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USGA GREEN SECTION RECORD

A Publication on Turf Management
by the United States Golf Association

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The Teeing Ground

No. 2 Hole at Merion Golf Club, Ardmore, Pa. A beautiful tee that is large enough for constant tee marker changes adding to the enjoyment of this golf hole.

by WILLIAM G. BUCHANAN, Eastern Agronomist, USGA Green Section

Years ago the quality of a golf course was determined by how well the greens played. Today a course with just good greens hardly receives honorable mention. Golfers now look for excellent turf from tee to green. New machinery, high quality chemicals, high maintenance budgets and trained, knowledgeable superintendents have made quality turf throughout the course a reality. More leisure time, Arnold Palmer, Jack Nicklaus and television have brought the golfers and would-be golfers out in droves.

In 1969 the National Golf Foundation estimated there were 200 million rounds of golf played in the United States. In 1973 they estimated the number of rounds played to be 240 million. That is a lot of golf. The NGF places the annual average at 22,000 rounds per 18-hole facility in the United States. Increasing play is good for business for golf clubs and golf equipment manufacturers, but it causes problems for the course superintendent. Increased play means more cart and foot traffic. Although foot traffic and compaction have been a problem since "day one," they are still among the major problems we face today. Golfers wear foot paths between bunkers; wear the turf around benches and ball washers to bare ground; compact and wear putting surfaces; and as each year ends, greens become more difficult to manage.

Invariably, we think of traffic damage on greens when we think of traffic problems. Actually our attention should be on the tees. The tee is the one area that receives the most concentrated traffic on the golf course. The tee is a relatively small area that must withstand the punishment every golfer deals out. Tees are subjected to the most violent strokes in the golf game; the "tee shot." The golfers wiggle and shift their feet to get a "firm" stance and then swing with all their might trying to hit the ball out of sight.

The superintendent thinks of the tee as an area that is slightly raised, square to rectangular in shape where tee markers are placed. This area must be big enough to allow the location of tee markers to be changed frequently to prevent excessive wear of the turf in any one location. The Rules of Golf define the teeing ground as a rectangular area two club lengths in depth, the front and sides of which are defined by the outside limits of two markers. Now let's do a little math. The Rules say the limits of the tee are defined by the outside limits of two markers. Let's say these markers are 18 feet apart. Of this 18 feet only 13 are actually used for teeing. Since most golfers will not tee the

Flowers can be used to make tees attractive as well as to control traffic.

ball any closer than one foot to the marker because of the distraction or fear of hitting the marker, two feet are lost. Another three feet are lost because of the stance. So, multiplying 13 feet (18 minus 5) times 3 (the width of the stance), we get 39 square feet used for teeing ground. Now, on this particular day we have a tournament with 100 players, all playing the same course and using the same markers. Each player is wearing spikes and each shoe has 12 spikes. We said the tee was 18 feet wide; the golfers have to walk on the tee, tee the ball, hit the ball, and walk off the tee—we won't make them pick up their tees today—so very conservatively, each man takes nine steps on the tee, seven of them within the 39 square feet we spoke of earlier. So 100 (the number of golfers) times 7 (the number of steps) times 12 (the number of spikes per step) equals 8,400 spike marks in this 39 square feet which is equivalent to 216 spike marks per square foot!

Physical Requirements

Most people concerned with golf course maintenance will agree that the numbers mentioned above are conservative. Most golf courses expect more foot traffic damage on their tees. There are several ways the problem of foot traffic wear on the tees can be reduced and held to a minimum.

One way is to insure the tee has enough *usable* teeing surface so that the tee markers can be rotated on a regular basis. We often ask ourselves how much area is enough? An excellent rule of thumb for tee size is to have a minimum of 100 square feet of *usable* teeing area for every 1,000 rounds of golf played on your course per year on par-4 and par-5 holes, and a minimum of 200 square feet per 1,000 rounds per year on par-3 holes. The first and tenth tees where a lot of standing and practice swings take place, should be treated as par-3 holes. Going on this basis, from the figures the NGF came up with this year for the average 18-hole facility, par-4 and par-5 holes should have a minimum of 2,200 square feet of *usable* teeing area and par-3's, No. 1 and No. 10 should have 4,400 square feet of *usable* teeing surface. We also must take into consideration, when tees are being built or rebuilt, the potential play five to 10 years from now. It's almost certain the number of golfers will not decrease and construction costs in all probabil-

ity will not decrease. Therefore build the tees for the future, not the present. If you don't, the tee you build today will, in all likelihood, soon be outdated.

Another requirement of a tee is the location. The tee should conform to the topography of the area surrounding it. Not just the immediate area but 20-30 yards around the tee. This will enable you to control traffic flow around the tee as well as on and off the tee. Many tees that are now badly worn can be improved by not changing the tee itself but the surrounding area. Traffic control around the first and tenth tee is especially important. Many ideas can be very artistically developed for traffic patterns with the use of paved paths, curbs, split-rail fences, low-growing hedges, flower arrangements, well thought-out placement of ball washers, trash containers, score card boxes and water fountains.

Manicuring or general house-cleaning around tees can influence traffic patterns. If a tee is well kept, the golfers will be more likely to stay on paths and around areas where trash can be deposited. Higher heights of cut on the edge of tees can make golfers observe paths more readily because the areas where they should go are better defined.

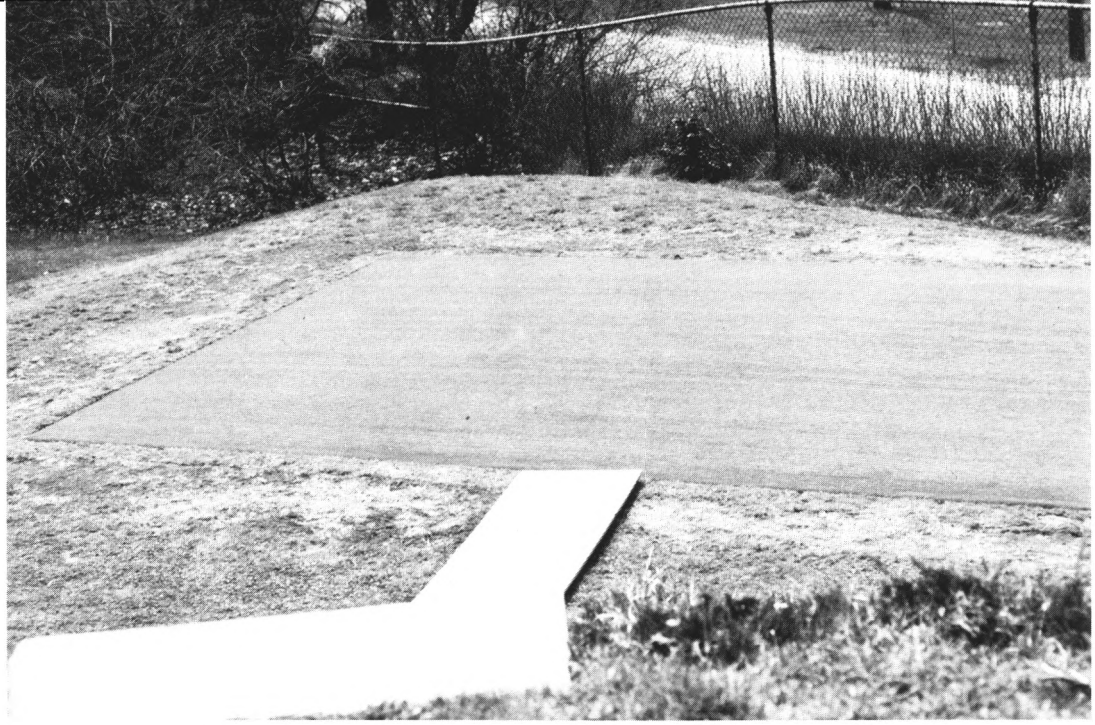
Before locating a tee, look at it from the golfer's standpoint. Is the tee located in a way that the golfer does not have a blind shot? Is the tee aimed towards the center of the fairway, or does it point directly at a water hazard or an out-of-bounds area? Does the golfer have a good tee shot to the fairway from any point on the tee? If you can answer yes to these questions, then you are well on the way to a good tee from a golfer's standpoint as well as your own. A tee of this caliber will enable you to use the entire teeing surface for marker placement. Now all you have to do is give the tee a shape that will enable you to control the traffic around it and will meet the golfers' needs for location.

