Effects of Excess Rain On Turf Management

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THE ANNUAL distribution of rainfall plays a major role in turfgrass care and management. The ideal situation, with regard to annual rainfall, would be periodic rains of a gentle-soaking nature. Seldom, if ever, does Mother Nature cooperate to this extent. The average annual rainfall for a given area may remain more or less constant, but the distribution, as well as the intensity, varies from year to year and particularly from season to season.

It is the seasonal variation in intensity and distribution that creates problems for the turfgrass manager. He must continually adjust his management practices to fit the prevailing weather conditions. The techniques employed to counteract the adversities of weather, whether they be drought or excessive rainfall, will influence, to a large extent, the quality of turfgrass produced—especially golf course turfgrass. There will be certain conditions brought on by adverse weather over which the manager will have no control; there will be others which will create no special problem, providing adequate materials, equipment, and facilities are available.

In many instances, however, the turf pro will be able to counteract the adversities and prevent serious damage. Careful planning and programming based on the facilities available to him, as well as a knowledge of the special features and conditions on the course, will enable turf specialists to produce satisfactory turfgrass in spite of adverse weather conditions.

Excess moisture may be defined as that moisture which is applied in excess of the actual needs of the particular crop or plant being grown. Basically, the amount of water needed or used is a function of the environment in which the plant is growing. Environment is used in its broadest sense and means climate and soil.

Over the years, a number of investigators have worked to determine just how much moisture is required by various plants. Research on estimating evapotranspiration has been in progress since the heat effect method was developed by C. R. Hedke in 1924. In 1940, C. W. Thorthwaite developed a method based on climatic data. This method was simplified by Harry F. Blaney and Wayne D. Criddle in 1945, and was further adjusted to reflect turfgrass needs by the Soil Conservation Service in 1960.

When the potential evapotranspiration is subtracted from rainfall, the result indicates the *average* excess or deficit for a given period of time.

Tables I-III, calculated by the Commercial Research Department of Toro Manufacturing Corporation, present data for three locations in Iowa.

Excessive rainfall may be

classified into two categories: (1) frequent rains—mostly of low to medium intensity, and (2) floods —whether arising from prolonged rainfall or from heavy, intense rains of a relatively short duration. For convenience, the problems associated with these two conditions may be discussed from the standpoint of the effect they have on soil and growth.

Drainage Problems

Soil. The most obvious condition created by excess rainfall is that associated with drainage—both surface and internal. Surface drainage is the most rapid and effective means of removing excess water. When the soil is saturated from continuous rainfall and the topography is such that water does not move off rapidly, then the excess water will accumulate in the low areas. If the water remains "ponded" for too long a period, turfgrass may be destroyed. The length of time that water may remain ponded without killing the grass depends upon the temperature and the species of grass. High temperatures will cause severe damage in a very short period of time; whereas if the temperatures are cool, the grass will survive for a longer period. *Poa annua* appears to be quite susceptible to damage from ponded water, while bentgrass is more tolerant.

Surface runoff may cause washouts and severe erosion, especially on newly seeded areas or on steep slopes with thin cover. Floods, particularly along rivers and streams, often leave heavy deposits of silt which may destroy the turf and leave layers that will create future problems. Heavy silt deposits often must be removed in order to restore the flooded area for play.

Heavy, slowly permeable soils, when subjected to frequent and prolonged rainfall, become saturated and may remain at or near this level of soil moisture for extended periods. Under such conditions there will be a deficiency of oxygen and buildup of reduced compounds which are

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Table I: Precipitation—Evapotranspiration, Dubuque, Iowa

Month	Average Potential Evapotranspiration	Average Precipitation	Deficit or Surplus
January	...	1.83	1.83
February	...	1.40	1.40
March	.46	2.76	2.30
April	1.79	3.08	1.29
May	3.65	4.22	.57
June	5.50	4.21	−1.29
July	6.56	3.51	−3.05
August	5.64	3.73	−1.91
September	3.42	3.74	.32
October	1.77	2.74	.97
November	.45	2.59	2.14
December	...	1.90	1.90
Total	29.24	35.71	+6.47

1. Rainfall is based on 30-year average. (1930-1961)
2. Potential evapotranspiration calculated from modified Blaney-Criddle formula. See: Blaney, Harry F.; "Climate As An Index of Irrigation Needs" in the Yearbook of Agriculture, 1955, entitled *Water*.
3. Consumptive coefficients for lawngrass as developed by the Soil Conservation Service in 1960—reported in a paper entitled "A Method For Estimating Irrigation Water Requirements Of Lawns" Presented by Quackenbush, T. H.; and Phelan, J. T.; 1963 Meeting of the American Society of Agronomy at Denver, Colorado.

