

# USGA GREEN SECTION RECORD



A Publication on Turf Management  
by the United States Golf Association



*The No. 10 tee at North Shore Country Club, Glen Head, N. Y., enlarged by Supt. Bill Sloan with 8,000 cubic yards of coke slag fill and discarded telephone poles furnished by a utility company. An extreme example of measures to which clubs in confined areas sometimes have to resort. (Story page 1).*



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Published by the United States Golf Association

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# Tees and the Golf Course

By **Alexander M. Radko**, Eastern Director, and **Holman M. Griffin** and **Lee Record**,  
Northeastern Agronomists, USGA Green Section

**T**he Rules of Golf define the teeing ground as "a rectangle two club-lengths in depth, the front and sides of which are defined by the outside limits of two markers."

In the early days of golf, an area so defined could well have served as adequate teeing area on any hole for the greater part of the golfing season. Tees then were relatively small, usually were elevated, had steeply sloped sides, and were almost square in design. In the ensuing years, emphasis was placed on larger tees to accommodate the increase in play. With the increase in size, tees were constructed with gentle slopes so that the sides and even the surfaces if necessary could be maintained with larger units rather than by hand.

While there is no set rule for the size of tees, they should be large enough to accommodate the frequent change of markers and to avoid unnecessary turf wear in any one area. A good rule of thumb for tee size is a minimum of 100 square feet of useable tee space per 1,000 rounds of golf per year on par 4 or par 5 holes, and a minimum of 200 square feet per 1,000 rounds of golf per year on par 3 holes subjected to iron play from the tee. For tees on par 3 holes played with a wood, the same rule of thumb applies as is suggested for tees on par 4 and par 5 holes.

## Shapes

Tees may be built to any conceivable shape but the design should be such that it fits well with the existing terrain and is easy to maintain. Multi-level, tiered, or abruptly elevated tees seem to have lost favor in popular and practical design which has been in-

fluenced greatly by today's heavier use of the course. There appears to be much room for improvement in the general design of tees. Many of the newer tees are long, narrow, and rectangular in shape, in fact some are so long they are sometimes affectionately referred to as "The Landing Strip." Unfortunately, the average player seldom likes to tee off except from the front third of the long tees, and such tees require maximum maintenance for minimum usage.

Tiered or multi-level tees also are dwindling in popularity because much valuable teeing area is lost in-between tiers. Some of the more interesting shaped tees are circular, semi-circular, "L" shaped, "T" shaped, or "U" shaped. While there is no limitation on shape or design, tees should not restrict the flow of traffic nor create areas of concentrated wear. They should be designed so that all parts of the tee may be used equally well and that traffic will be as widely and uniformly dispersed as possible.

## Location

The location of a tee with respect to the flow of traffic and its relation to surrounding objects is important. No tee should be placed in the direct line of traffic from one facility to another, and the flow of traffic should be around rather than across the tee. Foot and car paths with plants of one sort or another subtly interspersed and strategically located to guide traffic is often helpful. This is especially critical in and around the clubhouse where ugly and untidy paths can develop which detract from the overall beauty of the club grounds.





*If tee is small and in a confined area, it usually is necessary to make it one level. No. 18 at Forest Hill Field Club, Bloomfield, N. J., is adequate in size as a multi-level tee.*



*The slope of the same tee which must be maintained by hand. It is too steep to mow with large units.*

In the case of small tees, tees under repair, or very heavy play in winter and/or summer, alternate teeing areas may be required. Alternate teeing grounds, during periods of adversity, can distribute wear over a wider area, thus reducing wear and tear on the regular tee.

Tees ordinarily should be located in areas not confined by trees nor shaded from direct sunlight for any period of time. Trees should not be planted so close that they will compete with grasses for water and soil nutrients. Hedge rows and other ornamental plants normally are not desirable around tees for the reasons stated, and also because usable teeing area is considerably reduced. Hedge-like plantings do have value when used near the tee as a screen to block out traffic noises, untidy buildings, or the view of unwelcome spectators.

Womens' tees are now receiving more attention, and rightly so because of the increased use of the course by ladies. All of the considerations which go into the construction of the men's tees should also be employed for the ladies' tees to make a really adequate course. One exception might be in tee size. Because of the difference in ferocity with which men "attack" the game, ladies could get by with smaller tees, possibly one-half the size suggested for the men. Certainly, the

"postage stamp" tees of the past are no longer adequate to accommodate the amount of ladies' play at most courses.

