A Publication on
Turfgrass Management by the
United States Golf Association®

July/August 1984

USGA®

Green Section RECORD

Ball Control and Golf Course Maintenance

USGA®

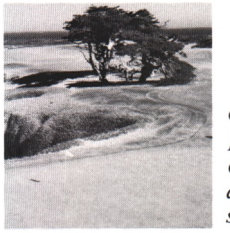
Green Section RECORD

EDITOR:
William H. Bengeyfield

MANAGING EDITOR:
Robert Sommers

ART EDITOR:
Miss Janet Seagle

Vol. 22, No. 4
JULY/AUGUST 1984



Cover Photo:
Hole 17, Cypress Point Golf Club. Excellent fairways allow players to properly spin the ball.

GREEN SECTION RECORD (ISSN 0041-5502) is published six times a year in January, March, May, July, September and November by the UNITED STATES GOLF ASSOCIATION®, Golf House, Far Hills, N.J. 07931. Subscriptions and address changes should be sent to the above address. Articles, photographs, and correspondence relevant to published material should be addressed to: United States Golf Association Green Section, Golf House, Far Hills, N.J. 07931. Second class postage paid at Far Hills, N.J., and other locations. Office of Publication, Golf House, Far Hills, N.J. 07931. **Subscriptions $6 a year.**

Close-cut zoysiagrass provides excellent fairway lie.

Why Don't The Greens Hold?

by WILLIAM G. BUCHANAN

GRASSGROWERS of the world unite! There needs to be some information relayed to the golfing public, and everyone needs to pull together. The problem is greens that will not hold. How come? Why?

Everyone who has played the game has, at some moment in the heat of battle, questioned the integrity of a green, the integrity of all golf course superintendents, and anyone else who could possibly be blamed. Why is this?

Scholars, seasoned consultants, hardened golf course superintendents, avid enthusiasts of the game, and novices of the sport all have opinions, but now we need some rational answers. Is it the construction of the green? Is it the maintenance of the green? Is it the lie of the ball? Is it the type of ball that is used? Is it the club that is used? Is it the quality of the stroke that hits the ball? The answer, please.

In trying to find an answer, it might well be useful to modify the old cliché "When all else fails, read the instructions" to "When all else fails, use some logic and scientific fact." This type of information will come from many sources: textbooks, trade journals, golf magazines, instruction books, and good old practical experience and common sense.

Volumes have been written containing all the best ideas on the proper design and construction of putting greens, but more has been written on hitting the golf ball.

There are many theories about how to strike a ball properly, what equipment to use, what grip to use, what weather conditions are the best to play under, and what type of golf course to play. Some of these theories have even been written down. Ben Hogan, Byron Nelson, Tommy Armour, Bob Toski, Arnold Palmer, Jack Nicklaus, Lee Trevino, and others have written books about the golf swing and the proper way to strike a golf ball. These books explain in layman's terms what is necessary for a good golf swing. Bobby Clampett and others have gone as far as to become more scientific in their approach by reading and becoming disciples of *The Golf Machine*, written by Homer Kelley. This is not for the layman, but for the heavy thinkers.

All the books and instruction articles, heavy and light, discuss at great length the driver, fairway woods, long irons, middle irons, short irons, bunker shots, chip shots, all kinds of trouble shots, putting, and the mechanics involved in properly executing these varied shots. Some even discuss the requirements of the player to plan his strategy in playing the golf course and the particular shot. Mention is made of wind conditions, whether the shot is being played with the wind, against the wind, or with the wind coming from the right or left. Some mention is made of playing conditions or methods of play if play is taking place in inclement weather, even rock-hard conditions.

It probably has been written somewhere concerning shots to the green: "Strike the ball with a descending blow and backspin will result; once the ball

comes back to earth, the resultant backspin will make the ball stop. The ball will hold the green." Sounds great! However, one slight change in the written word generally occurs after the shot has been played. The *ball* no longer holds the green. This is changed to, "The *green* should hold the ball." This is especially true after the golfer has hit the "perfect" shot and watches it gently settle on the green, then bound, skip, and roll off the green into some undeserved position. Thus, another chance for the elusive birdie, par, or bogey has passed — again.

Surely the cry will soon be heard, "The greens don't hold!" Why must it always be the greens' fault? Generally because somewhere between the written word and seeing the actual results, the logic of the backspin principle is lost.

Maybe more speeches, articles, or books need to be written on the agronomics involved in the properly played golf shot. The title of the piece will be tough to find. How about "Your Failure to Perform"? Nah, too self-defacing. How about "Dead Solid Almost Perfect"? Nah. Maybe "How to Score When the Greens are Right." Getting close. Aah, got it! "How Aeration, Vertical Mowing, Topdressing, Fertilization, Design, Construction, Water Control, Grooming, and Some Skill Helped Me Shoot My Career Round." The title may be a little long, but if a big name player will write it, the superintendent may be on the way to practically getting off the hook.

Just in case this book is not written in the next decade or so, some sort of thinking should be given to the subject now.

BALL CONTROL and golf course maintenance do not seem to be logical companions. But when we think of the overall game of golf, they must be not only companions, but close companions. The ball must rest somewhere, generally on soil covered by a turf. How that ball sits while at rest will greatly influence the way the player can strike the ball.

When the ball has been launched from the fairway toward the green, it will spin so the player can control its flight and landing, assuming this has been done properly. As the ball strikes the green, the combination of ball control and course maintenance becomes the most obvious. This spinning aerodynamically designed wonder will come in contact with a scientifically prepared soil mix covered with a specially prepared turf and displace a certain volume of soil and turf. Hence, all the theory of ball design and course maintenance must combine to yield the desired result for the player, or there is going to be some serious complaining taking place, generally about the landing, not the launch.