Agronomic Requirements

No matter how good a tee may look once it has been built, it is not worth the time and effort expended to build it if you cannot grow grass on it. A tee must be well drained. If not it will compact easily, grasses will be shallow rooted and it will be impossible to keep the tee looking good for the entire season. Therefore the topsoil mixture shall be composed of a sandy soil. The top mix for tees should be at least as sandy at the putting green mix. The ideal teeing surface is firm without being compacted.

Sand particle size has come under close scrutiny in the refined putting green specifications published by the USGA Green Section. These same specifications hold true for tee construction as well as green construction. No more than 3 per cent of the sand should be two mm or larger, and no more than 7 per cent of the sand should be between the one and two mm size. At least 65 per cent of the sand should be between 0.25 mm and one mm in size, and not more than 25 per cent of the sand should be smaller than 0.25 mm. A very important point

Tees must be located to enhance the hole and permit easy traffic flow around the tee. Better planning of cart paths is needed in this area.



This tee is made of sand covered with artificial turf when all else failed.

is not to have more than 3 per cent clay or 5 per cent silt in the sand mixture. In most areas a mason or brick sand will meet these standards. By using the smaller size sand particles and higher percentages of sand, the water infiltration rate can be increased to an ideal range of four to six inches per hour *after* compaction. At this rate it is possible to have a firm, dry tee which retains enough moisture to support the needs of the turf.

As previously mentioned, internal drainage in the topsoil mixture is important but subsurface and surface drainage is essential. Good surface drainage will keep water from accumulating on the tee, while subsurface drainage will remove water passed through the soil by internal drainage. In the opinion of the author, the biggest cause of poor tees is poor drainage. Subsurface drainage should be installed in the same manner as drainage under greens is installed, i.e. a drain line surrounded with pea gravel (1/4 inch stone) and leading to an out-of-the-way traffic pattern outlet. Surface drainage can be easily supplied by gently sloping the surface of the tee. A 1-1.5 per cent grade in any direction away from a high bank can be done easily. The main concern is, do not slope the tee's surface so that surface water becomes trapped against an embankment, a cart path or something of this nature.

Air and light are essential for good turf growth on tees. The area around the tee must allow for good air circulation and several hours of sunlight each day. Oftentimes tees are located back in "chutes" or "holes" in the woods where sunlight is very limited and air movement is practically non-existent. When this situation exists, how can one expect the grass plant to survive under close cut and concentrated foot traffic?

Although the mowing heights are usually higher on tees than on greens, tees are mowed frequently. Tees must be considered high maintenance areas. The fertilization level should be slightly higher than greens in order to make rapid recovery and to stand up under traffic stress. Although we need vigorous growth on tees, we must irrigate them less to provide the golfer with a firm footing. Proper tee irrigation is a very exacting operation. The grass must receive enough water to survive, but the water preferably has to be off the surface when the golfer arrives. Courses with large tees have an advantage in this respect, because they can irrigate portions of the tee not in play and leave that portion in play without water.

Aeration and top-dressing is important to tee management. Aeration should be a regularly scheduled practice to relieve compaction and to aid in keeping the tees level.

Construction

Tees have been and will continue to be built in strange places. About the only thing stranger than the location of many tees is the material from which they have been built. Tee foundations have been made from anything from garbage to metal scraps to tree stumps and to (very popular) dredge material from ponds and swamps. Regardless of the material used to

The front portion of this tee is asphalt with rubber mat.

elevate the tee, there must be a level surface on top with a slight slope for surface drainage. Once this point is reached, proceed as you would in building a green. Install the subsurface drainage line, and add the prepared topsoil.

The topsoil layer must be a minimum of 4 inches thick after compaction, but a 6-inch top layer is better. The topsoil mix should be prepared off-site.

The ideal tee, of course, would be one built to the USGA Putting Green Specifications. If this method is used, the Specifications should be followed exactly as outlined.

Limited Space

The increase in play makes it necessary to have larger tees. The amount of golf being played on many courses is simply too much for the present tees to bear. Therefore larger tees are needed. Where confined conditions exist, it is ever so much more important to make the top mix right for tees. Sometimes a tee can't be lengthened but can be widened, possibly by removing trees. Another alternative is to make tiered or multi-leveled tees one level. This increases the amount of *usable* teeing surface and allows more frequent tee marker rotation.

A solution that many courses refuse to consider is that of lengthening the tee by shortening the hole. This may not meet with favor with members at first, but the loss of distance can be compensated for in many ways: (1) the fairways can be narrowed; (2) the size of the green can be reduced; (3) a well-placed fairway bunker could make the new short hole very challenging; or (4) a well-placed grouping of trees or a "specimen" tree could enhance strategy. More often than not we are only talking about 5-10 yards. Many times, after the initial shock of thinking about the hole being shortened has worn off, the above solutions will not be necessary anyway.

When all else fails, the only remaining solution is periodic resodding or seeding of the tees. The first thing necessary, if you are going to sod, is to have you own nursery so you can choose the type of soil and sod you wish to grow. Then you can allow play on one portion of the tee while another portion is being sodded. The other alternative is to rope off the front 10-12 feet of the tee, keeping the markers in this area while completely renovating the back portion. Strip the sod, loosen the top inch of soil, firm and level, and then reseed. As soon as this area is established, repeat the operation on the front of the tee.

These solutions are not a replacement for a tee of proper size but they certainly can help with problem tees. Many times problems on tees can be solved by critical examination of the area around the tee. As years go by, small shrubs grow larger, trees overhang more, and drain lines become plugged. If these things are kept under control, tees can then receive the light, air movement and water movement so necessary for survival.

From Synthetic Grass to a Purr—Wick Tee

by C. WILLIAM BLACK, Golf Course Superintendent,
Fountainhead Country Club, Hagerstown, Md.

John Brodie, of the San Francisco '49ers, said artifical turf gets too hot. Brig Owens, of the Washington Redskins, said it causes too many injuries. In fact, leaders of the National Football League Players Association said most players do not like it at all and many of the golfers at Fountainhead Country Club did not care for the synthetic turf on our Number 1 Tee.

Five years ago we decided to make a change on Number 1 Tee. We not only had a problem keeping a good stand of turf growing on the surface, but the banks were sloped so sharply it was impossible to trim them with riding equipment and very difficult to trim them with hand mowers. At this time, synthetic grass tees were becoming popular. After weighing all the advantages and disadvantages of synthetic tees and being aware of the difficulties trying to maintain grass on our first tee, we decided to try a synthetic grass tee. We followed the instructions for the installation of a 15- by 20-foot tee, constructing a wooden box frame, underlaid with crushed stone, fiber pad with sand impregnated into the pad, then the synthetic grass carpet tightly stretched and nailed to the frame.

The synthetic surface held up quite well, but after a period of time the area adjacent to the tee was completely bare of grass. A number

Old No. 1 tee with synthetic turf.

Concrete retaining wall being faced off with railroad ties.

Sand being graded over polyethylene liner and drainage pipe.

Finished product waiting for use this Spring. Quite an improvement over the synthetic turf.

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of complaints were heard about the tee; "too difficult to get my tee into the surface"; "my feet slip when I make a good swing"; and "it just looks unnatural—like having artifical flowers." The consensus of the membership was unfavorable toward the synthetic turf tee.

The Green Committee knew it had to go, but any new tee would have to be built on a sloping area, making it difficult to construct without having steep, sloping banks. We then decided to build a retaining wall faced with limestone to match the stone on the clubhouse. After some investigation, however, we found that stone facing was too costly. Finally we decided to face the wall with used railroad ties.

Last summer (1973), after much procrastination, we mentioned to Holman Griffin, Mid-Atlantic Director for the USGA Green Section, that we intended to construct a new Number 1 Tee and retaining wall. Holman suggested we consider trying a tee with a PURR-WICK rootzone system. We wrote to Dr. William Daniel, the originator of the PURR-WICK system, at Purdue University and received construction information. In the interim, I spoke to Doctors J.C. Harper and D. Waddington at Penn State and got their ideas.

