DRAINAGE IS MAJOR TURF NEED

Rutgers short course paper

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THE removal of excess or unnecessary water by drainage is continually growing in importance as scientific knowledge gives us greater assurance of the benefits to growing plants and reduces the fear that drainage will remove water which might later sustain growth. Plants can use only capillary moisture or that moisture which clings to the soil particles and does not move downward in response to the force of gravity. Free water moves downward by gravitation and tends to form a water table thus filling the pore spaces in the soil and driving out the air. Air as well as moisture is necessary to plant growth.

Removing the free water or lowering the water table improves growing conditions by increasing the zone in which plant roots may feed, resulting in a larger root system, an increased supply of capillary moisture, more air, a warmer soil and more available plant food. It is now generally believed that the water removed by drainage can only benefit rather than hinder plant growth. Sturdier plants with deeper root systems and larger areas of root pasturage can withstand more severe drought than those with limited root systems cramped during early growth by excess water in the soil.

Nature has provided soil conditions allowing abundant plant growth as well as conditions under which little vegetation can exist. Nature's methods of drainage are surface run-off and percolation through the soil. Water moves downward in the soil much more rapidly than laterally hence the tendency to form a water table. Heavy soils so greatly retard percolation that free water may be held for too long a time.

Twelve Benefits of Proper Drainage

Man has long known that he could improve plant growing conditions by providing channels for the escape of free water and the lowering of the water table. He may also improve surface run-off conditions by open ditches, terraces and grading. Underground channels have been made of stone, brush, logs, wooden box drains, and various forms of tile.

Any form of drainage which effectively removes excess water from the soil within the requisite limit of time improves the crop, soil and water relations, thereby increasing the productive capacity of the soil. The result is a hardier vegetation, more luxuriant growth or a higher crop yield. Benefits of drainage so effectively stated by Powers and Teeter in their book "Land Drainage," in abbreviated form, are:

1. Removes excess water—Lowers the water table or removes excess free water, vacating open pore spaces and drawing in air.
2. Increases the capillary supply of moisture—A lowered water table increases the zone in which capillary water, clinging to the soil particles, is available to plant roots.
3. Improves the soil-structure—A wet soil is pasty and will not crumble in response to tillage, hence cannot readily become loose and friable. Drainage allows deeper root penetration followed by increased bacterial activity and leaving a residue of vegetable matter.
4. Increases root-pasturage—Lowering the water table or the zone of free water proportionally increases the area in which roots may feed.
5. Diminishes the effect of drought—Vegetable matter in the soil increases its water-holding capacity which coupled with a larger zone of capillary water greatly increases the reservoir of usable soil moisture. Experimental data show that drained soils may contain a higher percentage of moisture at the close of a dry season than adjacent similar but poorly drained soils.
6. Affords better air circulation—The

The first caddie tournament in West Virginia will be played at White Sulphur, July 25. All West Virginia clubs have been invited to send the winner and runner-up of their caddie tournament to White Sulphur where they will be guests at the Greenbrier hotel.

Reported Stolen—One 24" Jacobsen power putting green mower, serial number P 13-1216-12. Anyone having information on the whereabouts of this mower is requested to notify GOLFDOM at once.

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continued downward movement of the water afforded by drainage draws air into the pore spaces thus vacated and supplies the oxygen and nitrogen needed by plant life and soil bacteria.

7. Makes the soil warmer—Excessive vaporization from a wet soil may reduce the temperature 3 to 8 degrees. A warm drained soil permits earlier germination and more rapid growth.

8. Lengthens the growing season and firms the soil—A warm, drained soil becomes firm much earlier. As frost releases the water drainage removes it leaving a firm sod or a workable soil early in the season.

9. Assists decay and nitrification—Soil bacteria causing the decay of vegetable matter secure oxygen and nitrogen from the air and build up the reserve of nitrogenous plant food. Water-logged soils deficient in air encourage denitrifying bacteria rather than the nitrifying types.

10. Prevents erosion—In poorly drained soil excessive surface run-off removes much of the most valuable soil. Good drainage permits absorption of the water carrying plant food into the subsoil and encouraging deep root pasturage.

11. Prevents heaving and winter killing of grass and grain crops—Freezing wet soil causes heaving, lifting the crowns of plants, shearing the roots or exposing them to extreme cold.

12. Prevents the rise of alkali — In some soils excessive vaporation brings to the surface soluble salts which will in time inhibit plant growth. The common salts, sodium chloride, calcium chloride, sodium sulphate, magnesium sulphate and sodium carbonate give little trouble in this region because the annual rainfall is sufficient to prevent their accumulation.

Open Ditch and Tile Drainage Merits

Open ditches have the disadvantage of cutting land into smaller plots, or requiring frequent cleaning and of being less effective in removing the excess water from the land. They are seldom deep enough to draw water from the lower subsoil and are too far apart to be effective in this way. The action of water on the banks of a ditch tend to seal it against infiltration of water from the soil. Hence open ditches serve primarily as channels for surface run-off. The advantages are that they may function when an outlet sufficiently depressed for tile drainage is not present, that they require less slope and are more effective and economical when large quantities of water are involved. Sub-surface drainage ultimately empties into some form of open ditch.

Ditches Require Little Slope

Large ditches will function with slopes as little as 1 ft. per mile. Smaller ditches operate better on 2 or 3 ft. per mile. One ft. per mile is roughly equal to ¼ in. per 100 ft.

