DRAINAGE—
The Key to Better Golf Turf

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Good drainage is essential to the production of healthy turfgrass! The greatest number of all the problems we encounter on golf courses either directly or indirectly involve drainage.

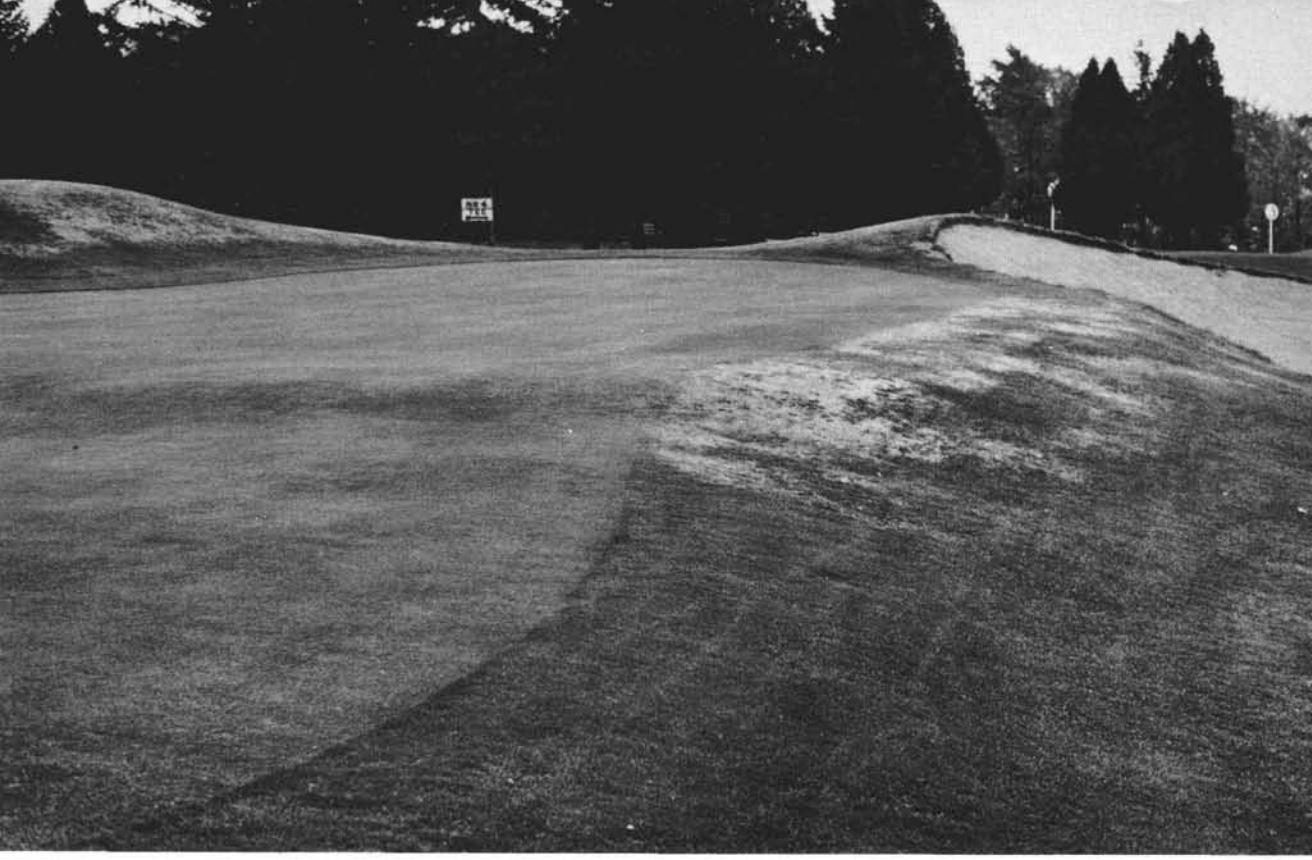
Effects on Growth

Drainage promotes many conditions favorable to the growth and development of plants and soil organisms. It promotes aggregation and reduces the effects of traffic and compaction. Even during the winter when turf is in a semi-dormant state, drainage is extremely important. It reduces damage from the alternate freezing and thawing action of the soil. Good surface drainage in northern regions can prevent the loss of turf, which often results when surface moisture collects and freezes in close proximity to the crown of the grass plant. Lowering the water table also promotes the development of a deep and effective root zone.

Each textural class of soil has different water retention as well as drainage characteristics. The textural class of a soil is determined by the relative amounts of sand, silt and clay that are present. The percentage of organic matter, although small, has a tremendous influence on the chemical and physical properties of soils. The drainage and moisture retention properties of a soil are essentially a product of pore size and not total pore space.

There are two size-classes of pores in soil; the large, or macropores, and the small, or micropores. Moisture in the large or macropores is subject to the pull of gravity, while the moisture in the micropores is held with such tenacity

Drainage problems not eliminated during construction must be solved at a later date.



