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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HERE are a number of reasons why underdrainage benefits growing turf. In taking some of the important reasons up, one by one, it is well to study them carefully, in order to determine exactly why proper drainage has so direct a beneficial effect upon the healthy growth of grass.

Improves the Physical Character of the Soil

Underdrainage aids greatly in the formation of soil granules. The granular structure is particularly desirable in fine grained soils, as they then have the desirable properties of coarser grained soil in permitting the rapid passage of moisture and air. One of the important factors in soil granulation is alternate wetting and drying.

When a soil is saturated the soil grains are held apart, and partially floated, by the water. In addition to this, the water acts as a lubricant so that the soil will not support the weights necessary in maintenance and play. When the soil is saturated continually the soil granules are broken down and the smaller grains move into the spaces between the larger ones. In this condition the soil becomes almost a compact mass and is termed puddle. Underdrainage prevents puddling.

These actions and conditions are often expressed by saying that underdrainage makes the soil more loose, more open, or more mellow, and that standing water, or saturation, packs it. These are but different methods of expressing the conditions discussed above.

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

Improves the Aeration

Many authorities hold that the physical changes which cause a more rapid and greater passage of air through the soil are the largest single benefit of underdrainage, in that thorough aeration is one of the most important factors in turf production. Underdrainage improves the aeration in two ways; it removes the surplus, or gravitational moisture, thus leaving the soil pores open for the passage of air; and promotes soil granulation, thus providing larger channels for the circulation of air.

Increases the Supply of Available Plant Food and Moisture

This is probably the most important effect of underdrainage upon the soil, but it was not taken up till now because of its dependence upon (1) and (2). This effect is due to several actions, all resulting from the drainage, the most important of which will be mentioned.

Plant roots take up food that is in solution in soil moisture; they can take up this moisture only when it occurs in the soil as capillary moisture; and the capillary moisture is present only after the surplus, or gravitational moisture has been removed. This chain of facts makes it at once apparent how underdrainage may increase the available supply of plant food. Underdrainage lowers the plane of saturation, thus making available the food supply of a larger volume of soil.

By causing the formation of granules, the underdrainage increases the amount of capillary moisture and thus increases the food supply. Underdrainage improves aeration which in turn causes the formation of additional plant food in the soil.

Underdrainage promotes the growth of the desirable forms of soil organisms and retards the growth of the undesirable forms. If the soil is saturated, the products of the undesirable bacteria are held in the soil causing the destruction of all organisms. The desirable organisms increase the amount of plant food in the soil by converting unavailable elements in the soil into available plant foods.

Underdrainage increases the supply of plant food through chemical changes which are dependent upon this moisture condition.

It has already been explained that underdrainage causes certain changes in the physical character of the soil and thus increases the maximum content of available or capillary moisture. This explains why grasses in a thoroughly drained area withstand drought better than those in a similar undrained area. Underdrainage increases the supply of available plant moisture by removing the injurious surplus gravitational moisture from a wet soil and by causing physical changes in the soil that result in the storage of an increased supply of available moisture in the soil after this surplus has been removed. The benefits of underdrainage in increasing the supply of plant food and moisture are well illustrated by the deeper green color and more luxuriant growth over tile line.

Raises the Average Temperature, and Increases the Length of Playing Season

The specific heat of water is much higher than that of soil. The greater the proportion of water a soil contains the more heat it requires to raise the temperature of the soil a given amount. The continual evaporation from the surface of a wet soil reduces the temperature or retards the increase in temperature. The heat applied to a given soil area is fairly constant, so that if this heat must be used up in evaporating water the temperature of the soil body is not raised.

Drainage removes the excess water from the soil, reducing the heat required for evaporation and causing the soil body to warm up more readily. As a result of this, a drained soil warms up much earlier in the spring, and so lengthens the growing season. This enables the greenkeeper to start his spring work earlier, which is especially valuable in a so-called "backward" spring. The growth of the grass upon drained land is greatly benefited by the high temperature that prevails on drained land in the spring and fall. Investigators have found that at a depth of seven or eight inches a drained soil is from 12 to 15 degrees warmer than an undrained soil of the same nature and in the same climate.

Reduces Heaving

It is often noted that posts and dandelions have been raised out of the ground during the winter. This heaving is due to the freezing of a wet soil. When water freezes it expands one-eleventh of its volume and in a saturated soil this expansion must be upward, the amount of the heaving depending upon the amount of water in the soil and the depth to which it is frozen. The same action tends to raise the roots of the grass out of the ground, as the soil settles back after thawing, more rapidly than the plant root. This heaving also breaking many of the small roots and is the actual cause of winter kill.

Reduces Erosion

In an undrained area all of the rainfall must either be absorbed by the soil or pass away over the surface. In a continued rainy season the soil soon becomes saturated after which all the rainfall must flow away over the surface. The particles of the saturated soil are easily displaced and carried away by the water.

In an underdrained area the soil has a greater water capacity and allows of a continual removal of the surplus water by the drains. This greatly reduces the amount of water which must pass away over the surface and thus reduces erosion. Underdrainage of slopes will often prove a profitable investment if installed for no purpose other than reducing or preventing erosion.

Surplus Water Not Used by Turf

Greenkeepers often remark that they do not need tile underdrainage, that their land has such a great amount of natural drainage that underdrainage is not needed. This is a great mistake. Remember tile underdrainage is essential in both hilltop or rolling lands and in low lands. Tile underdrainage helps in time of wetness or drought, for the simple reason that it removes the surplus water that is a detriment but retains the water needed for the growing plants and supplies same in time of drought due to the capillary action.

Better drainage (1) makes lands dry up earlier in the spring and prevents water standing after rains; (2) warms the soil so that the season is lengthened in both spring and fall; (3) ventilates and increases air content of the soil so that organic matter is decomposed; (4) removes the injurious salts and acids; (5) favors a deep root development; (6) prevents winter kill; (7) prevents shrinkage and cracking of soils in periods of drought.

Growing Chewing's Fescue On Hard Clay Fairways

By FRANK ERMER, *Secretary*
Cleveland District Association of Greenkeepers

IN picking up the January issue of THE NATIONAL GREENKEEPER, one of the first articles that attracted my attention was one by Lyman Carrier on fescue grasses. In this he explained how true red fescue, or more commonly called Chewing's fescue, spreads by stolons into a close, fine mat.

I have had a little experience with fescue on our fairways, which were of very hard clay, and baked badly in summer. It was quite a task to get what Chewing's fescue we had to spread and fill in the bare and cuppy places you hear the golfer howl so much about while playing summer golf.

First of all I took a disc with blades set straight, and cut the fairway in three different directions, then top dressed with a good grade of screened compost. On top of this surface I seeded the poor spots with Chewing's fescue, mixed with a small quantity of red top.

As there were still plenty of bad cuppy places, I decided not to use any seed, but to try and force the fescue to spread over them. These spots I spread with well rotted manure, raking it in well to make a kind of mulch around the grass roots. With this treatment I now find the fescue making rapid strides in filling in the bare spots and living up to its reputation of making a fine, closely matted turf.

George Sargent of Scioto Country Club, Columbus, Ohio

New Member

In joining the National Association, Mr. Sargent wrote President Morley, as follows:

"I wish to congratulate you upon your splendid work in founding this organization. Such work is definitely constructive, and holds a value few of us appreciate."

Mr. Sargent is now preparing an article for THE NATIONAL GREENKEEPER, from his long experience in greenkeeping.