GOLF IS PLAYED ON GRASS

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IN UNITED STATES there are six thousand-odd golf courses that occupy roughly 750,000 acres of land. The investment in land, buildings, machinery, clubs, balls, clothing, and the other necessities, and the labor required to maintain the courses make golf a multibillion dollar sport. This year more than 2,500,000 golfers played an estimated 70,000,000 rounds. To avoid belaboring the obvious, let it suffice to say that all these items depend on grass.

The regulation golf course has 18 holes, by tradition, but often courses in smaller communities have 9 holes; a few have multiples of 9, such as 27, 36, or 45 holes. The turfed areas of the course comprise the tees, fairways, greens, and roughs.

Of the hundreds of grasses that have been identified in the United States, only a few of the permanent turf-forming grasses are suitable for use on golf courses. They include the bluegrasses, fescues, and bents in the North and on the Pacific coast; Bermuda, carpetgrass, centipede, and Zoysia in the South; and buffalo, blue grama, and the Fairway strain of crested wheatgrass in the Great Plains region. Temporary grasses such as redtop and domestic and perennial rye are used to some extent. They are employed in the North to furnish a grass cover until the slower growing permanent grasses become established. In the South they are used to provide green turf on greens and fairways in winter when the true southern grasses are dormant.

Courses in the North, in the Great Plains, and in the Pacific Northwest use bentgrass on greens. In the early days the fescues and South German mixed bent were used. More recently seaside and colonial types of bent have been employed for this purpose. Another development has been the use of creeping bent selections which have been propagated and planted vegetatively. The bluegrasses, fescues, and colonial type of bent are used for tees and fairways; the first two are usually chosen for roughs. Recent studies indicate that hardier, coarser grasses more tolerant of drought and low soil fertility may find wide usage.

The first stroke on each hole is played from the tee, a flat area with a slight slope from front to back and from one to several thousand square feet in area. Most courses have a long tee for each hole, or several smaller ones, so the length or yardage of the hole can be varied. The back tee is usually known as the championship tee. The sharp spikes fitted into the bottom of the shoes worn by golfers to prevent slipping on dry turf have a severe abrasive action on the grass.

Further and greater damage is caused by the club head as it makes contact with the teed-up ball. The small clumps of sod, called divots, removed by the club head leave scars in the turf. Tees on short holes are injured the most because clubs with iron heads are used.

The best and most satisfactory turf is self-healing and produced from stoloniferous grass (creeping surface stems or runners) or from rhizomes (underground creeping stems).

The golfer demands a firm stance; a relatively "dry" surface is desirable. Drought-tolerance is therefore a good feature of tee grasses. Minimum quantities of water should suffice to maintain a turf.

Ability to withstand close clipping is more important than drought resistance. The teed ball must stand above and clear of uncut grass. The most common height of cut is one-half to three-fourths inch.

Disease resistance is extremely important in tee grasses because turf from them is easier and cheaper to maintain, invasion by clover and weeds is less likely, and the tee is more uniform in appearance.

A pleasing color throughout the playing season is highly desirable because it adds to the enjoyment of the game, even though it may not affect playability of the turf.

The grasses most widely used on tees are listed on page 328, along with several that have promise of being satisfactory. The list is divided according to regions. There is some overlapping in the border zones between North and South. For example, in places like St. Louis and Washington, D. C., Zoysia, which is usually looked upon as a southern grass, may become a good grass for tees. Bermuda-grass is another possibility; new cold-resistant strains, some of which are in use on tees and fairways as far north as Washington, have been developed.

Bermuda-grass is used in the South on tees for the summer play. Overseeding in the fall with domestic ryegrass, bent, or redtop is a practical way to provide green grass during the winter. Zoysia is an excellent new grass and may supplement Bermuda for summertime use.

We need new and better tee grasses, however. The grasses now available cannot survive, as well as we should like, the terrific punishment from heavy play on the small tees of the daily fee courses. The public courses particularly need a better grass.

In building new tees, or rebuilding old ones, it is good practice to follow these principles:

Make the tee large enough so there is time for the turf to recover before play is resumed from the same spot. Tees on iron-shot holes (the short par-3 holes) should be one-fourth to one-third larger than the others to permit more frequent change of tee markers.

Elevate the front end of the tee to make a slight slope (6 inches in 100 feet) from front to back.

Elevate the tee above surrounding terrain, but have gently sloping sides to permit mowing with mechanized units, preferably with tractor and fairway units.

If necessary, use humus and coarse sand to modify the texture of the surface soil and to produce a sandy loam soil that will support plant growth with a minimum of irrigation.

