

Drainage Research May Pay When Course Turf Thins

By WENDELL P. MILLER

THE cycle which many of the older clubs in the clay belts have passed through may be described as follows:

1. Course construction and installation of water and drainage system.

2. The struggle to develop turf on scalped soils and exposed subsoils occasioned by construction.

3. Operation and the development of fair turf.

4. After reaching a peak, years of use and packing down of the course, gradual loss of turf, growth of weeds, bare spots, increased cost of maintenance, breakdown of original drainage tile.

5. The urge for fairway irrigation (the surest way to make a bad matter worse) as a cure-all; also, rainbow chasing after cure-all fertilizers.

6. Investigation—the discovery that the soil has lost its virgin porous structure, is much less receptive of rains, and low in fertility—and a decision for proper drainage.

7. Marked improvement in fairways following re-drainage.

8. A program of planned turf development bringing the fairways to finest condition; reduction in cost of maintenance.

9. Installation of fairway irrigation facilities under favorable conditions for results.

Drainage is intangible, so to speak. It is largely underground. Irrigation is tangible, it is on the surface. The members see the equipment and the outlets. They see water put on the course as needed—and the fairways remain green during the dry season. Members everywhere readily accept the idea of fairway irrigation. Fairway irrigation installations are usually dependent upon availability of funds, not upon approval of the idea. But drainage is entirely different. The members have only a hazy idea at best of what artificial drainage is and how it works. Snows melt, rain falls, the water disappears and the ground becomes hard and dry. This is a natural phenomenon. The exact manner in which it is facilitated by artificial means

and the effect of the artificial drainage on the soil and turf is not at all understood by those who have not intimately studied the subject.

Out of Sight—Out of Mind

Proper artificial drainage which is entirely out of sight quickly removes excess water in the spring or any other time (not however beyond the water holding capacity of the soil which is substantially increased by proper drainage). The club members cannot see the drainage system when it is present—they do not see it operate—and not understanding just how it operates, do not give it credit for its accomplishments. And when proper drainage is lacking, likewise the members cannot see that this lack prevents their full enjoyment of the course, prevents proper turf development, limits the water holding capacity of the soil, permits the course to dry out much faster than it would if properly drained, and actually increases the cost of operations in many ways.

As this is written three committees of engineers are functioning for three well known old-timer clubs. All three committees were appointed primarily to deal with fairway irrigation. One committee ascertained that its club has a legitimate need for fairway irrigation at this time. This committee determined and recognized the necessity for future drainage requirements, possibly in six to ten years. But inasmuch as there is every prospect of condemnation of its property within that period the committee was unquestionably warranted in proceeding with fairway irrigation, backed by a soil survey, turf program, drainage study, and several obviously needed supplementary drainage lines. In this particular case the hydraulic engineers admitted their inability to design an irrigation system embodying the best features of turfed area irrigation. This committee will secure positive results.

Neglected Drainage Serious

Another committee fortunately includes an engineering member of considerable ex-

perience and sound judgment. Incidentally he is a village father who understands his village water, sanitary, and storm water situation. The golf course is located within the village and this engineer has been able to direct the irrigation committee into an exhaustive investigation of both the drainage and storm water disposal. This engineer has already developed the fact that his golf course is taking off much of the village surface and sub-surface water. This committee will get results because of the care taken and orderliness of its procedure. It so happens that this club, after 20 odd years of hard usage, is rapidly developing a serious agricultural problem in which drainage, soil conditioning, and the turf program are of paramount importance to irrigation. Recognizing this, the engineer mentioned will be able to steer his committee along rational lines.

Where Committees Fail

A third committee is about to cost its club much future grief and some unnecessary present cash outlay. In this case the green committee has ordered fairway irrigation installed and turned the matter over to municipal engineers who are members of the club. This club has a distinct and prior separate problem of drainage, soil conditioning, and turf program which is fundamentally prerequisite to fairway irrigation. More serious than this is likely to be the result of continued applications of water to soil that already is afflicted with the "water indigestion." Further, when the necessary drainage is installed in the future, much hand trenching will be necessary because of the presence of the water lines which prevent the use of trenching machines. This committee has the "cart before the horse." Obviously, they are proceeding blindly and their club must suffer accordingly.

Cites Examples

Sometimes a new course is unplayable; never dries up. For example, the North Shore G. C. at Chicago was designed and constructed in 1922, opened for play in 1923, and by summer of 1924 was pronounced unplayable. The original drainage system was abandoned and in the fall of 1924 a new system was designed and installed. The following year, 1925, showed positive results and by 1927 the drainage was in complete effect, with marked results. Here was a case where the necessity for drainage was obvious.

Midlothian is one of the older clubs in the Chicago district. Originally a very

good course, in 1923 and 1924 the course was in bad shape and getting worse every year. The original drainage was inadequate in respect of the use to which the course was put and by 1925 the ground was packed so tight the old drainage facilities failed to function. In 1925 a complete new drainage system was installed with very satisfactory results in subsequent years.

