Irrigation and Water Use

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Water is essential for plant growth and plant activity. It is involved either directly or indirectly in all phases of the care and management of turfgrass and landscape areas. Water transpired by leaves and evaporated from the surface serves as a temperature regulator. Syringing of the golf greens during periods of excessive evapotranspiration is based on this phenomena. The amount of water within the cells of grass leaves plays an important role in combating the effect of traffic.

When the plant cells are filled with water, they are said to be turgid, a condition that helps the leaves resist pressure from traffic (foot or vehicular) and avoid the damage, or even death, that might otherwise occur. Wilt is a condition that exists when the cells do not contain enough water and are said to be flaccid. A ten percent loss of water from the plant body will usually cause permanent wilting and death.

To understand the complexity of factors involved in water management and irrigation of turfgrass, one must recognize the fundamental role water plays in plant growth; understand the effects climate and weather have on growth rates and how they influence water-use rates and choice of grass. Further, effective and efficient satisfaction of water requirements of turfgrasses demands a knowledge of the basic physical and chemical soil properties and how these relate to water absorption, storage and drainage as well as the frequency, rate and manner in which water must be applied. All such basic information must be correlated with the requirements for **colour, play or use** adjusted to fit the existing or planned irrigation facilities, and modified to suit or to be adjusted to the level or standard of maintenance at which the turfgrass facility is being kept or maintained.

Evapotranspiration

Evapotranspiration (ET) refers to the water lost by surface evaporation (grass and soil) and from transpiration by the plant on turgrass areas. Transpiration accounts for most (80 to 85%) of the water lost by plants. ET is a solar driven "pumping" phenomenon. Plants literally pump water taken in by the roots through the plant body and pass it off to the atmosphere as water vapour. Only a small portion (5 to 10%) is retained for growth and development.

Transpiration rates vary almost hourly within any given season, They are greater in summer and lower in fall and spring. A similar phenomena, desiccation, occurs during the winter months and is often responsible for the loss of turfgrasss on high, exposed sites. Light intensity and duration, temperature, wind, rainfall and physiological factors all influence the rate of transpiration. Of these sunlight is the most critical. Thus, a measure of solar energy can be used to develop ET data which serves as the key to meeting irrigation needs of turfgrass.

Let me give you some very basic principles which may guide and direct your irrigation programs.

1. Determine texture and degree of compaction of your soil - controls infiltration rate.
2. Determine water holding capacity of your soil.
3. Determine depth of the root system

Then, if the need for moisture as indicated by ET is 0.25 inches daily — as the case may be during the heat of summer in many locations — the soil must supply to the plant 0.25 inches of water between irrigations. Soils that are otherwise very good for putting greens may hold only 0.5 to 0.75 inches per cubic foot. This would be an adequate amount of water for one to two days ***if all of it were available to the plant.*** For this is not the case, the roots must extend through (permeate) the entire volume of soil and the soil must have the capability to supply the needed amount of water at a rate rapidly enough to permit uptake by the roots. The root system of many turfgrass areas, especially golf and bowling greens and often sports fields frequently do not extend to a one-foot depth (especially in the summer). When they grow only to a depth of three or four inches, the volume of potentially available water is reduced by one-third to one-fourth.

Water management under these conditions calls for the reservoir (soil) insufficiency to be replenished by irrigation. Thus, the advice to water deeply and infrequently is not valid for many putting greens; or for that manner, for many turfgrass areas. To water in this manner may not be cost effective. Water cost, energy and equipment wear are higher since a large portion of the applied water leaches below the root zone or runs off.

Poor aeration, whether from poor drainage, compaction or an inherent soil condition, further complicates the water management practices needed to meet water requirements of turfgrass on shallow soils of low water-holding capacity and poor drainage characteristics. To sustain growth and keep turfgrass green during the growing season requires uniform precipitation throughout the season; otherwise supplemental water (irrigation) will have to be applied in varying amounts.

The problem is ***uniformity of precipitation not amount,*** put another way "location" of rainfall and amount on ***your turf facility*** - not Joe's which lies across town.

The most effective, most efficient, most convenient and most economical way to water golf courses, parks, lawns, sport turf playing fields and other landscaped turf and recreational facilities is by automatic underground sprinklers. Solid state controlled systems, when properly programmed, are flexible and constant - always on duty and available on demand. They are cost effective and a practical means of preventing waste, conserving water and of assuring good watering techniques.