Mounds and slopes tend to dry excessively and often require hand watering.

that it can be moved upward through the soil profile by capillary action.

A sandy soil consists primarily of macropores and is droughty by nature. Clay soils have primarily micropores and are basically wet soils. A well-granulated silt loam at the optimum level of moisture for plant growth would have a total pore space near 50 per cent. In this case, 25 per cent of the pores would be micropores containing moisture and 25 per cent would be macropores containing air.

The old saying, "In the spring, a wet soil is a cold soil" holds true for our turfgrass areas. Good drainage is imperative in the spring if the soil is to warm up rapidly and properly.

Soil aeration is perhaps the factor affected to the greatest degree by drainage. Generally one-half or more of the pore space of a well-drained soil is occupied by air. This is again a factor of soil texture as air adequately supplied with oxygen is usually contained in the large or macropores.

In the fine-textured soils, however, air space may be well below 50 per cent of the total porosity. Most of the pores are micro-size and tenaciously retain their water.

The atmosphere that is present is likely to be too low in oxygen to supply plant roots with the amounts of oxygen needed for metabolic processes. Under these conditions nutrient intake is slowed down even in the presence of abundant amounts of essential elements and the growth of aerobic soil organisms is adversely affected. The lack of adequate percolation of water through the subsoil can also result in an excess accumulation of soluble salts in the root zone.

The most apparent effect of poor drainage and soil aeration is a decrease in the rate of organic matter oxidation. This reduction seems to be associated more with the lack of oxygen than with the accumulation of excess carbon dioxide. The slow rate of decay of plant residues in swampy areas is an exaggerated example of how a lack of oxygen prevents rapid decomposition. All aerobic organisms are unable to function properly in the absence of gaseous oxygen. This includes the symbiotic and non-symbiotic nitrogen fixing groups. The anerobic organisms that are able to function under these situations, using combined oxygen, consistently yield reduced forms of iron and manganese, which are phytotoxic.

If a turf area is saturated by a heavy rain and then exposed to bright sunlight, the turf, in many instances, will severely wilt in a short period of time. This condition, "wet wilt," is most severe under conditions of poor drainage. It is caused by a retardation of water absorption

as a result of water replacing the soil atmosphere and leaving the roots poorly aerated. When transpiration occurs at a rapid rate in bright sunlight, the combined effect of accelerated water loss with retarded water absorption results in the development of a water deficit in the plant.

There are several reasons why poor aeration and drainage retard water absorption. They slow down the metabolic rate and, conversely, the uptake of nutrients and moisture. Secondly, the poor exchange of gases in the soil could result in an accumulation of CO_2 which appears to increase the viscosity of protoplasm and reduces permeability. This in turn retards water absorption.

Pathogenic turf fungi are promoted under conditions of poor drainage where liberal quantities of moisture are available. Saturated soils and high localized humidity create ideal conditions for their rapid development. Under conditions of prolonged excess moisture, you get a development of soft growth, a low pH, and a state of reduced vigor which facilitates invasion by pathogens.

Solving the Existing Problems

In many cases the only remedy for poor drainage on established greens and tees is reconstruction. Generally, reconstruction is the answer where existing soil has poor texture and structure, or the area lacks surface drainage. Minor depressions or low areas that hold surface water can be eliminated by stripping off the sod, filling and grading the area and replacing the sod. In northern regions where water collects in depressions when the soil is frozen, tile drains are of no value. Surface drainage is the only answer!

Sandy areas and steep banks around greens and tees tend to dry excessively and require frequent supplemental moisture to maintain satisfactory growth. Aeration and soil conditioners have been effective in reducing runoff and conserving moisture in these areas.

Tile or slit trenches can be used to correct poor drainage caused by impervious subsoils. Drains function on the principle that they can conduct water faster than the surrounding soil. Where a fairway has been constructed on heavy soil that requires uniform drainage over the entire area, a simple gridiron or herringbone pattern of drains will usually remedy the situation. Where tile or slit trenches will not function properly because of high groundwater levels, open ditches or grass waterways would be more suitable. In extensively low and wet areas, relief wells or reservoirs equipped with relief pumps may be the only means of lowering the water table.

Drainage encourages healthy, vigorous growth and reduces management problems. Drainage also keeps the player's feet dry, provides him with firm footing and smooth resilient surfaces for putting. Drainage promotes better overall conditions for both golf and turf.

Alexander Joins Green Section

Dr. Paul Alexander, recently of Clemson University, Clemson, S. C., has joined the USGA Green Section Staff effective July 1. He will be based in the mid-continent regional office in Chicago with F. Lee Record.

Dr. Alexander received his Bachelor of Science degree from California State Polytechnic College. He later earned a Masters degree and Ph.D. from Ohio State University. Most recently Dr. Alexander served in the Department of Horticulture at Clemson University.

He was actively involved in producing the USGA Green Section movie, "The ABC's of Putting Green Construction," which was filmed at Clemson. He has a smooth golf swing as well as an excellent background in turfgrass management.