Table II: Precipitation—Evapotranspiration, Des Moines, Iowa

Month	Average Potential Evapotranspiration	Average Precipitation	Deficit or Surplus
January	...	1.30	1.30
February	...	1.10	1.10
March	.62	2.09	1.47
April	2.10	2.53	.43
May	4.28	4.07	− .21
June	6.16	4.71	−1.45
July	7.46	3.06	−4.40
August	6.42	3.67	−2.75
September	3.99	2.88	−1.11
October	2.15	2.06	− .09
November	.58	1.76	1.18
December	...	1.14	1.14
Total	33.76	30.37	−3.39

1. Rainfall is based on 30-year average. (1930-1961)
2. Potential evapotranspiration calculated from modified Blaney-Criddle formula. See: Blaney, Harry F.; "Climate As An Index of Irrigation Needs" in the Yearbook of Agriculture, 1955, entitled *Water*.
3. Consumptive coefficients for lawngrass as developed by the Soil Conservation Service in 1960—reported in a paper entitled "A Method For Estimating Irrigation Water Requirements Of Lawns" Presented by Quackenbush, T. H.; and Phelan, J. T.; 1963 Meeting of the American Society of Agronomy at Denver, Colorado.

Table III: Precipitation—Evapotranspiration, Sioux City, Iowa

Month	Average Potential Evapotranspiration	Average Precipitation	Deficit or Surplus
January	...	.78	.78
February	...	.89	.89
March	.56	1.46	.90
April	2.00	2.25	.25
May	4.12	3.23	− .89
June	6.09	4.33	−1.76
July	7.28	3.11	−4.17
August	6.27	2.66	−3.61
September	3.82	2.74	−1.08
October	1.97	1.42	− .55
November	.28	1.16	.88
December	...	.74	.74
Total	32.39	24.77	−7.62

1. Rainfall is based on 30-year average. (1930-1961)
2. Potential evapotranspiration calculated from modified Blaney-Criddle formula. See: Blaney, Harry F.; "Climate As An Index of Irrigation Needs" in the Yearbook of Agriculture, 1955, entitled *Water*.
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toxic to turfgrass. More will be said about this situation later.

Both desiccation and wilt are more likely to occur when internal drainage is poor. Sometimes in the summer it may become necessary to syringe the turf frequently to prevent loss—in spite of the fact that the soil may be at or near the saturation point. This is especially true if temperatures or wind movement is high. In the late winter and early spring, desiccation of turfgrass areas may be prevented by applying water.

One of the more serious and direct effects of excessive rainfall on soil is structural deterioration (compaction). This may result from the beating action of the raindrops, or from the traffic—both player and equipment—to which the area is subjected. Soil displacement—permanent rutting and footprinting—is likely to occur if the wet soil is subjected to traffic during these periods.

Spike Disking Helpful

Spike disking of greens during the summer months will do much to offset some of these adverse effects. Spiking is recommended over aeration during the summer because of the reduced growth activity of cool season grasses during the summer.

Growth. The prevailing temperature and the fertility level of the soil also must be considered in a discussion of the effects of excess rainfall on growth activity.

Prolonged rainfall will tend to extend the springlike growth of turfgrass if the temperatures are moderate. Such conditions result in a soft, succulent turfgrass that is easily damaged by traffic (has poor wearability) and which is more susceptible to attacks by disease and insects. These factors weaken the permanent turfgrasses and open them up for weed invasion. Sudden "hot spells" during such periods intensify these situations and may prove disastrous. In very early spring, a sudden cold snap with snow or freezing rain may result in substantial loss of turfgrass. A recent example of this is the New England area in the spring of 1963.

Heavy Traffic Harmful

Golf courses and other turfgrass areas subjected to heavy traffic will suffer to a greater extent than those subjected to light traffic. Under conditions of excessive rainfall or moisture, this situation may cause an abnormal loss of turfgrass. Obviously, such soils would be poorly aerated. Because of the important role of aeration and the effect it has on root function and plant growth, a brief review may be in order.

Roots growing in well-aerated (adequate-oxygen) soils are long, light colored, and well supplied with root hairs. These roots have a longer portion covered with root hairs; hence, a longer portion over which absorption of water and nutrients may occur. Roots growing in poorly aerated (low-oxygen) soils are short, thick, and dark, and have less than the normal number of root hairs.