If we can't answer the complaint, what can be done to at least keep the noise down to a dull roar?

Education is the key. We must make an effort to inform and thus educate the golfer as to what his responsibilities are and what the superintendent's responsibilities are. The player feels his responsibility is to get the ball started, and it's the superintendent's job to get the ball stopped.

Golf course superintendents are hired to maintain and condition the golf course for the play of the game. Now there are all different ideas on how the course should be conditioned, but basically it breaks down to the superintendent's taking into consideration the climate, course location, soil types, and maintenance budget and making the best out of it. There are golf courses that have been on land that seems to have been created for the specific purpose of providing a pleasurable place to play golf, and there are other courses that have literally been built from the sub-soil up. This is not the superintendent's fault. He must adjust the maintenance to suit the conditions.

There are good methods of building golf courses and there are poor ones. Unfortunately, the amount of available money will generally dictate which method is used. If there is adequate funding, a golf course can be built using good soil mixes and have good drainage. With these there is a good chance of a good end result. The superintendent can manage these with minimal problems.

Not all clubs have the resources to build, or even maintain, ideal grass-growing mediums. But even the poorest club cannot afford to construct greens in a slipshod or cheap manner.

THE USGA'S GREEN SECTION Specifications for Putting Green Construction have been developed to provide the best growing medium and conditions for grass that will be groomed for a putting surface. Not all greens have been built to these specifications. The main reason is a tremendous number of courses were built before the Green Section Specs were created by Dr. Marvin Ferguson in 1960. Since 1960, a substantial number of greens have been built using this technique. Nevertheless, too many golf courses are still building greens that do not conform to the Specifications. Clubs will insist their superintendent build greens without checking the soil mix because they want the greens built quickly. A similar problem occurs with contract work. The ingredients for a very good topmix may be available, but the materials will be mixed on site, and a very poor quality topmix results. Then, when the green becomes hard or the grass will not grow, the superintendent must find the answers.

The hardness or firmness (if you will) is dependent on such things as solid particle density, bulk density, and percentage pore space, and another number that is called the coefficient of restitution. All very impressive names. Imagine telling your playing companions of your concern for the coefficient of restitution on No. 15 green. Anyway, here is how these things fit together.

Solid particle density is the weight of a unit volume of soil solids. Bulk density is a different method of expressing soil weight. The total soil space is considered. Therefore, bulk density is the weight

(Above) Three heights of cut, used at a USGA Championship, reward the accurate player.

(Below) The coefficient of restitution and spin stop the balls quickly.

per unit volume of dry soil. This volume includes solids and pores. To illustrate, imagine a cube filled with soil. The cube with pore space and solids would be full (bulk density). Then, if the cube's contents were compacted, all air or pore space removed, and the result was a cube half full, the measurement would be solid particle density.

Percentage pore space is of course that portion of the soil occupied by air and water.

The Green Section has requirements for these measurements. Bulk density ranges between 1.25 and 1.45 grams per cubic centimeter, and total pore space volume ranges between 40 and 55 percent. Now, how about the coefficient of restitution and how it relates to golf putting green management?

The coefficient of restitution is found by dividing the velocity of separation by the velocity of approach. Translated, that means that when a golf ball hits the putting surface, it will bounce. The ball will bounce with less velocity than when it landed. The first bounce will be higher than the second, the second higher than the third, etc., until the ball has come to rest.

Now that this scientific phenomenon has been explained, it is easy to see how bulk density, percentage pore space, and the coefficient of restitution can be related to each other. Bulk density will ensure that there is air space in the soil mix. Percentage pore space ensures we have enough porosity in the soil mix to allow good plant growth. Pore space will also be taken up by water, which will make the putting green soft when abundant and firmer if limited. Therefore, the coefficient of restitution can be controlled by soil mix and water. Sounds simple enough. Turn on the water and make the greens hold — oh no! More explanation is needed.

As we mentioned earlier, ball spin affects the flight of the ball; it also affects the reaction of the ball when it strikes the ground. The coefficient of restitution does not take spin into consideration.

Top amateurs and professional golfers are very proficient at judging how far they can carry a ball with a given club. They also know that when the ball lands, it will stop quicker if it has been struck with a 7-iron than with a 3-iron. The 7-iron shot will stop quicker because a 7-iron's standard loft is 40 degrees,

whereas 24 degrees is standard loft for a 3-iron.

BALL SPIN can affect the flight of a ball; side spin can result in a hooked or sliced shot. The hook or slice spin will be of more help in stopping a ball than top spin. Top spin on a golf ball is almost nonexistent unless the ball has been completely topped when struck.

Frank Thomas, the USGA's Technical Director, has studied golf balls and their flight. Several statements can be made that should be considered when spin of the ball is considered as a factor in the ball's holding the putting green. One: When a ball is launched with a driver, the flight time for an expert player is roughly seven seconds. Two: The type of ball being used will affect the rate of spin. A two-piece ball will spin at about 45 revolutions per second (RPS), or 2,700 RPM; a surlyn-covered ball will spin at approximately 55 RPS, or 3,300 RPM; and a balata-covered ball will spin at a rate of 60 RPS, or 3,600 RPM when struck with a driver. Drivers generally have a loft ranging from 10 to 12 degrees. Three: A ball will lose about 50 percent of its spin after being in the air for four seconds.

