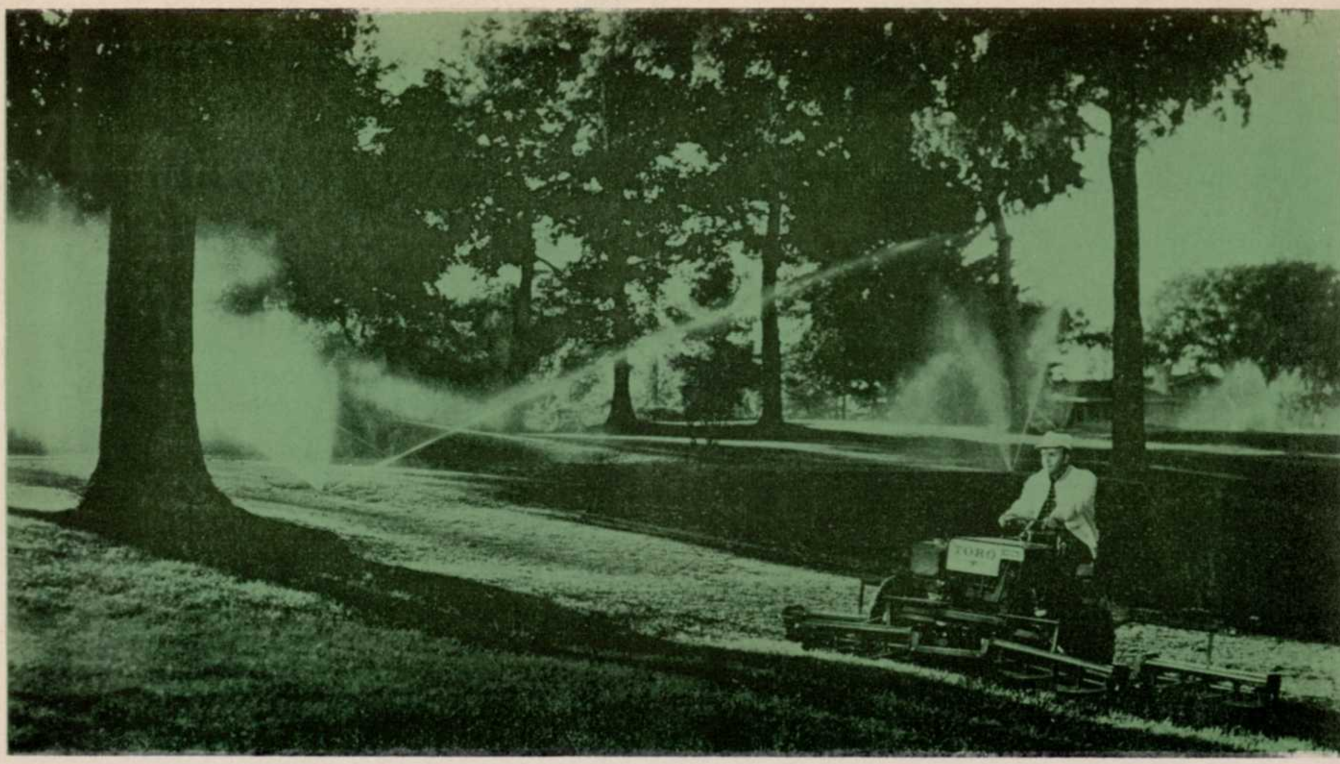

Watering Practices As A Function of Clipping Height and Frequency

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TURFGRASS watering practices are determined by a number of factors. Clipping height and mowing frequency may be among the more important agronomic influences. Others include the kind of grass, soil conditions and climate—length of growing season, distribution and amount of rainfall and evapotranspiration. The degree of color and the growth rate required to maintain the grass in the condition necessary to meet the demands of play, or other use, for which the turfgrass is grown, are important in determining watering practices. So likewise the capability of the irrigation system and, in the case of manually operated systems, the availability of labor exert a major influence on scheduling and execution of watering programs.

There is very little documented information dealing with water use rates as affected by clipping height and frequency. It seems likely that evaporation and transpiration will be greater on a dense, closely clipped turfgrass area such as a putting green than will be the case on a more open turf cut at a height of two to three inches. If such is the case, then water requirements will be affected directly by clipping height and frequency.