The Detroit G. C. (36 holes) when seven years old (1926), was almost unplayable, except during droughts. It is an actual fact that in the seventh year of operation of this course the players frequently wore boots. In this instance it was not necessary to tell the club that their drainage system was a failure. A properly designed system corrected their difficulties in one year.

Tile Breakage

Packing and sub-surface clodding of the older courses is accentuated by the physical breakdown of the tile itself, accompanied by partial or complete stoppage of the tile lines. Alternate thawing and freezing of the tile, strains resulting from the stresses of soil pressures and surface pressures, and especially the expansion of frozen, wet ground, together with the chemical actions of soils and waters, cause the breaking and often the complete disintegration of the tile. Untoward results of this kind have been observed after one or two years, though generally serious results are observable only after a period of years.

The foregoing situation is further accentuated for all of the old clubs on tight ground, and most of the new clubs built upon lump sum price contracts, in that tile varies widely in quality (and in price) and that even experienced contractors cannot detect defective tile because defective tile generally looks good to the eye! There is only one way to determine the quality of the tile and that is to test it in the physical testing laboratory. Tile not bought to exact specifications and tested before installing, is the cause of much trouble for many clubs. When the older clubs installed their tile drainage systems, tile manufacture had not reached its present stage of development and tile was not sold on specification as it is now.

As to the new clubs, built upon lump sum contract basis, rarely will you find in these courses tile bought upon rigid specification and test.

Surveys Reveal Faults

Two of Chicago's oldest clubs (Onwentsia, 1893, and Glenview, 1899), and a new

club (Ridge, about 1918), after years of successful operation began to experience severe turf difficulties, weed growths, winter kill, and a shortening of the playing season. These clubs did not know what the trouble was. One of the clubs, Glenview, was preparing to spend large sums for water supply and fairway irrigation, as a remedy. None of these three clubs knew that faulty drainage had finally proved ineffective and had permitted soil conditions to develop which precluded satisfactory fairways. The prompt recovery of the turf after new drainage installations, and lengthening of the playing season at these three clubs not only proved the correctness of the diagnosis, but afforded the members complete satisfaction, not to mention providing the fundamental conditions prerequisite to successful fairway irrigation.

On Sunday, March 16, 1930, Glenview had 60 players who enjoyed a dry course. Here we have an outstanding example of the beneficial results of proper drainage. Incidentally, it may be added that the Glenview club is spared the expense of spring conditioning occasioned by erosion of slopes, heaving of the turf, winter kill caused by air starvation, and other untoward effects of inadequate drainage.

These cases show that there is something to drainage beside connected tile lines and provision for surface run-off. All of the clubs mentioned had more or less sub-surface tiling. What they lacked was drainage based upon an accurate knowledge of their soils, and high quality tile.

Drainage Demands Research

The field of drainage engineering is greatly circumscribed by the fact that engineering colleges have not coordinated the study of soils and soil research with hydraulics. Soils research is a function of the agricultural colleges and hydraulics is a function of the engineering colleges. These two branches of modern science usually do not meet under the same roof and for this reason civil, mechanical, and other engineers going out of the engineering colleges are not grounded in the subjects concerning soils which are dealt with only in the agricultural colleges.

For what use is a drain tile if the water cannot get through the soil to the tile? The soil itself is the starting point in drainage engineering. There is not one golf course in a hundred with an absolutely uniform type of soil over its entire area. The problem then is to determine the char-

acteristics of these various soils that exist on each golf course. The soils must be classified according to their textural qualities and ranged according to their drainage abilities. The next step is to determine the area and location of each type of soil.

There is no man living who can dig, feel, taste or look at a soil and tell how much sand, silt, clay, colloidal clay or organic matter the soil contains, or whether it is alkaline or acid in reaction, or how far apart the drainage lines should be placed, how deep they should be placed, or where they should be placed.

The story of the soil and its drainage requirements can be determined only by a complete study of its physical qualities in the laboratory, combined with a thorough study in the field, and these, together with the topographical map and the judgment and experience of the drainage engineer, form the basis for the design and specifications of the drainage system.

Drainage Reduces Water Needs

It seems paradoxical that when excellent provision is made for the removal of water, less water is required to maintain the proper moisture content in the soil and keep the turf in best condition. Good drainage, by causing a chain of physical changes in the natural undrained soil, actually increases the absorption and moisture holding capacity of all types of soils. Thorough tile drainage increases the content of capillary moisture in the soil to such extent that this factor alone is of sufficient value to make thorough drainage a sound investment in reducing the cost of maintenance.

Capillary moisture, which is the only form of soil moisture of value to turf plants, moves in all directions in the soil regardless of the force of gravity but the rate of movement toward the surface is largely dependent upon the tilth of the surface layers of soil. Drainage keeps the soil mellow and open. Puddled soils, that is, soils that have been compacted by rolling or trampling when full of free soil water, contain a minimum supply of capillary moisture and the natural replacement of the capillary moisture is thus reduced to a minimum, hence more artificial sprinkling is required under such condition. If saturation is maintained for more than a few days, air starvation results in killing the turf.

Properly installed tile drainage produces and maintains the proper aeration of the soil.

Air and water cannot occupy the same space in the soil at the same time.