These little tidbits of information make for some interesting reading because it is not hard to see how much spin a good player can put on a ball and how much more the player can achieve by using a particular type of ball.

Scientific observation also tells us that when a properly struck ball comes to earth, the first bounce will make a ball mark and spin will have very little effect. The second bounce will have some "check" to it. The third bounce should stop the ball. If the ball bounces more than three times, forget it. The ball did not have enough spin to stop. You can either blame yourself for a bad shot or complain that the greens don't hold.

The amount of backspin is high when the ball is hit from a lie where there is no grass between the club and the ball. Ever notice how fast the ball stops when played from a bare lie? Tees and fairways are groomed to provide a good, close lie for the ball. The rough is intended to partially penalize the player for not hitting his shot in the fairway. The height of cut of the rough will reduce the amount of spin a player can impart on a ball and therefore make it more difficult to stop the ball quickly because the grass blades are smashed between the club and ball. If you will notice the course setup in a USGA Championship, PGA Tour, or LPGA Tour event, you will notice the fairway cut short, an intermediate rough cut slightly higher, and then the primary rough cut, which is the deepest. This type of mowing will place more emphasis on accuracy.

A helpful suggestion to courses where the greens will not hold may be to check the fairway height of cut. If the height is more than ¾-inch, the problem may be the fairways are being mowed too high. If the cut is ¾-inch or less, the problem may be the fairways are not being mowed often enough. A frequently mowed fairway will generally provide a good playing surface.

Another consideration is how many complaints come from golfers playing preferred lies. Ever notice how they move the ball from a close lie (good for spin) to a teed-up lie (flyer) and then complain the greens won't hold?

Even armed with all this knowledge about ball spin, bulk density, coefficient of restitution, and mowing heights, there is still this ambiguous term of "firmness" to consider.

Firmness is a relative term. In golf, a firm green to one might be a soft green to another. Generally it depends on the type of shot the player has just made as to whether the green is soft or hard or just right. This sounds like a story I heard about a little girl with golden locks and some bears. Anyway, attempts have been made to put accurate numbers to the firmness of putting greens. Measurements were made with an instrument that calculates the penetration of a lead golf ball into a green. This device measured penetration in thousandths of an inch. Now, this is high mathematics! In the formula $[1/3\pi h^2(3R-h)]$, h is the penetration and R is the radius ($1.68 \div 2 = .84$). Therefore, volume = $2.638h^2 - 1.047h^3$. This would not be good to use in everyday locker room discussions to determine the displaced volume of penetration for a golf ball into a green.

THIS HARDNESS TESTER yielded some very good information. It showed that greens are not uniform in hardness from green to green or even over the same green, and greens that are steeply sloped are often softest in the back. However, this device is not what is needed to rate a green's firmness the way the Stimpmeter can rate the roll of a ball. We need a better instrument that will help the firmness argument.

Now, let's recap and combine all this information:

1. Putting greens can be constructed to grow grass that is best for putting.

2. Not all putting greens are created equal; some may be firmer than others.

3. Depending on maintenance practices, some greens will putt faster than others.

4. The coefficient of restitution is a measure of how much a ball will bounce on a green, but not a good factor in determining if the green will hold.

5. Backspin on a ball will make it stop quickly, generally on the third bounce.

6. Golf balls make a difference in the amount of spin a player can impart on the ball. Two-piece balls spin slower than surlyn-covered balls.

7. Close, frequent mowing on fairways and tees will help the putting greens hold.

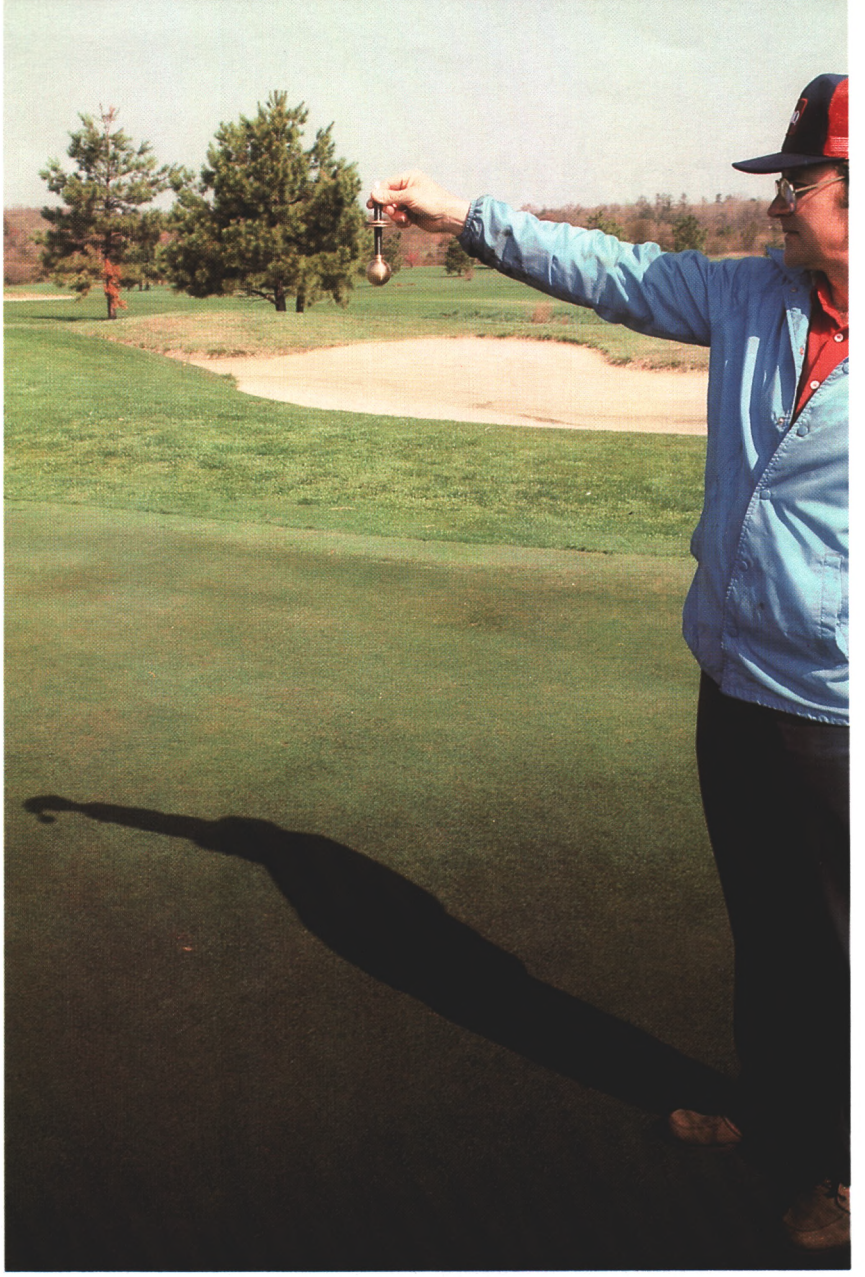
8. Hardness testers for greens will not solve the problem. They only give us more numbers to use. (Has the Stimpmeter made putts for anyone?)