Juska and Associates at Michigan State and at Beltsville, Maryland; Davis at Ohio State, Roberts at Iowa State and Madison at the University of California, Davis, all have shown there is a reduction in root growth of a given species as a result of decreasing heights of cut. This, obviously, has a very direct effect on watering practices since maintenance of root zone moisture is one basic consideration of all sound watering programs. Hence, the frequency, rate of application and the amount of water applied at each irrigation are a function of clipping height and frequency.

Pertinent to a discussion of watering practices as a function of clipping height and frequency, is a short review of the role of water in plant growth, the influence of soil properties on root growth and the effect of mowing on grasses.

Water is essential to plant growth and activity and is involved either directly or indirectly in all phases of the care and management of turfgrass. Water is necessary for germination, cellular development, tissue growth, food manufacture (photosynthesis), temperature control and resistance to pressure. It acts both as a solvent and as a carrier of plant food materials. Nutrients dissolved in the soil are taken in through the roots and then carried to all parts of the grass plant in water. The food manufactured in the leaves is also distributed throughout the plant body in water.

Turgid Leaves Help Resist Traffic

Water transpired by the leaves serves as a temperature regulator for the plant. The amount of water within the cells of the grass leaves plays a role in counteracting the effects of traffic. When the plant cells are filled with water, they are said to be turgid, a condition that helps leaves resist traffic (foot and vehicular). Hence, adequate water within the cells helps avoid the damage which may result when pressure (traffic) is applied to grass in a state of wilting. Wilt is a condition that exists when cells do not contain enough water. They are said to be flaccid.

For all these functions, very large quantities of water are required and they, along with other considerations, must be kept in mind when developing a watering program for turfgrass.

In addition to watering practices, mowing influences turfgrass growth, development, maintenance and playability in a number of other ways. First, good mowing practices are one of the more important factors contributing to appearance—especially a well-groomed appearance—of any turfgrass area. Second, because of the regularity of the mowing process, grass cutting is the major time-consuming operation in the maintenance program. Third, the manner in which turfgrass is mowed will greatly influence its health, vigor, density, degree of weed invasion and longevity. Also, mowing is one of the factors limiting or controlling the adaptability or suitability of a given grass for turf purposes; and, since mowing practices must conform to the specific demands created by the use for which the turf is grown, it becomes one of the major management practices with which the turfgrass supervisor is concerned.

To be suitable for the production of turf, a grass plant must be able to grow and persist under the environment to which it is subjected. Good turfgrass is judged by standards of playability and usability as the case may be, and unless a grass is able to survive under the type of maintenance demanded by players or users, it must be replaced or maintenance practices must be modified; otherwise, use must be restricted. For those concerned with the production of turfgrass, restriction of use always should be considered a last resort. The primary objective of the supervisor and grower is to produce high quality turfgrass suitable for use or play irrespective of environmental adversity.

More often than not, practices which are desirable for good grass growth have to be modified extensively to meet turfgrass requirements for use or play. As stated earlier, such is the case with mowing practices.

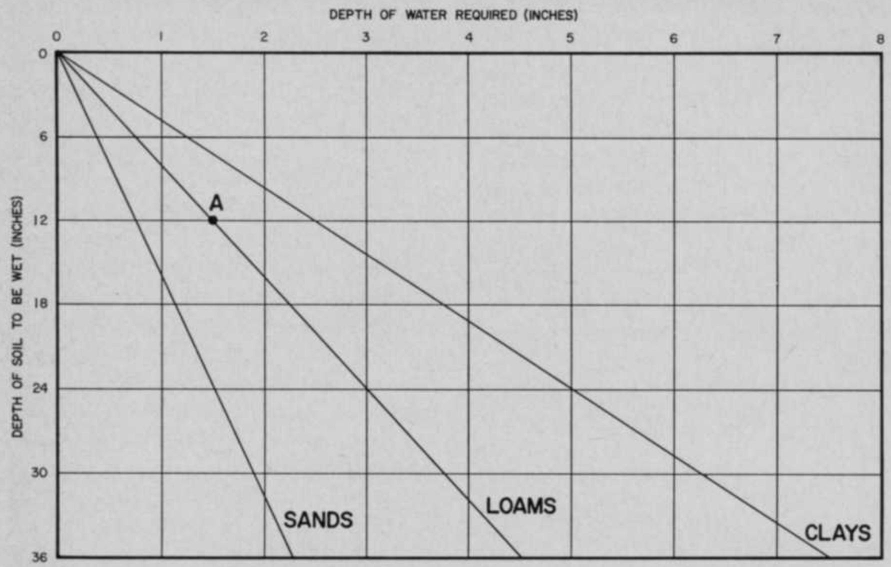
Athletic Field Turfgrasses Limited In Number