### Construction

Next to greens, tees and aprons are the most intensively maintained areas on a golf course. The trend today is directed toward tee maintenance and management programs similar to that of greens. There is a growing tendency to mow tees with putting green mowers, to remove grass clippings, to cut close and frequently, to apply quantities of fertilizers and disease control materials that are applied to greens and generally to groom tees as neatly as greens. To pursue the intensive maintenance required demands that most of the major considerations afforded greens in construction are also built into tees.

The tee topsoil should be a prepared mixture of sand, soil, and organic matter in a ratio which insures a friable soil with good internal percolation and drainage. The prepared soil should be placed on the site at a settled minimum depth of four inches, and preferably should be sterilized before seeding to insure freedom of weeds. Lime and fertilizers should best be applied at this time and mixed into the four-inch topsoil surface. The need for limestone should be determined by soil test while nitrogen,



phosphorus, and potassium are supplied in amounts normally required for turfgrass establishment. All nutrient elements should be thoroughly and carefully incorporated into the topsoil. The topsoil must be allowed to settle or it must be firmed well by other means prior to planting the grass. If there is not adequate time to allow for natural settling, then it is necessary to rake and roll several times over, also to do some "footing." This is accomplished when workers walk over every square inch of the new soil, assuring against uneven settling of the tee as the turf develops.

Tee soils should not hold water excessively or they will suffer during periods of traffic or weather stress. As with greens, good internal and surface drainage is required and should be provided for during construction. Good surface drainage requires that pond-like depressions be averted and that water drains away from the tee quickly in broad shallow sheets rather than in narrow run-off channels. Normally, a very slight descending pitch from front to rear is desirable. The pitch must allow for quick surface drainage and yet be subtle enough so that the player will feel that he has a level stance. A slope of one to 1.5 percent will prevent surface water from ponding. If tees are multi-level, it is extremely important that the rear-most portion of each level be pitched slightly to right or left so that surface water does not collect between levels. Ponded water not only detracts from the beauty of a tee, but it makes the tee uncomfortable underfoot and will injure the turf if the water remains there for any length of time.

Good internal drainage is necessary to allow water into and through the soil so that roots receive the

proper amounts of moisture. Soil types greatly influence internal drainage and if the soil is not porous, then tile drainage lines may be required. Four-inch tile lines would be installed in the same manner as for a golf green with the outlet placed in some out-of-play area away from the normal traffic pattern.

### Irrigation

Principles of irrigation apply to tees in much the same manner as those for other areas of the course. The quantity of water used, the frequency and the rate of application must all be adjusted to meet the needs of the turf as well as the specialized playing conditions. The major difference in tee irrigation is that it is geared to the minimum requirement so that tees will be kept on the dry side. Tees should be watered at periods which will allow the longest possible time between irrigation and heaviest play. The tee must have a reasonably dry surface to avoid unnecessary turf damage and provide a firm stance for the golfer. With larger tees, perhaps sections of the tee could be irrigated on a schedule so that only drier areas could be utilized to conform with heavy play schedule and the movement of tee



*The Ladies' Tee on the 6th hole at Upper Montclair, N. J., Country Club. Ladies tees are receiving more attention and are being made larger due to the increase in play by women.*





Supt. Michael O'Grady inspects his No. 3 tee at the Country Club of New Bedford, New Bedford, Mass., a good example of an adequate-sized tee for a par-4 hole. It is principally bentgrass turf maintained at 1/2 inch. The petunia flower bed adds beauty, yet is not confining—as are hedges.

markers. Over weekends and on days when the heaviest play is expected, it is desirable to set the markers on areas conditioned to the dry side.

Most courses today have underground lines leading into tees for irrigation purposes. Quick coupling systems have been most popular to date but the trend toward semi and fully automatic systems in new course construction is on the upgrade. Hoses and movable sprinklers appear to be on the way out because of the labor requirements involved, and the difficulty in completing irrigation in the required pattern without players or caddies moving them or turning them off prematurely.

### Choice of Grass

The choice of grass for tees will hinge upon several factors. The turf must allow for a firm stance; it must be tight and dense but still easily penetrated by a wooden or plastic tee; it must be cut close so that the advantage of teeing up to each individual golfer's liking is a real one;

it must be tough enough to recover from golf club and traffic injury in reasonable time; it must have spreading or creeping qualities in order to provide a uniform and smooth-looking and smooth-playing turf; it must be attractive, and it must be groomed neatly for golfers to care for it as a valuable asset to their golf course.

