USGA GREEN SECTION

RECORD

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DR. ROBERT C. SHEARMAN

2006 USGA Green Section Award Recipient

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Cover Photo
The 2006 USGA Green Section Award was presented to Dr. Robert C. Shearman for his contributions as a researcher, educator, and leader in many facets of the turfgrass industry.

2006 GREEN SECTION EDUCATION CONFERENCE

It's More Than Just Turf Maintenance

February 10, 2006 • Atlanta, Georgia

For the 25th consecutive year the annual Green Section Education Conference was held in conjunction with the Golf Industry Show. This year, more than 800 people attended the Green Section's program on Friday, February 10, at the Georgia World Congress Center. Kimberly Erusha, Ph.D., director of education, served as moderator for the morning's program of nine speakers who addressed this year's theme, "It's More Than Just Turf Maintenance."

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DR. ROBERT C. SHEARMAN

2006 USGA Green Section Award Recipient

Robert C. Shearman, Ph.D., widely respected researcher, educator, and leader in many facets of the turfgrass industry, is the recipient of the 2006 USGA Green Section Award. The award is bestowed annually to persons who have made significant contributions to the game of golf through work with turfgrass. It was presented at the Golf Industry Show in Atlanta, Georgia, on February 10, 2006.

A native of Oregon, Bob began his career earning a B.S. degree in farm crops/agronomy at Oregon State University before moving on to receive both an M.S. and Ph.D. from Michigan State University. He worked as an industry research agronomist before joining the University of Nebraska staff in 1975. The rest, they say, is history.

"Bob has tremendous vision for the entire turfgrass industry," states Mike Kenna, Ph.D., director of research for the USGA Green Section. "He has helped build the University of Nebraska into one of the finest turfgrass research universities in the country." Under his direction at Nebraska, Bob has advised 10 Ph.D., 13 M.S., and many undergraduate students during his career. A prolific author in scientific journals and educational literature, his research has concentrated on issues of sustainability in turfgrass management systems, including water conservation, drought resistance, and reduced inputs, such as nutrients and pesticides. His strength lies in his ability to develop a well-rounded, cooperative team approach for investigating a number of research subject areas.

Between 1994 and 2003, Bob served on the USGA's Turfgrass and Environmental Research Committee, which consists of ten university scientists along with several other specialists and USGA staff. During his 10-year stint on the committee, Bob was not just the most experienced and knowledgeable participant, but he also became the leader who carried great influence in determining which projects received funding. When the committee faced uncertainty with respect to particular projects, Bob's balanced, persuasive arguments were almost always decisive in determining the outcome.

Volunteering to serve on the USGA Research Committee carries with it the responsibility of a substantial time commitment. Each year the program receives grant requests consisting of 70 to 130 pre-proposals, followed by 25 to 40 full proposals, all of which are evaluated by committee members. In addition to the time spent in reviewing proposals on their own, committee participation includes two three-day meetings annually, along with the opportunity to attend monitoring visits to university sites each year. Bob played a significant role in helping administer the largest private turfgrass research program in the

Right: USGA Green Section Committee Chairman Lewis H. Blakey (left) presents Dr. Robert C. Shearman with the 2006 USGA Green Section Award. In recent years, Dr. Shearman's research has emphasized developing seeded and vegetatively established, turf-type buffalograss cultivars that are drought resistant, water conserving, and require minimal inputs of fertilizers and pesticides.

Opposite page: Studying turfgrass root growth can be a challenge! Scientists at the University of Nebraska work with mini-rhizitrons as a non-destructive technique to observe root growth. The front panel of the boxes opens to reveal a slanted plexiglass panel. As the roots grow down the panel, researchers can observe and monitor the growth patterns in response to various treatments.

world during his committee tenure, and the turfgrass industry is all the better for it.

Dr. Shearman is well known as a leader within the turfgrass industry. As executive director of the National Turfgrass Evaluation Program (NTEP) from 1993 to 1998, he adopted a strategic long-term action plan for the program. He was instrumental in establishing the first cooperatively sponsored, on-site turfgrass evaluation program between the USGA, NTEP, and GCSAA. As a result, turfgrass managers nationwide have access to information about the grasses best suited to their particular region.

His leadership was invaluable in serving as president of the Crop Science Society of America and volunteering on numerous society and university committees. His visionary skills also led to the development of the first turfgrass Integrated Pest Management (IPM) program in the country. Over a short period of time, the Nebraska IPM program generated a number of publications and slide sets that are still the backbone of many IPM programs today. Much of the work was centered on educating golf course superintendents about this important concept and developing ways to put IPM into practice.

Numerous letters of support were submitted for Dr. Shearman's nomination for the Green Section Award. Repeatedly, the authors mentioned Bob's leadership and his aptitude as a skilled communicator. As one nominator stated, "Bob has the innate ability to consistently take the whole-picture view and identify the needs. He can carry the research results to the scientist, grower, and public in a manner so that each group understands the importance and implications of the work. Dr. Shearman's ability to place things in perspective has often focused the turf industry toward the future."

While Dr. Shearman has given so much of his time and commitment to the turfgrass industry, he keeps a strong devotion to his family, friends, and students outside of the university. He continues to mentor many of his former students, both professionally and personally, long beyond their years in Lincoln, Nebraska.

Bob Shearman is a vital and committed voice for the importance of turfgrass and turfgrass sustainability. His broad local, regional, and national turfgrass perspectives will be crucial in guiding the industry through the environmental issues facing the game of golf and the turfgrass industry in the years ahead.

NATURAL AREAS: Wild or Wonderful?

Natural areas that are planned well and maintained properly can be both wild and wonderful.

BY JIM SKORULSKI, DARIN BEVARD, MATT NELSON, AND ROBERT VAVREK

Do not expect natural areas to be maintenance free! Annual mowing and/or burning, combined with practices to remove weeds, will be necessary to keep the areas playable and visually acceptable.

Natural areas have been an important part of golf courses ever since the game was developed. Granted, the words *natural area* usually evoke an image of expansive no-mow grassland like those associated with seaside or prairie golf courses. But forested areas, woodlands, meadows, desert, shrublands, wetlands, and riparian areas are all important natural areas that can encompass more acreage of the golf course than expected. Some truly appreciate the environmental benefits, the unique wild look and added challenge the areas add to the golf course. Others view natural areas as unkempt, unsightly, ball-hungry monsters that need to be tamed. Finding a workable balance between the two points of view is often a challenge, but with sound planning and good communication it is possible to incorporate naturalized areas into any golf course.

WHY NATURALIZE?

Naturalized areas provide many environmental benefits on golf courses. Numerous research studies have demonstrated that golf course natural areas can safeguard and enhance water quality and provide important habitat for plants and wildlife. This habitat is invaluable in urbanized areas where golf courses are the primary green space. Golf courses are frequently touted for their important role in landscape conservation, and natural areas are the key in that regard.

Naturalized rough areas are often created as a means to reduce the total acreage of maintained turfgrass on golf courses. The elimination of weekly mowing and lower water usage can cut operating costs and conserve resources. Naturalizing severe slopes, rocky areas, and other hazardous sites can reduce maintenance headaches. Naturalized areas can also help define playing areas and provide an appealing contrast with the more manicured portions of the golf course. When properly placed, they provide a fair challenge while adding variety and interest to the landscape.

SELECTING THE RIGHT SITES

The location of naturalized areas is often the key to their success or failure. There are some important questions to ask when reviewing sites as potential no-mow areas.

What are your objectives? Define and prioritize what you are trying to accomplish. Do

you want to reduce maintenance, add strategy to the golf course, attract wildife, protect a water body, or eliminate an eyesore/hard-to-maintain area? Clearly defining the objectives will make it easier to develop a good plan, pick the proper sites, select the right plants, and convince golfers to accept the program.

What are the impacts on play? The type of golf course and golfers' attitudes regarding course conditioning must be understood when developing a naturalization plan. It is equally important to consider the impact the proposed plan will have on pace of play! Like any hazard, the naturalized areas should be positioned properly to add challenge without unfairly penalizing the weakest golfers. Long forced carries from front and middle tees will never be popular and should be avoided. The width of landing areas and the severity of contouring should be considerations. Rough areas that frequently receive play are probably not going to be accepted as no-mow areas. Begin by selecting smaller and less controversial sites for the initial work. This provides an opportunity to learn the establishment and management programs that work best and allows golfers time to accept the new areas.

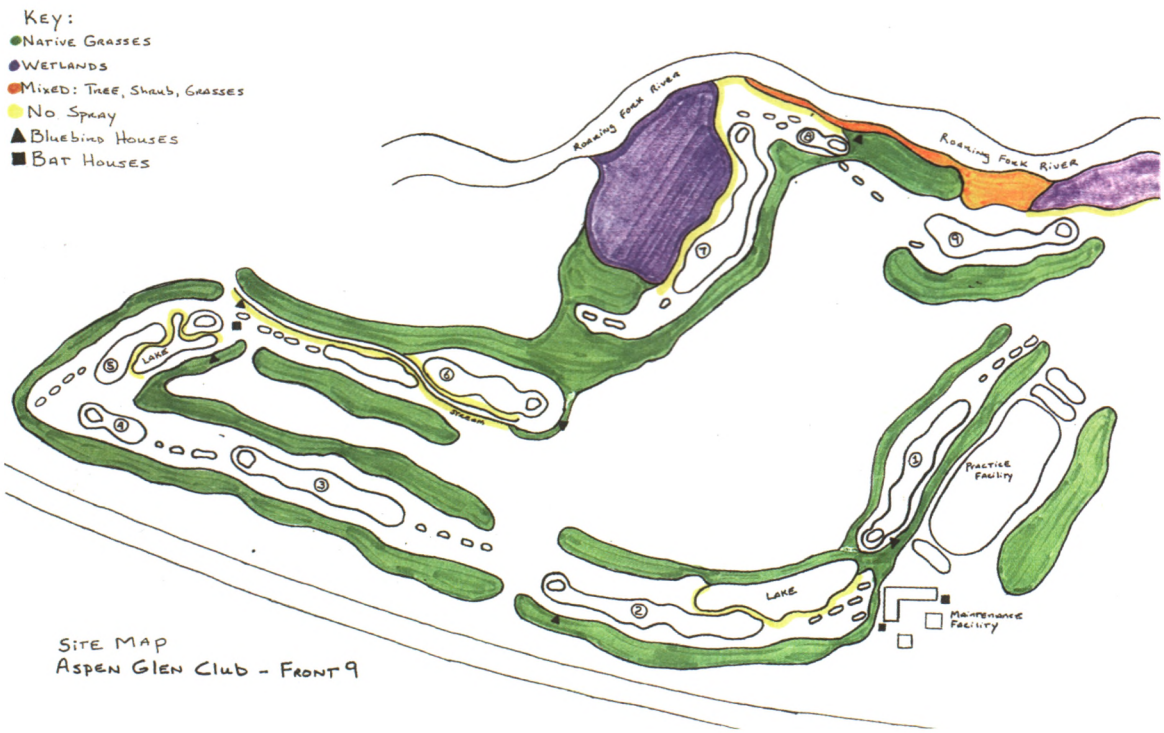
Use the committee approach when selecting sites and developing program objectives. Participation from members of the green and golf committees and the golf professional will more accurately reflect the golfers' viewpoints. The professional advice of a golf course architect can also be helpful, especially for those sites that have more strategic value or that are controversial.

A map can be a valuable tool to help visualize proposed sites and their impacts. More detailed site maps can also be created based on site conditions, anticipated play, plant inventories, etc., and used for the planning and communication processes.