Turfgrass management practices, including mowing, severely limit the number of grasses that may be used to produce satisfactory lawns and playing fields. Only 25 to 30 of the more than 1100 species known to grow in the United States are adapted. Consequently, growth habits and characteristics play an important

Control box for automatic irrigation system permits control of water applications with a minimum expenditure of time. Conservation of water and higher quality turfgrass are additional benefits cited for automatic irrigtion systems.

Underground automatic system permits flexibility required for efficient operation. Watering practices based on grass needs and keyed to existing soil and climatic conditions assure high quality turfgrass, necessary for maintaining green color throughout season.

Surface Inches of Water Required to Wet Soils To Given Depths Assuming No Surface Runoff
(Robert M. Hagan, Dept. of Irrigation, University of California, Davis)



HOW TO READ CHART: If a 12-inch depth of loam soil is to be wet, run down left-hand scale to 12-inch line; then across chart to diagonal line labeled "loam" (at Point A), and then project line vertically up to scale across top of chart. Depth of water required is 1 1/2 inches.

role in selection of a grass for turf purposes.

On the basis of growth type, grasses may be classified into three general groups. Bunch-type grasses, such as ryegrass and chewings fescue, produce new shoots which grow inside the sheaths of the previous stem growth. Stoloniferous grasses, such as bentgrass, spread by runners or stolons which develop from shoots that push through the sheath and run along the surface of the ground rooting at the nodes (joints). Kentucky bluegrass, a rhizomatous type of grass, develops shoots at the underground nodes. Some grasses, such as bermudagrass and zoysia grass, spread by both rhizomes and stolons. There are also intermediate types with decumbent stems which root at the nodes, such as crabgrass and nimblewill.

The grass leaf, because of its shape, intercepts a maximum of sunlight which is essential for photosynthesis (food manufacture). A reduction in the plant leaf area exposed to sunlight reduces the plant's capacity to carry on this vital function.

The ability of grasses to withstand frequent and relatively close cutting is related to certain peculiarities of the grass family. Grasses exhibit basal growth, as opposed to terminal growth found in most other plants. Basal growth means simply that growth initiates at the base rather than at the tip of the blade or stem. From a practical standpoint, this means that normal and frequent mowing does not cut off the growing areas of the grass leaf. Removal of too much leaf surface at any one cutting may, however, destroy some of the growing points. For this reason, as well as from an appearance standpoint, grass should be mowed often enough so as to never remove more than one-third of the leaf surface at any one clipping.

Management Practices Must Be Balanced

To compensate for the reduction in root growth produced or caused by clipping, soil environment and management practices —fertilizing, watering, cultivating and programs of disease, insect and weed control—must be balanced one against the other and applied more intensively and with greater care. Development and maintenance of good soil properties are essential to satisfactory production of turfgrass. Soil properties relate directly to root development and are a major factor in developing watering practices.

Soil as the medium for turfgrass growth must provide support for the plant, serve as a storehouse for nutrients, supply oxygen, and act as a reservoir for moisture. The texture (size of soil particle), structure (arrangement of soil particle), and porosity (percentages of soil volume not occupied by solid particles) of a soil are the basic physical factors which control the movement of water into the soil (infiltration), through the soil (percolation) and out of the soil (drainage).

Texture, structure and porosity, along with organic matter content, determine the water-holding capacity and control the air-water relationships of the soil; hence, have a direct influence on root growth and development.