There are numerous selections to choose from but those used for tees seem to be narrowing down to the very same selections being used for greens. These are mostly bentgrass selections for northern courses and the fine-leaved bermudagrass for southern courses. In the North, the creeping strains such as C-1 Arlington, C-19 Congressional, C-7 Cohansey, C-15 Toronto, C-52 Old Orchard, Nimisila, and Penncross are widely used. All mentioned, except Penncross, are vegetative strains and are planted by means of stolons. The usual rate of stolonizing varies from four to eight bushels per 1,000 square feet. Penncross is a seed variety and the rate of seeding is generally from one to 1-1/2 pounds per 1,500 square feet.

Other means of establishing turf on tees is by means of sodding or by spreading aeration cores gathered from greens aeration. The latter technique is mostly utilized in nursery establishment but it has been done successfully on new tees also. Sodding is not normal practice in new course construction because of the comparatively high cost of sod and, oftentimes, the local unavailability of the type of sod desired. Sod is used normally to renovate tees when weaknesses develop after years of play. Nursery sod is grown on the course by the superintendent for use in emergencies, for divot repair, to renovate, or to sod tees which the superintendent subsequently alters or constructs himself.



Normally, it is desirable to establish a tee nursery on a prepared soil similar to that used for tees on the course. Using similar soil prevents problems of layering. Layering is detrimental to a soil profile because it restricts or inhibits root, water, and nutrient penetration to a desirable depth.

Other grasses used for tee cover are Merion bluegrass, Kentucky bluegrass, creeping red fescue, Seaside—Astoria—Highland bentgrasses, and *Poa trivialis* on courses where cool-season grasses principally are grown; and bermudagrass and the zoysia grasses where warm-season grasses are encouraged. The rate of seeding of the grasses listed will vary from two to five pounds per 1,000 square feet depending on the choice of mixture.

#### **Maintenance and Management Requirements**

The teeing area is the first opportunity for the golfer to closely view the turf cover and to form an impression of the course he is about to play. Above all, the tee area must be attractive and neatly groomed. The tee markers must be squared away with the intended line of flight, the turf must be uniformly cut and the grass cover must be attractive, firm and full. It must be free of trash and litter. To provide such a picture day in and day out during the playing season,

many man-hours are required, principally for the following tasks:

Tees are mowed three or more times weekly during the time the grass is actively growing. They are mowed with individual power units, self-propelled triplex type mowers, or tractor-drawn gang units similar to those used on fairways. The direction of mowing is changed from time to time to help provide a smooth, clean cut. Clippings are removed with each mowing at some clubs while at others they are only removed when they accumulate. Tees preferably should be mowed between 5/16 to 1/2 inch if established to bent, zoysia, or bermudagrass and higher if established to other grasses.

Grain, mat, and thatch removal are important to the health and welfare of tee turf. Aeration, thatching, spiking, and vertical mowing are some of the principal mechanical means of cultivation that help insure against a buildup of grain, mat and thatch. These practices also better insure a firmer footing for players. Tees generally are aerated more often than greens, especially when they are small in relation to the amount of traffic they bear. Normally, tees are aerated from two to four times yearly but it is not uncommon to see small tees aerated once a month during the regular golfing season.

A view of No. 17 tee on the upper course at Baltusrol Golf Club, Springfield, N. J., showing tee construction of early vintage.

The No. 17 tee on lower course at Baltusrol provides 6,300 square feet of usable teeing area. Note gently tapered slopes which can be completely maintained by larger mowing units.





## Renovation or Repair

There are no set rules for the timing of tee repair and renovation. Normally, it is done when necessary. Larger tees may require only an occasional topdressing and tee repair while small tees may require repair weekly. There is an inverse ratio as regards tee size and the amount of repair normally required on heavily played courses. Divot holes are repaired by means of plugging, seeding, or filling the holes with soil alone or with a soil and seed mixture. In plugging, a tool is used somewhat similar to the one employed for changing cups on greens. There are different types of pluggers, some circular and some oval. They come in sizes varying from two to 10 inches in diameter. If soil and seed are used, they are pre-mixed and the worker simply places a handful into each divot hole and firms it in with his foot. Some clubs pre-germinate seed by moistening the soil-seed mixture several days prior to its use on the tee. In cases where creeping grasses make up the tee cover, it is important to fill the divot holes with soil so that smooth and speedy recovery is made. Placing soil in divot holes helps prevent the bruised turf within the divot perimeter from drying out, it provides a good medium for the creeping grasses to re-root faster, and it keeps the surface from becoming excessively bumpy.