Practical Water Management

Once the physiological requirements of the grass and the influence of climate and soil properties are understood, irrigation management or the proper use of water, relates to the frequency of application, the amount to apply and the manner in which the water is applied.

Actual watering practices become a matter of judgement — judgement based on knowledge and understanding of the particular set of conditions existing on each turfgrass area. The limitations imposed by frequency and amount of play, the capacity of a given irrigation system, the availability of personnel and the prevailing weather conditions, all have important bearing on specific watering practices.

Frequency

The frequency of irrigation is governed by the water-holding capacity of the soil and the rate at which the available water

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is depleted. Depletion rate is a function of evapotranspiration and drainage. For the most vigorous and healthy growth, watering should begin when approximately 50 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. Theoretically, maximum growth occurs at field capacity because minimum stress — zero tension exists at this moisture level. Assuming equal depth of rooting, sandy-type soils will have to be watered more frequently than will loams or clays.

Some climatic conditions as high wind movement, intense sunlight, low humidity and high temperature contribute to high water use rates. When the transpiration rate (discharge rate) exceeds the rate of intake (by the roots) or flow (by the conducting tissue - xylem) the plant will wilt. It may wilt even through there is adequate soil moisture available. At such times "syringing" to reduce temperature is imperative. This will initiate translocation of accumulated photosynthesis and re-initiate photosynthesis.

Frequent watering (too often and too much) on poorly drained or compacted soils (inadequate amount of large pores) tends to keep the upper layers of the root zone near the saturation point most of the time. This condition will encourage shallow rooting and will promote weak turf which is susceptible to weed invasion (especially Poa annua) and insect attacks as well as further damage from traffic, since soil compacts more severely when wet. Frequent and excess watering of well-drained soils may not, in itself, be too serious but such practices, unless controlled, may not be economical. They cause excessive leaching of nutrients, require more manpower, use more water than necessary and produce more wear and tear on equipment and facilities. In short, poor irrigation practices are expensive and should not be tolerated.

Amount to Apply

The amount of water to apply at any one time will depend upon how much water is present in the soil when irrigation is started, the water holding capacity, root depth and drainage characteristics of the soil. The amount to apply also will depend to a certain extent upon the kind of grass and to a large extend, on local weather conditions. For good irrigation management that amount which is used by the plant should be replenished. Computer controlled systems connected to local weather stations have the capability to calculate daily water use and direct the controller to supply the needed water.

The amount of water actually needed is a function of the difference between evapotranspiration (use) and rainfall. This assumes excess water has drained. When evapotranspiration exceeds rainfall, the deficit must be supplied by supplemental irrigation. Water deficit tables will serve as a guide in determining the amount.

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 bring about contact with subsoil moisture. 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 is serious only if the soil is poorly drained and the excess cannot be removed within a reasonable period of time.

Manner of Water Application

Water should never be applied at a rate faster than it can be absorbed by the soil. Irrigation systems that do not adequately disperse water; or those equipped with 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 waste and

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costs increase. The sound irrigation program, then, would call for sprinklers that apply moisture slowly enough to permit ready absorption. When compaction exists, it should be corrected by aeration (cultivation) or spiking. This will materially improve the infiltration rate of water. Likewise, lowering of the precipitation rate and recycling after a period of time may be necessary for efficient watering practices.

At any rate, once surface runoff is evident, the sprinklers should be turned off. If the soil has not been watered to the desired depth — this may be determined by probing and examining the depth of penetration — then the system may be turned on again at the end of thirty minutes to an hour, depending upon the permeability of the soil. This type of recycling should be a routine part of programming an automatic system.

SUMMARY

To irrigate properly and conserve water requires an understanding of the fundamental role water plays in plant growth, and of the effects climate and weather have on growth rates; how they influence water use rates and choice of grass. Good irrigation management demands 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 requirements for play, for mowing and other management practices and programming a cost effective watering schedule to fit the existing irrigation facilities so as to make the most efficient and cost effective use of them and the available labour force.

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UBC plans Turfgrass Centre

At the 1995 Western Canada Turfgrass Conference, an announcement was made of plans for a turfgrass centre to be established at the University of British Columbia. Dr. Bryan Holl of the Plant Science Department of UBC says the function of the centre would be to research problems of direct and long-term significance to the turf industry and to provide ecological services which relate to sound management alternatives, disease monitoring, identification and prevention.