Are the growing conditions favorable? Soil texture, pH, salinity, drainage, irrigation, existing vegetation, and traffic patterns are important considerations when evaluating sites for naturalization. Soils higher in clay, silt, or organic matter retain more moisture and nutrients that will promote more vigorous growth and will be better suited for more out-of-play areas.

Higher-play areas that receive supplemental irrigation are not the best choice for naturalization. More abundant moisture will create dense growth and favor grasses and plants that are better suited for areas far from play. Frequent cart traffic will damage natural grassland areas, leaving them unsightly and making them difficult to play from. Avoid attempts to naturalize such areas until the traffic can be rerouted.

Does the site connect with any larger natural area? Small habitat "patches" are more valuable for wildlife when connected to larger natural areas. For instance, naturalizing a grassland or meadow area bordering a larger wooded area is



A simple map should be developed to help with the site selection process and as a communication tool.

Naturalizing stream and pond bank areas stabilizes the soil and protects water quality while providing habitat for a number of organisms.

more effective than a naturalized "island" between golf holes. Creating similar corridors linking the areas to bodies of water is also encouraged.

PLANT SELECTION

Plant selection is a critical step in the planning process. It should be based on the location of the site and growing conditions. Make a list of plants that will look attractive, meet play expectations, and when possible offer wildlife food and cover. Visit a local nature preserve or wildlife management area to obtain planting ideas. Local university specialists, government agencies, and seed/plant suppliers can be a tremendous source of information and guidance at this point. More out-of-play areas can be established with grasses, plants, shrubs, and trees that provide thicker cover and food sources for wildlife, while areas in play can be seeded with native or naturalized grasses that exact less penalty on an errant shot.

ESTABLISHMENT CHALLENGES

The establishment phase may be the most difficult part of the project, and the process can sometimes be slow and frustrating. Ease into the program by initiating work in smaller out-of-play areas where the site conditions and existing plant material are favorable. The establishment work may be as simple as stopping routine mowing, completing selective weed removal, spot seeding, or planting work. The smaller areas also provide an opportunity to become familiar with the management programs that will be necessary to keep the areas playable, free of invasive weeds, and meet the plan's objectives.

More extensive renovation work should also be initiated on a smaller scale, if possible. The renovation will involve the removal of unwanted vegetation, soil preparation, and a larger-scale seeding or planting effort. Existing vegetation can be removed mechanically or with herbicides, depending on the plant material and the site. A soil nutrient test is advisable so nutrient and pH adjustments can be made if necessary. Soil preparation and seeding or planting programs also vary depending on the site and region where you are located. The specifics of those practices can be found in the articles listed under "Suggested Reading."

THE MAINTENANCE CONSPIRACY

Somewhere, somehow, the misconception that naturalized areas require no maintenance was conceived. The fact is, all naturalized areas, whether forest, grassland, meadow, or wetland, require some seasonal maintenance to keep them playable, visually acceptable, and to maximize their environmental value. The degree of maintenance depends upon the location of the area in relation to play and the level of visual quality expected by golfers. That said, established natural areas are less intensive to maintain on a daily basis.

The primary maintenance concerns with naturalized grassland areas are weeds and insect pests. Fertility management is usually minimal once the areas are established, unless additional stand vigor is desired. Mowing grassland areas is completed annually in fall to manage weeds. More heavily played areas may be cut again following the initial growth flush in spring as a way to control density. The debris left following mowing should be removed. Controlled burning is also an excellent weed management tool often used on a rotational basis with mowing. The burning is most often initiated in spring to con-

trol weeds and remove excessive organic material from native grassland areas. Fire has other benefits as well, including stimulating seed germination, warming the soil, and making nutrients more available. Those who regularly use fire do so with careful planning and extreme care. This management option is not applicable for every site, and acquiring permits can be a challenge in some locations.

Not all weeds can be managed with mowing or burning practices. Selective weed control will have to be accomplished by hand-picking and herbicide applications. Annual weed grasses and some broadleaf weeds can also be managed with spot applications of pre-emergent herbicides. Insects can also be damaging to grassland/prairie areas. Various species of white grubs, sod webworms, armyworms, and chinch bugs can cause catastrophic damage if left unchecked. Curative applications of insecticides may be required based on monitoring populations and determining damage thresholds.

COMMUNICATION

The acceptance of change or of any new program on a golf course always requires good communication. Start talking with golfers and committee members when you first start to make plans. Explain what you are trying to achieve and solicit input on the initial site selection. Be a strong advocate for the environmental benefits and potential cost savings that are expected. Post information and pictures, write articles for the golf course newsletter, or use a Power Point presentation to educate and build support for the program. Seek the help of interested members, join Audubon International, or contact local conservation groups to obtain information and to help get the message out. Arrange a day trip with the committee to tour another golf course where similar areas have been developed. A short meeting with the superintendent there will be invaluable.

Install nest boxes, feeder stations, and descriptive signage during the establishment of the sites to remind golfers of the project's objectives. A camera can be a great communication tool. Use it to take before and after shots and to record the various plant and animal species attracted to the site. Keep an active list of the native plant species and any new wildlife sighted.

In time, most golfers will come to appreciate the natural beauty these areas can provide and begin to realize their environmental worth. Do not become discouraged if some areas are not accepted. There will always be some give and take initially as the sites develop. Natural areas can be both wild and wonderful. Just give them a chance.

PLANT SELECTION GUIDES

- The Internet is a fertile source of information regarding plant selection. The Web site www.audubonccommunities.org/regional/search has been developed by Audubon International and lists native plant materials and provides informative links, illustrations, and supplier information.
- The National Wildlife Federation Web site www.enature.com also provides a state-by-state guide of native plants and other information for naturalization work.
- Your local university extension agency, USDA field office, BLM specialists, or State Department of Natural Resources can provide guidance in selecting appropriate and beneficial plant materials and tips on their use and establishment.

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Buffalo-Blow Your H_2O

A leaf blower and misting system can be an effective way to help greens survive a hot summer.

BY PATRICK J. GROSS

Kevin Hutchins at Mission Viejo Country Club fabricated a syringing system for greens using a utility cart and Buffalo Turbine Blower to help them save time on weekends and minimize interference with golfers.

Surviving a hot summer is difficult for people and plants. People, at least, can move into an air-conditioned building or turn on a fan. Plants, especially *Poa annua* and creeping bentgrass greens, are left vulnerable to the elements and often experience heat stress, wilt, and desiccation during a hot summer. The basic method used by most superintendents to keep greens cool during summer is to apply a light mist of water over the greens, known as *syringing*, in combination with insuring good air flow with the use of fans. This allows for good evaporative cooling to keep the surface of the greens below lethal temperatures.

A UNIQUE MISTING SYSTEM

Kevin Hutchins at Mission Viejo Country Club in Southern California decided to combine these two concepts so his crew could quickly syringe greens during the summer without causing too much interference to golfers. He and his mechanic made slight modifications to their Buffalo Turbine Blower by mounting two banks of misting nozzles on either side of the fan housing. Poly tubing connected the misting nozzles to a small diaphragm pump and a 25-gallon tank of water mounted at the rear of a lightweight utility vehicle. Following is the list of parts that Kevin and his mechanic used to make the modifications to the blower:

- 25-gallon poly tank
- 12-volt diaphragm pump (Sure-Flo)
- Poly tubing/fittings
- In-line automotive fuel filter
- Two sets of atomizing nozzles (10 nozzles on each set, available from Spraying Systems Inc.)

The total cost of the modifications was less than $500.

The staff at Mission Viejo Country Club typically uses this setup on Saturday and Sunday afternoons when the course is full of golfers and they want to syringe greens with minimal disturbance. One employee is scheduled from 1 p.m. to 4 p.m., which is enough

time to syringe each green two times. The disturbance to play is minimal and the club realizes a significant labor savings by needing only one employee to syringe greens.

COOLING EFFECT

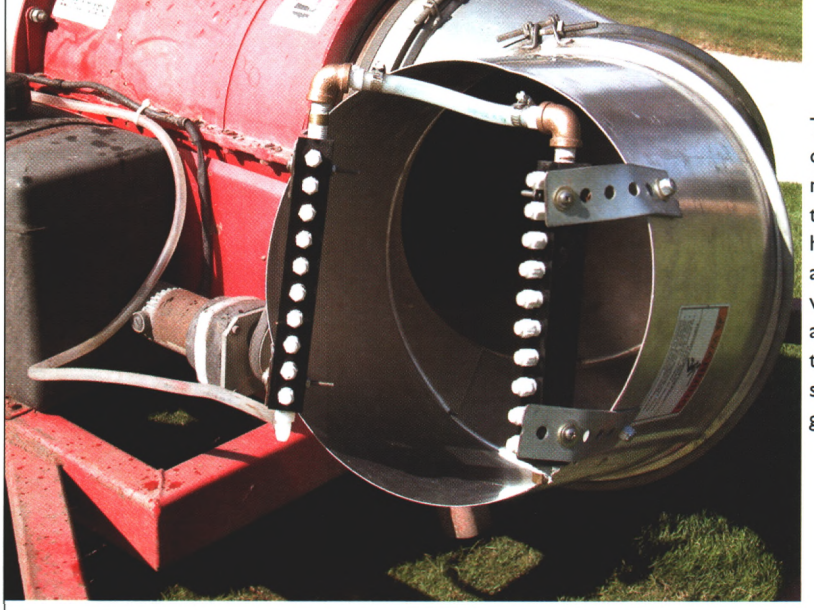
The cooling effect of this misting system has been significant. Kevin and his crew experimented with different methods to see which would have the most effect on cooling the greens. By making two passes with the misting system, it was possible to reduce surface temperatures from 97°F to 81°F. The cooling effect was enhanced even more by turning on the greenside sprinklers for one revolution, followed by making two passes with the misting system. This reduced surface temperatures from 97°F to 77°F.

COMMUNICATION

As with any new maintenance practice, golfers will tend to be skeptical and wonder what the maintenance staff is doing. Good communication is necessary so that golfers understand the temporary inconvenience of having to wait while the greens are being syringed. Kevin has done this by posting notices on the club bulletin board and including a short explanation on the club website. As Kevin has emphasized to his members, "You only need to give us 60 seconds so we can give you better greens." This method of cooling the greens is innovative, relatively non-disruptive to golfers, and inexpensive, while also reducing the amount of labor necessary to hand-water and syringe greens during the summer.

If your golf course is in the same situation of trying to keep greens cool during summer, instead of paying an army of employees to syringe greens, you may wish to consider this method to "Buffalo-Blow Your H_2O."

PAT GROSS *is the director of the USGA Green Section Southwest Region, covering the states of California, Arizona, and Nevada.*



Two banks of atomizing nozzles fastened to the fan housing provide a light mist of water into the air stream of the blower to syringe the greens.

A small 12-volt diaphragm pump supplies water to the misting nozzles. An inexpensive in-line automotive fuel filter removes any debris in the water that could clog the nozzles.

The staff at Mission Viejo Country Club typically uses this setup on Saturday and Sunday afternoons. With two passes around a green, it is possible to reduce surface temperatures by 16°F.

GMOs — A Crossroads for the Turfgrass Industry

Traditional breeding methods have brought turfgrass a long way. Is biotechnology now the path to follow?

BY DR. MIKE KENNA

The turfgrass industry is entering the century of biotechnology. Biotechnology refers generally to the application of a wide range of scientific techniques to modify and improve plants and animals of economic importance. In the broadest sense, traditional biotechnology has been used for thousands of years for the improvement of agricultural plants. However, the new molecular methods available to turfgrass scientists will help produce new cultivars with exciting improvements that would be difficult to achieve with traditional breeding methods.