After much consultation with Dr. Daniel, Green Committee Chairman Bob Nichols designed the new tee and convinced the Board of Governors we should try this method of construction. A drawing was prepared and an explanation of the PURR-WICK system was placed in the clubhouse for all members to see.

Last September, 1973, the synthetic grass tee was removed, the area regraded, a concrete footing and retaining wall were constructed and faced off with used railroad ties. The first phase of the construction was completed by a contractor. Then, with golf course maintenance personnel, we installed two layers of 6 mill polyethylene sixteen inches below the final grade. The edges of the polyethylene sheeting were overlapped by at least three feet and taped, forming a water-tight seal. The vertical edge of the sheeting extended to the top of the retaining wall, forming a 16-inch reservoir which will retain water. Horizontal collecting drains were installed, using 2-inch corrugated plastic pipe with narrow perforated openings designed especially for use with sand.

The drain lines were installed in such a way that water would not have to travel more than 10 feet in any direction to reach the perforated drainage pipe. An adjustable control outlet to conserve and drain water was installed into the upper and lower levels of the tee. With these outlets, water can be drained or stored in the tee by regulating the outlet valves. Irrigation lines and a pop-up rotary sprinkler was installed in both levels.

A member of our green committee donated 160 tons of Pennsylvania Glass Sand Company's Berkeley size 2 Q-ROK sand. Another member donated his small bulldozer and personally graded the sand over the surface, being careful to avoid shifting the drainage pipes. One-half inch of peat moss was spread onto the surface and 50 pounds of sewage sludge and 10 pounds of 30-3-10 fertilizer per 1,000 square feet were mixed into the top two inches of the surface. The surface was then compacted using a mechanical tamper, and it was hand raked. We purchased a blend of Fylking, Pennstar and Merion bluegrass sod and instructed the sod grower to cut it as thin as possible. The sod was hand tamped as it was laid and top-dressed with 2 Q-ROK sand. Within 8 days after laying the sod, we aerated the surface, overseeded with a mixture of improved perennial ryegrasses and top-dressed again with sand. The surface was kept moist by irrigation or precipitation and the grass root system started growing into the sand.

Before any landscaping, the new tee looked like a Revolutionary War fort. In fact, one member's comment was, "All it needs now is some cannons sticking through the walls." Our landscaping was completed with the assistance of Dr. Craig Oliver, of Penn State, and another green committee member in the nursery business. This final landscaping touch was all that was needed to make it a beautiful new tee.

A pile of topsoil from the initial grading had been stored to the front left of the tee. Instead of hauling the topsoil away, we graded it into another small tee and sodded it with leftover sod. This tee may be used for comparative purposes, to give our PURR-WICK tee a rest, and as a winter tee.

The upper level of the tee measures 1,800 square feet, the lower level 1,300 square feet, and the extra tee a little less than 1,000 square feet.

The cost of constructing these tees was $6,100 for the work completed by the contractor, initial grading, footing, retaining wall and railroad tie facing; and another $2,800 for the balance of the materials, landscaping and labor.

Club members are quite eager to play from the new tee, so much so that some of the lady golfers have indicated they would be willing to move back 75 yards from their present tee to play it.

Everyone is quite proud of the final result and we certainly hope it will provide us with an answer to the difficult problem of growing turf on a restricted area that takes tremendous abuse. This summer will be its first test.

Composting: Alchemy in Action

by **STANLEY J. ZONTEK,** Eastern Agronomist, USGA Green Section

You've heard of ancient alchemists trying to turn iron and sulfur into gold. They, of course, failed. Unlike these alchemists, you can change useless organic golf course trash and wastes like grass clippings, pine needles, paper, leaves and wood chips into good organic matter that is (almost) worth its weight in gold.

Composting today can be an efficient means of utilizing organic wastes in times of decreased open burning and general environmental concerns. It can tremendously reduce in volume golf course "wastes" and in fact can turn them into a product for use in top-dressings, mulches and general soil improvement. In this case, iron and sulfur (the wastes) can be changed into gold (the compost) quicker and easier than most people think.

WHY COMPOST?

There are three basic reasons why.

First, when a superintendent buys a commercially available peat for use on the golf course, he expects to get a material that is 100 per cent organic. But, as Figure 1 points out, peats can vary in their mineral content from 3.9 per cent ash (which is usually non-organic silt and clay) to 73.2 per cent ash . . . that is, peats can be from 96 per cent organic to only 27 per cent organic.

Figure 1. Variability encountered in organic amendments for topsoil mixtures.

Organic Material and Source	pH	% Ash (Non-Organic)
Sewage Waste (Calif.)	7.3	67.3
Muck—Peat (Ind.)	5.8	25.8
Muck—Peat (N.C.)	3.8	73.2
Moss Peat (Ore.)	4.0	3.9
Sedge Peat (Wis.)	6.0	12.8
Moss Peat (Ga.)	6.2	19.4
Lignified Wood (Calif.)	5.6	1.0
Rice Hulls (Tex.)	6.4	24.3
Cotton Gin Trash (Tex.)	8.3	43.3

So, if you can't find good organic matter, why not make your own so that you will know for sure exactly what you are using.

Second, almost every golf course superintendent composts in one form or another. Simply piling up leaves, as in Figure 2, and letting them rot is composting. It may be rather inefficient and may take years instead of months to decompose, but it is basic composting. Why not invest in the time and effort to make it faster and better? You may be pleasantly surprised at how easy it is to properly compost and how good the material is when you finish.

Third, like it or not, with more and more

Simply piling up leaves and letting them "rot" is composting. In this operation the pile on the near right is one year old, the pile on the left is two years old and the small pile center left is the usable compost three years old.

laws being passed restricting open burning, composting of golf course trash may be one of the best long-range alternatives left for getting rid of these wastes. What was previously burned must now be either stored in large out-of-the-way dumps, hauled away, or composted. In reality, composting is recycling of the first order and can work to your benefit in public relations, and in a well composted organic end product.

HOW DO YOU CONSTRUCT A COMPOST PILE?

Composting is simply the breaking down by small plants and animals (microbes) of complex organic residues into a simpler end product called compost. In this process the microbes do all the work; all we do is give them the proper environment for growth. The optimum conditions in the compost pile for rapid and unrestricted microbial growth are:

(1) Water. 50-70 per cent (moist but not soggy).

(2) Temperature. The compost pile generates its own heat, often up to 140-170°F., which in effect sterilizes the compost, but those piles started in the fall or winter when temperatures are cool will take longer to decompose.

(3) Nutrients. A carbon to nitrogen ratio (C:N) of 30-1 is optimum, because microbes use 30 parts carbon to 1 part nitrogen in their growth.

(4) Air. This is most important. Good aeration of the pile is essential for good microbial growth; when poorly aerated the process slows down and a foul odor is emitted.

If the pile is properly constructed, taking these factors into account, the microbial growth is rapid and the breakdown is completed to a friable, crumbly compost end product often in several months.

There are and have been many different ways of composting dating back to biblical times, like Luke's reference to "dunging the fig tree." In more recent times, beginning, believe it or not, with George Washington's writings of 1760, there have been various systems of composting. They all had the same thing in mind, i.e., doing everything possible to get good microbial growth for a rapid breakdown of the pile. Figure 3 illustrates what we think is one of the best methods of constructing a compost pile for golf course use. The pile consists of alternate layers of nitrogenous (wet and green) wastes three to four inches thick and carbonaceous (dry and light) material eight to nine inches thick. The piles should be at minimum three to four feet but not more than six to eight feet wide, and as long as space and ease of handling and turning dictate.

In the general category of wet and green (nitrogenous) wastes would be materials like grass clippings, weeds removed from bunkers or flower beds, bunker edgings and old or discarded sod from patchings or renovations.

The dry and light (carbonaceous) wastes would be materials like leaves, wood chips, paper, pine needles, thatch, etc. Mulching leaves before adding them to the pile is a good practice, since this greatly reduces their volume and increases the surface area for the microbes to work. A mulching, chipping, or shreading machine would be a good investment and a big help in any composting operation both in its preparation and final processing.

