



Plenty of clearing was necessary during the construction of the Sandy Beach (Ohio) course, but utilization of modern, cost-cutting machinery such as the Caterpillar tractor shown here, resulted in a job of record speed and thrift.

## Watch Construction Pitfalls

By O. J. NOER

**B**UILDING committees charged with the construction of new courses are rarely conversant with the basic principles underlying the production of good turf. In their zeal to reduce construction costs they are often penny-wise and pound-foolish. Essential fundamentals are omitted for the sake of economy and the club is forced ultimately to expend huge sums to effect turf improvement. Incidentally the club revenues are seriously restricted during the first few critical years because golfers are not easily induced to join and retain membership in clubs possessing poor turf on fairways and greens.

Terrain and accessibility are usually considered more important in the selection of a golf course site than adaptability of the soil for turf growth. Now that manure is scarce and expensive, farmers in the vicinity of large cities are not maintaining soil fertility, anticipating early sale for sub-division or golf course use, so the soil may be badly depleted if the course is established on farm land. Failure to recognize this has been disastrous to many new clubs.

### Critical Period

The first weeks following seeding are most critical and determine success or fail-

ure in obtaining dense uniform turf quickly. Occasionally poor turf can be traced to unfavorable weather, but more frequently it is the result of adverse soil conditions, usually improper texture, insufficient drainage or depletion of essential plant food elements. The physical condition of heavy soils cannot be successfully modified after turf is once established, and surface application of certain fertilizing elements do not diffuse rapidly into such soil. Failure to modify soil and provide plant food prior to seeding hampers any subsequent attempt to turf improvement.

Neglect to provide soil of suitable texture (refers to the size of the predominating soil grains, and, silt or clay during construction of greens is responsible for more distracted green chairmen and greenkeepers than all other mistakes combined. The extravagant claims of some bent enthusiasts, that stolons will grow anywhere, might lead one to suppose that bent grass will thrive on cement slabs. While bent seems to grow under a wide variation of soils, good putting surfaces are not easily maintained on greens constructed of heavy silt or clay.

The character of the surface four inch layer of soil is most important. If too sandy it has such low water holding capacity that the surface soil dries out rapid-

ly during hot weather. Clay soils, while they have a greater capacity to retain that the ball will not bite when pitched to water, become so hard during the summer the green. The very fine pores between the soil particles impede the free movement of water and the surface soil, following heavy watering or rains may become water-logged. This restricts the soil supply of air and interferes with normal growth. In extreme cases where surface drainage is imperfect excess water saturates the depressions and drowns the turf.

### Watering Danger

The tendency is often to apply too much water in attempts to provide surfaces which will hold the ball. Where soil of proper physical condition is used during construction good turf can be maintained with less effort and expense. Incidentally grasses tend to grow coarser on heavy than on lighter soils. All things considered the best soils for greens are sandy to medium loams. These provide ample water-holding capacity, are plentifully supplied with air and move water rapidly.

In past practice manure was extensively used to modify the texture of the surface soil layer, and in rare instances thick layers were imbedded in the green, anticipating deeper root development. These layers are the source of much trouble, and uneven settling leaves irregular surfaces. During winter water stands in the depressions and winter-kill results. Worms seek and multiply in these manure layers and are hard to control. The main feeding roots of turf grasses occupy the surface soil and are not benefited by plant food imbedded in the green. While less manure is required to affect soil modification than sand, there are several factors which must be considered in connection with its use. Unless thoroughly rotted and composted large numbers of troublesome weeds may be introduced. When large amounts of manure are used worms become more numerous, and the abundant plant food, particularly nitrogen, encourages coarser growth of the bent wherever possible. Manure should be dispensed with and sand or other suitable material substituted, applying the plant food requirements in other forms so as to control the character of growth.

The large amount of sand required to effectively modify heavy soil, and the relatively small quantity of clay required to change a sand is rarely appreciated. A sand contains 20 per cent or less of the

fine clay particles, whereas a clay soil is any containing 30 per cent or more clay, the balance may be sand. This addition if only 10 per cent clay may convert a sand into a clay soil. Hence relatively large amounts of sand should be used with clay soils, and only small quantities of clay suffice for sands.