Fairways

Fairways comprise 20 to 30 acres on a 9-hole course and 40 to 60 acres on an 18-hole course. They average 50 to 60 yards in width and 100 to 600 yards in length. The quality of turf should be superior to that on the finest lawn.

The golfer prefers to play on a fairway where the turf can be mowed closely at ½ to 1 inch—rarely higher. He desires a dense, tough grass to support the ball and firmness under foot to aid in making the shot. Maximum resistance to diseases, insects, drought, heat, cold, and invasion of weeds and clover is desirable for proper maintenance and play.

Modern golf demands weed-free fairways. A weed in golf turf is any plant that interferes with the accuracy of play and the enjoyment of the game—a definition that makes clover a weed on a golf course. Herbicides like arsenic acid, sodium arsenite, and 2,4-D can keep weeds out.

Most of the grasses used on fairways are the same as those used for lawns and pastures. The appearance of the turf is secondary to playability, yet golfers prefer well-kept fairways of a pleasing color.

Leading amateurs and professionals say they prefer well-kept Bermuda-grass; they like the good lies they get on the dense mat of evenly fertilized, closely cut Bermuda-grass. Bermuda is the principal fairway grass of the South, although there are a few courses with carpetgrass and centipedegrass fairways. Red fescue is rated high in the North; the next choice is a well-kept fairway bent. Kentucky bluegrass cannot tolerate the close clipping demanded by the golfers.

Old-timers talk about the fescue fairways of former times on northern courses; they bemoan the fact that

modern courses do not have as good turf. Creeping red fescue is a wiry grass that gives a perfect lie when the turf is dense. Low fertility levels and infrequent cutting in the horse-mowing days enabled fescue to resist invasion by more aggressive grasses, such as Kentucky bluegrass and the bentgrasses. Only a few courses with fescue fairways remain; they are in less densely populated areas where maintenance standards are less exacting.

Kentucky bluegrass is commonly used for fairways in the North. Some clubs have good turf of it. Unless Kentucky bluegrass is cut reasonably high (1 to 1½ inch), it does not persist and becomes infested with clover, crabgrass, *Poa annua,* and other weeds. At 1½ inches a rather open, unsatisfactory fairway turf is produced.

The inherent weaknesses in a grass become apparent under intensive management of frequent and close mowing, heavy fertilization, and the overwatering practiced on some courses. These are the main reasons why fescue has disappeared from many fairways and why Kentucky bluegrass is faltering on others. Bluegrass suffers badly from leaf spot in cool, wet weather. As the bluegrass weakens, clover, knotweed, *Poa annua,* crabgrass, and chickweed become troublesome pests.

Bentgrasses have performed better than fescue or Kentucky bluegrass on the watered and intensively managed courses. They make a tighter and denser turf which resists invasion by clover and weeds. Bentgrass can be cut short. The erect-growing types, such as colonial bent, are best, but some of the creeping types have possibilities. Better selections of bentgrass would be desirable for watered courses; superior strains of fescue and possibly of bentgrass and Kentucky bluegrass are needed for unwatered fairways. New and better grasses for fairways are being requested everywhere. Their development is one of the pressing problems requiring solution.

Putting greens occupy only a small part of the total area on the golf course but they are the most important from the standpoint of the play. At least half the strokes in a round of golf are played on the greens. The average size of a putting green is about 5,000 square feet. The total area in the greens on an 18-hole course is about 2 acres.

Putting Greens

Many golf courses began with sand greens, and still have them in dry localities where water is not available to irrigate properly. A few of the first grass greens were seeded to bluegrass, red fescue, and redtop. Only traces of these grasses remain on a few isolated courses. Today, the world over, grassed putting greens are either bentgrass or Bermuda-grass.

Bentgrass greens are in use in nearly every section of the United States. Some bentgrass greens are scattered through Florida, Texas, New Mexico, Arizona, and southern California. The replacement value of the turf is about $1,000 a green, or $10,000 an acre. Some bentgrass sod sells for a dollar or two a square yard, which is at the rate of about $5,000 to $10,000 an acre.

The surface of the putting green must be as smooth and true as a billiard table, firm enough to avoid footprints, which deflect the ball, and sufficiently resilient to hold a pitched ball, even though the soil is on the dry side. Maximum density of the turf is demanded without any graininess. A grainy turf causes the ball to roll faster with the grain than against it. Putting-green surfaces are rarely flat. Gentle contours and slopes add to the interest by demanding greater skill and judgment on the part of the player.

Putting greens represent one of the most highly specialized uses of grass known. Without an excellent turf on the greens and a keen putting surface, golf would not be the popular sport that it is today. Maintenance of the turf is both an art and a science and it requires years of study and experience on the part of the greenkeeping superintendent.