Texture (size of soil particle) is a most important characteristic of soils because it describes, in part, the physical qualities of soils with respect to porosity, coarseness or fineness of the soil, soil aeration, speed of water movement in the soil, moisture storage capacity and, in a general way, the inherent fertility of the soil. Sandy soils are often loose, porous, droughty and low in fertility; whereas, clay soils may be hard when dry or plastic when wet and poorly aerated, but high in moisture retention and possibly high in fertility. Clays have a higher total porosity than sands. Clays have a large number of small pores which contribute to a high water-holding capacity and slow drainage. Sands, on the other hand, have a small number of small pores with, therefore, a low water-holding capacity and rapid drainage.

Compaction of soil refers to a condition in which aggregation is reduced or absent; hence, the soil is dense (the number of large pores reduced). Degree of compaction at or near the surface is of special importance insofar as infiltration or movement of water into the soil is concerned. A thin layer of compacted soil materially reduces the rate of infiltration, and unless alleviated, often necessitates a change in watering practices. Fortunately, since most of the compaction on turfgrass areas occurs within the upper two-inch layer of soil, the condition may be temporarily alleviated mechanically.

Drainage, or the removal of excess water from a soil, is of two types—surface and internal. Surface drainage is accomplished through grading and contouring of surface areas. Internal drainage is a function of the physical soil properties and has an important bearing on root growth and development as well as on watering practices.

On most turfgrass areas, one is usually able to apply water if soil moisture becomes limiting. In too many cases during periods of heavy rainfall, rapid percolation with subsequent removal of the excess water, does not take place. This is particularly true of many green and tee areas. Unless soils are adequately drained, many problems associated with saturated soils will arise.

Proper Watering Needed To Keep Grass Green

Supplemental irrigation is always necessary if turfgrass areas are expected to remain green throughout the growing season. The frequency of irrigation is governed by the water-holding capacity of the soil and the rate at which the available water is depleted. For the most vigorous and healthy growth, watering should begin when approximately forty to sixty percent of the available water has been depleted. Most plants show a marked growth response when soil moisture is maintained between this level and field capacity. Assuming equal depth of rooting, sandy type soils will have to be watered more frequently than will loams or clays. Climatic conditions such as high wind movement, intense sunlight, low humidity and temperature all contribute to high water use rates. Such conditions dictate more frequent watering than the reverse set of conditions.

The amount of water to apply at any one time will depend upon how much is present in the soil when irrigation is started, the water-holding capacity and the drainage characteristics of the soil. Enough water should be applied to insure that the entire root zone will be wetted. Too, on natural soils (as opposed to those modified for intensive use) sufficient water should be applied to maintain contact with subsoil moisture and to assure percolation especially in arid and semiarid regions. Continuous contact between the upper and lower levels of moisture will avoid a dry layer through which roots cannot penetrate. Application of too much water at one time (misuse) is serious when the soil is poorly drained and the excess cannot be removed within a reasonable period of time.

Water should never be applied at a rate faster than it can be absorbed by the soil. Sprinklers that do not adequately disperse water, as well as sprinklers that deliver a large volume of water within a concentrated area, cause surface runoff. Whenever water is applied at a rate faster than it can be absorbed by a given soil, the water is being wasted. The sound watering program, then, would call for sprinklers that apply moisture slowly enough to permit ready absorption. When surface conditions such as compaction exist, it should be corrected by cultivation (aerification) or spiking. Such will materially improve the infiltration rate of water.

Once surface runoff is evident, sprinklers should be turned off. If the soil has not been wet to the desired depth—this may be determined by probing and examining the depth of penetration—then the sprinklers may be turned on again at the end of thirty minutes to an hour, depending on the permeability of the soil.

In summary, watering practices are a function of clipping height and frequency because of the relationship between clipping height and root development. Grasses clipped within the generally recommended height of cut range for the given species will produce adequate root growth provided a satisfactory management program can be followed. Sound watering practices are necessary to assure satisfactory growth of roots.

To use water properly requires an understanding of the fundamental role water plays in plant growth; of the effects climate and weather have on growth rates; how they influence water use rates and choice of grass. Good watering practices demand a knowledge of the basic physical and chemical soil properties, how they affect water absorption, storage and drainage as well as the frequency, rate and manner in which water must be applied.

Further, proper use of water means correlating such basic information with the requirements for play and programming a watering schedule to fit the existing irrigation facilities, so as to make the most efficient use of them and the available labor force.

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