The spring and fall are the normal seasons for thorough renovation of weak tees. If the tee requires complete surface renovation and seeding, then aerating, thatching, and spiking machines are used to prepare the seed bed, usually without taking the tee out of play. In renovation prior to seeding, the turf should be aerated several times over, thatched in more

than one direction, then dragged and seeded.

Tees also require topdressing in order to keep them true and level. Topdressing once or twice yearly is normally required; however, here again the smaller the tee the more club and traffic injury sustained and the more frequent topdressing required. Grasses that exhibit spreading qualities, such as the creeping bentgrasses and the fine-leaved bermudagrasses, require more frequent topdressing than most others.

Tees generally should be fertilized and limed about on the same schedule as greens. The exact program will depend upon the grass cover chosen. Bentgrass, bermudagrass and Merion bluegrass require more fertilizer over the year than other tee grasses. Bermuda and bentgrass tees also require approximately the same fungicide program administered to greens. However, because tee grasses are



No. 4 hole at Baltusrol Golf Club, Springfield, N. J., a good example of adequate teeing area for iron play on a par-3 hole. Rear tee is for professional and low handicap golfers, front tee for regular play. Front tee measures 10,800 square feet.



mowed higher and there is more leaf surface to protect, higher rates of fungicide are required in spraying. Phenyl mercuric acetate formulations should not be applied to Merion bluegrass tees as Merion is sensitive to this chemical and could be weakened or badly injured by it.

Insecticide treatments also are needed on all tee grasses but again the finer ones such as bentgrass, the hybrid strains of bermudagrass and other dense spreading grasses require extra treatments over the season to combat surface feeders as well as grubs. The finer the turf and the more accelerated the program of fertilizer and water application, the softer and more palatable the grass plant and so the greater the protection needed against insects over the year. Tees and greens are prime targets for instinctive insects.

A definite program of tee marker

movement is a must for any successful tee program. Markers should be moved daily on heavily played courses. They should be moved by someone who appreciates and understands the game of golf. It is important to square each set of markers with the intended line of flight on each hole.

Finally, clean towels, ball washers with fresh soap and water, and adequate trash receptacles are an important part of the overall tee picture. These, together with all else discussed, round out the sum total of the important factors for a complete tee program which make up one important part of the exquisite beauty that is the well-managed, well-maintained golf course.

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### COMING EVENT

June 8-9

Mississippi Turf Conference  
Mississippi State University  
State College, Miss.

## Shield for Housing Area

How would you cope with the problem of shielding a new housing development that suddenly sprang up adjacent to some hole on your golf course? The solution of the Salem Country Club in Peabody, Mass., was to build a soil abutment along the right side approximately seven feet high.

This blocked out the right and directed tee shots to the left side of the 13th fairway, almost entirely eliminating any stray shots to the development. The housing development is obscured entirely from the tee and so presents little or no mental hazard.

In the photograph, Supt. John



O'Connor is flanked by Green Section Staff Member Holman Griffin, left, and Green Section Committeeman Charles Wenzel, right.



# Turf Preparation for the '64 Open

By **Walter E. Gallagher**, Green Chairman,  
and  
**Frank J. Murphy, Jr.**, General Chairman, 64th USGA Open

The golf course of Congressional Country Club, site of the 64th USGA Open Championship next month, consists of 27 holes. It is located in Montgomery County, Maryland, a suburb of Washington, D.C. This geographical area is neither in the northern or southern belts, but rather on the dividing line. Consequently, it is an area in which it is very difficult to maintain year-'round grasses. Eighteen holes comprising the championship course are watered.

In the past years and until the winter of 1962-63, considerable success has been obtained with native bermudagrasses and U-3 bermuda. During the summer months the bermudagrasses provide a nice green carpet for play, but after frost and before sufficient growth begins in June, it is a brown color. The severe winter of '63 resulted in substantial "winter-kill" of the U-3 bermudagrass on fairways and tees. This was an experience shared by most golf courses in the Eastern United States.

