well structured soil and drainage are critical in

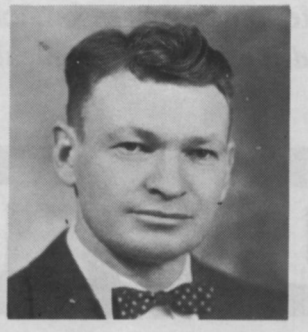
Golf Green Construction

Construction, maintenance and renovation of putting greens make up the greatest cost item in the budget of the average golf course. Golfers demand a high quality putting surface and it becomes the job of the golf course administration to see that they get it.

About half of all strokes by the average to good golfer will be made on the greens. Further, the total surface area of these greens may be only one or two percent of the entire acreage in the course. These facts alone point up the need for careful greens construction and maintenance to produce good putting surfaces.

Charles Calhoun, Ames, Ia., says that most problem greens have "built-in" features. Most common are poorly drained topsoil coupled with an inadequate system of underdrainage, if any. With heavy play on such greens, the problem grows because topsoil compacts easily and the needed large pore space for drainage is lost.

Calhoun, who works closely with golf course superintendents in Iowa and edits their association newsletter, does consultant work on course construction and



Charles Calhoun

In Brief:

Golf greens fail most often because of poor drainage. Rebuilding existing greens or constructing new ones are expensive processes if the job is done right. Yet with the extensive play today on most courses, administrators can seldom afford not to obtain the best greens possible. WTT this month presents the ideas of Golf Course Consultant Charles Calhoun, Ames, Iowa, a turfgrass specialist with many years experience in working with golf course construction. Calhoun has worked out a system for mixing and laying down topsoil, sand, and peat which produces a well drained green. WTT presents the steps in his system in picture form along with his ideas on golf course management.

is a consulting turfgrass specialist. As such he has studied many of the underlying problems in course construction which lead to turf maintenance problems. He lists five key causes of problem greens which affect operators and owners of golf courses.

Specific Problem Areas:

No. 1 problem, according to Calhoun, exists because many golf courses were built years ago with only native soil of the area. From year to year various types of topdressing have been added, layer upon layer. Next problem, he says, is the fact that many courses have been built with poorly engineered plans and specifications. No. 3 problem area has been the "cutting of corners" because of a shortage of funds or financing. Poor supervision or inspection during construction of greens accounts for many not meeting specifications. And finally, the fifth problem listed by Calhoun is the "built-in" problems which result from poor maintenance procedures, particularly regarding use of topdressing and soil amendments.

Seasonal changes also unduly affect problem greens. Most greens, Calhoun states, will recuperate in the fall and the following spring after being given a good renovation treatment. Areas where cold winters prevail benefit by the natural aeration of freezing and thawing.

Then in the spring, grass on such greens gets a good start and by May is in excellent shape. But deterioration begins shortly with heavy foot traffic which reaches a peak during the hottest part of the summer. Greens soil which was a lively dynamic medium in the spring becomes a compressed often soggy plastic-like mass. Pore space is lacking to the point that life-giving oxygen for grass growth is choked off. With this low oxygen supply condition, excessive (toxic) carbon dioxide concentration and

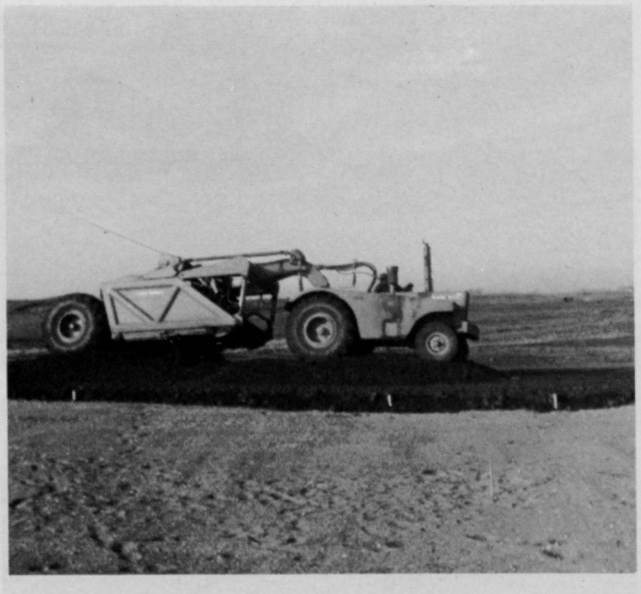
Step 1. Roto-tilling soil in 20-foot strips permits equipment to work on both sides without compacting. Soil has previously been spread to rough 4-inch depth by grading.