TRADITIONAL PLANT BREEDING METHODS

Traditional breeding methods exchange genes by crosses between the same or closely related species. Depending on the starting point and what trait is meant to be improved, this effort can take considerable time to achieve the desired results. For example, cold-hardy, fine-textured, seed-propagated bermudagrass took 20 years to achieve. In contrast, improving gray leaf spot resistance in perennial ryegrass took only about five years.

Frequently, the characteristics of interest do not exist in any related species. In Figure 1, the progress that can be made with traditional breeding methods is illustrated. The vertical axis measures the frequency of individuals with the desired trait and the horizontal axis measures the level of negative or positive response.

When progeny from a cross are plotted on the graph, it produces a bell-shaped curve. The curve with the dashed line is the original population. The best progeny plants are selected from the tail of the bell curve and crossed to produce the next generation of offspring. After several cycles of selective breeding, significant improvement can be made for the trait of interest. This improvement is indicated in the bell curve with the solid line. The average performance of the improved population is better than the original population.

NEW PLANT BREEDING METHODS

In the 1970s, a series of advances in the field of molecular biology provided scientists with the ability to readily move DNA between more distantly related organisms. Today, this recombinant DNA technology has reached a stage where scientists can take a piece of DNA containing one or more specific genes from nearly any organism and introduce it into a specific plant species.

The application of recombinant DNA technology frequently has been referred to as genetic engineering. An organism that has been modified, or transformed, using modern techniques of genetic exchange is commonly referred to as a *genetically modified organism* or *GMO*. However, the offspring of any traditional cross between two organisms also are "genetically modified" relative to either of the contributing parents.

Turfgrasses generally are transformed using the biolistic gun. External DNA is coated on the surface of small particles of tungsten and the particles are physically shot into plant cells. Some of the DNA comes off the tungsten particles and is incorporated into the DNA of the recipient plant. Those recipient plant cells can also be identified and grown into a whole plant that contains the foreign DNA.

Plants that have been genetically modified using recombinant DNA technology to introduce a gene from either the same or a different species also are known as transgenic plants. The specific gene transferred is known as the transgene. Not all GMOs involve the use of cross-species genetic exchange. For example, recombinant DNA technology also can be used to transfer a benefit between different varieties of the same species or to modify the expression of one or more of a given plant's own genes.

ADVANTAGES OF GENETIC ENGINEERING

The application of recombinant DNA technology to facilitate genetic exchange in plants has several advantages over traditional breeding methods. The exchange is far more precise because only a specific gene that has been identified as providing a useful trait is being transferred into the recipient plant. As a result, there is no inclusion of ancillary, unwanted traits that need to be eliminated in subsequent generations, as often happens with traditional plant breeding.

Application of recombinant DNA technology to plant breeding also allows more rapid development of varieties that contain new and desirable traits. Further, the specific gene being transferred is known, so the genetic change taking place also is known. This is often not the case with traditional breeding methods, where the fundamental basis of the trait being introduced may not be known at all. Finally, the ability to transfer genes from any other plant or organism into a chosen recipient plant means that the entire span of genetic capabilities available among all biological organisms has the potential to be genetically transferred.

A comparision of traditional breeding and genetic engineering is illustrated in Figure 2. On the left, parents are crossed to move resistance genes into a commercial cultivar. Resistant progeny are backcrossed for seven cycles to get back to the original cultivar with the resistance genes. This process may take 8 to 10 years or more. On the right, genetic engineering can precisely incorporate the resistance gene into an existing cultivar. In fact, this diagram shows how three different resistance genes are inserted into a commercial cultivar. The amount of backcrossing would be greatly decreased and the time needed to improve disease resistance would be reduced.

WHY USE BIOTECHNOLOGY?

Whether scientists use traditional breeding or genetic engineering methods, the goal with turfgrass is to reduce pesticide use and make efficient progress on complex traits such as temperature or drought tolerance. A combination of new and old technology also will help increase the adaptation of our turf species to a wider range of environments and help conserve natural resources by reducing inputs such as water and fertilizer.

BENEFITS AND RISKS

One way to look at the benefits and risks of a GMO is to consider the *inherent* and *transcending* risks of the technology. Technology-inherent risks include safety issues and the behavior of a biotechnology product in the environment. For example, gene transfer, weediness, trait effects, genetic and phenotypic variability, expression of genetic material from pathogens, and worker safety need to be considered. In the United States, this process is regulated by the USDA Animal and Plant Health Inspection Service (APHIS), the Food and Drug Administration, and the U.S. Environmental Protection Agency. It is a very rigorous process.

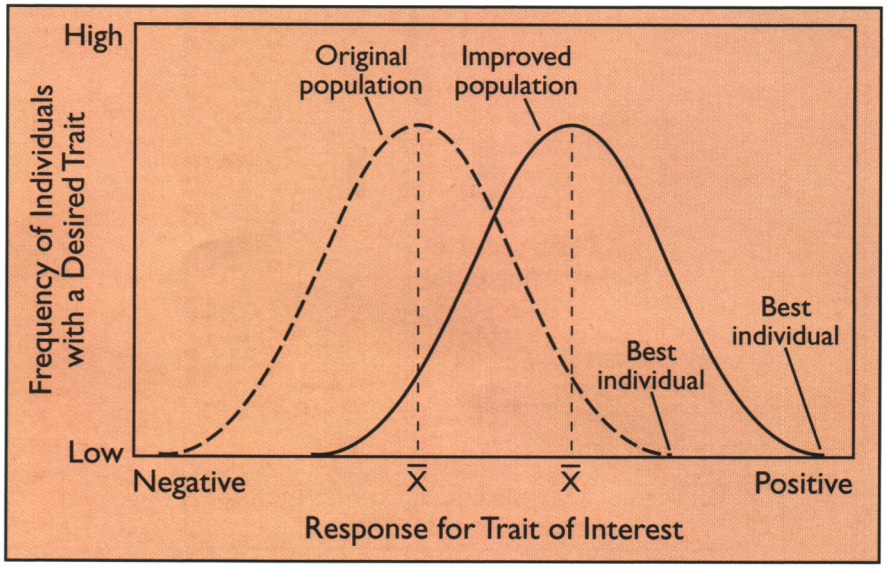


Figure 1. Through traditional breeding methods, progress can be made to improve the frequency of desired traits.

Technology-transcending risks deal with the political and social context in which the technology is used and how these uses may benefit or harm the interests of different groups in society. Will the technology increase the gap between rich and poor countries or small and large companies? Will the technology decrease biodiversity? Will it impose a burden on regulatory systems? And how will the intellectual property issues be managed? No single person, company or government agency can foresee all the benefits and risks, and that is why the process must be transparent and allow time for public comment and debate.

ROUNDUP-READY™ CREEPING BENTGRASS

The USGA Turfgrass and Environmental Research Program was involved early in the development of genetically modified grasses. In 1989, the USGA funded a project at Rutgers

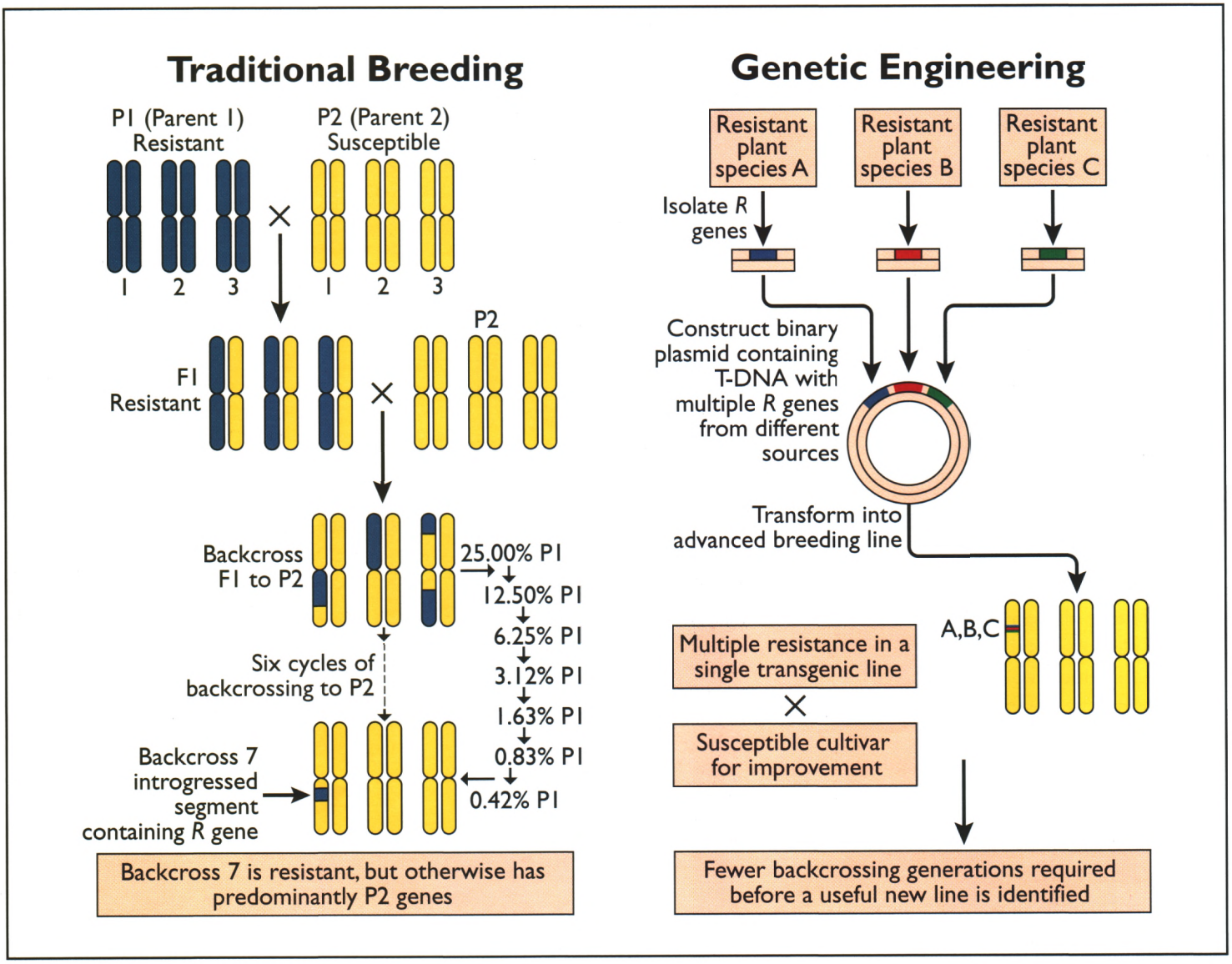


Figure 2. Traditional breeding methods for introducing one or more genes require making crosses, usually within the species (left), followed by a series of backcrosses to return to an acceptable cultivar. A decrease in breeding time and effort is possible using genetic engineering by inserting genes directly into the callus cultures of useful turfgrasses (right). Genetic engineering also allows genes from very different species to be incorporated into turfgrasses.

Adapted from Buchanan, Bob B., et al., 2000. *Biochemistry & Molecular Biology of Plants.* Am. Soc. of Pl. Phys., Rockville, Md.

University to determine if endophytes could be introduced into creeping bentgrass. The thought was that this would increase insect resistance. There was some discussion about using genetic engineering to achieve this goal. By 1991, the prospect of an endophyte for bentgrass seemed remote, so the project direction turned toward herbicide resistance. In 1994, a successful transformation system for bentgrass was achieved and there were a few scientific papers published on the techniques.

In 1996, the Scotts Company became interested in using biotechnology to improve grasses, and by 1998, Scotts acquired 80 percent of Sanford Scientific. This gave Scotts the right to use the biolistic gun for turfgrass and ornamental plant genetic transformation. In 2003, the Scotts Company and Monsanto petitioned the USDA/APHIS to deregulate a GMO bentgrass with glyphosate tolerance, and there was a lot of excitement, but there also were concerns.