When bentgrass began to be used for putting greens it was discovered that a mixture known as South German bent produced highly satisfactory putting surfaces. Many of these old greens still exist after 40 years or more of continuous play. When world conflict in 1914 made it impossible to get this seed, search was started for other types of bentgrasses. There followed years of collecting material, testing the value of various sources of seeds, and propagation of vegetative bentgrass (creeping bent) by the United States Golf Association Green Section. The present-day bent putting greens are South German mixed bent on the old greens, but on the more recently planted ones they are Seaside creeping bent from seed (with mixtures of colonial bent) or vegetative plantings of selected creeping bents.

A number of superior strains of creeping bents are being produced commercially and sold for vegetative planting. Many golf courses grow their own planting stock in nurseries. A mere handful of stolons of parent stock quickly produces a large quantity of stolons. The outstanding named strains are Washington, Arlington, Cohansey, Toronto, Congressional, Collins, Old Orchard, and Norbeck. All have been selected from established putting greens—none is the product of breeding and selection.

Bermuda-grass greens can be developed by seeding or by planting with stolons, an operation that sometimes is called sprigging.

Golf courses in the South use Bermuda-grass for summer play, and overseed with northern grasses for play in winter, when Bermuda-grass is dormant.

The secret of keeping a good Bermuda-grass green is to feed generously with nitrogenous fertilizers and to topdress whenever necessary to keep the surface stems buried.

Recent work indicates that fine-leaved strains of Bermuda-grass can be selected and developed. Under proper care they will produce a putting surface as true and as fine as bentgrass turf.

Imported seed of Italian ryegrass was first used for winter greens. Domestic seed produced in the Pacific Northwest has been equally good and less expensive. Those prefering ryegrass use it exclusively. A few clubs use only redtop and others prefer to mix a little redtop and bluegrass with the ryegrass. In recent years bentgrasses have been tried from seed. They have been satisfactory when seeded properly at the right time and given the right kind of aftercare.

Customary practice is to renovate the Bermuda turf before seeding in the fall, by slicing or raking, followed by close cutting, top dressing, and seeding.

In building a putting green, consideration must be given to a number of important details. Drainage to remove excess water quickly both from the surface and through the soil is a main consideration. By providing perfect drainage, the soil is better aerated and a deeper growth of roots is encouraged. Good soil texture, combined with drainage and aeration, also is vital. Drainage and aeration insure firmness and resilience, and prevent the soil from becoming puddled and compacted even under constant traffic by man and machinery. A sandy loam soil that contains 20 to 30 percent by volume of durable organic matter is considered ideal. Clay soils must be modified to produce a sandy loam. Coarse sands are less likely to become too compact for good plant growth than fine sands. Reed and sedge peats and peat moss are commonly used to furnish the organic matter fraction.

First the subgrade is prepared and given adequate drainage by the use of tile or porous gravel material. Then about 10 inches of the especially prepared topsoil is placed on the surface. This is graded for proper contours to avoid ponding areas and to allow the surface water to drain off in two or more directions. Lime (if needed) and fertilizers are then incorporated in the soil and the green is ready to be seeded

Grasses Most Widely Used on Tees; Also Those That Show Promise of Being Satisfactory

[All have pleasing color and stand close clipping]

Grass	Rapidity of healing	Drought tolerance	Disease resistance	Density
Northern region:				
Bentgrasses:				
Colonial type	Fair	Good	Good	Excellent.
Creeping type	Very good	Fair	do	Do.
Bluegrass	Fair	Good	Fair	Fair.
Fescue	Slow	Excellent	Good	Good.
Poa annua [1]	Good	Very poor	Fair to good	Do.
Southern region (summer):				
Bermuda-grass	Excellent	Good	Good	Do.
Centipedegrass	Good	Very good	do	Do.
Zoysia	Slow	Excellent	do	Excellent.
Southern region (winter):				
Ryegrass (winter)				
Redtop (winter)				
Western Plains:				
Buffalograss	Very good	Excellent	Good	Good.
Crested wheatgrass (Fairway strain)		do	do	Do.

[1] Usually considered a weed but tolerates shade and makes excellent turf where weather is cool and moist.

or, if necessary, planted with stolons.

If the green is to be seeded, the seedbed must be firm but mellow to avoid covering the tiny bentgrass seeds too deeply. Coverage of one-fourth inch is sufficient. Frequent light watering with a gentle spray is essential to obtain rapid and maximum germination and establishment. Usually 3 pounds of seed to 1,000 square feet is adequate—often less is used. Because the green will be mowed at one-fourth inch or less, it is highly important to start mowing as soon as the grass is one-half inch high.