In conclusion, all aspects of golf must be considered with any problem relating to the golf course. Large numbers of golfers have been raised on soft putting greens. They have not played on firm putting surfaces. Golf courses of the future will be forced into conserving water, and the game will be better for it.

Players who have not played under firm conditions are in for a treat, once they learn to allow for the roll. In golf, the player should adjust his game to course conditions. The superintendent is employed to maintain the grass so it will best suit the play of the game. It is both unfair and unreasonable for the golfer to expect the superintendent to adjust the golf course to each individual's game. The handicap system should be used to equalize skill, and the golf course should provide the test. Richard S. Tufts, a former USGA President, said, "Play the ball as it lies and play the course as you find it." We need more of his philosophy.

Golf courses hire superintendents to maintain putting greens. They want the greens to provide the best possible putting surfaces. To be good, greens must be firm, closely mowed, and smooth. Some golfers want the putting green also to be an ideal landing area, soft and resilient. Some kind of an agreement must be reached; either maintain a putting green or a landing area. Since the Rules of Golf do not define a landing area, but they do define a putting green, my vote goes for the putting green. Therefore, when asked, "Why don't the greens hold?" we might tell them they are "putting greens," not "landing areas."

Bluegrass fairways must be mowed frequently to prevent flyers.



(Above and left) The Green Hardness Tester only showed that putting greens were not uniform in firmness from green to green or even on the same green.

Going Around with Big Wheels

by **LARRY W. GILHULY**
Director, Western Region, USGA Green Section

LAZINESS HAS probably been responsible for more shortcuts, not to mention valuable innovations, than we are ready to admit. Most of us are always looking, at least subconsciously, for easier ways to perform laborious or routine tasks.

An example of imagination spurred on by outright lethargy is contained in the story of an old mountaineer and his wife who were sitting in front of the fireplace one evening just whiling away the time. After a long silence the wife said, "Jed, I think it's raining. Get up and go outside and see."

The old mountaineer continued to gaze into the fire for a second, sighed, then said, "Aw, Ma, why don't we jest call in the dog and see if he's wet."

Although this story illustrates laziness at its extreme, we will all agree that at times everyone feels this way. When ideas evolve that will speed maintenance operations and do less damage to the turf, they can become very valuable inventions for the golf course superintendent, his staff, and the playing membership.

One such idea originated in 1958 with Earl Morgan, owner of Similk Beach Public Golf Course, in Anacortes, Washington. Morgan, who also owns an oyster farm, needed a machine that would provide traction over the oyster beds but cause little harm during the harvest of the oysters. Using the same idea in 1960, he used the big tire tractor on his golf course for mowing fairways and roughs under the moist conditions of northwestern Washington.

Milt Bauman, retired superintendent at the Seattle Golf Club, in Seattle, Washington, borrowed the idea and applied it to the rolling hills of Seattle Golf Club *(Figure 1)*. He was not only pleased with the mowing results, but he also began using the big tire for many other operations that previously had been done by heavier and slower pieces of equipment.

Before the specific jobs are outlined, some pertinent data about price, availability, wheel sizes, etc., should be discussed. These tires and wheels may be available at outlets across the country. In this case, however, an Oregon firm manufactured the wheels in their machine shop for the specific tire size. They must first know the make, model, and year of the tractor. Next, they go to a local dealer and get the stud bolt size for the wheels, mount the tires, and ship them to your door. Tires and wheels can be made for most conventional tractors, such as John Deere, International, Ford, Massey Ferguson, etc.

The size of the tires varies according to personal wishes. The front tires are 31 x 15.50 x 13. They cost $400 per wheel and $250 per tire, or $1,300 to equip the front of the tractor. The rear wheels are 48 x 31 x 20, or 44 x 41 x 20. (Although the tractor pictured here has an overall width of 11 feet, recent modifications allow the width to be reduced to 9 feet 6 inches.) For the 31-inch wide wheel, the cost is $450. The tire cost is $2,000 each, or $4,900 to equip the rear of the tractor.