Fine grained sands are not suitable for modifying soil texture. The coarser sands are to be preferred and can be depended upon to materially lighten heavy soils if sufficient quantities are used. So far as possible select sands free of lime carbonate, otherwise clover control may be difficult because it thrives in soil abundantly supplied with lime.

### Avoid Blue Clays

Soils bordering streams are often underlaid with a bluish gray, heavy clay subsoil, usually stained with brown concretions. The bluish color is an indication of poor drainage. These subsoils are so compact that they are impervious to water and hence unsuitable for use even in the base of the green. Clubs will be amply repaid for the slight additional cost occasioned by hauling suitable soil from adjacent higher land.

Thorough drainage is fundamental and best provided during construction. Most golfers think of drainage in terms of playing conditions, realizing earlier play is possible in the spring, later play in the fall and following heavy downpours of rain if provision is made for rapid removal of water. Drainage should be considered primarily in relation to turf maintenance and the other benefits will follow naturally.

In the spring, turf grasses in common with all plant life begins growth first on well drained soils. Excess moisture prevents soils from attaining temperatures at which growth commences. Sandy soils are commonly referred to as early soils. They are sufficiently porous to permit excess water to pass down through them. As the season advances turf or areas saturated with water rarely makes satisfactory growth and may even succumb, because the roots fail to obtain needed oxygen.

One club has re-seeded two fairways every spring for years. In this way a fair growth of turf was maintained during the summer only to disappear in the late fall and winter. Poor soil rather than drainage was blamed because a large ditch and haphazard lines of tile had been installed. These fairways run parallel and adjacent

to two steep slopes. During the late fall and early spring, seepage water oozes out from the hill sides and effectively kills the grass.

Permanent turf cannot be maintained until lines of tile are installed above the fairway and along the slope to cut the lines of seepage. Had the condition been recognized not only would money have been saved but better fairways and a more contented membership would have been the result.

Both surface and under drainage of greens are important. Surface drainage especially so on the heavier soils where movement of excess water down through the soil is slow at best. Sandy soils being more porous permit more rapid movement and hence failure to provide for surface drainage is not usually so disastrous. When contours permit, excess water moves off much more rapidly than it passes down through the soil. By providing good surface drainage severe winter damage is frequently avoided. During mild spells when the deeper soil layer is still frozen, surface water formed as a result of melting snow or from falling rain cannot pass down through the frozen soil and is a source of grave danger.

### Drainage Requirements

More attention is being given to tile drainage of fairways, and the benefits of employing competent drainage engineers to design the system is being realized. The depth and distance between lines depends upon the kind of soil. Lines must be placed closer on heavy than light soils. Shallow tile are a menace, subject to shattering from alternate freezing and thawing, and do not receive water from great distances laterally.

When greens are located near slopes look out for seepage water and if present cut it off above the green, for lines of tile in the green rarely effectively receive the water.

Tile should be placed deep enough to effectively cut the seepage and obviously should run at right angles to the direction of flow. It is advisable to back-fill with pea gravel or other similar material.

If greens are to be planted with bent stolons select one of the better strains. These strains produce finer turf, grow more erect, are more resistant to brown patch, and are not so prone to grow coarse when fertilized. Undoubtedly much of the present criticism of bent stolon greens is traceable either to the use of poor strains

or improper care. After greens are once put into play they are difficult to change. This not only involves considerable expense, but puts the greens temporarily out of play.

### Stolon Handling

The various stolon nurseries supervise planting or supply detailed instructions, but these are some points often overlooked. Obviously planting should be sufficiently thick to permit rapid closing. Stolons not more than a year old are most vigorous. Every effort should be made to plant stolons just as soon as received. They are usually shipped in burlap bags, chopped and ready for planting. If permitted to stand in the bags heating takes place and the vitality of the stolons is lowered. Should rainy weather prevent immediate planting, stolons should be stored in a cool place and if possible spread out in thin layers to prevent heating.

The amount and kind of fertilizer to use on greens depends upon the character of the soil. Some acid phosphate often encourages root development and can be safely applied at rates of 5 to 10 pounds per 1000 square feet. It is best applied prior to planting and then raked out the surface soil. Initial applications of nitrogen should be moderate so as not to encourage too coarse growth. If sulphate of ammonia is used it is best applied a week to ten days in advance of planting to reduce the danger of injury.