If the layers tend to become more dry and light than wet and green, it will be necessary to add some nitrogen to the pile. The decomposing organisms require nutrients to sustain their activity. Generally the addition of 10 to 15 pounds of actual nitrogen per dry ton of wastes in either an organic form or inorganic form should help overcome any nutrient deficiency and help speed the decomposition process along. In this case the fertilizer addition serves another purpose by helping it boost the nutrient content of the compost when the material is ready for use. If however, the pile is constructed as illustrated in the diagram, there should be no reason to add any fertilizer, because the carbon and nitrogen should be in about the desired 30-1 ratio. It is only when the dry and light materials are out of proportion to the wet and green that nitrogen needs to be added. Conversely, if the wet and green wastes predominate, then leaves, wood chips or sawdust must be added to bring up the C:N ratio in the pile.

One other point. It has been a practice for many years to add some lime to the pile to sweeten it. As it turns out, unless an acidifying fertilizer like ammonium sulfate is used, no lime is generally needed in the compost pile. If the pile is built with normal golf course wastes and if a 10-6-4 type of fertilizer is added to the pile, then the addition of lime is not needed. In fact, the across-the-board addition of lime will cause a serious tying-up of nitrogen needed by the microbes in the pile and may **slow down the decomposition process.** Therefore, use lime only when it is needed.

Once the pile is constructed, proper timing in turning the pile for moisture and aeration is all-important in the rapid completion of the decomposition process. With the pile constructed as illustrated, it should be turned once after three weeks and again every two to three weeks after that. If the pile needs water, it should be moistened (50-70 per cent moisture is optimum). A rainy day would be an excellent time for 'turning' as the pile is then re-moistened. Usually, this is one day when labor is available for such work.

It is difficult to say exactly how long it

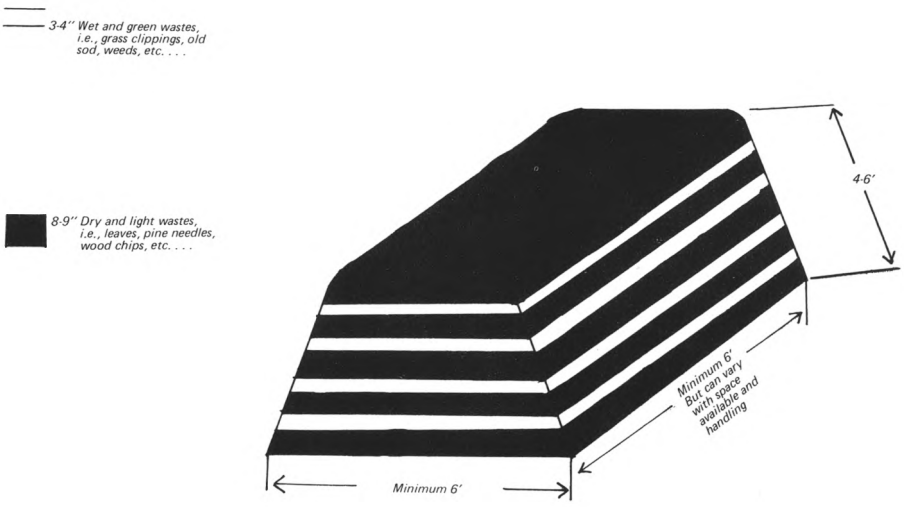


Figure 3.

takes a compost pile to decompose. This depends on proper moisture content; proper nutrient levels (not too much nitrogen and not too little in relation to the carbon present in the pile); proper temperature in the pile (which kills weed seed as well as pathogens); and proper aeration. All of these are interrelated and are essential for the proper decomposition of the pile. If the pile fails to decompose properly, one of these factors is probably limiting.

Interestingly enough, if all the needed elements of the pile are in the proper range and the pile is properly turned, the decomposition process will start and stop all by itself leaving us with a weed-free nutrient enriched compost.

WHAT ARE SOME USES FOR COMPOST?

Compost is nutrient-enriched organic material that has many golf course uses. Compost from an average golf course has a chemical analysis of from 1.5-3.5 per cent nitrogen, .5-1 per cent phosphorus, and 1-2 per cent potassium, averaging out about 2-1-1 overall, which is about that of dehydrated cow manure. This nitrogen-phosphorus-potassium is in a slow release form, and because it is derived from living matter, the compost also contains many trace elements essential for plant growth.

Perhaps more important than its value as a fertilizer is its value as a soil conditioner. In poor soils it improves soil structure, soil aeration, water-holding and nutrient-holding capacities. After being shredded and screened, it can be mixed with a good mason or brick type sand and used for topdressing greens. A good point to remember is, always topdress good greens with the same soil mixture that is already in them and topdress poor greens that can't be rebuilt with lighter and sandier blends. This avoids heavy soil layering on the good greens and helps to build up the poor greens.

Compost used for topdressing greens has other benefits besides being essentially weed-free organic matter. The compost is enriched with ***both*** nutrients and microbes. The nutrients give a slow gradual feed, and the microbes help break down thatch. As in composting, microbes do all the work in thatch decomposition. Periodic topdressings with this microbe enriched topdressing increases the surface area for them to work and can only increase the effectiveness of this operation.

Compost also makes an excellent material for preparing seedbeds, potting plants, mulching flower beds and new plantings of all types. All in all, there will probably be more uses for the compost than the amount that is available.

IN CONCLUSION

Composting is a practice that has generally fallen from our graces over the years. Waste disposal could be taken care of quicker and easier than by composting, but with the ever-increasing environmental pressure against open burning, among other things, perhaps the practice of composting should be reviewed to see if it can again be worked into your normal golf course routine. If properly done, the decomposition process is quicker and easier than most expect. Sometimes it is completed in only two to three months, and the composted end product has a wide range of important golf course uses.

The ancient alchemists tried in vain to turn iron and sulfur into yellow gold. Today, with a little time and effort, it is possible to change golf course wastes into gold . . . black gold.

UPDATING 20 YEARS OF RESEARCH:

Spring Dead Spot

by **GEORGE M. KOZELNICKY,** Assistant Professor
of Plant Pathology & Plant Genetics, University of Georgia

Spring dead spot is the most important disease of bermudagrass, so say the turf researchers of the southern land grant institutions. There is some evidence that this disease has been affecting turf since 1936. These reports came from the transition zone but evidently SDS was not too great a problem before 1954. It is surmised that the reasons for its lack of importance at that time may be two-fold. First, the management of fine turf had not yet reached a high level of sophistication, and, second, the hybrid and other selections of bermudagrasses had not yet made their appearance.

The first research with this disease was by D.F. Wadsworth and H.C. Young, Jr. of the Oklahoma State University in the spring of 1954. In 1960 these workers were the first to describe the symptoms, host, range, probable causal organisms, and attempted controls of the disease. It is essential to point out that what these workers said about SDS at that time is still basically true today. For example, it was observed only on bermudagrasses, not associated with any one type of soil or topography, observed only under conditions of management producing high quality turf, not reproducible or controlled consistently in any tests, and the true cause unknown.

At about the same time, W.A. Small, of Mallinckrodt Chemical Works, conducted trials with a number of fungicides and other chemicals in an attempt to find a means of control. From these efforts came the program of the application of 85 percent nabam (disodium ethylenebisdithiocarbamate) four times at monthly intervals beginning at least six weeks before the average killing frost date in the fall.

SDS was present on bermudagrass golf greens in Georgia as early as 1960, but oddly enough, it was not golf turf that gave the Georgia program its impetus. In 1962, a building boom had set in in the city of Atlanta as a result of which, in 1965, complaints came from homeowners who had purchased homes during that boom. The hybrid bermudagrass lawns of these homes were now severely affected by SDS. From the complaints came the establishment of a research project to study SDS in all of its aspects. The project was initiated in the Department of Plant Pathology & Plant Genetics at the University of Georgia with the author as project leader and with workers in other departments and stations cooperating.