In 2004, APHIS decided to conduct an Environmental Impact Statement or EIS. This was the first time APHIS took such an action, and the primary reasons listed were that bentgrass is an open-pollinated, perennial species and that there was concern for gene escape and weed problems. Also in 2004, the EPA pollen study determined that pollen moved farther than scientists originally believed. Last year, in 2005, public hearings were held; in 2006, APHIS will complete the draft EIS, set a time for public comment, and make a final decision at the end of the year.

Roundup-Ready™ creeping bentgrass would be a wonderful addition to the golf course industry, and it is hoped that the USDA/APHIS will approve the deregulation of this particular GMO. I see no reason to delay the release of this

technology, especially in light of the APHIS decision to deregulate Roundup-Ready™ alfalfa, which also is an open-pollinated, perennial crop.

The turfgrass industry has been mistreated in the press. Herbicide tolerance would allow our industry to control unwanted weeds and, in the long run, reduce our overall pesticide use. This has already been proven in agricultural crops, and it also would be true for the turf industry. There is a constant stream of anti-genetic-engineering, anti-golf, anti-turf stories in the mainstream media that is quickly picked up by the so-called organic movement that wants to prevent the use of GMOs as well as pesticides.

WHAT IS THE FUTURE?

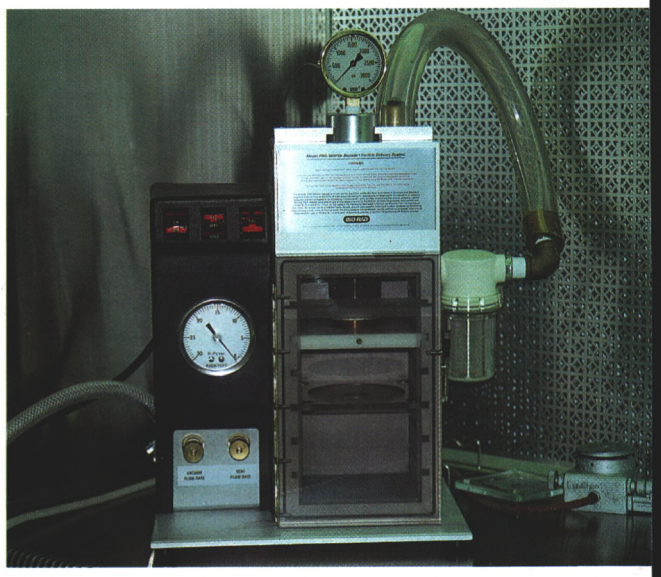
The USGA will continue to support traditional plant breeding efforts to improve both warm- and cool-season species for several important characteristics. For example, significant improvements in bermudagrass cold tolerance, spring green-up, and resistance to spring dead spot will help our industry to reduce pesticide and water use. The genes involved in heat tolerance mechanisms of bentgrass will be identified in *Agrostis* species selected from thermal soils near hot springs in Yellowstone National Park. Can we move these genes into creeping bentgrass using traditional breeding methods, or will genetic engineering be needed? How will this trait be regulated? Dollar spot resistance will be developed in creeping bentgrass by moving resistance genes from colonial bentgrass, as well as improving dollar spot resistance by selective breeding of resistant genotypes.

The difference in all of these studies is that we are using the new molecular tools to understand the function of the genes that produce the desirable characteristics, whether it is cold or heat tolerance, or resistance to disease. USGA-supported scientists can now locate where the genes are on the chromosomes of our various turfgrass species using genetic linkage maps. There is an expanding tool kit of molecular techniques that allow scientists to understand how genes function in plants, and this information will be used to develop improved cultivars with or without the need for genetic transformation.

Turfgrass scientists also will benefit from the millions of dollars spent on cereal grass genomics. The beauty of Mother Nature is that she does not reinvent the wheel; she only rearranges it a bit. The genes in rice, sorghum, maize, wheat, and oats are all very similar, and the chromosomes of these species also have similarities. Turfgrass scientists will be able to capitalize on what is already known in the cereal grasses so improvements can be made in our important turfgrass species as well.

SUMMARY

In the broadest sense, biotechnology has been around for a long time. Genetically modified organisms or GMOs can be produced in many of our turfgrass species that we use on the golf course. This method is more precise, avoids unwanted traits, and will enable faster improvements. Functional genomics will help us use information from the cereal grass species to more efficiently breed grasses in concert with traditional breeding programs. With GMOs there is a defined regulatory process to examine the benefits and risks, but there also are political and social implications to be considered. In the case of Roundup-Ready™ creeping bentgrass, it is my hope that the USDA-APHIS makes the right decision and allows the turfgrass industry to step forward into the 21st century of biotechnology. Regardless, GMOs are here to stay!



The biolistic gun has been used in the lab to transform turfgrasses. External DNA is coated on the surface of small particles of tungsten and the particles are physically shot into plant cells.

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Does This Stuff Work or Not?

An experimental green in Waco, Texas, may help answer the question.

BY JIM MOORE

It is a fair question, and one that should be asked more often. Today's turfgrass managers are faced with an extraordinary diversity of products to utilize in their efforts to produce the best possible playing conditions for their employers. The best managers base their selection of these products on a variety of factors, including effectiveness, cost, and continued support from the manufacturer.

Product information is certainly not hard to find. Sources include trade shows, industry journals, superintendent meetings, consultants, and, of course, the Internet. But in one respect, the Internet has complicated the search for reliable information. New products can be introduced to the industry for the price of a Web site. In the process, almost any claim can be made regarding product efficacy.

The USGA Green Section deals with this issue on a daily basis. The Green Section agronomists are frequently asked whether or not products work, and they base their assessments on many factors, including what they see actually in use on the courses they visit. But how about new products that have yet to be introduced to the mass market — how is information gathered regarding installation and application?

An experimental green was constructed at Ridgewood Country Club in Waco, Texas, to facilitate the on-site testing of new products. This green provides the opportunity to evaluate the efficacy of new products and to experience firsthand the installation or application issues that are associated with the products. The green is 8,000 square feet and does double duty as a short-game practice facility for the Ridgewood membership.

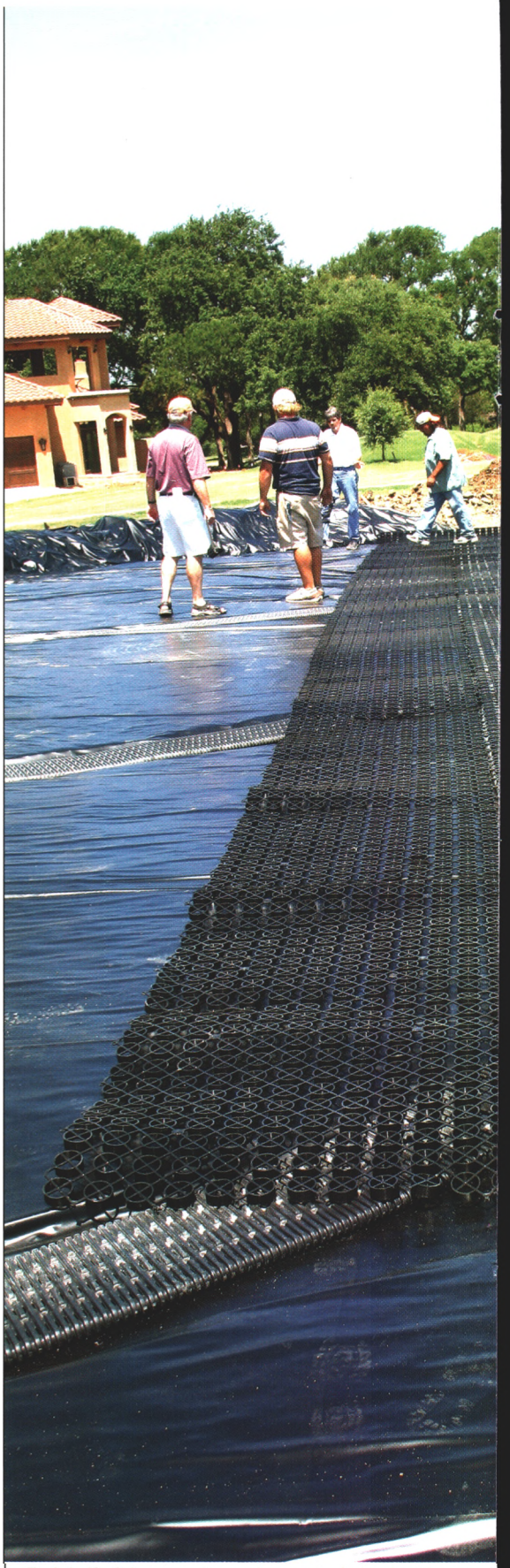
The following describe the products currently under evaluation.

IN-LINE FILTRATION TESTING

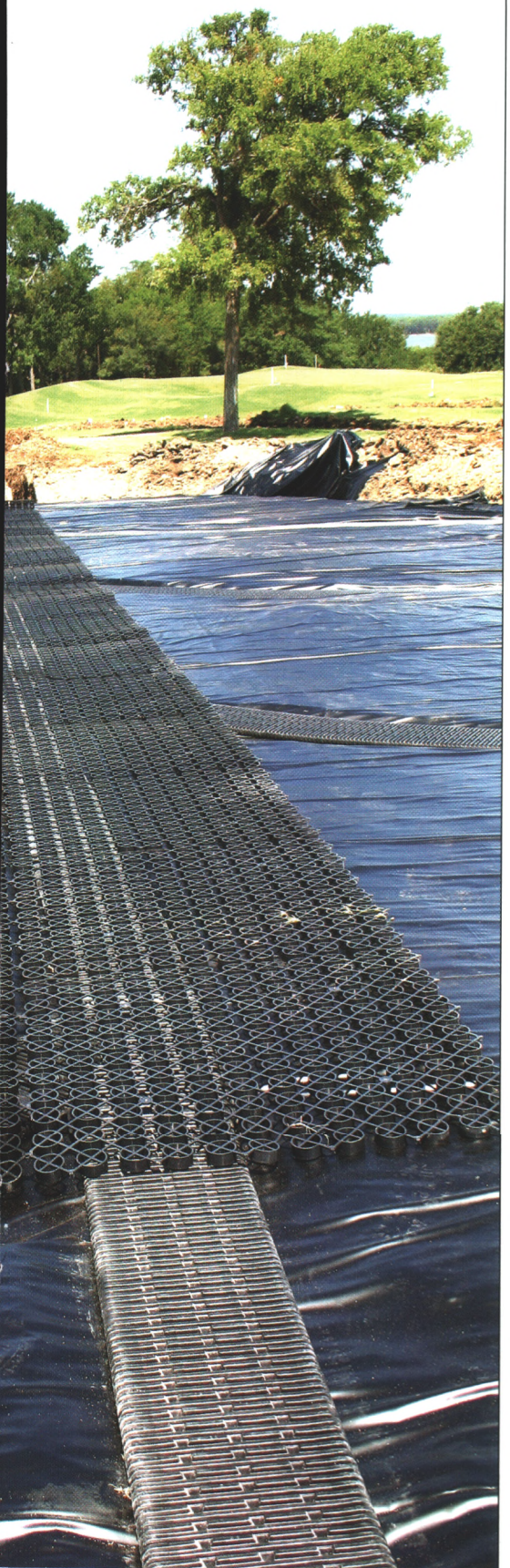
The experimental green was constructed of straight sand and lined with an impermeable membrane to simulate a "worst-case" scenario in terms of the leaching of fertilizers and pesticides from a putting green. There are two 4,000-square-foot halves to the green, with each half having its own independent drainage system. The exit drains from each half are plumbed to in-line filtering devices contained in an underground structure near the experimental green. Flow-monitoring devices and autosampling units are installed in the structure. Whenever 500 gallons flows through a drain line, a 900 ml sample is collected upstream and downstream of the in-line filtering unit. These samples are shipped to Dr. Kevin King of the USDA Agricultural Research Service in Columbus, Ohio, where they are analyzed to determine how effective the filters are in removing fertilizers and pesticides applied to the experimental green. The ultimate goal of this project is to work with the filter manufacturer to determine the most effective media for the filters to enhance their effectiveness.