On the advice of the Green Section of the United States Golf Association, a seeding of bentgrass was made in late August and early September over tees, fairways, and collars. It was

hoped that the resulting bentgrass turf would supplement the bermudagrass. Because of the setback experienced last winter, it was the opinion of Alexander M. Radko, Eastern Director of the Green Section, that a combination bent-bermudagrass turf would offer far better insurance over the next few years than would allowing for weeds to supplement the grass. In his opinion, to do nothing would be risking weaknesses in the years ahead. Accordingly, on August 19, 1963, a major renovation was commenced. (See Photo 1).

First, a thatching machine cutting a swath of four feet and to a depth of 3/4 to one inch was used on the fairways. The thatcher was pulled by a tractor and operated off the tractor's power take-off. Following immediately behind this blade a tractor pulled a sweeper which was driven by its own motor and which picked up the thatch, loose runners, dead grass, and crabgrass seedheads in its hopper.

Second, the fairway was aerated 10 times to a depth of 1/2 to 3/4 inch. Aeration units were fitted with 3/4 inch spoons. At the completion of this operation a mixture of bentgrass containing 20% Seaside, 30% Astoria, and 50% Highland was sown at the rate of 70 pounds per acre. The fairways then were dragged with a heavy chain link fence drag after which they were mowed twice, cutting in opposite directions. (See Photos 2-3).

Third, 200 pounds of 0-20-0 superphosphate per acre followed by 400 pounds per acre of pelletized 10-10-10 fertilizer were applied. The fairways then were watered lightly daily until

Photo 1—Load after load of thatch, loose bermudagrass runners, and other vegetative matter was removed from each fairway.





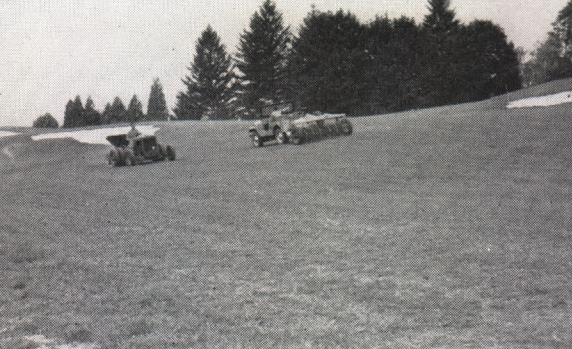


Photo 2—Fertilizer spreader begins its work while the aeration unit is finishing up on this fairway.



Photo 3—Dragging and mowing operations.

germination was complete. The same procedure used on the fairways then was used on the tees.

Fourth, the collars of the greens were mowed vertically twice, the thatch was raked with a lawn rake and they were then heavily aerated and dragged. The same application of seed and fertilizer was made after which collars were topdressed and watered.

Here is a tabulation of the dates on which the work was done, the acreage covered, and the man-hours required:

Monday & Tuesday—August 19-20, 1963:			
Front Nine			
Fairways	22.51 acres	25 hours	Supervisor
Collars	.235 acres	205	man-hours
Tees	1.131 acres		
Monday & Tuesday—August 26-27, 1963:			
Back Nine			
Fairways	22.83 acres	27 hours	Supervisor
Collars	.296 acres	234	man-hours
Tees	.959 acres		
Tuesday & Wednesday—September 3-4, 1963:			
Middle Nine			
Fairways	17.13 acres	14 hours	Supervisor
Collars	.211 acres	236	man-hours
Tees	.856 acres		

The total areas so treated were 62.47 acres of fairways, .742 acres of collars and 2.946 acres of tees. The man-hours listed above take into account the normal breakdown and replacement of blades on equipment and also reflect the fact that the back nine and middle nine were farther away from the shop headquarters and the debris dump. The tremendous amount of thatch that was cut out and lifted from the course, and that had to be hauled away, accounted for a large proportion of the man-hours. An inspection of the course on September 18 by the USGA Green Section showed that a large percentage of the

seed had caught and the general appearance was most satisfactory.

During the last two weeks in September an application of organic sludge at the rate of 700 pounds per acre was made. Because soil tests indicated a need for it, an application of 3,000 pounds of ground limestone per acre was made during October. On four of the fairways, where the tests showed the soil to be lacking in magnesium, the dolomitic type of limestone was applied. On the remaining fairways the regular ground limestone (60 mesh) was applied. (See Photo 4).