Figure 2. Fairway mower in operation.

Figure 1. (Left) Milt Bauman, CGCS (retired), left, and fairway mowerman George Howen stand next to the "shaved" rear wheels.

Figure 3. (Below, left) Overseeding of greens is one of the many operations possible with the high flotation tires.

Figure 4. (Above) Overseeded bentgrass results three weeks after using the large slicer/seeder on No. 5 green, Seattle Golf Club.

The total cost in 1984 to equip a tractor with big tires would be approximately $6,200.

At this point, it is very easy to dismiss these tires and wheels as being too costly. However, let us go over a list of functions these tires perform and then come to a decision. As for Seattle Golf Club and Bauman's experience, he states, "The best thing about big tires is that, if you can walk on the golf course, you can work the tractor. If it is too wet to work, the tractor will spin out, but it causes little damage to the turf. I maintain we cannot afford to be without these tires."

JUST WHAT MAKES big tires such a good investment? First, the tires are 10-ply and, at this time, the tires at Seattle Golf Club are 12 years old and still going strong. This fact alone, however, does not show where the time savings lie. What makes the large tire

cost effective is the reduction in compaction and versatility in its operation.

With the advent of the large 7-gang hydraulic lift mowers, the need for a standard turf or farm-type tractor might seem to be on the decline. However, how versatile are the large hydraulic units? Once they have mowed the fairways or roughs, their use ends. This seems a costly piece of equipment (over $30,000) to sit in the maintenance facility with no alternate use.

On the other hand, the big tire tractor performs many tasks:

1. Mows fairways and roughs. The tires come equipped with large tread for traction. However, for golf course management operations, this tread most be removed *(Figure 2)*. By making a slick tire and leaving just enough tred for traction, the tractor can mow effectively until the course becomes too wet to work. One good aspect of this tire is that when it spins, the turf is not damaged and it will not tear out chunks of sod, as most tractors do. As William C. Campbell, former President of the USGA, commented after the 1981 USGA Senior Amateur Championship, "With the use of the high flotation tires, Seattle Golf Club provided some of the smoothest, tightest fairways to be found anywhere."

2. Fertilizes the entire golf course. When ammonium sulfate is applied to fairways, tees, greens, and rough at Seattle, it takes the operator five hours to complete the task *(Figure 3)*. To fertilize greens alone, only 30 minutes is required for 18 greens. After a green or tee is fertilized, it is difficult to determine where the tractor actually drove, because there are no wheel marks and no compaction. This one task saved countless dollars in labor costs and, according to Bauman, nearly paid for the tires.

3. Light topdressing of the greens. Whether using a Lely or Meter-R-Matic II topdresser, the big tire provided little compaction when applying small amounts of sand. It also greatly speeded the operation.

4. Allows the use of a large fairway slicer/seeder on greens. As shown in *Figures 4 and 5*, the tractor gave excellent results with little disruption when using this equipment on greens. The bentgrass seeding operation takes approximately 45 minutes to one hour per green. Light topdressing immediately followed the slicer/seeding and was repeated in one week. After two weeks, the greens were back to normal and bentgrass populations were increased.

5. Overseeding fairways or seeding new areas. The big tire equipped with the fairway slicer/seeder does a very good job of overseeding existing fairways. With the wide width of the tires, the overlap of the tires provides a rolling action to permit better soil/seed contact. After new areas have been seeded, the large tires are perfect for rolling.

6. Brush removal. In the Pacific Northwest and elsewhere, severe wind storms can cause considerable damage to trees. Many times, these winds are followed by excessive moisture, and conventional tires mar the turf or are unable to get onto the golf course. The high flotation tires are able to go anywhere a good operator wants to go and will not rut the turf. This tractor, combined with trailers (also with large tires), is an efficient labor-saving vehicle in inclement weather *(Figure 6)*. Furthermore, when the course is too wet to haul material with small dump trucks, the big tire tractors and trailers offer good alternatives.

7. Aerification or slicing fairways. Under wet conditions, the use of the high flotation tractor will cause little or no damage during the aerification or slicing of fairways. It also does a good job of smoothing the surface during the operation because of the tire overlap.

8. Allows fairways and roughs to be swept under wet conditions. Many times the golf course superintendent and his staff are frustrated by the inability to clean up the golf course during wet conditions. Although the sweeper may cause some rutting, the tractor will work well under these conditions.

9. Allows closer access to greens or tees for spraying operations. The big tire, combined with large tires on the spray rig, allows an operator to move closer to the green and not rut or compact the area around a green or tee. Again, this speeds the operation and reduces employee fatigue.

These are some of the many jobs this versatile piece of equipment can perform. Whether the large tires would effectively fit into your operation will be determined by the climate, topography, type of soil, etc., with which you must deal.

They have worked well at Seattle Golf Club and others report similar success. They should work well for you. After all, maybe you can teach old, wet dogs new tricks!

Figure 5. (Below) Fertilization and light topdressing provide little compaction and increased efficiency in the operation.

Figure 6. (Bottom) The "big tire" combined with a large-tire trailer is excellent for brush cleanup or soil movement under wet conditions.

Over three-and-a-half feet of sand was removed from No. 13 green front bunker and the grass fingers reshaped to the original height.