ALTERNATIVE DRAINAGE MATERIALS

Greens built to the USGA method include a gravel layer that is a minimum of 4 inches in thickness and is installed



Each half of the experimental green is drained with materi
drainage blanket normally used in USGA greens.



ls that have the potential to substitute for the gravel

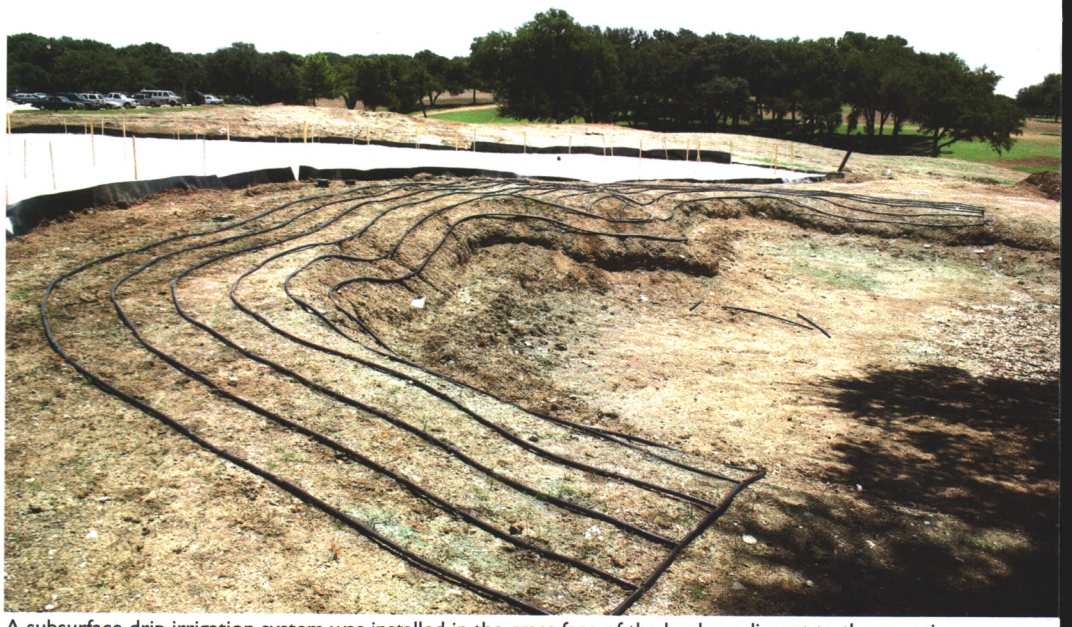
beneath the 12-inch rootzone. The gravel layer is an integral part of the drainage system of USGA greens. In some parts of the country, properly sized gravel is hard to find and can be expensive. Gravel is very heavy and is expensive to haul, particularly given the rising cost of fuel.

Two products are being evaluated with the potential for being used in lieu of the gravel layer. These materials are lightweight and easy to install. Each half of the experimental green is drained by one of the products. Both products are similar in their function in that they use a porous membrane sandwiched by filter material to prevent the rootzone sand from plugging the membrane. Water flows through the membranes to the drainage pipe and eventually to the in-line filters described above. Moisture sensors have been installed to measure the ability of the products to adequately carry excess water from the green cavities.

WIRELESS ROOTZONE SENSING

The ability to monitor soil moisture, salinity, and temperature has long been limited to turfgrass scientists using expensive equipment in very specialized research environments. Recently, the cost of such sensors has dropped, making them more reasonable to install on the golf course. This reduced cost, combined with significant advances in wireless communication devices, makes the installation of rootzone monitors in greens much more practical than ever before. The experimental green has been equipped with four wireless rootzone monitors. Each monitor, or node, has two probes. The probes were installed at 4 inches and 10 inches beneath the green surface. Each probe has three sensors: moisture, electrical conductivity (for salinity measurement), and temperature.

The nodes were buried in four areas of the experimental green, with a fifth node installed on the number-three green at Ridgewood. Each node transmits the information collected by the sensors to a communications module mounted on a tree adjacent to the experimental green. This module sends the information to a receiver and a computer in the superintendent's office. Software allows the information to be viewed in a variety of ways. Particularly useful is the ability to monitor the



A subsurface drip irrigation system was installed in the grass face of the bunker adjacent to the experimental green. This allows the turf on the face to be irrigated without overwatering the adjacent areas.

An integral part of the wireless rootzone monitoring system is the node, probe, and sensor unit. Four of these units are installed in the experimental green to monitor soil moisture, soil temperature, and electrical conductivity (salts). The probes are installed 4 inches and 10 inches below the surface.

changes in moisture and electrical conductivity over hours, days, and weeks. It is even possible to connect the computer via the Internet to read the sensor values from a remote location.

Wireless rootzone monitoring is a promising new technology that should give the superintendent another tool for managing turfgrass areas and improving turfgrass health.

SUBSURFACE DRIP IRRIGATION ON BUNKER FACES

Grass bunker faces are difficult areas to irrigate properly. In addition to the steep slopes used on many bunkers, golfers blast large amounts of sand onto the faces, resulting in droughty growing conditions. During the hot summer months, applying enough water for these areas through the overhead sprinkler system can result in over-watering of the adjacent green or other areas around the green. One possible solution is the use of subsurface drip irrigation (SDI) installed in the bunker face. An SDI system was installed in the bunker adjacent to the experimental green at Ridgewood. The overhead sprinklers used for the green were adjusted to avoid applying water to the bunker area. The system has been in use for almost a year with very good results. SDI appears to be a viable solution to this irrigation challenge. Additional work with SDI is underway at two other courses in Waco and will hopefully yield equally promising results.

ALTERNATIVE PLANTING METHODS

The experimental green was established using four different bentgrass varieties. A unique planting method was utilized on two-thirds of the green. The seed was literally rolled onto the rootzone mix like carpet, using a lightweight paper-based product that is impregnated with seed and fertilizer. It comes in various widths and lengths as well as different seed and fertilizer combinations. After the product is rolled onto the area to be seeded, it is watered in by hand or with overhead sprinklers. This "melts" the product into the surface of the rootzone mix, resulting in very good seed-to-soil contact. Although wind is certainly an issue when using this product, the ease of application and the uniform seed distribution make it worth considering.

CONCLUSION

The experimental green has been heavily utilized over the past year with good success. In addition to the continuing study of the products already installed, more products will be evaluated in the future. This green provides an excellent opportunity to get a hands-on look at these products as they are introduced to the golf industry. In addition, the membership of Ridgewood Country Club now has an excellent short-game practice area.

This project would not be possible without a great deal of cooperation from many sources. The following companies have contributed their products and expertise to this project.

The Toro Company
Advanced Drainage Systems
Hancor Incorporated
Fabco Industries Incorporated
KriStar Enterprises Incorporated
The Freudenberg Company
Caylor Sports Sands
Colorado Lining
Airfield Systems
Advanced R2 Wireless
Thomas Turf Services
Turf Diagnostic and Design
Ridgewood C.C.
Cottonwood Creek G.C.

Special thanks to the maintenance staff of Ridgewood Country Club, past superintendent Tom Werner, and current superintendent Dan Wegand.

JIM MOORE *is director of the Green Section's Construction Education Program.*

The Little Roller That Could

A useful technique to firm up soft greens after close-center aeration.

BY BOB BRAME, BOB VAVREK, PAUL VERMEULEN, AND BUD WHITE

Golfers often ask, "Why is it so necessary to riddle the putting surface with holes and then bury the greens with sand when the grass looks healthy?" Certainly the answer varies, but, for the most part, core aeration is scheduled in conjunction with heavy topdressing to manage organic matter accumulation.

To enhance the results of core aeration, superintendents have had the options of changing the size of the tine, which ranges from 0.25 inches to 1.25 inches in diameter, or running the aerifiers in multiple directions. Unfortunately, the agronomic gains in either case can be more than offset by the disadvantages of greater putting surface disruption and extended turf recovery, thus creating a Catch-22 situation.

Unsatisfied, several superintendents in the USGA's Northeast Region reportedly began experimenting in the early 2000s. Eric Greytok, superintendent of the 2006 U.S. Open Championship site at Winged Foot Golf Club, had the club's Ryan Greensaire aerifiers retrofitted with quadra-tine holders bored out to accommodate 0.50-inch-diameter hollow tines. This changed the aerifier's hole spacing from its normal 2.5-inch square pattern to a 1.25-inch triangular pattern. As a result, core aeration became more effective without added disruption or delayed turf recovery — a win-win situation for everyone.

Close-center aeration (CCA) is the popular term used when referring to aeration with modified equipment for the sole purpose of reducing the hole spacing of large hollow tines. Having proven to be a valuable technique for managing abundant organic matter accumulations on putting greens established with warm- or cool-season turfgrasses, it has since been widely accepted across the country.

If the merits of CCA sound too good to be true, it is important to mention that some superintendents have been caught off guard by one possible side effect. Specifically, because CCA has a greater impact on the soil profile, the putting surface can become so soft under foot that riding equipment creates severe tire ruts. This problem typically is associated with newer, sand-based greens that have accumulated excessive organic matter and exhibit shallow rooting. As these two issues are addressed over time, after two or three CCA treatments, the problem generally subsides.

To restore order to soft greens following CCA, initial attempts to compact the surface were made using various types of putting green rollers. These efforts bore little fruit, however, as the small size and relatively light weight of the rollers limited their ability to firm up cultivated ground. Consequently, attention quickly turned to the use of mini-construction rollers typically found at equipment rental yards.

Concerns about employing the little yellow rollers engineered for use on asphalt driveways were clearly on everyone's mind. A number of people simply assumed that using a piece of equipment that weighs a ton or more would damage a green's infrastructure or, worse yet, crush the delicate turf. In practice, though, such dire problems never developed because the weight of a small construction roller is distributed across a large surface area.

When renting a mini-construction roller, keep in mind a few key features. First, units that have a split front roller are less apt to damage the turf around the perimeter of a green because they turn more easily. Secondly, some rollers allow for the addition of ballast to the front and rear drums, if desired. When rolling greens for the first time, it is best to start with empty ballast tanks, adding weight gradually to achieve the best possible results. Remember, too, that cored greens can also be rolled in several directions, albeit with a 24-hour resting period between treatments.

If unstable ground has been a concern at your course following close-center aeration, the technique of using a small construction roller may be the ticket for future success.

BOB BRAME, *director, and* BOB VAVREK, *senior agronomist, represent the North-Central Region.* PAUL VERMEULEN, *director, and* BUD WHITE, *senior agronomist, represent the Mid-Continent Region.*

Dave Frieta (right) superintendent at Pronghorn Golf Club in Bend, Oregon, regularly communicates both the short- and long-term goals of the golf course to his interns and staff as a whole.

It's All About The People

How to get the most out of your most important asset.

BY BILL GRIFFITH

For a number of years I have been interested in ways to motivate employees and have had many opportunities to observe maintenance crews in action while visiting internship sites of students in the Turf Management Program at Walla Walla Community College (WWCC). I have visited more than 150 worksites in the last 10 years and have seen some really motivated crews and others that are not so motivated. This article is about those observations and some materials gained from other sources.