Vegetative planting requires a different technique. The growing grass is lifted from a nursery, pulled apart or shredded, and the living plants scattered on the prepared surface. Usually 1 square foot of nursery stock will plant 8 to 10 square feet of putting green surface. This is equivalent to about 4 to 6 bushels of stolons for each 1,000 square feet. The stolons are scattered uniformly, pressed down with a roller, and top-dressed with about one-fourth inch of screened, prepared soil similar to that on the green. With frequent light watering, the grass will be ready for the first mowing in 10 days to 2 weeks. With excellent care, the green may be ready for use in 4 to 6 weeks. Frequent light top dressings are necessary to fill the low spots and to produce a true, smooth surface.

After the grass on the putting green has been established, a regular program of fertilizing must be considered. Normally it is general practice to apply in several applications a total of 6 to 8 pounds of actual nitrogen to every 1,000 square feet during the growing season. This amount equals approximately 60 to 80 pounds of a fertilizer containing 10 percent of nitrogen or 95 to 125 pounds of a fertilizer with 6 percent nitrogen. Calculations easily can be made on the amount to apply for the fertilizer which may be available. Every effort should be made to apply at least 30 percent of this nitrogen in the organic form to give a greater carry-over effect. Proportionate amounts of phosphorus and potash fertilizers should be included also to give a complete balanced feeding.

Accepted practice is to use lime judiciously on bent and Bermuda-grass greens and on turf in general, especially when soils become more acid than pH 6. The use of a dolomitic limestone of high magnesium content is desirable in regions where the acid soils are low in available magnesium.

Regular and frequent mowing of putting greens is essential to keep a true putting surface. The frequency of mowing is determined by the rate of growth; during the growing season, three to four mowings a week is not considered excessive. Many greens are cut daily. A mowing height of three-sixteenths inch during the growing season is necessary for the prevention of a mat, which will develop if the grass is mowed at a higher cut. Every effort should be made by close mowing, brushing, and raking to keep this mat from developing, as its occurrence will increase the disease incidence and make the watering problem more difficult during the hot, dry days of summer. It is generally a good practice to rake bentgrass greens heavily in the early spring and fall, at the beginning of the growing seasons, to remove any excess growth. At these two seasons, the grass will quickly recover from the rough raking treatment.

The principal diseases of closely mowed turf, particularly the putting greens, are brownpatch, dollarspot, snowmold, copperspot, pinkpatch, and pythium. Most of these diseases are controlled by the skilled use of chemicals, including calomel, bichloride of mercury, various organic mercury compounds, and nonmercury preparations. New materials which contain cadmium as the active ingredient appear very promising.

Insects have plagued the greenskeepers since the game began. Among the most destructive insects are chinch bugs, grubs of the Japanese beetle and the May beetle, cutworms, sod webworms, and armyworms. Pests that annoy but are not destructive are ants and earthworms. Arsenate of lead has been a standard insecticide for many insects. Recently DDT has found its place on golf courses, and other newer chemicals offer great promise. One of these is Chlordane.

The question of top dressing is a moot one, but generally is practiced on most golf courses today. Care should be exercised in applying a top dressing of any material that may cause layering in the soil. Peat or any other organic matter, heavy loam, clay, or sand when used alone will cause layering and ultimately stop root penetration. Layers in the soil create a shallow-rooted turf that will wilt and die during hot weather.

A good top-dressing mixture should contain approximately equal parts by volume of soil, organic matter (reed or sedge peat), and a coarse concrete sand. If the soil that is being used in the mixture is a sandy loam, then it would be best to use two parts of soil, one part of organic matter, and one part of a coarse concrete sand by volume. The normal rate of applying top dressing is 1 yard to a green of 5,000 square feet. The rate should be reduced one-half or two-thirds in midsummer if it is necessary to use the dressing then. Top-dressing material should be free of weed seeds; it can be made so by mixing fertilizers with the top dressing and storing for several weeks, or until heating ceases.

No specific recommendations can be made for watering putting greens. The use of water must be based upon the need for it, common sense, and judgment. Prevailing conditions, such as normal rainfall and drainage on the green, both surface and subsurface, will determine the amount and frequency of watering. The proper use of water is the key to good turf.

Many of the difficulties on putting greens can be traced to poor soil conditions which were either built into the green or have developed by compaction by foot and maintenance-machinery traffic.

Several methods can be employed to correct poor soil conditions. The tubular-tine fork can be used to good

advantage, but it is a device that takes time and labor. Several mechanical devices can accomplish the operation with less manual labor. Although quite expensive, these pieces of machinery will more than pay their original cost in the saving of labor.

The roughs are penalty areas for the player who is off line. It is the region 75 to 100 yards in front of the tee, along each side of the fairway, and surrounding the green. The grass is cut at 4 to 5 inches—to penalize the golfer who has to play from it.

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