And The Sand Runneth Over

by BILL WHITAKER, Golf Course Superintendent,
Seminole Golf Club, North Palm Beach, Florida

WHAT'S THE PROPER depth for bunker sand? Most would agree that between two and six inches should suffice. In 1981 several of the 193 bunkers at the Seminole Golf Club, in North Palm Beach, Florida, had between two and four feet of sand! Over 50 years of bunker sand accumulation had occurred. Even though digging out this amount of sand would be a sizeable task, the Board of Governors decided to go ahead and re-do the greenside bunkers during the summer of 1981. Their intention was to bring the depths back to conform to the architect's original plans. Donald Ross designed and built this course in 1929, and it was obvious to me, from studying his plans, that no sand had ever been removed from the bunkers.

I was faced with moving approximately 9,000 tons of sand. We rented two nine-yard dump trucks and one Gradeall with an operator. These were used to load and move the sand to the low fairways, where it was used as topdressing. Several of Seminole's fairways are less than two feet above sea level, and this causes a chloride problem. Raising the low fairways one or two inches minimizes the chloride uptake during dry weather. The added elevation also creates drier fairways during the rainy season. The bunker-sand topdressing was applied two inches thick down the middle of the fairways and feathered out to zero at the perimeters. Thus the fairways were crowned slightly. This enables golf carts to be used during marginal weather conditions, as long as they are driven straight down the middle.

Heavy trucks and equipment can cause damage to the golf course unless traffic is controlled. Therefore, the wettest areas were covered with plywood. Plywood was also used when the rubber-tired Gradeall was entering and leaving the bunkers.

I planned to complete the 86 greenside bunkers during July and August, 1981. Several small bunkers would have to be shoveled out by hand because of the elevations of some of the greens. There

was no way to move heavy equipment close enough to complete the job.

Even though Seminole is closed during the summer months, the golf course must be maintained in reasonably good condition. This requires ten full-time employees. During this renovation, half of my crew was needed to help with the bunkers. Two drove dump trucks, one operated the box blade, another dragged the fairway after the sand was dry, and the fifth followed the drag and watered in the remaining sand by using the irrigation system.

THE ACTUAL OPERATION was very simple. The Gradeall operator dug out a place to park his machine and then drove into the bunker. The trucks were parked on plywood at the bunker's edge and were loaded. The sand was dumped in nine-yard piles on each side of the fairways. The sand was then box bladed over the fairways. When the sand was dry, it was dragged into the turf and then irrigated. Due to the heavy topdressing, only half of the sand could be spread at one time. We usually waited three or four days before spreading the remainder.

The fairways were not mowed for seven days prior to the topdressing. This was necessary because some fairways received 220 cubic yards per acre. When sand was applied at that rate, fairways were raised at least one-and-a-half inches. That's a mighty slow way to raise your fairways, but it's faster than lowering the nearby Atlantic Ocean.

It was amazing to view a sand profile three feet thick that had built up since 1929. Both bunkers behind number 14 green were very carefully hand-dug to the bottom. As I stood there looking at the layers of old sand, I couldn't help but wonder how deep this bunker sand was when Pearl Harbor was attacked in 1941. One of the old timers, who had worked for the club for 41 years, explained the black ring about six inches from the bottom. He said, "That's from growing watermelons in the traps during World War II." The club was closed from 1942 through 1945.

The particle size was consistent throughout the profile. Over the years the club had used sand found in its irrigation well field, which is about 2,500 feet from the ocean. This sand conforms to USGA recommendations as far as particle size and shape. Between 75 percent and 80 percent by volume falls between .25 mm and .50 mm in size. The remainder is about equally divided between the coarses and the fines. There is only a trace of extra fines.

A critical factor in the bunker sand removal was an experienced Gradeall operator.

I was hoping the maintenance crew could finish digging out and spreading the sand in about six weeks. After the sand was spread, the bunker fingers had to be reshaped and resodded. New sand four to six inches deep had to be added and spread. All damaged areas around the greens had to be repaired and sodded. Several irrigation lines that were found running through the bunkers were rerouted wherever possible. On holes number 1 and 12, the average water table was higher than the base or bottom of the bunker. Drains had to be installed at the lowest point and carried to nearby drainage ditches.

AFTER FIVE DAYS it was obvious the crew could not complete this job in the allotted time. They finished holes number 12 and 13 the first week. Those two holes have a total of 14 greenside bunkers. I decided the crew would work on this project for six weeks and complete it the following summer. Forty-nine bunkers were finished in July and August, 1981. Progress was slower than I had anticipated due to trucks being stuck, irrigation lines being broken and having to be repaired, and, of course, rainy, wet weather stopping all traffic on the low fairways.

By September 15, 1981, all of the new sand was in place. I had hired six men from the labor force for two weeks to shovel this sand into place. The new sand was smoothed with riding bunker rakes and irrigation used to pack the sand. All of the damaged areas had healed, and the fingers had been resodded. When we finished the job in July and August, 1982, things went much smoother and better. If I had this job to do over, I would give myself more time — perhaps doing six holes each summer.

What was accomplished by all this digging, topdressing, and resanding? First, the bunkers were put back to the depth Donald Ross designed them to be. Several of the bunkers had been raised so high that the center of the bunker was actually higher than the green. Now the golfer can no longer chip and putt from the greenside bunkers, but instead must hit the explosion shot with a lofted club, usually a sand wedge. Second, the centers of the low fairways were raised from one to two inches. This expedites runoff during rain storms and improves the soil profile. Third, except for the sand that has blown out during the past season, the depth is consistent.

In years to come, the low fairways will probably be raised an additional four to six inches. Do you know someone who has 50,000 yards of sand he doesn't need?