Each nine was closed through Friday of the week in which the work was done and membership reaction indicated that the treatment did not interfere with play. Results showing at this time have brought forth favorable comment from the golfers. It is our feeling that the thatching blade and a sweeping machine are a "must" for every greens crew in the general maintenance of weak areas that develop during the golfing year.

Photo 4—A view of the No. 3 hole from the championship tee six weeks after renovation.





# Knotweed Control at Wethersfield

By Alexander M. Radko, Eastern Director, Green Section, The United States Golf Association

**K**notweed is an annual weed that was a serious problem on golf courses in 1963. Because of the severe winter-spring problems encountered in the Northeast during that year, knotweed grew uninhibited.

In this area knotweed germinates "like clockwork" during the first week of April every year. It had no competition from the permanent grasses or from *Poa annua* in fairways or tees because April was unseasonably cold, dry, and windy. It normally makes its appearance in areas of heavy traffic made by foot, car, or cart. It also volunteers where weaknesses occur. Once it germinates, it makes rapid growth to maturity, then seeds heavily and dies with the frost in fall. It grows from a single tap root, and its vine-like branches make progress despite unfavorable weather. It is a well known fact that the drier the climate, and the more compact the soil, the better this weed seems to thrive.

Once the plant has gone to maturity, it is a certainty that come next April, hundreds of seedlings will emerge on the spot where old plants matured and died the year before.

Because of the dry, cold, and windy climate in spring and the severe droughty summer, 1963 was a particularly difficult year to attempt control of the seedling knotweed. But there is always the exception that disproves the rule. Wethersfield Country Club in Wethersfield, Connecticut, annually is host to the Insurance City Open, and Supt. William Dest strives to give the touring pros the very best playing conditions possible. Except for knotweed, which seemed to be his major fairway problem, Dest has provided fine turf conditions for tourna-

ment play each year. For the 1963 tournament, he vowed to go after knotweed at all costs. As fate would have it, 1963's infestation was the worst ever and Dest decided to go ahead with plans despite adverse weather conditions and no fairway irrigation system. Choosing his days carefully he embarked on the following spray program of sodium arsenite per acre, resulting in very good overall control:

Date	Amount
April 24	1 pint
May 1	1.5 pints
May 13	1.5 pints
May 21	1 quart
(It rained after May 21 spray)	
May 24	1 quart
June 12	1.5 pints

On June 13, 1/2 pint of 2,4-D was sprayed per acre and on June 21, Dest sprayed a mixture of one quart PMA (10%) and 1/2 pint 2,4-D per acre.

The liquid sodium arsenite used was five pounds per gallon strength.



Supt. William Dest on No. 10 fairway after final application of sodium arsenite. Note lack of severe turf injury despite unfavorable climatic conditions for knotweed control.



Thirty-five gallons of water per acre were used for each spray treatment. Control was very good and it appeared that very few plants matured. It was estimated that 80% control was obtained.

Supt. Dest was able to apply sodium arsenite by spraying in the early morning when temperatures were below 70°F. and by waiting for even

the slightest rainfall so that there was some soil moisture available. These are the two important requirements for using sodium arsenite . . . ample soil moisture and air temperatures below 70°F. By choosing days wisely, progress in control is possible even during the most difficult seasons as experienced in 1963 in the Northeast.

## Tifgreen (Tifton 328) Bermudagrass for Golf Greens

By Glenn W. Burton\*

**T**ifgreen is a sterile  $F_1$  hybrid ( $2n=27$ ) between a fine-textured common, *Cynodon dactylon*, selection ( $2n=36$ ) from the fourth green on the Charlotte Country Club, Charlotte, N. C., and *Cynodon transvaalensis* ( $2n=18$ ). It was bred and evaluated at Tifton, Georgia, and is a product of the turf research supported by the Georgia Coastal Plain Experiment Station, the U.S. Department of Agriculture, the United States Golf Association and the Southern Golf Association. Created in 1951, released in 1956, planted on hundreds of golf courses in the United States and around the world, Tifgreen has passed the test of time.

Tifgreen is a low-growing, rapidly spreading, disease-resistant hybrid that makes a dense, weed-resistant turf. Its fine, soft forest green leaves and few seedheads are largely responsible for its excellent putting qualities. It tolerates overseeding with winter grass better than most bermudas. Although it has survived the winter at Manhattan, Kansas, and Beltsville, Maryland, Tifgreen is recommended for golf greens only in the

bermudagrass belt. Its short stems bear yellowish-green heads that never shed pollen and never produce seed.