I have observed two major areas that hinder motivating employees. One of those areas is the lack of organization and clear directions to the staff. The other is that the supervisor's communications to the staff are infrequent and/or negative in nature. Employees want a leader who leads and provides consistent communication to them. Informed workers are much more likely to be motivated.

THE LINK BETWEEN ORGANIZATION AND MOTIVATION

Organization gives workers confidence, direction, and power while planning out the work day, work week, and even longer. Something visual works best and is much more likely to be understood than just verbal planning and direction. Advance notice of tournaments, special maintenance practices, and scheduled events empowers employees because they know what to expect and are mentally prepared. When employees know the plan, they are better able to process what needs to be done and are more efficient at doing their job.

THE LINK BETWEEN SHARING GOALS AND MOTIVATION

Setting and sharing goals with all of the staff moves the organization forward because the staff has a better idea of the

big picture. If you want your workers to buy into the goals of the organization, make them part of the goal-setting process. Regularly communicate the short- and long-term goals to your workers. Reaching your goals is the perfect opportunity to give positive reinforcement that can go a long way in motivating your employees. Employees who know the big picture of the puzzle are better able to fit the pieces together.

THE POWER OF A "GOTCHA" MANAGEMENT STYLE

"Gotchas" are often used when workers do something wrong and for communicating their mistakes to them. "Gotchas" may correct wrong behavior, but seldom do they have any long-lasting positive motivational effect. In fact, this management style becomes very counter-productive and eventually the employee will not believe what you are saying about him.

Another closely related point to remember is to concentrate on the behavior or action, especially patterns of behavior. Obviously, these situations need to be dealt with, but care should be taken to differentiate between the person and the behavior or action. The other thing that happens with a "gotcha" management mentality is that critical attitudes and words flourish. Eventually, this becomes part of the maintenance crew's normal operating procedure, and the interaction between management and crew becomes critical in nature. "Gotcha" management styles erode trust from those we manage and produce fear, uncertainty, and resentment. One positive comment usually stops critical comments and changes the direction of the conversation.

THE POWER OF A "WELL DONE" MANAGEMENT STYLE

"Well done" managers notice when things are being done right and communicate the same to workers. What do we pay the most attention to — when workers do something wrong or when they do something right? Unfortunately, of all our response options, the one that is most used for a job well done is "no response." Over a period of time, consistent "no responses" tend to be perceived as negative in nature. We need to understand what a positive difference it makes in their motivation when people are appreciated for what they do right. "Well done" managers communicate to workers when they see progress, not just when something is done perfectly.

Do not confuse this process with manipulation, which is used only for the manipulator's benefit. The goal is to get people self-motivated so that the reward comes from within when they do a good job. They will learn this best if we provide a model for them. One of the best quotes from Ken Blanchard's *Whale Done* is, "Praise progress. It's a moving target." Write this on your wall or make a sign above your desk, but make sure to keep reminding yourself of how important it is to recognize progress.

Accentuating the positive is a learned process and works only when it becomes a habit. How many of you wake up just before the alarm goes off every morning? That is a learned habit, and when we repeat something often enough, it becomes a habit and eventually part of our character. Involve your employees in helping to add ways to accentuate the positive at your work sites. This also works well in the area of customer service. It gives the employees ideas for better customer service and communicates to them the importance of good customer service. We need to consistently model customer service to our employees and reinforce the message that, without the golfers, we wouldn't have jobs. Work sites that practice affirmation and "well done" management create an environment of safety and trust. People are willing to hear and accept the truth in a place that has trust and is without fear. If our employees are given consistent affirmation, they will really take notice when we point out a mistake or a behavior problem.

Try this with one or two people for a week or two and see if it doesn't make a difference. Start by making a list, and note every time you see an employee do something right, and then comment individually to the employee. Remember to look for progress from your employees and praise them for it. Consider practicing this in your personal life, too, and you will probably be surprised at the difference it will make in your personal relationships. As a parent, it made a tremendous difference in my relationship with my children when I started appreciating them for what they did well and focused less on what my expectations were for them. Finally, promote a work site that encourages employees to learn and grow. Make your positive and redirective comments to individuals first, then to groups when necessary. A well-motivated work force will always accomplish more and make the manager look good.

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BILL GRIFFITH *is Turf Management Instructor at Walla Walla Community College.*

Write It Down

Using a master calendar to be prepared.

BY KEITH HAPP AND DARIN BEVARD

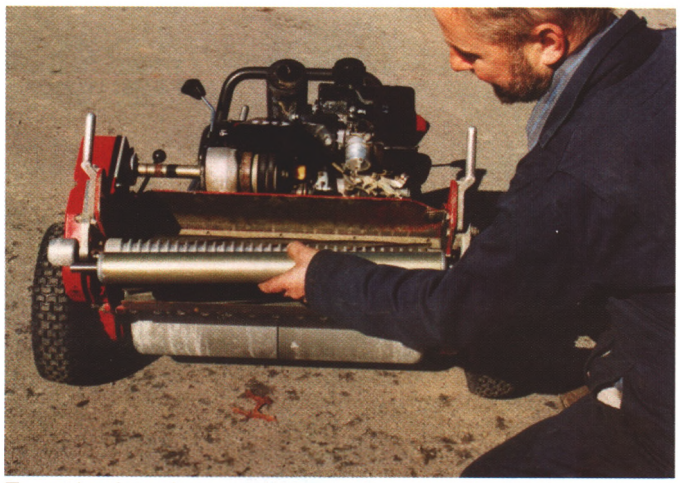
Each growing season is a learning experience, and some are more trying and difficult than others. Weather patterns may have been more punishing, or a rash of equipment breakdowns may have contributed to deteriorating turf quality. After a difficult year it is wise to reflect on programs that worked and those that did not. If mistakes were made, learn from them. Make every attempt not to repeat the past. All turf managers have the best intentions for the upcoming season, but it may take more than just good intentions. Consider immediately documenting the good, bad, and the ugly as you progress through the season. It will pay off as you prepare for the following year.

Many golf course maintenance programs are time sensitive, and they recur on an annual basis. This presents a specific window of opportunity to proactively control problems such as white grub populations, annual weed grasses, *Poa annua* seedhead development, and turfgrass diseases. Controlling snow mold (Microdochium patch), for example, is dependent on timely fungicide treatment at the same time each season. The simple fact is that many critical maintenance and preparation programs must be scheduled around other equally important programs, with the main goal of producing the best possible playing conditions for the golfers.

A good example of this is the desire to suppress *Poa annua* seedheads at a time when the core cultivation of the putting greens needs to be completed. Growth regulation for seedhead suppression and speedy recovery from core aeration simply do not mix. With effective scheduling, though, *Poa annua* seedhead suppression can be performed in close proximity to core aeration practices and positive results regarding playability can be expected. University researchers have examined these practices and have demonstrated that satisfactory recovery can be promoted even when both are implemented. Healthy turf can be produced and excellent playability can be offered.

Another example is pre-emergent weed control. Mistiming the application by as little as 7 to 10 days can lead to

An annual wall calendar can be an excellent tool for planning upcoming maintenance programs. The visibility of a wall calendar allows more staff members to see what needs to be done and take ownership of planning or implementing a particular task.



To avoid scalping damage, solid front rollers should be fitted to greens mowing equipment well in advance of conditions that could result in mechanical damage.

Weather is an uncontrollable variable associated with maintaining quality golf course turf. Document when weather conditions cause localized dry problems on the greens.

control failure. A significant investment is wasted, additional measures for post-emergent control must be implemented, and often the superintendent must answer to course officials because of visible weeds. Timing is critical!

To help plan for the season ahead and allow all recurring programs to be placed on a master schematic, purchase a master calendar. This purchase should take place well in advance of the end of the current year, providing the opportunity to place many recurring maintenance strategies on the calendar while they are fresh in your mind. Something as simple as a large annual wall calendar or a computer program will work very well.

Other examples of things that can be marked on the calendar are the first appearance of a specific disease problem, when a phenotypic indicator bloom triggered the need for insect control strategies, and when the change from grooved to solid front rollers on greens mowing equipment was needed. Naturally, notations of significant weather history also can be documented. This will aid in utilizing pro-active procedures during the season ahead. It may also help minimize the number of times the words "I wish I wouldn't (or would) have done that" are uttered during the season.

Do not rely on memory to recall what worked well and what did not. A master calendar allows project, program, or task results to be posted immediately. Following is a list of suggestions that can be included as regular postings on the master calendar of management practices:

- The date when a new calendar will be purchased for the next year.
- The last heavy frost of the spring.
- The first hard frost in the fall.
- The first mowing of the greens.
- The first topdressing.
- When the soil temperature reached 55°F.
- When isolated dry spot problems developed.
- The date the first hand watering was necessary.
- When pest control measures were implemented for greens, tees, and fairways.
- When front rollers were switched on mowing equipment for greens and collars.
- The date weather conditions mandated that mowing heights be increased.
- The date solid rollers were fit to the front of fairway mowers to manage the outside edge of the fairways.
- Delivery dates for topdressing.
- Aeration treatments.
- First growth regulator treatment.
- First disease outbreak.
- Soil samples collected and submitted for analysis.
- Fertility applications.
- Turf conferences and educational opportunities.

Turfgrass management is a dynamic business. While planning is essential, no program or series of programs is set in stone. Some flexibility regarding implementation is needed; there should be some degree of wiggle room. Programs posted on the calendar of events should not be positioned on the absolute "drop dead" date.

While this tip may seem simplistic, observations from our travels and visitations in the Mid-Atlantic and Northeast Regions offer evidence that those who plan in this manner are the exception rather than the rule. Do not try to forget a bad year. Rather, use it as a learning experience and don't repeat the mistakes. All turf managers are looking for the best tools to produce the desired turf conditions at their facilities. A calendar is an effective tool to plan efficient and timely course maintenance activities.

KEITH HAPP *is a senior agronomist for the Green Section's Mid-Atlantic Region.*
DARIN BEVARD *is an agronomist working out of the Glen Mills, Pa., office of the Mid-Atlantic Region.*

The Truth About Trees

Although trees offer benefits, they also can have unfavorable effects on turf and the game of golf.

BY DAVID A. OATIS

Trees with low branching habits should not be located in high-play areas. They punish golfers indiscriminately and create a hazard for which there is no reward for a skillful recovery shot.

A recent search of all USGA publications on the Turfgrass Information File database (TGIF) for articles that mentioned trees yielded a remarkable 198 hits! Additional investigation shows that many of the articles written since the 1970s discuss the need for tree removal. Furthermore, the number of courses that are planning, implementing, or have completed major tree work is growing each day. So why, in the last 35 years, has tree removal become a thoroughly discussed and popular topic? A further review of some of the older tree articles yields the answer. Tree planting was very popular in the first three quarters of the 20th century, and the early golf course tree planting programs around North America achieved remarkable success. Large, open areas were gobbled up by tree plantings, and many greens, tees, and fairways were effectively encircled with trees. Many courses now are paying the price for the success of those tree planting and course beautification programs, as the combination of reduced sunlight and reduced air circulation have contributed to a host of turf problems. Innumerable playability problems also have been created.

Making matters worse, many courses gave little thought to the specific characteristics of the various species that were planted. It seems many courses chose the short-term economy of planting nursery overstock. While some courses planted more desirable species, many other courses planted fast-growing, short-lived, soft-wooded, disease-prone, and invasive-rooted species. These are trees that compete most effectively with turf. Perhaps the saddest part of the story is that some courses are continuing to plant too many trees, effectively perpetuating the problem.

