Golf Course Drainage

A series of articles written exclusively for The National Greenkeeper by America's foremost golf course drainage engineer

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THE cost of a drain is made up of two elements; (1) the cost of construction and (2) the cost of maintaining it in working order. The most profitable drain is that which costs but little for construction and maintenance, or that which, costing more yields correspondingly greater profits. The cost is less to drain thoroughly with tile than with open ditches. Tile keep their depth, and with the trench filled over them they leave the land free for play and maintenance. Uncrossable open ditches are objectionable. Shallow open ditches and sodded surfaces are better in this respect, but they are not deep enough for underdrainage and suffice only where surface drainage is the sole requirement. Good underdrainage requires lateral drains three feet deep and with a good outlet.

Editor's note: Mr. Miller was formerly Extension specialist in Agricultural Engineering at Ohio State University, and his background of training includes several years of study in soil physics and chemistry. Since 1920 his unusual abilities have been devoted to solving the drainage and soil improvement problems on golf courses

Tight Subsoils: In a tight subsoil water moves no faster toward an open ditch than it does toward a tile of the same depth because it has the same path to travel to reach either one. An open ditch or surface run may remove some water from the surface of tight clay without subjecting it to the slower process of seepage. This advantage is lost, however, where flat areas are not provided with good, broad, shallow, open ditches and where the tight clay of the subsoil is covered by a foot or more of loose soil, which, if dry, absorbs water readily. Surface obstruction traps the water in the subsoil, and lines of tile 30 feet apart and costing from $150 to $200 an acre are required to overcome the damage done by poor surface drainage. It is cheaper to keep the water out of a tight soil than to take it out after it gets in. A $100 tile drainage system aided by broad shallow open ditches costing $20 per acre may do better than the $200 system alone.

Effect on Floods: Thorough tile drainage does more to reduce flood water than is commonly believed. When several parallel lines of tile lower the water-table three feet below the surface of the soil, they not only give the plant roots a better opportunity for development, but they put the upper three feet of soil in condition to absorb a rainfall that a saturated soil would shed as surface water. Using the upper three feet of soil as a reservoir from which the tile may have two weeks' time for removing the water, an 8-inch tile may be ample for an outlet, where if the water had to escape suddenly as surface water a ditch 3 feet wide at the bottom, 6 feet deep, and 15 feet wide at the top would not be too large. By working 24 hours a day, a good tile drainage system gives the soil such absorptive powers that excessive demands are seldom made upon the outlet at any one time.

Importance of the Outlet: A drainage system is no better than its outlet. The smaller lines of a tile drainage system discharge into the larger ones, and the larger ones discharge into outlet ditches or ravines. The top of the water in the outlet drain should be below the outlet of the lateral tile except possibly for a few hours after a freshet when a submerged outlet is permissible. Tile outlets discharging large quantities of water all winter may be permanently submerged with safety, but their efficiency is impaired nevertheless.

The Right Drain for the Right Place: To drain wet lands, first find the cause of the wetness and then prescribe the remedy. The water is either entering too fast or leaving too slow. High or steep land above an area causes too much water to enter it. Lack of fall within or below an area keeps the water from getting away. Fine subsoils also retard the movement of water.

Drainage may be effected either by carrying the water around important areas or by facilitating its passage through it and away from it. If the water is entering too fast either as seepage or as surface water from higher land, try to cut it off at the upper side and carry it around the area to be drained. The more water kept out, the less there is to be taken out. The damaging water that enters in spite of the intercepting drains may be removed either by getting a better outlet, or by putting in better drains to a present outlet, or by supplying both of these necessary features.

Potholes: Potholes are depressions which have no natural surface drainage. Drainage is usually possible only by a deep cutting through the lowest point in the surrounding ridge. Occasionally the conditions in the subsoil are such that a vertical drain may be dug through a tight layer of soil into a more open dry soil below. Frequently intercepting surface drains may be installed to keep surface water from entering potholes. This lessens the demands made upon their outlet drains and reduces

the expense of drainage. The drainage of small potholes in playing areas is highly desirable. It is easier to drain them than to dodge them when wet.