The Tifway (419) bermudagrass lawn of the City of Athens, Georgia, Sewage Disposal Plant was severely affected by SDS and provided an excellent test site for studies of fungicides and of cultural methods for control of SDS. For four years, 1965-1969, we tested a large number of fungicides. Our criterion for control was the reduction or elimination of the spots and on this basis no one chemical was found that consistently controlled SDS when sprayed or drenched into bermudagrass in late summer or fall. However, in a test on a Tifgreen bermudagrass golf green, five fungicides reduced the number of spots over a two-year period with no re-appearance of spots in treated plots the third year. This points out the irregularity of results associated with SDS research. Concurrently with the fungicide tests, we conducted trials to determine the feasibility of core aerification and/or vertigrooving, complete turf renovation, liming, soil removal and replenishment, on SDS. One of these test sites is shown in Figure 1. Only complete renovation by rototilling to a depth of 12 inches reduced the amount of spots permanently. All other treatments were inconsistent from one year to the next.

Simultaneously, we surveyed the fungi and nematodes associated with the roots of grass affected by SDS. Many parasitic and saprophytic species of fungi were found, the most important being the *Helminthosporiums, Pythiums, Fusariums,* and *Curvularias.* Isolates from these were inoculated onto Tifway and Tifgreen bermudagrass either singly or in combinations in the greenhouse and field, but we were unable to induce any symptoms of the disease. At least five genera of nematodes were found, but they were present only in extremely low numbers and only in a few instances. Thus, we had to assume that these played no role in SDS development. We also determined that myco-

on Bermudagrass

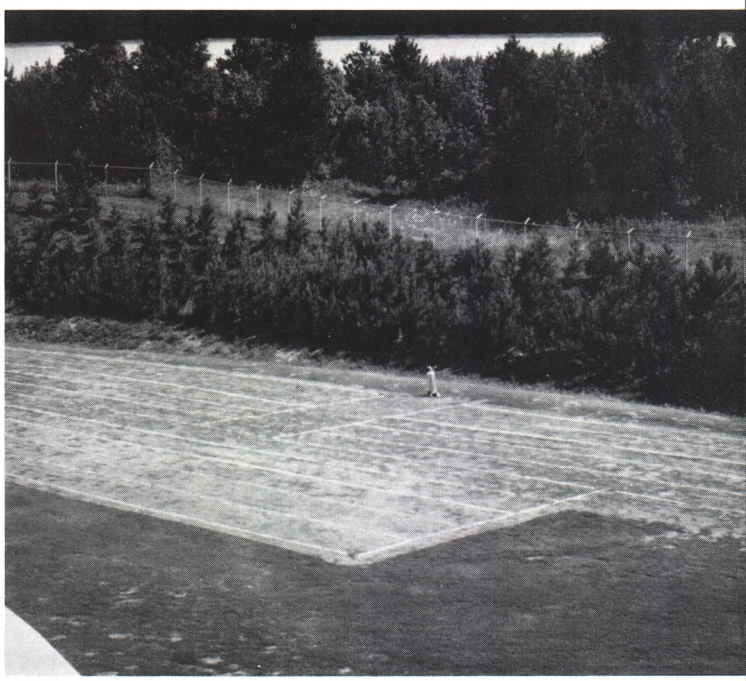


Figure 1. Test site for cultural control of SDS, one year after initiation. The high incidence of spots all over the area is clearly evident.

plasma (virus-like organisms) were not causal agents.

Since the counting of spots was an unreliable indicator for control, it became necessary to re-evaluate our hypothesis. We adopted a rating system based on necrosis (rotting) of roots, rhizomes and stolons. This is proving to be a more reliable and accurate indicator of the activity of SDS. Counting of spots, at times, supplements the rating system.

By now we were led to adopt the hypothesis that we were dealing with a weak parasite whose effect on the host was subtle, occuring in the summer-time too late to be affected by late summer application of fungicides, but such that a severe winter would bring about death of grass. If this hypothesis were sound, then prevention of this weak parasitism could be accomplished by applying the fungicides as the grass emerged from dormancy. Since our work with fall applications of fungicides revealed no favorable data, we decided to apply fungicides in the spring. We established a test in 1970 on an infected Tifway bermudagrass golf course fairway and applied fungicides on a monthly basis beginning in March. Data for 1970 and 1971 show that necrosis due to SDS was reduced substantially by two fungicides, captan and terrazole, but that most others could bring about some reduction as well. Interestingly, the number of spots did not appear to be reduced in the two years, but the test area had no SDS the third year.

The new rating system allowed the initiation of studies to determine the actual time of death of bermudagrass affected by SDS. Four years data (1969-1972) show that the grass dies in the winter (January-February) but the amount of grass that dies is dependent on the severity of the winter. Complete weather information for this period is collected, and once it is fully analyzed and correlated with the necrosis data it should provide, an accurate picture of how this disease complex works.

INTERESTING FILTRATES

Previous research in Arkansas by Diaz and Dale in 1964 and in Oklahoma by McCoy and Young in 1968 showed that filtrates from *helminthosporium spiciferum* could induce rotted root systems on bermudagrass in the laboratory. Our work in this vein was designed to obtain information on root rotting under as natural conditions as possible. At first we subjected SDS-infected bermudagrass sod (never completely or wholly dead) and passed water through it, doing the same with unaffected sod. The leachates thus collected were passed through 3-year old "healthy" sod which had been growing in 6-inch pots in the greenhouse. The results showed a subtle reduction of topgrowth, as evidenced by clipping weights, attributed to the leachate. We have now taken SDS-affected and not-affected soils and leached them under controlled temperatures. Using annual ryegrass germinating seedlings in rag dolls, we found that the leachate apparently contained a toxin, or toxins, which seemed to substantially reduce the respiration rate (as

Figure 2. Top Crop Bush Beans. Stems have become necrotic and are broken in addition to being retarded in growth.

Figure 3. Bragg Soybeans. Some necrosis has occurred and yellowing and retardation are evident.

evidenced by growth). A second series of the same tests apparently corroborates the findings of the first, and a third series is currently underway. The source of the toxin(s) is not yet known. The toxin can be a metabolite of a fungus, of the fungus and host, or from dead plant material (thatch). The need to identify the toxin is paramount because we feel that such identification will answer the most important questions about SDS.

It would be highly desirable to have a grass that could be seeded into the spots, flourish, and blend in to give a pleasant appearance. Our greenhouse work shows that certain plants, when seeded into SDS soils are stimulated in growth during the two weeks after seeding. These are common bermudagrass, Pennfine perennial ryegrass, Pencross bentgrass, Golden Cross Bantam sweet corn, Rogers barley, Bragg soybeans, Top Crop beans, and Yellow Straightneck squash. These plants do not exhibit such stimulation when grown in soil from the same site but which is unaffected by SDS. Thereafter, however, the trend is reversed and retarded growth occurs in SDS soils. Growth in unaffected soil is normal. Figures 2 and 3 are illustrations of the abnormal growth in two legumes. Aerial stems (stolons) of grasses sprigged into SDS and non-SDS soils also show retardation in the SDS soils. Among those tested were: Tifway, Tifgreen, Tifdwarf, Tufcote and common bermudagrasses, Meyer and Emerald Zoysiagrasses and Pencross bentgrass. The most flagrant exception to the behavior described is volunteer *Poa annua* which exhibits extraordinary growth in SDS soils over that in non-SDS soils. This is shown vividly in Figure 4.

INTERESTING GYPSUM

At the present time, we are looking at an interesting aspect. We have a little evidence that gypsum ($CaSO_4$) may have been instrumental in reducing SDS in the field. Work in the greenhouse with gypsum incorporated into a clay soil and into a sandy loam soil at four different percentages by volume, using healthy U-3 and Tifway bermudagrasses, showed that the pH of soil and availability of calcium and magnesium increase with the higher concentrations of gypsum but that phosphorus and potassium decrease as the gypsum concentrations increase. Weights of the first clipping were greatest in both the clay and sandy loam 1 percent (least gypsum) amended soils. Two other clippings have altered this picture. Now, weights for three clippings in the clay soils are greatest in the un-amended soil, whereas the weights in sandy loam soil remain greatest at the 1 percent level. This apparently is another irregularity which keeps arising in SDS research and we have no explanation for it at this time. We intend to progress into the incorporation of gypsum into actual SDS soils.