So what about the original question, *the truth about trees*? There are many truths, some of which identify the positive benefits of trees. Trees are valuable to many landscapes, both aesthetically and environmentally. Trees can create definition and separation, and they are helpful in screening unwanted views and softening the appearance of structures. Trees can have a pleasing, naturalizing effect on the landscape. Some species provide valuable food, cover, and habitat for wildlife. In fact, retaining dead and dying trees can provide homes for cavity-nesting birds and other wildlife. Even though turf does not perform as well in the

shade, golfers certainly appreciate shade on hot days. Trees also can function as wind breaks, which can be helpful in harsh, windswept environments. Perhaps more significant than anything else, most people love trees, and they enjoy planting them.

GOLFER SAFETY

Now for some of the negatives: trees also can be dangerous. Few like to admit it, but trees can damage property and injure or even kill people. A poorly maintained stand of trees can be a liability and can be very expensive to rectify. Potentially hazardous trees can be found on many golf courses. Although a structurally flawed tree that is located deep in the rough or in the woods may not be much of a concern, structurally flawed trees in high-play or high-traffic areas create unreasonable hazards and should be removed forthwith. Failure to do so could be considered negligence! Surprisingly, golfers and committee members frequently argue against removing hazardous trees. Essentially, they are arguing that trees are more valuable than the health and well-being of their golfers!

TRAFFIC

Trees located in high-traffic areas create permanent traffic patterns that funnel traffic and concentrate wear problems. The combined effects of concentrated traffic, shade, and root competition frequently push turf over the edge and make it virtually impossible to maintain turf cover. Trees and healthy turf simply cannot coexist in high-traffic areas. Such areas include walk-on/off areas around greens and tees, and the entry/exit areas around cart paths.

GROWING ENVIRONMENT

An inescapable agronomic truth is that trees can make it physically impossible to grow healthy turf that plays well, is reasonable to maintain, and is reliable. Light is the fuel source that runs the photosynthesis engine, and trees block sunlight very effectively. Insufficient light prevents the engine from running at or near optimum efficiency, and this produces a weaker, less wear-tolerant turf. Tree roots compete very effectively with turfgrass for moisture and nutrients, and when they are surface roots, playability suffers and turf maintenance equipment and golf carts may sustain damage as well. Areas that are heavily treed with dense-canopied and surface-rooted species often lack turf cover and may even experience soil erosion. Playability is especially poor in these types of locations.

It is a commonly held belief that tree root systems extend out to the drip line of the tree, but that is far from the truth with many tree species. Depending on the species, a tree's roots may extend hundreds of feet outward from the trunk of the tree. Tree root systems are soil robbers. They use and greatly benefit from nutrients and moisture intended for the turf. As a result, the growth rate of trees on golf courses can be considerably faster than those in the wild. This rapid growth rate can fool golfers into believing the trees are much older than they are and even into believing that the trees predated the course. This

Trees located in front of bunkers create a "double hazard" because they block advancement from the bunker.

Tree roots compete very effectively with turf for moisture and nutrients and, depending on the species, can extend outward two to three times the height of the tree.

is particularly the case with faster-growing species. Even though the growth rate is rapid, it usually goes unnoticed, so tree problems can sneak up on courses. Trees that may not cause significant shading or air blockage in year one may become major problems by year 15-20. Some tree species grow more than a foot vertically a year, so 20 years of growth can mean a 20- or 30-foot difference in height!

Lest we forget, more obvious damage also can be caused by tree root systems. Surface-rooted species can destroy cart paths in just a few years. Frequently, paths are resurfaced without addressing the underlying tree-root problem, so the solution is expensive, but temporary at best. Trees also can inflict significant damage to maintenance equipment, golf carts, and even golfers. Hidden surface roots can hurt!

Excessive tree plantings are a common ingredient in the development of poor grass-growing environments. Poor air circulation reduces the cooling potential of the turf and helps to raise the relative humidity level. Higher humidity creates an ideal environment for fungal pathogens to infect, and weakened, less-vigorous turf is extremely susceptible. Turfgrass responds to a low-light environment by altering its growth habit. Turf grown in a shaded environment assumes a more open growth habit, becoming longer and leggier (etiolated), and the leaves become fatter and more succulent. This leaves the turf more susceptible to wear injury from both golfers and maintenance equipment. Increased wounding potential, combined with an ideal environment for fungal growth and development, produces predictable results: more and more severe disease outbreaks, especially on greens. Making matters worse, the reduced sunlight reduces the rate of recovery accordingly. Minor injury and minor disease outbreaks that might go nearly unnoticed in vigorously growing turf become a significant problem with weak turf.

WINTER INJURY

Winter injury, a phenomenon common in some areas, is often very closely related to the growing environment. Although winter sunlight may be discounted as unimportant, winter sunlight can have a major impact on the incidence of crown hydration injury. Thus, trees that are far away from a green or too short to influence sunlight penetration during longer day-length days, may block a great deal of light during short day-length days. As an example, full sun until early afternoon may accelerate melting, but the water may refreeze rapidly as a result of early afternoon shade. A lack of sunlight in the fall also can influence the turf's ability to harden off properly, also increasing the likelihood of winter injury. Poor light penetration in the early spring increases the thaw period, also increasing the potential for winter injury. The combination of shade and traffic can be especially devastating in more southerly climates to warm-season grasses such as bermudagrass. Spring green-up, growth, and recovery also will be slowed accordingly on all grasses. From a golfer's standpoint, shaded turf prolongs frost delays.

PLAYABILITY

From the playability perspective, excessive and/or poorly located trees take away options and can leave a course with a claustrophobic feel and "one-dimensional" playability. Good topography is a key ingredient in designing a topnotch golf course, and interesting and strategic topography can be hidden and neutralized very effectively by indiscriminate tree plantings.

Trees can provide some measure of strategy to the game, but they frequently create unfair and overly penal situations. Trees located between hazards and a green can make advancement impossible. These are termed *double hazards*. Trees with dense canopies that extend down to the ground (e.g., spruce trees) penalize indiscriminately as they create a severe penalty for which there is no reward for a skillful recovery shot. Finding their golf ball under such a tree, both the expert and less-skilled players are left with the same option: take an unplayable lie or back under the tree and try to hack the ball back into play. Conversely, more skill is required to extricate an errant shot from deep rough or a severe bunker. Many golfers wind up being affected when this type of tree is located in a high-play area, and if the location is such that short hitters and/or high-

handicap players are most affected, a severe and highly undesirable inequity results. The game is difficult enough for these players; they do not need an additional challenge!

It takes great imagination, knowledge, and foresight to plant trees so that they are properly located when they reach their mature size. A young tree that is close enough to influence play will likely be too close once it reaches maturity. Trees that extend well out into the fairway where they can block shots to the green from the fairway may be too penal. New tree plantings should look sparse for many years if there is to be enough room for them to reach maturity without impinging on one another. A good rule of thumb is that any new tree planting that looks good initially is likely overdone. In theory, over-planted trees could be thinned out and moved as they get larger, but this almost never happens. Finally, consider the look that is desired. Many golf courses hope to achieve a "natural" appearance. Assuming that is the desire, straight-line, half-moon, and neat circular arrangements should be avoided. Plantings should be as random as possible and should not appear too evenly spaced or too perfect.

THE BOTTOM LINE: COST

Trees are remarkable natural resources that provide many benefits. However, too many trees elevate the cost of golf course maintenance, reduce turfgrass reliability, increase disease pressure, reduce turfgrass wear tolerance, and slow turfgrass recovery.

While the cost of planting trees is easy to calculate, the long-term costs of maintenance are impossible to compute and are rarely considered. These can include leaf, branch, and fruit removal, pruning (both above and below ground), fertilization, pest control, and eventual removal. Long-term costs of tree and turf maintenance dwarf the initial planting expense. Keep in mind that the costs of years of these activities add up quickly, particularly considering that some tree species live well over 100 years.

As with many other things in life, moderation is the best policy with respect to golf course tree plantings. Far too many courses get caught up in the "quantity" versus the "quality" aspect of tree planting. Virtually every aspect of most courses can be improved by systematically removing undesirable, hazardous, and unnecessary trees. Turf and playability can be improved and the relative value and quality of tree plantings can be increased at the same time.

DAVID OATIS *is director of the Green Section's Northeast Region.*

An overabundance of trees blocks sunlight and air circulation and is the primary cause of poor growing environments. Turf located in these types of areas usually fares poorly.

MIXING IT UP

Preparing chemical spray batches in a large-volume tank saves time and improves worker productivity.

BY PATRICK O'BRIEN, CHRIS HARTWIGER, JOHN FOY, AND TODD LOWE

How do you apply pesticides and fertilizers if you are a golf course superintendent faced with double tee times at #1 and #10 tees at 7 a.m. every day? In the popular resort area of Myrtle Beach, S.C., most golfers want to play 36 holes daily, and to maximize revenues, golf courses in this area schedule tee times as soon after sunrise as possible. More tee times mean more revenue.

The challenge facing golf course superintendent Bob Graunke, CGCS, and his staff at Tidewater Golf Club is to keep the golf course in top condition without reducing the number of early morning tee times. Tidewater received the "Best New Course" award in 1990, and it is known for excellence in both layout and conditioning. With 40,000 rounds played annually at Tidewater, staying ahead of golfers on days when fertilizer or pesticides are scheduled to be applied makes this a difficult challenge to overcome. The installation of a large-volume mixing tank has reduced the amount of time required to mix and load spray solutions at the maintenance facility. This time savings gives the maintenance staff just the head start they need to stay ahead of golfers and overcome this challenge.

The construction of a large-volume mixing tank offers several advantages to the staff at Tidewater. The bottom line, though, is that it saves time and helps the spray technician stay ahead of golfers.

MIXING AND LOADING SPRAY TANKS TAKES A LONG TIME

Few golfers realize that more than one hour may be required to mix and load products into a spray tank. Usually, product mixing and loading occurs in the spray tank at the chemical storage area. This time can be longer if the applicator must mix up a second or third batch and reload the spray tank. It is difficult for the spray technician to stay ahead of play under the best of circumstances, but it's impossible with golfers teeing off at both the #1 and #10 tees just after sunrise.

In the summer of 1999, Mr. Graunke assigned his four college interns a project to construct a large-volume mixing tank. This tank would allow the staff to premix and store overnight the entire quantity of spray solution needed for the job the following day. Sprayer loading time would be reduced and the staff would have a much better chance to make the application ahead of golfers. The interns had read about a golf course in Arizona that built a large chemical mixing tank, so they inquired to learn more about it. With some working knowledge of this innovative idea, the interns constructed the batch mixing tank over the summer months, and this project ultimately produced a valuable tool at Tidewater. All building materials were obtained from local agricultural and farm supply stores at a cost of less than $2,000.

BUILDING THE MIXING TANK

A cone-shaped 1,000-gallon polypropylene agricultural tank is the key component. This tank shape promotes better water circulation. The tank sits above ground, mounted to 0.25-inch steel angle iron. A steel strip is wrapped around the middle of the tank, and it is welded to the angle-iron base. Two-inch PVC-pipe fill and discharge lines allow for rapid filling of the tank with water and transferring solution to the sprayer. Backflow prevention devices are in place on both the fill and discharge lines.

Agitation of the solution is created in the tank by a 1 HP Jacuzzi pump and

an air compressor. The Jacuzzi pump circulates the solution out from the bottom of the tank through a PVC pipe along the side of the tank and back into the top of the tank. Agitation with the Jacuzzi pump is sufficient to mix most products.