Tile drainage has the advantage of being completely covered and offering no obstruction on the surface of the land drained. It affords much more effective drainage and requires no attention excepting to keep the outlets unobstructed. When an entire area must be tiled the cost is rather high. Spot drainage following the natural contour and effecting only low wet areas is more advisable. This is usually called the natural, grouping or random system of drainage. Other systems, named for their form, are the grid system, herringbone system and double main system. These may be used for complete drainage of an area or as parts of a natural or grouping system.

Tile may be made of clay or concrete, clay being the more common. Much concrete tile is subject to deterioration from the action of soil acid or alkali. Clay tile is made in vitrified, salt glazed and hard burned types. The last, being lower in price and yet satisfactory, is most commonly used. Porous walled concrete tile, also available and apparently resistant to soil acid and alkali, is higher in price and used chiefly where extremely rapid drainage is needed. Agricultural tile is round in form and sold in 1 ft. lengths. It is rated in size according to its inside diameter; the 4 in. size being the smallest generally recommended. A slope of 3

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For a number of seasons, Pine Brook GC, Gloversville, N. Y., has allowed the general public to use certain portions of its grounds for recreational activities if they did not interfere with the golf play. But that is all over now, because the public carelessly and often maliciously committed a long series of abuses to the club property during the past two years. Now the grounds are posted and local police are cooperating in giving the bum's rush to trespassers.

inches per 100 ft. is usually the minimum fall for laterals. These limits are intended to guard against excessive silting which will ultimately choke the tile. Larger size tile used as mains carrying considerable water may be laid as flat as 1 inch per 100 ft.

The depth at which tile will provide best drainage and the frequency or spacing between lines is effected by the soil, its drainage characteristics, the use of the land, the degree of drainage necessary, the allowable time for complete drainage, the underlying geological formation, topography, annual rainfall and the elevation of the outlet. Placing the tiles at a greater depth permits wider spacing of the lines and materially reduces the rate of drainage. For agricultural purposes the allowable time for complete drainage (48 hours) permits 2½ to 4 ft. depths and 40 to 100 ft. spacings. For turf on estates, in parks, on golf courses, on lawns and playing fields drainage should be effective in 6 to 8 hours and the depth should be 1 to 2 ft. with spacings of 10 to 25 ft., according to the soil type. Heavy soils require close spacing.

How to Plan Tile Drainage System

The first requisite of a drainage system is an outlet which is not submerged at times of high water and which will permit ample fall in the tile lines coming from the most remote part of the area. This is frequently difficult, yet if such an outlet is not available, adequate drainage may be impossible. The remaining steps may follow in about this order. Study the drainage characteristics of the soil for an appropriate depth; this will determine the approximate spacing. Study the topography for alignment and type of system, a random system on rolling land or a more complete system on level land. These determinations will be made with due consideration to rainfall, time allowed for drainage and the completeness of drainage necessary.

A chart showing the relation between tile size, slope, area drained and discharge may readily be secured. Many small areas may be drained with 4 in. tile. Under usual conditions as much as 3000 ft. of 4 in. tile may be laid without fear of over-taxing its capacity. A 6 in. main will drain 10 to 100 acres, according to conditions. When larger systems are installed, the tile size should be chosen by referring to the chart or by accurate calculation, using the proper formulae.

A memo for the caddie committee: Many members have in their lockers and at their homes items of worn wearing apparel that could be used by caddies. Collection and distribution of such clothing is a proper job for the caddie committee.

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The slope of the main and laterals in a drainage system must conform to some extent with the topography of the area, increasing or decreasing the slope as needed. Increasing the slope as we approach the outlet is not objectionable, but decreasing it tends to cause silting and may choke the tile at the point of change. When necessary to decrease the slope it should not be reduced to less than half at any point. For example, a slope of 8 inches per 100 ft. might be changed to 4 in. per 100 ft. As the flow increases the silt carrying capacity is increased, hence successive reductions in grade may be made. The total permissible change depends upon the silting characteristics of the soil. If silting cannot be prevented on very flat land, silt basins must be installed.

Abrupt changes in the slope of laterals and main may be avoided by running laterals diagonally across the slope instead of directly down. This practice is particularly advantageous where the drainage from a hillside must pass over a valley bottom to reach the outlet.

Ledges of shale, rock or heavy clay often cause the water collected in the soil above to seep out on the hillside. The wet spot is formed just below the out-cropping ledge, hence a line of tile or a ditch placed just above will intercept the seep water and correct the difficulty. Normal percolation from a hillside causing a swampy bottom may be corrected in the same way if the seepage is the only source of water. When there are other sources of water additional drainage may be required.

Terraces may be considered as a form of surface drainage. They are rapidly becoming popular as a means of erosion control and are particularly adapted to use on turf in meadows, pastures, parks or lawns and golf courses. The broad base terrace is no more than a shallow trough and a rolling ridge built across the slope of a hillside and sloping slightly toward one end, or from the middle to both ends. It intercepts the flow of water down the hillside, diverting it to one side and reducing its velocity. Terraces must empty into an outlet ditch which is protected against erosion. The ridge when compacted should be 6 in. to 1½ ft. higher than the trough and the slope 3 to 6 in. per 100 ft.