SDS usually appears the third year after establishment of bermudagrass where the grass is managed at a high level of maintenance, but this may not be necessarily binding in each case. It has also been said that soils high in organic matter may be free of SDS. We have worked with a sward that has been SDS-free for five years, its soil amended with high amounts of sewage sludge (direct from the drying beds), with fungicides applied, and yet severely affected with SDS the sixth year, and thereafter for two years. It has also been assumed that SDS is confined to the heavier soils. Georgia's first

Figure 4. Volunteer Poa annua. *Extra-ordinary growth in SDS soil on the right is evident. Number of plants in each soil at the beginning of the experiment was the same.*

Figure 5. SDS from tee to green on a golf hole composed of sandy soil.

SDS report on golf turf came from middle Georgia from sandy greens. Figure 5 shows a heavily infested fairway from a golf course located in the sandy coastal plain of North Carolina, the picture taken in May 1973.

SDS is a disease which remains unsolved today. However, a great deal has been learned about the disease which will ultimately lead to a fuller understanding of it. On the basis of our work and observations we believe SDS to be a disease (root rot) of bermudagrasses which appears because the grass is predisposed to one or a group of fungal organisms (saprophytes, weak parasites, or parasites) by factors of management. We feel that the best means of control is preventive maintenance; i.e., the use of sound principles of turf management. We propose the following:

1. Apply only enough nitrogen to maintain the grass for play or other intended use. Any nitrogen over that amount may result in SDS.

2. Keep thatch at a minimum by not overfertilizing. Use the verticut and other equipment and methods to control the thatch. Sensible topdressing goes a long way toward keeping thatch under control.

3. Prevent compaction by routing traffic and aerify when compaction does occur.

4. Sensible use of water is absolutely necessary.

5. Use a preventive schedule of fungicides for the control of all turf diseases. If you have SDS, we feel that most fungicides will reduce it in time, but only when applied at the right time. Our work shows that time to be early spring into summer.

ABOUT THE AUTHOR:

George M. Kozelnicky has been with the University of Georgia since 1951. He received the B.S. and M.S. in agriculture from that institution, majoring in plant breeding and plant pathology. Since 1961 he has been researching turfgrass diseases.

Consider

A New Management Program for Greens[1]

by JOHN H. MADISON, JACK L. PAUL, and WILLIAM B. DAVIS[2]

Since World War II, we have seen play on some nearby golf courses go from 20,000 rounds a year to over 100,000 rounds a year. The pattern has been the same throughout the country. This has required changed maintenance practices, principally an increased use of nitrogen fertilizer and water to grow more grass in order to keep up with wear. Because the resulting grass is more succulent and more attractive to insects and fungi, increased amounts of control chemicals have been used. Increased irrigation and increased play have aggravated compaction, which is relieved by use of coring machines. The coring operation provides a seedbed for annual grasses which become a continuous problem.

We now use maximum amounts of fertilizer on greens, but play continues to increase. What direction can we take now? In considering this question, we felt that a different approach to putting green maintenance was worth considering. With support from the USGA Green Section, an alternate program has been worked out. We present this for your consideration as a packaged program. We don't ask you to buy the package. We ask you to consider it. If it appeals to you, we suggest trying it experimentally on a limited test area. If your equipment can't handle the whole program as a total unit, break it down and apply the various materials separately.

What is the basis for the program?

Although great progress has been made in putting green management over the past 25 years, the major problems continue to include thatch and compaction. Thatch provides a reservoir for diseases and both thatch and compaction limit air, water and root movement in soil. Coring, to relieve the problem, creates a serious weed problem with *Poa annua*, goosegrass and crabbrass.

Our solution to these problems is to provide light and frequent top-dressing with

Figure 1. Two and a half years of conventional top-dressing practice has resulted in a typical layer cake of thatch and sand.

[1] A contribution of the Department of Environmental Horticulture, College of Agricultural and Environmental Sciences, University of California, Davis, California 95616.

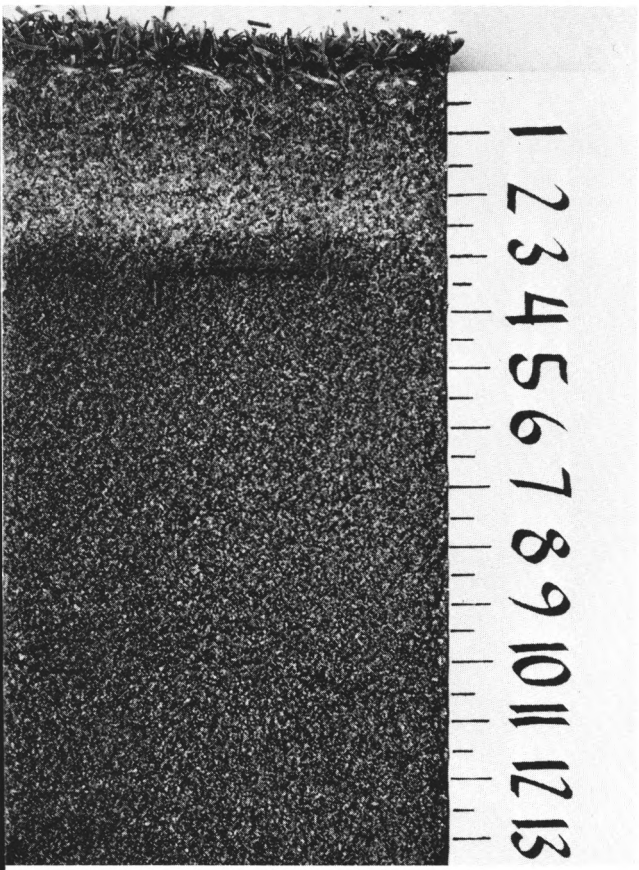
[2] Horticulturist and Associate Horticulturist in the California Agricultural Experiment Station and Extension Landscape Horticulturist, University of California, Davis, California, 95616.

sand in the 0.05 to 1.0 mm range. This sand will drop out of sight and the golfer will never know the green has been dressed. Just enough sand is applied to mingle with the stolons and prevent a thatch layer from forming. Coring is eliminated because compaction is reduced. Bentgrass seed is added to the top-dressing so there is continual crowding of weeds and rapid replacement of turf whenever bare areas occur. For the sake of economy, seed, herbicides, insecticides, and fertilizer are added to the top-dressing so all operations are combined.

Does the program work?

We have worked with the program into our third year. Preliminary research contributed much background information. We have found the program to work at Davis; it has been used successfully by co-operators; and we are confident that any superintendent who clearly understands his goals with the program will be able to make it work.

Figure 2. Two years of frequent top-dressing have resulted in a homogenous mixture of sand and stolons. The initial layer from one year's growth has been buried 1¼" deep but is still visible. It is slowly breaking down.



When the program is begun on an existing green, there may be some immediate response if the green is badly thatchbound. If the green is the ordinary layer cake of thatch and sand layers occasionally pierced by aerifier holes, no immediate results should be expected. However, by the end of the second growing season there should be noticeable weed suppression and good general vigor. Improved rooting should begin to result in a turf more tolerant of stress.

The program.

We top-dress every three weeks with the following materials for 1,000 square feet of green:

Material	per 1000 ft^2	per 100 m^2
Sand-0.05-1.0 mm (-#18 + #200 screen)	3 cu. ft.	90 liters
Nitrogen source to provide N at	3/4 lb.	350 grams
K_2SO_4	5-6 oz.	150-175 g
Dolomitic lime (acid soils) or dolomitic gypsum (soils above pH 6.5)	2½-3½ oz.	75-100 g
(If dolomites are not available add Epsom salts	1½ oz.	45 g)
Zinc chelate or mixed minor element chelates	1/2 oz.	10-15 g
Iron chelate	1/2 oz.	10-15 g
Phosphorus source to provide P at	1½ oz.	30-40 g
Bentgrass seed	1/2 oz.	30-75 g

When pesticides are used, we add them as wettable powders to give the recommended rate. We alternated between the insecticides Diazinon, a somewhat systemic phosphate, and Sevin, a carbamate. Depending on season and disease, we have used thiram, Dexon, captan, Koban, and Daconil 2728.®

How the program has worked so far.