Until a root system is established the surface soil must be kept moist. This may involve sprinkling twice a day. If the soil is dry at the time of planting, more water may be required at the first sprinkling because dry soil absorbs water slowly.

Many bent greens are ruined during the first couple of months. They must be cut closely from the start. Inexperienced greenkeepers permit the bent to grow unhampered expecting the bare areas to close in more rapidly. Long runners develop, grain and nap appear, and the turf becomes tufted.

### Fertilizing

Early and persistent cutting is essential to the development of erect turf. Clippings should be allowed to fall, and the greens should be top-dressed frequently. Nitrogenous fertilizers should be applied, the amount and frequency of application depending upon the color of the turf, character and rapidity of growth.

Seeded greens usually require more gen-

erous fertilization than those planted with stolons. Grass seed contains so much less stored food than stolons that mineral plant food elements must be obtained from the soil immediately growth begins. Abundant phosphoric acid is particularly important to stimulate root development and insure a uniform stand. Not less than 10 pounds acid phosphate should be applied per 1000 feet of surface and worked into the soil prior to seeding. Some nitrogen should be applied also, about 3 to 5 pounds per 1000 square feet if from sulphate of ammonia and 30 to 40 pounds if one of the better organic nitrogen fertilizers are used. Too much soluble fertilizer must be avoided to prevent injury to the sensitive young seedling. The danger is lessened by making applications somewhat in advance of seeding.

Failure or sparse turf are altogether too common on new fairway seedings and are often traceable to insufficient plant food. Once obtained, thin turf is difficult to improve especially on heavy soils.

Last fall a new club, with a considerable farmer membership ignored what later proved to be sound advice, and seeded fairways without fertilization. This spring these fairways were entirely devoid of turf. The short sparse grass which developed last fall succumbed during the severe winter. This spring before reseeding landing areas and approaches were treated with generous amounts of acid phosphate and moderate amounts of nitrogen. Six weeks later when the sparse grass on the unfertilized areas was one half inch high, the fertilized areas carried dense grass at least two inches high. Had the fairways been fertilized last fall, seed and soil preparation would have been saved this spring and play would have been possible early this year.

Manure is not always essential particularly on soils of good physical condition, namely sandy loams, loams, and silt loams. On heavier soils generous applications disced into the surface produces marked improvement of physical condition. If time permits this same effect can be obtained by growing a green manure crop. One of the legumes, cow-peas, soy beans, sweet clover, etc., should be used because they draw upon atmospheric nitrogen and thus enhance the soil supply. Legumes are heavy phosphorus and potassium feeders, and should be fertilized with a fertilizer containing these ingredients. Nitrogen is not necessary.

As already mentioned phosphorus stimulates root development and hence is most important. A dependable chemical method for determining available phosphorus in the soil has been devised recently and serves as an excellent guide in recommending phosphorus needs. Since phosphorus exerts such marked effects on root development maximum benefits are only obtained when applied in available form, and worked into the soil prior to seeding. Applications of 250 to 350 pounds of acid phosphate usually suffice, but when the soil contains only small amounts of available phosphorus 500 to 600 pounds may prove more effective.

While nitrogen can be supplied later, some should also be used at the time of seeding. The amount depends upon the type of soil and fertilizer material used. Soluble fertilizers must be used sparingly to avoid injuring whereas organics such as cottonseed meal, poultry manure, milorganite, etc., can be applied in amounts ranging from 750 to 2,000 pounds. Sandy soils may need some potash which is best supplied from muriate of potash, usually 100 to 200 pounds per acre suffice. Since this material is water soluble large applications must be avoided or damage may result.

### Plant Food Failures

Failures resulting from the substitution of concentrated plant food materials have often been due to one or both of two causes. Selection of improperly balanced fertilizers or too small applications. A twenty-ton application of manure supplies 150 to 200 pounds nitrogen, and 75 to 100 pounds phosphoric acid. How can several hundred pounds of commercial fertilizer be expected to produce equally good results?

### Low Cost Leads Astray

To sum up the success of a new course from a turf standpoint depends primarily upon proper soil conditions, including adequate drainage, good physical condition, and ample plant food. Then, if high grade seed is correctly sowed in a good seed bed, a fair break in weather will insure good turf on greens and fairways. Construction committees should stress these points rather than low cost figures. The slightly larger expenditures will be more than offset by lower initial maintenance costs and a more contented membership.