### GOLF GREEN ESTABLISHMENT

1. Locate greens in full sunlight with good air movement.

2. Provide good soil drainage. Tile 18 inches below the surface overlaid with six inches of crushed rock and some 12 inches of a suitable putting green soil (perhaps a mixture of sand and topsoil) is recommended.

3. Contour the green to drain water from its surface and away from paths of heavy traffic.

4. Uniformly apply and work into the soil lime and fertilizer according to soil test. On most soils, a complete fertilizer such as an 8-8-8 applied at a rate of 20 to 25 pounds per 1,000 square feet will be adequate.

5. Fumigate soil with one pound of methyl bromide per 100 square feet under well-anchored airtight polyethylene covers for 24 to 48 hours to kill weed seeds, nematodes, and other soil-borne pests. Soil temperatures must be above 50°F. Wait 48 hours before planting except on heavy soils and in cold weather when a

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waiting period up to seven days may be required.

6. Plant pure Tifgreen bermudagrass (certification guarantees purity) only in moist soil by setting sprigs six to 12 inches apart or broadcasting five to 15 bushels of shredded sprigs per 1,000 square feet. Planting heavier rates permits earlier play. Press sprigs into soil with disk planters or cover with about 1/4 inch of sterilized soil. Poultry wire laid on sprigs ahead of topdressing and removed afterwards helps to cover them.

7. Convert old greens by mowing close, spiking, and fumigating with methyl bromide to kill grass and weeds. Wait at least 48 hours after cover is removed. Then broadcast five to 15 bushels of shredded sprigs and cover with sterilized soil as above. If thatch on the old greens is very thick, strip sod, add sand or soil to improve texture of green soil, mix thoroughly with a rototiller, and proceed as if establishing new greens.

8. Water immediately after planting and keep moist by frequent light watering (two to three times daily) until the grass is well-rooted and growing.

9. Apply and water-in about 1-1/2 pounds of nitrogen per 1,000 square feet when grass starts growing (two or three weeks after planting) and repeat application every three to four weeks.

### **GOLF GREEN MAINTENANCE**

1. Fertilize with 10 pounds of 14-7-7 (or a 2-1-1 ratio of fertilizer to supply same amount of nutrients) per 1,000 square feet monthly or 4-1/2 pounds of ammonium nitrate per 1,000 square feet monthly plus six pounds of 0-14-14 per 1,000 square feet quarterly. Research suggests that activated sewerage sludge or urea formaldehyde applied at 25 pounds and about four pounds, respectively

(similar rates of actual nitrogen), will give slightly better growth of turf and may be applied less frequently. Light sands may require minor elements. Lime only according to soil test recommendations to keep soil pH between 5.5 and 6.5.

2. Topdress lightly (1/4 to 1/2 cubic yard per 1,000 square feet) with weed- and nematode-free loamy sand soil once a month. Soil from a virgin wooded area far removed from cultivated fields may not require fumigation. Generally fumigate with methyl bromide under a tight polyethylene cover using one pound per two cubic yards of soil. For best results have soil under cover moist, loose, and less than one foot deep. Keep under cover for 48 hours. Wait at least two days after treatment before using. Mow greens close before applying soil and work soil topdressing into sod with a steel door mat dragged over the grass in opposite directions.

3. Water as needed to prevent wilting. Apply 1/2 to 3/4 inch each time. Do not overwater.

4. Mow (usually daily) with a sharp mower set to cut at a height of 1/4 inch. Change mowing direction and use verticut as necessary to prevent grain formation.

5. Spike or aerify only as needed to relieve soil compaction.

### **DISEASE CONTROL**

Learn to identify diseases and the weather conditions that favor their development. **Watch continually** for early symptoms and treat for their control as recommended by Homer D. Wells in Circular N.S. 39, Georgia Coastal Plain Experiment Station, entitled "Turfgrass Diseases and Their Control."

### **INSECT CONTROL**

Learn to identify important turf insects. The most common turf in-



sects in the South are mole crickets, sod webworms, cutworms, and army worms. **Watch continually** for the first sign of their presence and treat immediately with 2-1/2 to five pounds of chlordane dust per 1,000 square feet. Other insecticides are effective and all are poisonous. Follow directions on the container label and heed all precautions.

### WEED CONTROL

An ounce of prevention is worth a pound of cure. Weed problems can be greatly reduced with proper management.