(Above) Bunker sand was placed on each side of the low fairways to be used for topdressing.

(Left) A box blade was used to smooth the sand on the fairways.

(Below) The dark layer of sand near the bottom shows where watermelons were grown in the bunker during World War II.

TURF MANAGEMENT IN ENGLAND AND SCOTLAND:

So Similar, Yet So Different

by STANLEY J. ZONTEK
Director, North-Central Region, USGA Green Section

THIS IS A STORY of travel. It begins in April, 1984, and takes us to Cambridge University, England, for Golf Course '84 — one of the first Great Britain - European international turfgrass conferences devoted to golf. I represented the USGA Green Section and traveled with a number of American golf course superintendents, builders, and owners.

Several days prior to and following the conference, our group played and visited some of the world's famous courses in England and Scotland. It is from these experiences the following notes were gathered. Perhaps from them a better understanding of the similarities of turf management problems on the two Atlantic shores may be possible. And strikingly so, the differences also become apparent!

Common Problems Shared by U.S. and British Isle Courses

A. *Poa annua* (annual meadowgrass) is by far the biggest agronomic problem in Europe and the United Kingdom. It tends to burn out in the summer, becomes thatchy on greens, makes for slow, soft, and bumpy putting surfaces and tends to increase the disease susceptibility of turf, especially for thatch fungi.

B. Poor drainage on greens, tees, sand bunkers, and on fairways. It rains a lot in the U.K., and poor internal soil drainage and surface drainage problems (pockets that hold water) are of constant concern.

C. Compaction and shallow rooting are found on many golf courses in the British Isles receiving heavy play. According to a conservative estimate by Walter Woods, the superintendent, over 70,000 rounds are played each year over the Old Course at St. Andrews, Scotland. Much of this play is on rain-wet soils. Almost all compaction problems are the result of foot traffic — not golf cart traffic, as in this country. During my entire stay in Great Britain, I did not see one golf cart operating on any golf course.

Divots and divot repairs are also a problem and must be constantly attended to in order to maintain good turf density and quality.

D. Soil layering. As in this country, different soil layers are frequently present and impede the movement of water and roots. This can equate to poor rooting, poor soil drainage, weak turf, and eventually thatch and *Poa annua*.

E. Thatch. In comparison to golf turf in the United States, turf in the U.K. is closer cut, especially on fairways, and firmer. Excessive thatch under these conditions cannot be tolerated, and their management problems are geared to reduce, control, and avoid thatch. Interestingly, they rate *Poa annua* as their most thatchy turfgrass species.

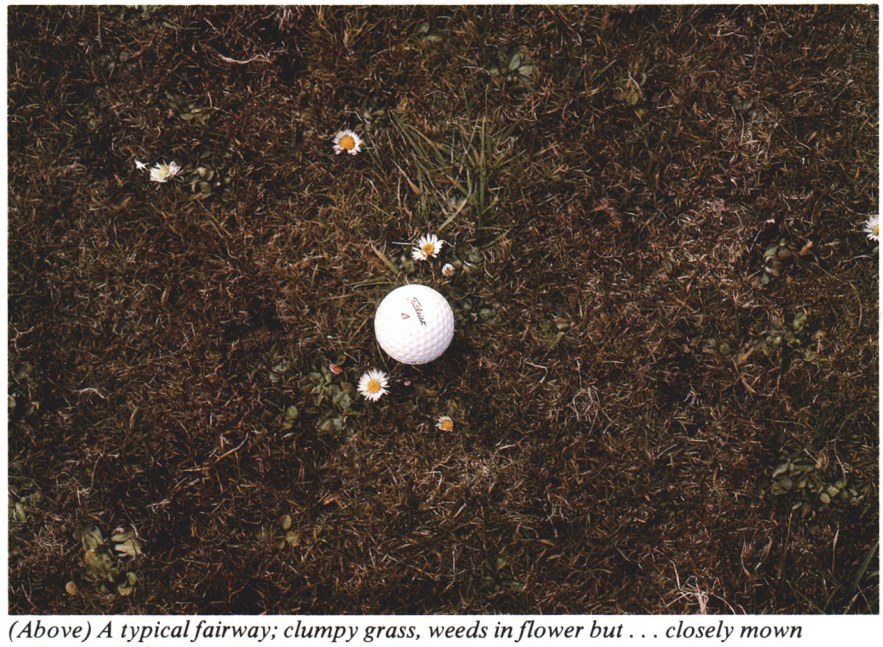
F. Poor soil mixes in greens. The on-site versus off-site soil mixing controversy rages there as it has here. They have also found that on-site mixes, although cheaper and easier, just aren't as satisfactory as off-site mixing. Off-site mixing is something the Green Section has advocated for years.

G. Irrigation. They seem plagued with problems associated with bad installation jobs, poor head spacing, poor water distribution and generally improperly functioning irrigation systems.

H. Summer dry spots. We call them isolated dry spots. The preferred treatment for both sides of the Atlantic is the same — aeration and wetting agents.

I. Tee size. It seems they share a common problem with many of our golf courses; tees are too small. Filling divot holes with soil and seed is a routine operation for greenkeepers in England and Scotland, because they walk their courses every day.

J. Poor quality fairway turf. Many fairways are uneven and clumpy because of too many different grass types,



(Above) A typical fairway; clumpy grass, weeds in flower but . . . closely mown and a good playing surface.