1. Amount and Frequency of Top-dressing: This is critical. The goal is to apply just enough sand just often enough so thatch is mixed with sand but a good cushion or mat is left above the sand. If not enough is applied or if sand is not added frequently enough, alternate layers of sand and thatch occur. When sand is too coarse or is added too frequently or in too great a quantity, the cushion is buried; ball marks kill grass; traffic abrades the grass; little wear is tolerated.

We apply 3 cubic feet of sand per 1,000 square feet at three-week intervals, 15 times a year. This is a little over ½ inch of sand per year. In the Davis, California area, we continue to add the fertilizer amendments throughout the

winter months. During the active growing season we could easily go four weeks between top-dressing without getting into a soil layering problem, but with our nitrogen source, the 3-week interval seems necessary to maintain uniform growth. At the peak of the growing season, 5-week intervals between top-dressings is apparently a bit too long and traces of soil layering start to appear. In northern tier states where thatch is being formed in quantity only from May through August, six annual top-dressings may be enough. In Florida, 20 may not be sufficient. This still needs to be explored. However, increasing N will require increasing sand.

2. Top-dressing Sand: Sand, as specified (—#18 + #200), will drop from sight as soon as it dries, or it may be washed in by turning on the irrigation system for a minute or two. If the application is not even, one may need to drag or broom it in. The golfer should never know the green was top-dressed. Keep looking for a good sand. If the finest sand you can get is as coarse as plaster sand, forget the program until you can find a suited sand. Keep asking, though, and you are apt to find it.

3. Top-dressing Practice: We find that top-dressing machines apply material evenly at low rates. We figure on adding 1/28" of sand at each treatment. The machine which rolls material out on a belt can handle both damp and dry sand. The vibrating type of machine handles damp sand only if it is going fast and vibrating rapidly. With dry, mixed top-dressing in a vibrating machine, materials tend to segregate and you may get an overdose of fertilizer near the last of the hopperfull. Dry sand goes on well with a fertilizer spreader. We have found only one spreader equipped to handle damp sand and it has a special agitator to feed the sand.

If mixing top-dressing requires buying special equipment, the sand and fertility programs can be separated during the initial 2-4 year test period. For good mixing, the sand should be slightly damp. Pesticides, if used, should be added last and only after the operator puts on gloves and a dust mask. Sand containing pesticides should be used, or controlled so no children play in it.

4. Coring: A coring machine can be well used to break the interface at the first top-dressing. After that the coring machine should be prohibited. It is no longer needed and its use spoils the benefit of weed control.

5. Weed Control: Most weed seeds require light to germinate. Top-dressing buries them and replaces them with grass seed. In two years our *Poa annua* and other weed problems have virtually disappeared though they continue outside of the test area. (Don't dig up buried seed!)

6. Disease Control: Top-dressing should reduce inoculum by burying it. We have had Pythium on our aprons that failed to enter the experimental area. Top-dressed areas, in shade, continue to get Fusarium patch during long periods of cold, wet overcast. Our studies regarding disease control are still inadequate.

7. Insect Control: Without thatch, it is more difficult for caterpillars to burrow and easier for birds to find them, but control is still necessary. Insecticides in the top-dressing are effective and should be used as needed.

8. Mineral Nutrition: Different sands are more or less mineral rich. The minerals added are for assurance—actual need may be less. When more nitrogen is used, other minerals should be increased in proportion. Adding iron salts or chelates to the top-dressing is not effective in providing iron as a colorant. Foliar sprays are still needed for a deep green iron color.

9. Organic Matter: No organic matter is used in the top-dressing. This program is to control excess organic matter—thatch. Grass creates its own organic matter which adds to the cation exchange capacity of the soil. As old layers of thatch become buried, they slowly decay unless they remain saturated with water.

10. Infiltration Rate: Infiltration into the new surface is good, but if the old buried surface was impermeable, it may limit per-

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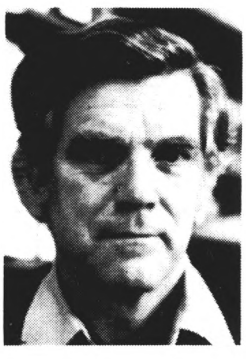
ABOUT THE AUTHOR:

Dr. John H. Madison was born in the Midwest, raised in New England and received his Ph.D. in plant physiology at Cornell University, New York. He came to the University of California, Davis campus in 1953 where he has worked continuously with turfgrasses. He is the author of two major texts; "Principles of Turfgrass Culture" and "Practical Turfgrass Management" as well as many other publications.



Support National Golf Day

by **ALEXANDER M. RADKO,** National Research Director, USGA Green Section

When one contributes to a cause he has every right to ask, "What has been accomplished with contributed money to date?" In reply, let's examine just one phase of the USGA's research funding, the fellowship support program which helps provide a stipend for worthy students who wish to follow a career in teaching, research, extension or some other phase of the turfgrass industry. This serves a two-fold purpose. The graduate selected receives financial aid, but equally as important, he works on a specific turfgrass project to fulfill the requirements for his degree. A partial list of turfgrass workers who received financial support in graduate study through the U.S.G.A. Green Section Research and Education Fund, Inc. is as follows:

James B. Beard
James E. Bogart
Cecil Brooks
Lloyd Callahan
Scott Cameron
William H. Daniel
R.R. Davis
Elwyn Deal
Albert Dudeck
Joseph M. Duich
James R. Fulwider
Fred V. Grau
Jack Harper III
Thomas K. Hodges
Leon Howard
Edward Jordan
Raymond Kunze
W.C. LeCroy
David P. Martin
Wallace Menn
Miles S. Nelson
George A. Niles
Tom Perkins
Sim A. Reeves
Terrance Riordan
B.P. Robinson
Robert C. Shearman
Robert Spartnicht
Charles Rumberg
Richard E. Schmidt
James R. Watson
Gary Wilson

In the early days, this program was given impetus through Green Section subscriptions promoted by Dr. Fred V. Grau, who at the time was director of the Green Section. Later, money was obtained from several sources, but mainly the National Golf Fund, the USGA, the Augusta (Ga.) National Golf Club, the New England Golf Association, the Georgia Golf Course Superintendent's Association, the Metropolitan Golf Writers Association, and individuals. Funds expended have already been returned many-fold. There is no way to place a value on the accomplishments of those mentioned above. Much has been done, but real progress isn't made by "resting on your laurels!" What can you do? SUPPORT NATIONAL GOLF DAY!!!

National Golf Day makes National Golf Fund possible. It is an enjoyable way for every golfer to contribute, merely by competing in National Golf Day. Watch for the announcements at your club. The cost is nominal. The rewards for you? BETTER TURF FOR BETTER GOLF!

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formance of the green with respect to water. It is best, initially, to aerify or cultivate the old interface. Once 2" or 3" of thatch free sand is built-up, the grass appears to perform well in spite of buried layers.

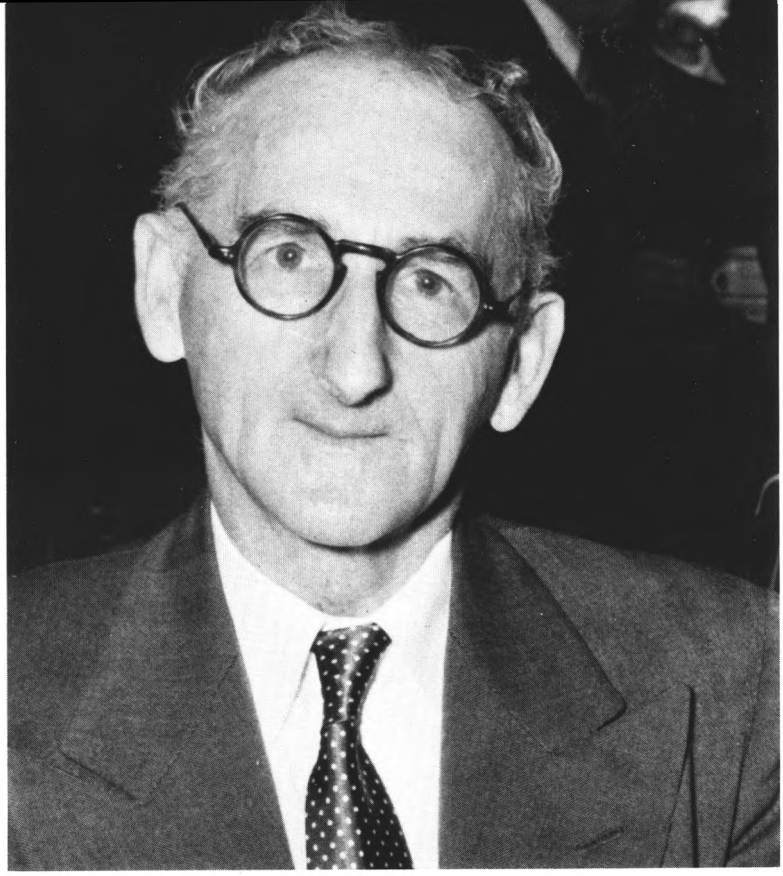
Summary

The above program provides a workable alternative management program for golf greens, and is being successfully used. The program continually buries weed seeds, disease inoculum, thatch, and blow dust. We think it is worth investigation by the superintendent. However, a critical test should be continued at least two years. It should use a sand that passes a #18 screen and light top-dressing should be accomplished every 3-4 weeks during the season of rapid growth. After the initial top-dressing, coring should be stopped, verticutting questioned, and grass seed added in the top-dressing.