A screen located inside the tank above the Jacuzzi pump filters the solution coming from the tank to this pump. Because of the screening device, the Jacuzzi pump has not had to be replaced, but union joint couplers with ball valves to turn off the water were installed at the Jacuzzi pump to make pump replacement fast and easy, if necessary.

The air compressor significantly increases agitation, and it is used for difficult-to-mix products. The air compressor sits adjacent to the tank on a wheeled cart. Three air jets at the end of the air line from the compressor tie in to the mixing tank just above the Jacuzzi screen. These jets are activated by turning on the air compressor.

On both the fill and discharge lines, in-line filters are installed to screen out any particles that might clog sprayer nozzles. Mr. Graunke reports that nozzles rarely clog.

A lift is used for staging fertilizers and pesticides that will be emptied into the top of the tank. The sprayer is filled with solution at a rate of 30 gallons per minute, and a 150-gallon sprayer is filled in just 5 minutes. The staff at Tidewater reports that the final blended solution is always of high quality, regardless of the quantity prepared.

At Tidewater, most mixing occurs in the afternoon prior to the application, and 30 to 40 minutes is required to prepare most solutions. The entire spray solution needed to spray the targeted areas is made at one time, and this has turned out to be a big time saver at Tidewater. Continuous activation of the Jacuzzi pump keeps the solution in suspension until it is loaded into the sprayer. When the spray applicator arrives, the solution is ready to be loaded directly into the sprayer. After the 5-minute loading time, the applicator is off to the golf course and can stay ahead of the golfers. If a weather delay occurs, the solution can remain in the tank, and it can be mixed continuously with the Jacuzzi pump.

SAFETY FIRST

Safety issues were considered prior to construction. The mixing tank is located in the pesticide storage building, and only the assistant superintendent or spray technician performs chemical mixing and filling operations. All electrical devices connected to the Jacuzzi pump and air compressor have no-fault grounding and low 110-volt requirements.

CONCLUSION

Maintenance workers are being asked to do more work on the golf course before play begins. Overcoming these challenges will be on the minds of more turf managers in the future, allowing golf courses to maximize revenues and not interrupt golfers. Spraying the golf course is always a challenge, but this innovative idea may help reduce the time it takes to complete this routine operation.

PAT O'BRIEN *and* CHRIS HARTWIGER *are agronomists from the Green Section's Southeast Region, and* JOHN FOY *and* TODD LOWE *are agronomists in the Green Section's Florida Region.*

STEP-BY-STEP GUIDE TO FILLING THE MIXING TANK AT TIDEWATER

- Fill the tank with irrigation water just short of the desired water level.
- Turn on the Jacuzzi pump and air compressor (if needed) to agitate the water.
- Bring products into the chemical storage area on the lift and elevate the lift to the top of the tank.
- Add products into the top of the mixing tank.
- Adjust water level in the tank to the desired final volume.
- Remove the lift from the batch mixing tank area.
- Let the products blend with the water with maximum agitation for 10 to 15 minutes.
- If the product will sit overnight, keep the Jacuzzi pump running, but turn off the air compressor.
- Prior to filling the spray tank, turn off the agitating devices.
- Point the hose into the sprayer and turn on the discharge valve.
- Fill the spray tank to the desired capacity.

In-line filters are installed in both the tank's fill and discharge lines. Plugged nozzles in the sprayer are a thing of the past.

ZONTEK RECEIVES DISTINGUISHED SERVICE AWARD

Stanley Zontek, director of the USGA Green Section's Mid-Atlantic Region, received the GCSAA Distinguished Service Award on February 9 at the Golf Industry Show in Atlanta, Georgia. Begun in 1932, the annual award is given in recognition of outstanding contributions to the advancement of the golf course superintendent profession.

The son of a golf course superintendent, Stan attended Penn State University, where he received a bachelor of science degree in agronomy before joining the USGA Green Section staff in 1971. He has worked as an agronomist in several sections of the country, from the Northeast to the Great Lakes Region to his current assignment in the Mid-Atlantic Region. Throughout this time, he has helped train many of the current USGA Green Section agronomists. As director of the Mid-Atlantic Region, he works with fellow agronomists Darin Bevard and Keith Happ, tending to the needs of the five-state region and Washington, D.C. In his 35 years with the USGA, he has made

more than 4,500 turfgrass visits to golf courses through the Turf Advisory Service.

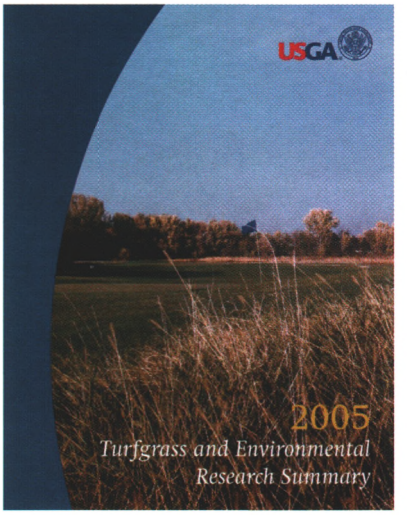
Stan also volunteers as a member of the Musser International Turf Foundation board of directors and many other industry committees, and he provides advice for the maintenance of the putting green at the White House in Washington, D.C. The White House putting green was originally constructed in the early 1950s for President Dwight Eisenhower with the help of USGA agronomist Al Radko.

NELSON RECOGNIZED WITH 'SENIOR AGRONOMIST' DESIGNATION

Matt Nelson, an agronomist in the USGA Green Section's Northwest Region, has been promoted to senior agronomist. This designation is awarded to Green Section agronomists who have demonstrated an outstanding commitment and dedication to their work over a minimum period of ten years on staff.

Having joined the Green Section in 1996, Matt started his career working in the Northeast Region for four years. Currently, he is based in Twin Falls, Idaho, conducting Turf Advisory Service visits on golf courses in Montana, Idaho, Wyoming, Colorado, and the Dakotas. Matt joins fellow senior agronomists Keith Happ (Mid-Atlantic), Chris Hartwiger (Southeast), Jim Skorulski (Northeast), Bob Vavrek (North-Central), and Bud White (Mid-Continent).

NEW EDUCATION MATERIALS AVAILABLE



The *2005 Turfgrass and Environmental Research Summary* is now available free of charge through the USGA Order Department. The research summary provides a one-page summary of each research project currently being funded by the USGA's Turfgrass and Environmental Research Program. This publication is appropriate for researchers, university extension personnel, and golf course superintendents who are interested in learning about the latest results from the program. Request publication NS 1644.

The USGA also has recently made available a CD titled *The USGA Golfer's Guide: An Animated Journey from Tee to Green*. Seventeen agronomic-based animations help address some of the questions most commonly asked of golf course superintendents. Topics such as aeration, frost delays, ball mark repair, and bunker etiquette are just a few of the subjects covered. The CD also contains an additional 29 animations pertaining to the Rules of Golf, an interactive golf hole, and a comprehension quiz. The CD is available for $14.95 ($10.95 for USGA Members), plus applicable shipping and taxes. Request item number VGRULA.

Both items are available by contacting the USGA Order Department at 800-336-4446.

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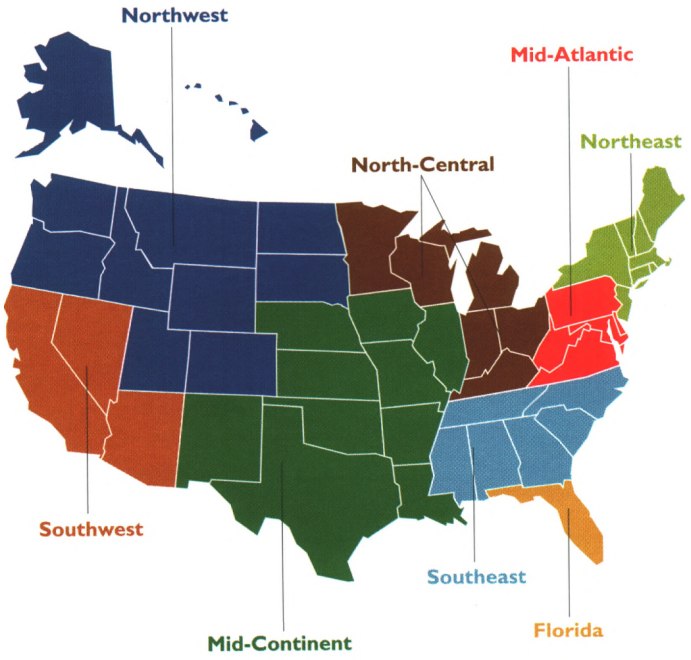

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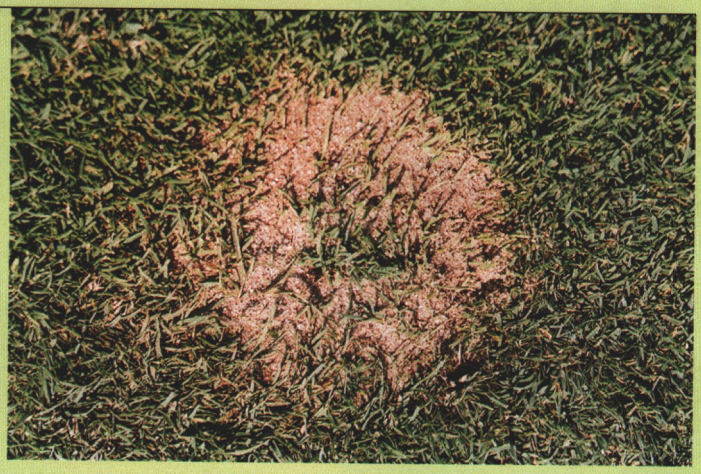
Turf *Twisters*

Q: Our golf course has ant mounds on the edges of the putting greens, and they don't seem to go away during the growing season. Why are these ants a problem, and where do they come from? (North Carolina)

A: The ants you see building mounds on the green surface near the perimeter of the greens are worker ants and have a scientific name of *Lasius neoniger.* The worker ants forage for food on the putting green edges since the mowers kill cutworms and earthworms. The worker ants take food to the main nest by excavating and digging through the sand rootzone and going through chambers. Small piles of sand come to the surface during this excavating operation. The main underground nest is usually located just outside the green collar areas in native soil. Based on research at the University of Kentucky, superintendents should focus their ant control measures around the perimeter of greens, from 6 feet inside the collar to 6-12



feet outside of the greens. In most cases it is unnecessary to treat the whole green. The best time to treat is during the early spring, after the mounds first appear, because at that time the new colonies are still small, and established colonies have been weakened from over-wintering.

Q: Our Tifdwarf bermudagrass putting greens are now 18 years old. Due to a high percentage of off-type contaminants, it has become very difficult to provide an acceptable play and aesthetic character. Resurfacing the greens is scheduled for the summer, and converting to an ultradwarf bermudagrass cultivar is being given strong consideration. What is the track record with the ultradwarfs as far as surface stability and occurrence of off-types? (Florida)

A: The ultradwarf bermudagrass cultivars have been in use for 8 to 10 years now and so far they have exhibited a more stable character. Typically, with Tifdwarf greens, off-type areas become apparent within 5 to 7 years after turf establishment. To date, no off-type areas have been observed with ultradwarf putting greens.

Q: There are a number of different types of ball mark repair tools on the market. Does the USGA recommend a specific type of repair tool? (Kentucky)

A: Although sales representatives may argue that their tool is the best, a good job can be done with a variety of different styles. Along with the obvious need to restore and re-smooth the playing surface, repairing a ball mark immediately is far more important than the tool being used. Conversely, delaying the repair will compromise turf recovery and playability, regardless of the tool being used. Refer your golfers to the ball mark repair animation located on the USGA Web site at: www.usga.org/turf/articles/educational_video_clips.html.

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