Absorption of ions (plant food nutrients) by roots is one of the most important physiological functions of living plants. It represents the connecting link between soil conditions and plant growth. Failure to obtain normal plant development in poorly aerated soils is related to restricted ion uptake by roots.

Inadequate aeration decreases the intake of water by plants directly through its effect on absorption, and indirectly by reducing root growth. Reduction of water uptake occurs only at relatively high carbon dioxide concentrations, and even then its effect is reduced by presence of oxygen; hence, carbon dioxide is of minor significance in water economy, *except in those cases where roots are growing in waterlogged soils in the presence of large amounts of readily decomposable organic matter.*

In the absence of adequate oxygen, anaerobic reactions predominate and large amounts of reduced soil constituents are built up. Among reactions most strongly influenced by changes in aeration are those involving manganese and iron. Iron chlorosis is usually quite prevalent under such conditions and the spraying of iron sulfate or related iron compounds during such times will be most beneficial.

Bad Aeration Hurts Seeds

Germination of seed is strongly affected by the concentration of oxygen and carbon dioxide. A faulty aeration condition is one of the primary causes of poor germination, and often occurs in soils having poor structure or excessive water content.

Root growth at various levels of oxygen is strongly influenced by temperature. Experiments have shown that at an oxygen concentration of 3% and at temperatures of 64 and 86 degrees, root growth is inhibited; whereas at an oxygen concentration of 10%, root growth is normal at 64 but reduced at 86 degrees. This indicates that at the higher temperature, 10% oxygen is deficient. Further work has shown that: (1) at oxygen concentrations of less than 1% roots lose weight; (2) concentrations from 5% to 10% are necessary for the growth of existing root tips; and (3) oxygen concentrations greater than 12% are required for root initiation.

Within the temperature limits for root growth, the greater the temperature of the soil, the higher must be the concentration of oxygen in the soil atmosphere for normal root growth. Canon attributes this relationship to decreasing solubility of oxygen in the soil solution with increased temperature. *Although this may be a factor, the effect of increasing temperature on respirational demands of the roots for oxygen certainly plays an important part.*

From the standpoint of disease incidence, it is well to remember that in addition to creating conditions more conducive to disease development, the effectiveness of fungicides may be reduced by heavy rainfall. More frequent applications may be necessary and the use of a wetting or "sticking" agent is recommended. Algae and fairy ring activity may be greater.

The frequency of fertilizer applications, especially of nitrogen, will have to be increased to offset that utilized for the additional growth as well as that lost by leaching.

Annual weed growth, especially grasses—such as crab, barnyard, pigeon, foxtail, etc., as well as clover, chickweed and knotweed—will be much greater during wet, rainy seasons. Chemical treatment of these weeds with the appropriate herbicide will aid materially in controlling their increase.

It must be remembered, of course, that chemicals are only a tool, and that unless the basic cause for turf deterioration (with subsequent weed invasion) is corrected, the elimination of weeds with chemicals will be of little permanent value.

Sidewalk Salt Threat to Lawns

Heavy use of salt on sidewalks to remove snow and ice may damage lawns and shrubs, says C. M. Drage, Colorado State University extension horticulturist. He suggests minimum use of salt and care in its application near grass and shrubs.

Drage explains that although plants are dormant during the winter, roots are still active. Salt solutions draining or swept off melting walkways may penetrate the soil around grass and shrub roots. This salt concentration in the soil around the roots results in the roots losing large amounts of water to equalize salt concentration.

This phenomenon is the result of osmosis, the horticulturist explains. Water already existing in plant or grass roots will move out through root membranes in order to dilute and equalize the salt concentration in the soil. Without necessary water in the root system, the plant dies or is damaged, Drage concludes.

North Central Weed Control Conference Meets Dec. 14-16

"Pesticides in Our Environment" will be the main subject for panel discussion when the North Central Weed Control Conference meets Dec. 14-16, in Kellogg Center, East Lansing, Mich.

Dr. Delbert D. Hemphill, Department of Horticulture, University of Missouri, Columbia, president of the conference, will address the group at its opening session.

Other topics to be presented turfmen are: New Products From Industry, Application Methods and Equipment, Industrial Areas, Aquatic Weeds, Horticulture, and New and Problem Weeds.

Program of the meeting and other information can be obtained from the program chairman, John D. Furrer, Department of Agronomy, University of Nebraska, Lincoln, Neb.