Mistakes have been made in draining potholes only deep enough to permit the surface water to escape. Successful drainage calls for a tile 3 feet below the surface of the ground at the lowest point in the pothole. In small potholes the required covering for the tile may be obtained economically by scraping in earth from the surrounding high land.

Seepage Marshes: At the foot of almost every hill there is a narrow zone kept wet by seepage from the higher land. This is most serious where the hills are high and where there are seams of sand or gravel in the subsoil through which water moves easily until it comes to the surface. Frequently large springs are caused in these places. In other places millions of smaller springs, each doing its share to keep the land wet, take the place of a few larger springs, and zones 80 rods and more in width are kept wet continuously by the seepage from the higher land. Seepage marshes, although relatively high and sloping, are frequently the wettest of lands.

The most economical way to drain the seepage marsh is to cut off the seepage water before it enters. If a line of tile can be laid in the layer of sand or gravel bringing in the seepage water, it may dry the area for 20 rods below it.

Seepage areas can be drained easily because they usually have a liberal fall—sometimes 1 foot in 100 feet. Their drainage is desirable also because they are adjacent to higher playing areas. The drainage of seepage marshes occurring in narrow swales is particularly desirable for the double reason that they increase the playing area and decrease maintenance costs.

(*To be continued*)

More Attention for Fairways

THE present day golfer demands better fairways. Golf clubs have been too much inclined to put more seed on their thin fairways and to overlook the fact that the grass already there was starving to death. Plants require food just as animals do. Greens are top dressed and fed regularly, but many fairways are allowed to shift for themselves. Much money is wasted in seeding impoverished fairways. Much money can be saved by properly fertilizing them.

At one Chicago district club it was the custom to spend about fifteen hundred dollars a year on seed for the fairways, and nothing on fertilizers. The soil was a worn-out clay hill farm. The turf was thin; bare patches were the rule rather than the exception. A change in policy brought fairway feeding. The first year under the new plan four hundred dollars was spent for seed and about a thousand dollars for fertilizer. The results were most satisfactory. The ground was completely covered with turf the first year and the grass stayed green much later in the summer. After the first year no seed was used on the fairways except for repair work, but fertilizer was used each year. There has been no winter kill and no bare spots since that time. Many other clubs have had similar experiences.

Unless the soil contains sufficient properly balanced plant food, the individual grass plants will not spread and cover the ground. Weeds will come into such thin spots and rob the grass of what little plant food may be there. The parallel veined plants such as all fairway grasses thrive on neutral or slightly acid soil. An alkaline soil promotes the growth of the broad leaved plants such as clovers and most weeds.

Fertilizing to Eliminate Weeds

All greenkeepers have seen the effect of the consistent use of sulphate of ammonia in eliminating weeds from greens, due to its residue of acid sulphate. A fairway fertilizer should also always be so compounded as to give an acid reaction and residue. The continued systematic use of such a mixture will gradually eliminate most of the objectionable weeds from fairways. Practically all grasses will grow in acid soils; few common weeds such as the dandelion, plantain, etc., are happy under such conditions, and they will eventually die out if such soils become well sulphated.

Fairways are usually not watered. The problem is to produce a grass plant of sufficient health and vigor to grow throughout the playing season, to maintain a thick solid turf that will afford a perfect lie and will quickly replace itself when divots are removed and when otherwise injured. A complete fertilizer containing all the plant foods, ammonia, phosphoric acid and potash is necessary.

A portion of the ammonia should come from nitrate nitrogen so as to be available at once while the soil is cold; the balance should be largely in the form of sulphate of ammonia, which becomes available during the growing season and leaves in the soil the sulphate residue so discouraging to weeds. A well balanced combination has been found to be a fertilizer analyzing 6% ammonia, 8% available phosphoric acid, and 6% potash.

(*Contributed by C. H. MacDowell, President Armour Fertilizer Works, Chicago.*)