Step 2. Peat (1½ inch depth) is added to roto-tilled topsoil. Work is being done at Jesup Golf and Country Club, Jesup, Ia. Considerable work was done by hand labor.

Step. 3. Calculated amount of sand was dumped beside mixing strip prior to spreading. Then sand (1½ inch depth) was placed on top of peat. Doing work in strips facilitates mixing with equipment.

Step 4. Sand, peat, and topsoil are mixed thoroughly with roto-tiller. This final mix will be moved to green site and carefully spread to avoid compaction.

Green site prior to adding mix. Mix is pushed onto site. Heavy equipment is used on green only after buildup of 10 inches or more of topsoil mix.



Equipment such as this used at Jesup, Ia., course is practical for moving and handling topsoil mix.

Drainage system is installed prior to forming of basin for green. This important step is often neglected.

other toxic byproducts such as methane and cyanide derivitives are often formed. Research further shows that at the same time, physiological processes of water and nutrient uptake are drastically curtailed or altered. This causes unbalance in the other numerous functions of normal plant behavior.

With a physiologically disabled turf population, high temperature periods often bring on failure. Many golf greens do not reach this critical stage but only approach it by degrees. Good judgment and luck often enable the superintendent to pull the green through in fair shape.

Solutions:

Poorly constructed greens require many unnecessarily wasteful and expensive hours of maintenance. Calhoun makes this statement advisedly because superintendents often have to do their best with what is available. But it may be wise, he believes, to consider spending some extra money in the beginning, knowing that it will be amortised in savings over the years. Choices for the golf course administration are (1) to build greens properly from the start, (2) to rebuild problem greens at one time or piecemeal as budgeting permits, or (3) maintain, renovate, and gradually improve existing greens. The latter is usually standard procedure.

Where the decision is made to get along with problem facilities, the fundamental procedure is to open or fracture the soil, and preferably permit entrance of desired soil amendment materials to improve air and water circulation. But as the budget permits, Calhoun believes it best to start a rebuilding program for greens. Money saved in lower maintenance costs will soon pay the original bill.

Green Structure:

Basically, a well structured soil which provides a good putting surface will have the ability to hold properly sized pore spaces for adequate water and air ciruculation within the growth medium.

Construction features of such a green involve four key components. First is the greens topsoil mixture for a growth medium to accommodate grass. No. 2 is a coarse ingredient such as concrete sand to impede downward movement of the topsoil mix. Then, thirdly, a coarser ingredient with particle size of ¼- to ⅜-inch diameter, such as pea gravel, is needed to permit rapid downward movement of excess water but which will hold back the finer material. Finally, the fourth feature consists of hollow, permeable conduits to carry away the excess water as it drains off. The greens section of the United States Golf Associ-

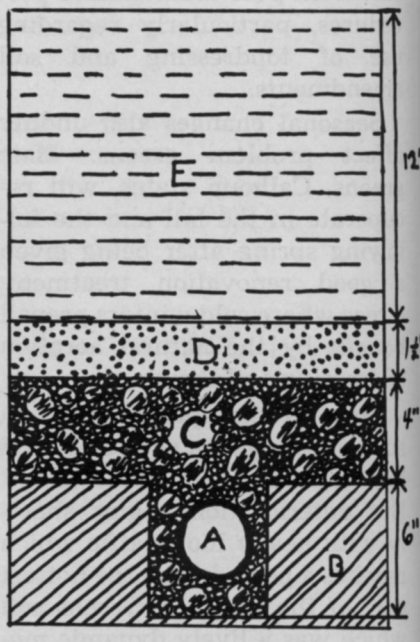


Figure 1. USGA Cross Section of a Putting Green Profile Showing a Trench and Tile Line. A. 4-inch diameter tile. B. Subgrade of native soil or fill material. C. Gravel—preferably pea gravel of approximately ¼" diameter. Minimum thickness 4 inches. D. Coarse sand—this sand should be a size of 1 mm. or greater. One and one-half to 2 inches in thickness. E. Topsoil mixture. Minimum thickness of 12 inches.

ation must be credited for the original concentrated research to develop an idealized green profile. Figure 1 shows a cross section of the USGA standard specifications.

The USGA recommends a loose, 12-inch minimum thickness layer of well drained topsoil mixture, a 1½- to 2-inch layer of coarse sand with particle size 1 millimeter or greater and a 4-inch minimum thickness layer of pea gravel of approximately ¼-inch diameter particle size. Water will drain through these layers into a 4-inch tile drain.

