Soil-Water-Turf Relationships*

by Dr. Henry Indyk

Intelligent and efficient water management for healthy and vigorous growth of turfgrasses for aesthetic and/or utilitarian purposes requires a basic understanding of soils, water, plants, and their interrelationships.

SOILS

Soil is a very complex heterogeneous medium with physical/chemical and biological properties which alone or with their many interrelationships influence soil-water relations and turfgrass growth. Functions of soil include: anchorage and physical support of turf plants; water reservoir; plant nutrient reservoir, and supporting medium for utilitarian purposes. The three distinct layers included in the soil profile are commonly called top soil, subsoil and parent material (or bedrock).

An ideal soil with optimum conditions for plant growth consists of two major factions: 50 % solids (further broken down as 45 % mineral, 5% organic matter) and 50% pore space (as 25% water [liquid] and 25% air [gaseous]). Though a small percentage, the organic matter content is an essential difference between productive and non-productive soils.

Total pore space varies with soil type; with somewhat less in sandy soils and somewhat more in clay soils. Air and water porosity are inversely related and subject to extreme fluctuations, depending on soil moisture conditions.

The term "soil separates" refers to the different size particles it contains. These are designated as sand (further classified from coarse to fine), silt and clay. Soil "texture" classification is based on the amount of sand, silt and clay present. Soil "structure" refers to the arrangement or grouping of the individual soil separates. Texture and structure in large measure determine the general characteristics of the soil: soil porosity, water movement, water holding capacity and infiltration.

WATER

Soil must contain a certain amount of available water to function as a medium for growth of turfgrasses. The manner in which the water is supplied, its infiltration, movement, storage and control must be understood and considered in its relationships to soils and plants.

Infiltration rate refers to the rate at which water moves into the soil before puddling or runoff occur. This is affected by soil texture and the physical condition of

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the soil surface, including compaction, salts, moisture content and organic mulch.

Soil moisture is determined on the basis of tenacity with which water is held in soil. The term "gravitational" (non-capillary) refers to water which moves rapidly downward due to gravity; "capillary" to water which is held in the small pores at varying tenacities; and "hydroscopic" to water which is held very tenaciously and exists as a very thin film at the solid-liquid interface.

Percolation is the movement of gravitational water through the soil profile. Percolation rate is affected by soil texture, impeding layers, textural zonation and the depth of the soil profile.

Infiltration rate, soil moisture levels and percolation rate all must be considered to determine the maximum rate of applying supplemental irrigation.

The depth of water movement is affected by the depth of the soil profile; the texture of the soil, and the soil moisture content. Water does not move down through the soil until the absorptive capacity of each soil particle is satisfied; only then is the added water free to move to the next particle. Depth of movement is used in determining the maximum amount of water to apply during each time of irrigation.

Water holding capacity (or field capacity) refers to the water retained by the soil after gravitational water has drained. This is affected by soil texture, the percentage of organic matter contained; the aggregation; the depth of the soil profile; and the degree of compaction. Water holding capacity is used to determine the amount and frequency of irrigation.

Available water refers to the portion of water retained by the soil between field capacity and the permanent wilting point of the turfgrasses. Constant replenishment of water is required due to water loss from surface runoff, drainage through the soil, evaporation, and transpiration.

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