We envision initial difficulties in mixing. Once several courses in an area adopt the program however, mixing can be done by a commercial supplier. The Program, if properly carried out, can reduce or eliminate continual labor consuming practices such as spraying, fungicides, insecticides, herbicides, aerification, vertical mowing, spiking, seeding, etc. The superintendent's main agronomic role can then be reduced to mowing, irrigating and top-dressing with more time left for personnel, budget, planning, etc.

The quality green which results may play slightly faster than the original green.

If you ask, "can the program do something for me?" look at your grass near the sand bunkers where golfers provide frequent light applications of sand as they blast out of the bunker.



FREDERICK H. WILLIAMS...1891—1974
Mr. Green Section

Good men must die, but death does not erase their names." Proverb.

Life expired for Frederick H. Williams on March 4th. He died as he lived, gently, with extreme concern neither to offend nor to burdern anyone. He asked nothing, but gave totally of himself.

Fred lived two separate but completely dedicated lives—one to the Green Section of the USGA; the second to thousands of "his boys" whom he sought out at sandlots and high schools everywhere within his reach to challenge them through sports to a better life. He lit the spark through his great knowledge of sports. He then worked tirelessly every free moment of his life patiently teaching each and every fundamental in logical succession to "his boys." Each youngster received his total and undivided attention regardless of ability. He showed no partiality, he challenged everyone to greater goals. His goal for them was a better life. Within some families Fred coached three generations in various sports. Baseball, bowling and/or basketball were his forte. His one regret he often said was that he never took up golf.

Fred retired from the Green Section in 1959 after 37 consecutive years of service. He joined the Green Section on March 15, 1922. He was executive secretary and office manager during the formative years when reams of published material on turfgrass maintenance and management was being formulated and disseminated to all interested in turfgrass management from the Green Section offices at Artlington, Va., and Beltsville, Md. Fred was the thread that held the Green Section together during the early years, through the Depression, and through changes of personnel until he retired.

He leaves no family, he was a bachelor and the last living member of the Williams family. His legacy, a host of better men, whose path crossed his, early in the game. He will be remembered by all his friends whether it be as Mr. Green Section, Mr. Challenge, Mr. Sports . . . or as a gentle man named Fred Williams.

The Turfgrass Service of the USGA Green Section

Direct turfgrass advisory visits to USGA Member Clubs started in June, 1952. In the 22 years since then, the Green Section Staff has increased to eight specialists, and it has made over 25,000 golf course visits! Every USGA Member Club should be a subscriber, for you have information other clubs need and can use. Why not put this highly trained team to work for you on your course?

Every club subscribing to the Green Section Turfgrass Service receives the following benefits yearly:

1—Several direct conferences with a Green Section agronomist, in this manner:

A—A scheduled half-day, on-the-course consultation, followed by a written report from the agronomist to the Course Superintendent and Green Committee Chairman or club representative. Second visits are available at reduced cost if requested.

B—Consultation with the agronomist at local group meetings and turf conferences.

2—Assistance by correspondence and telephone.

3—A subscription to the USGA *Green Section Record*, dealing with golf turf affairs, six times a year, addressed to the Golf Course Superintendent. (This is in addition to the subscription sent to the Green Committee Chairman in connection with USGA Membership.)

4—A voice in the direction of turf research whose results benefit golf courses. The subscription fee covers all services and expenses; there are no extra charges for travel. (The fee for the Green Section Turfgrass Service is additional to dues for USGA Membership). A list of regional Green Section offices can be found inside the front cover.

APPLICATION FOR TURFGRASS SERVICE OF USGA GREEN SECTION

(Open to USGA Members only)

Date _____, 19_____

Full Name of Club or Course _____

Permanent Mail Address (street or box) _____

Post office _____, State _____ Zip_____

Application authorized by: _____ Title_____

Course Superintendent _____

We hereby apply for the Turfgrass Service of the United States Golf Association Green Section and certify that we are eligible for the class checked below.

We enclose the fee (see schedule below) for the current year ending December 31. The USGA *Green Section Record* is to be addressed to our Golf Course Superintendent (this is in addition to the subscription sent to our Green Committee Chairman in connection with USGA Membership).

This application is automatically continuous from year to year unless interrupted by advance resignation.

Check Proper Class:

_____ Less than 18 holes $250
_____ 18 to 27 holes $300

More than 27 holes:

_____ 36 holes $325
_____ Per regulation course in addition to 36 holes . . . . . $ 75

Please send receipted invoice

Requests to agronomists for second visits will entail an additional charge of $100. For the third or more requested visits within the year, an additional charge of $200 each will be made. Clubs will be billed in October for all additional visits during the year.

USGA GREEN SECTION RECORD
MAY, 1974

TURF TWISTERS

A SHADE PROBLEM

Question: I need some new thoughts on growing grass under the trees around the clubhouse. (Indiana)

Answer: We're not sure how "new" these are, but at least one or two of them ought to work for you:

A) Try judicious pruning of some tree limbs to improve the amount of sunlight.

B) Have a soil test (2 inch depth) made and check on pH as well as nutrients. The trees may be sitting at "the first table," the grasses at the "second table." Monthly fertilization throughout the season may be necessary.

C) Occasional overseeding with a shade-tolerant grass is good business. *Poa trivialis,* the fine fescues, velvet bentgrass, even the zoysias do fairly well in the shade.

D) Check irrigation needs frequently through the growing months. Feeder tree roots are notorious for using up soil moisture at the surface.

E) Try aerification—check compaction.

IS SOMETHING LESS THAN

Question: Lately we have been approached by a company selling growth retardents for turf on the premise that we could reduce our cost and labor requirement for all areas of the golf course. What is your opinion? (Maryland)

Answer: There are several growth retardants sold under a great many trade or brand names. The major ingredient in most of these is maleic hydrazide. Several new growth retardants may soon be available, but as yet few, if any, have practical application for fine turf areas. The rates of chemical, stage of growth of the turf, temperature and other factors are critical for good results, plus the fact that vigorous growth is what heals the wear and divot marks and makes the turf resist traffic. Take this away in favor of mowing more often and you have something less than fine turf.

A BLESSING

Question: With the fertilizer shortage and what is available costing much more, I may be forced to use less fertilizer. Do you have any tips to help me use it more efficiently? (New York)

Answer: Yes. In your area of the country there are some good management practices you can perform to get the most out of your fertilizer dollar.

1) Take yearly soil tests so that you will know exactly where you stand, nutrient and pH wise. Use only those fertilizer elements your soil test calls for.

2) With acid soils, lime as needed to achieve and maintain a pH of 6.5. At this value fertilizer utilization is optimum.

3) Apply lighter amounts more often. One pound of actual nitrogen can be broken up into 1/4, 1/8, 1/16 pound increments. This "spoon feeding" really stretches out a pound of nitrogen and is good for the grass plant because it avoids peaks and declines of growth.

In reality, the fertilizer shortage could be a blessing in disguise because we may have to learn how better to utilize the fertilizer we have and still maintain quality turf.