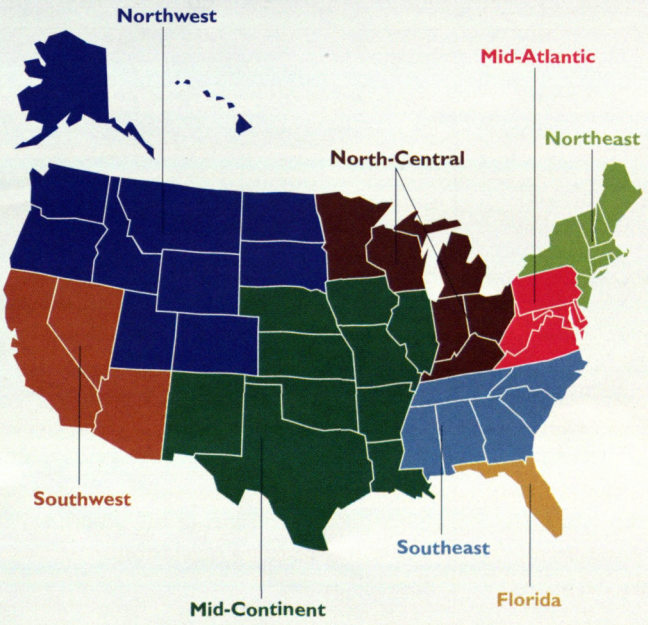

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Turf *Twisters*

Q: Last fall I covered greens with lightweight breathable covers because some vocal golfers believe it will make it possible for the course to open a few weeks earlier in spring. I'm not sure when to remove the covers, but I know there will be pressure to remove them as soon as possible. Any thoughts? (Michigan)

A: When to remove winter covers is one of the most difficult calls to make in turf management for courses in northern locations. If you leave them on too long, the stimulated growth makes the surface more suitable for a fairway surface than a green. No one wants to start mowing greens at a half inch when golfers are expecting fast surfaces. Pulling the covers too soon can expose the turf to dangerously cold temperatures. Most superintendents, however, tend to remove the covers earlier than later. If the cover is removed before the turf has completely broken dormancy, it has a chance to acclimate to the cool springtime temperatures. In any event, a hard frost will likely discolor and set back the growth of the turf, so the golfers' dreams of covering turf to start the season a few weeks earlier are, in fact, just dreams.

Q: During the spring our golf course superintendent has an irritating habit of delaying early morning play until the frost has melted on the greens. Is this truly necessary to protect the health of the turf? (Missouri)

A: The short answer to your question is yes. The long answer is that ice crystals on the surface of the grass blades make them brittle enough to break off at their base when stepped on. In fact, the turf can be so brittle that even the weight of a small animal, such as a goose, can cause unsightly damage to the turf.

Q: We keep hearing about how low mowing heights are bad for growing grass on greens, but are there any other negatives associated with ultra-fast greens? (Washington)

A: Very low mowing does make it more difficult to grow healthy grass. However, several other compelling reasons to raise mowing heights or slow greens down to a moderate level (9' - 9'6" range) include:

- **Speeding up slow play.** It takes less time to hit two or three putts than four or five.
- **Faster ball mark and old hole plug recovery.** This problem is not just players who don't fix ball marks or fix them improperly. Damage to very low mowed turf simply takes longer to recover, and old hole plugs are more susceptible to scalping injury.
- **More interesting and less ridiculous hole locations.** Based on current information, any slope 3% or more at a 10' Stimpmeter reading is too steep for hole use. This results in many older greens with hole locations always in the same areas, resulting in more wear on the turf. At the same time, those responsible for hole locations must avoid any steep areas to prevent the inevitable criticism. Isn't it interesting that the players who complain about slow greens are generally those who complain when a hole is placed on a slope that is too steep for the location and green speed!
- **Average players do not prefer fast greens!** With the average handicap for players in the U.S. standing at 16.1 for men and 28.4 for women, green speeds in excess of 10' greatly favor the playing ability of low-digit players (a small minority) while causing damage to putting surfaces. Don't believe for a minute that today's average players prefer to play putting surfaces that are 1' or 2' faster than those found at national championships only 20 years ago.

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