1. Sterilize the soil for the green with methyl bromide before planting.

2. Always topdress with sterilized weed-free soil.

3. Keep golf green turf healthy and dense with proper management.

4. Control weeds in fairways and roughs near greens to reduce weed seeds that might be brought in by wind, mowing equipment, carts, players' feet, etc.

5. Use chemicals where necessary as a tool to help control weeds. Generally, 2,4-D or 2,4,5-T will take out most broadleafed weeds, but Tifgreen will not tolerate more than 1/2 to 3/4 pound of these materials per acre in any one application. Disodium methyl arsonate and some closely related compounds injure bermudagrass less than most weedy grasses and may be used to help control them. Usually three to five pounds of active ingredient per acre applied two or three times at 5-to-7-day intervals is recommended.

Research is producing many new chemicals that may make current recommendations for disease, insect, and weed control out of date. Test new materials carefully on small areas before making extensive use of them.

### OVERSEEDING WITH WINTER GRASS

Reduce spring transition problems

by having Tifgreen in top condition when overseeded. To do this:

1. Fertilize, aerify if needed, and topdress greens with about 1/2 yard of sterile loamy sand per 1,000 square feet one month before overseeding.

2. Raise cutting height to 5/16 inch or more (if players will permit) to increase food reserves in stolons.

3. Delay planting if possible until late October or early November to reduce disease problems. Cottony blight is inactive below 70°F.

4. Precede planting by mowing greens close—1/8 inch.

5. Uniformly overseed with 30 to 50 pounds of domestic ryegrass; or eight to 10 pounds of *Poa trivialis*; or a mixture of 10 pounds of creeping red fescue, four pounds of *Poa trivialis*, three pounds of Kentucky bluegrass, and one pound of Seaside bent per 1,000 square feet.

6. Drag seed into turf with a steel door mat. Several passes in different directions may be required.

7. Apply and drag-in 3/4 to one cubic yard of good sterilized loamy sand or other topdressing material per 1,000 square feet to cover the seed.

8. Keep moist with frequent (usually once a day) light watering as needed.

9. Start mowing at a height of 3/8 inch as soon as grass is well established. Lower cutting height to suit players' demands.

10. Maintain winter grass with regular mowing, watering, topdressing, and disease and insect control as needed.

11. Generally, Tifgreen will gradually crowd out and replace the winter grass with no noticeable transition problem if the Tifgreen is treated as outlined above. Withholding water will usually hasten the disappearance of the less drought-resistant winter grasses.



# TURF TWISTERS

## MOWING BERMUDAGRASS

**Question:** I am cutting my U-3 bermuda nursery at the height of one inch. I have been told this may form a thatch and that I should cut it down to 3/4 or 1/2 inch. Is this correct? (MISSOURI)

**Answer:** You need not be too much concerned about the mowing height on your nursery, but when you begin to mow your fairway cut it just as close as possible because bermudagrass does have a tendency to form a mat.

## POND WATER AND TURF

**Question:** We are pumping our irrigation water from ponds that have been treated for aquatic weeds. The question arises as to whether or not this water, once we have sprayed it with sodium arsenite, would kill the grass on the greens and fairways? (TEXAS)

**Answer:** Two to four parts per million of sodium arsenite was indicated as the rate used for pond moss control. It is doubtful if this concentration of sodium arsenite would have any effect on the turfgrass. Ordinarily, when sodium arsenite is used as a herbicide we use it at the rate of approximately one pound per acre in about 200 gallons of water. This is approximately one part to 1,600. At the concentration you have suggested it would take a lot of water to do any damage on the grass.

## FERTILITY LEVELS

**Question:** In a recent soil fertility test of our Seaside bent greens, our fertility levels were very low, with the exception of phosphorus. The soluble salts are also low. In bringing up a higher potash level, would you recommend the use of muriate of potash? (KANSAS)

**Answer:** Muriate of potash probably is your most easily obtainable source of potash, and it is a very good source. Ordinarily, bentgrass should be fertilized with about nine pounds of the nutrient ( $K_2O$  equivalent) per 1,000 square feet per year. This would require approximately 15 pounds of muriate of potash per 1,000 square feet per year.

We suggest you divide this into several applications and apply the material mostly during the cooler seasons of the year. Potash leaches quite readily, so small, frequent applications are better than applying a large amount at one time.