Because placing a layer of sand over a layer of gravel without mixing the two in the process is a problem, few contractors are willing to do the meticulous job necessary for such an installation. Further, golf course administrations often balk at the relatively high cost involved. So, Calhoun says, a compromise method is often used which consists of using a mixture of sand and gravel in a single 5- to 6-inch layer under the topsoil. Excess water then drains through this layer and into the conduits. This permits quite rapid although slower drainage and at the same time impedes the downward movement of the topsoil mixture. See Figure 2.

Topsoil Mixture:

Calhoun deals in basic fundamentals in describing a good green topsoil mixture. Ordinarily, he says, it is made up of a natural native soil, sand, and a good quality of somewhat decomposed hypnum or sedge peat (See picture series on topsoil mixture used at Jesup Golf and Country Club, Jesup, Ia., construction of which was designed and supervised by Calhoun). Commercial products are on the market, Calhoun says, other than these mentioned which also do a good job. The final determination as to how much of each ingredient to use is best left for judgment of a qualified specialist. Such a specialist can provide a laboratory physical test of the materials to be used along with recommendations and specifications. At the same time it is advisable to arrange supervision and inspection during the progress of construction.

As a rule, the range of sand volume to be used will fall between 45 and 65 percent of the total final volume. The peat, Calhoun believes, should consist of 10 to 20 percent of the total. It is commonly believed that a soil with 30- to 50-percent sand in the natural state would not require much additional sand, but this is not the case. The sand in most natural soil consists of very small particle sizes and tends to clog rather than contribute much to the drainage and circulation characteristics necessary in the final profile.

In putting the topsoil mixture ingredients together, Calhoun has found it best to lay out 20-foot wide strips for mixing. This permits equipment to work on each side of the strip without disturbing the mix during the process.

Further, when the mixture is hauled and placed beside the green it can be worked onto the green with heavy equipment. But he makes sure that the equipment never crosses the green until at least 10 inches of the topsoil mixture is in place. This is done by working the mix onto the green ahead of the machine.

Costs are difficult to estimate, Calhoun says, because of the difference in wages between areas. Generally, he has figured labor at $3 per hour which makes materials handling run 40 to 50¢ per square foot. Thus, a medium sized green of 5000 square feet will run from $2000 to $2500.

Summary:

Fundamentals of proper green construction, Calhoun strongly believes, must be carefully followed to avoid later problems and high maintenance costs. Mistakes which appear small during construction can cause future troubles. It is as important money-wise and efficiency-wise, he says, to hire a professional to design the green and to administer construction, as it is for an expensive building. When done right, excellent greens and happy golfers result, which is the primary purpose for the venture.

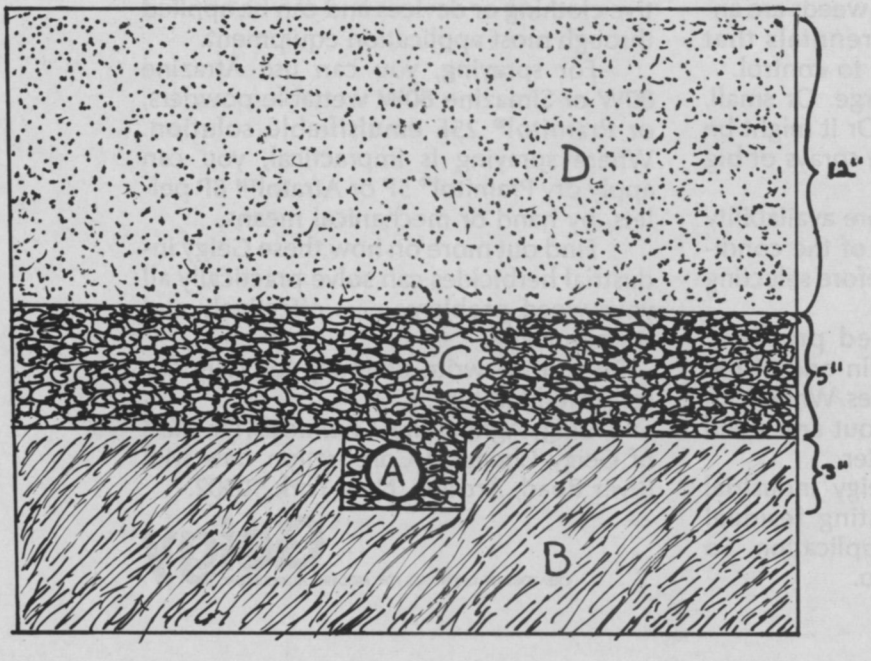


Figure 2. Cross Section of a Putting Green Profile with Simplified Construction and Lower cost. A. Hollow performance drainage conduit. B. Subgrade. C. Coarse sand-gravel mixture. D. Topsoil mixture. (45-65% sand).