(Opposite page) Workers at St. Andrews "bricking" a sand bunker's face.

ranging from *Poa annua*, to perennial ryes, to the fescues and bentgrasses — all in the same landing zone. Fairways are closely clipped for play, and this practice partially compensates for the problem. Overall fairway quality, however, remains a primary area of concern.

K. Short tenure of office for green committeemen. By the time a committeeman becomes trained, a new committeeman comes into the job and the training program begins anew.

L. Low budgets. In comparison to many of our courses, the average club in the British Isles has an extremely low budget and finds it painfully difficult to raise membership dues. They seem to try to compensate for rising costs by taking in more outside parties or golfers on slow days.

As you see, turf managers in England, Scotland, and the United States share many common problems. However, there are still great differences in how the grass is managed and how the game is played.

The Differences We Have

1. Soil cultivation. The British and Europeans seem to rely most heavily on slitting (similar to subsoiling), solid tine aeration, and spiking. Hollow-tine aeration is not widely used. The deep slitting is extremely disruptive to the putting surface. Membership complaints, however, seem not to be a problem there as much as they are here. They just play the course as they find it!

2. Pesticides. Except for problems with moss and a winter basidiomycete disease that sometimes occurs, chemical pesticide usage on the golf course seems almost non-existent. They do, however, employ specialists to trap and dispose of rabbits — by far their most serious outside problem. The four courses at St. Andrews employ a full-time rabbit catcher.

3. Fertility. Their average golf course seems to use much less fertilizer than our courses. Color does not seem to be as important.

4. Water. In the purest sense of the word, they keep their courses dry and hungry. They have found that liberal use of water and fertilizer only encourages *Poa annua*.

5. Course manicuring and overall turf quality. There is a vast difference between what the golfers there expect of course care and what the average American golfer has come to expect. Our courses are far more manicured than the ones I saw in Britain. They seem not to be concerned with consistency of quality or grass texture. It is part of their game and a reflection of their golfer's skill to see and compensate for any differences. "Rub of the Green" is still very much in effect.

6. Maintenance costs and budgets. Their maintenance costs and budgets are a fraction of ours. Undoubtedly, their weather conditions and more "natural" golf courses just do not require as much man-made maintenance. Their critical golfers seem to be more philosophical. They tend to play the course as they find it and realize that their budgets are quite low (they want them that way). They realize they are getting what they are paying for.

7. Tougher designs and penalizing sand bunkers. Remember the old saying about golf course design: "Reward a good shot and penalize a bad one." If you keep the ball in play on a British course, you can score reasonably well. Stray off line and you will be penalized. Natural heather, gorse, Scotch broom, deep grassy rough, along with water and sand hazards, severely penalize anyone unfortunate enough to land there. Oftentimes it takes an outstanding shot to recover and get the ball back into play and not necessarily hit the green and hold it.

Their putting green contours are amazing. Greens and bunkering in the United States are characterless in comparison to the majority of the courses I saw. The majority of their golf courses are studies in golf architecture.

8. Tradition. How can one put into words the inner feeling you have walking down the fairways of St. Andrews, Carnoustie, Royal Birkdale; playing on soils and grasses that once supported Tom Morris, Bobby Jones, and Ben Hogan; playing courses where the British Open, British Amateur, and Walker Cup have been played time after time? This kind of history and tradition comes only with time. One can feel it, sense it, as he experiences golf on the great courses of England and Scotland.

In Conclusion

The journey was an experience in meeting new people, seeing new things, savoring new sights, sounds, and smells. There was great companionship and camaraderie. No better representatives of the United States turfgrass industry and golf community could have been found anywhere than those making this trip. It was a marvelous professional and personal experience.

TURF TWISTERS

BY THE BUSHEL OR THE PECK

Question: We are getting ready to sprig our fairways with a winter-hardy bermudagrass this summer. The planting rate suggested was 400 bushels to the acre. What is a bushel of bermudagrass sprigs? (Virginia)

Answer: Look at it this way; a bushel of bermudagrass sprigs is obtained by vertical mowing a square yard of two-inch-tall bermudagrass. Rake the sprigs together from this area and you'll have a bushel of them.

MISERY LOVES COMPANY

Question: The past winter was one of the coldest winters on record in our section of the country. We have been hard hit by bermudagrass winterkill. What kind of reports have you received from others and what can be done about it? I'm hurting! (Kentucky)

Answer: You are not alone! Bermudagrass winterkill has been reported throughout the South, as far west as Oklahoma and Texas, and as far north as Kentucky and Illinois. Prolonged sub-freezing temperatures did a job on it. Under close cut and/or on droughty soils bermudagrass seemed to suffer more. In Illinois, a stretch of warm weather in February started greenup only to be snuffed out by a deep freeze in March. What's the answer? Get behind the long-range research program of the Green Section for development of better turfgrass for golf. This very problem (greater low-temperature tolerance for bermudagrass) is one of the major studies planned. For the present, reseed or restolonize the dead areas as early in the summer as possible. Fertilize generously to obtain maximum coverage by midsummer and then gradually reduce fertilizer applications in preparation for fall and winter. Keep adequate soil moisture levels at all times. Don't miss a chance to maximize the bermudagrass growing season.

BUT . . .

Question: The label on the insecticide I am using states that it does not necessarily have to be watered in. But I've always watered in insecticides! What do you think? (Kentucky)

Answer: As a general rule, it's always a good idea to water in an insecticide *when you are trying to control soil-borne or root-feeding insects.* This helps put the active ingredient closer to where the insect is working. For surface-feeding insects, little if any supplemental washing in is required. The insecticide is already where it should be.