IRRIGATION AND PESTS

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Turfgrass is judged by the standards established for its beauty, its use or playability and by its density, its freedom from pests and its uniformity of growth and color. A given turfgrass area is the product of the climate, the grass, the soil and the cultural practices required to maintain it in a manner suitable to the use for which it is grown. All of these factors, plus more, interact to produce the environment of the grass plant and the total environment of the pests that attack or infest the turf. The microclimate of this environment is dynamic and everchanging and represents the zone for growth and development of significant numbers of pests. All climatic factors, temperature, light, water, wind movement and humidity, and cultural techniques, watering, mowing, cultivation, fertilization and pest control programs -- have an effect upon the growth response of the turfgrass, and therefore, its susceptibility to and freedom from pests.

The basic cultural practices have both direct and interacting effects on the grass plant and the microclimate as well as the turf produced. Because of this, when one or more become limiting it is possible to overcome partially or to compensate by adjustment or modification of the other factors. Frequently, efforts to compensate lead only to other problems as well as to undue expense and are rewarded by only a very slight improvement in overall turf quality. For example, the complications and deleterious effects of successively lower heights of cut on root growth of Kentucky bluegrass have been shown by a number of investigators. As a result of lowering the height of cut, watering, fertilizing, and weed control programs are adjusted in an effort to compensate for the reduced root system and the general weakness of the grass. The resulting change in the microclimate of the sward, especially from improper watering, produces an environment conducive to the growth and development of disease-producing organisms. In addition, an overly wet soil reduced the oxygen supply, the turf becomes shallow rooted, and, if heavily trafficked the soil will become compacted and provide an opportunity for weed invasion.

Watering. Of all the cultural practices, watering probably exerts the greatest influence on the zones of turf and soil subject to pest infestation and activity. In this respect the presence or absence, as well as the level and uniformity of available moisture play a major role. The frequency, rate of application and the amount of water applied at each irrigation are influenced by the kind of soil, rainfall, the depth of root development and the rate of evapo-transpiration. Programming (or scheduling) irrigation to avoid many of the pitfalls of over or under watering is frequently impractical because of interference with play, inadequate distributive systems or unavailability of labor. Thus, many turf areas may be too wet or too dry at any given time. The effect on humidity and temperature of the microclimate is readily apparent, and if a negative effect, the impact on presence of pests is apparent. Precise controlled application by a properly designed, correctly installed automatic irrigation system will aid substantially in avoiding some of these problems.

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 reservoir (water-holding) capacity of the soil and rate at which the available water is depleted - utilized directly by the plant or lost by evapo-transpiration. For the most vigorous and healthy growth, watering should begin when approximately 40 to 60 per cent of the available water has been depleted. Most plants show a marked growth response when soil moisture is maintained between these levels. Assuming equal depth of rooting, sandy 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, how much the soil can hold (water-holding capacity) and the drainage characteristics of the soil. Enough water should be applied to ensure 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 where there is a likelihood of soluble salts accumulating (arid and semi-arid regions).

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. Ponding will cause a marked change in the environment and, under high temperature conditions, death of grass with subsequent replacement by weeds. A high water table also precludes full development of the rooting potential. Shallow rooted turf is not as strong as that with a deeper root system, thus, is more susceptible to invasion by pests. Soft, succulent turf results from improper fertilizer application. Such turf is more easily damaged by traffic and requires more frequent watering to prevent collapse under heat or moisture stress. A more humid microclimate is frequently produced by these practices.

Timing. The timing of irrigation plays a role in counteracting pests, especially fungi. Removal of dew has a twofold beneficial effect. First, the washing away of the plant exudates which serve as a source of energy for fungi and secondly, removal hastens drying of grass. Each situation minimizes development of disease.

Timing is also a factor during critical heat stress periods. Water transpired by the leaves serves as a temperature regulator. Sprinkling to relieve temperature stress is a standard cultural technique. In addition, syringing to maintain turgidity during periods of heat stress is a key factor in golf course maintenance operations. Traffic or pressure on grass leaves when they are under moisture stress will cause severe damage. A light showering of a turf area when the cells begin to lose water will reduce the temperature a few degrees and restore turgidity. Beard and his associates at Michigan State point out that the application of 0.25 inches of water at 12 noon resulted in only a few degrees drop in temperature in the turf. However, syringing did prevent the temperature from reaching the maximum which would have occurred had no water been applied.

Endo (UCR) has shown that a dry cycle in the surface zones triggers development of certain disease producing organisms. Thus, controlled precise application

will help to ensure freedom from pests.

SUMMARY

The relationship between water management (irrigation practices) and the pest population, (weeds, insects and disease producing organisms) in turfgrass is universally recognized and has been well documented by experimental and observational data. The successful and efficient use of water as a cultural technique for preventing and controlling weeds is predicated on three basic factors -- the grass, the soil and the climate. Each is of paramount significance in setting up a watering program conducive to the development and maintenance of pest-free turfgrass.

Frequent, shallow watering tends to keep the soil near the surface in a continually moist state. This has a three-fold effect on pests, especially weed encroachment and disease development. First, it encourages shallow rooting of the permanent grasses and produces turf which is susceptible to disease and insect attacks, as well as damage from traffic; subsequently, weed invasion follows. Secondly, such a condition is favorable for the germination of weed seed and encourages growth of seedling and mature weeds. Thirdly, many weeds - such as knotweed, chickweed, clover, crabgrass and Poa annua - thrive in soil too wet for favorable grass growth.

A close correlation exists between a high soil moisture content under turf and the presence of crabgrass and Poa annua. Both of these annual weeds develop profusely branched, but shallow root systems. The perennial turfgrasses, as a group, are capable of deeper rooting habits than annual weeds. When rainfall is not excessive, irrigation water may be applied to favor growth of the deeper rooted perennial turfgrasses.

If periods of heavy rainfall do occur, the soil must be well drained in order to take advantage of the difference between the rooting habits of weedy and perennial grasses.

Excessive watering during periods of semi-dormancy likewise favor the encroachment of weeds and insects. The indirect influence (disease, damage, leaching of nitrates, etc.) such a practice exerts on the deterioration of turf encourages weed growth. Similarly, failure to provide adequate moisture during periods of active growth, or when prolonged drought occurs will weaken turf to the point where weed invasion becomes only a matter of time.

A sound watering program, based on the requirements of an adapted grass and adjusted to environmental and use conditions, is basic to the production of satisfactory pest free turf. An automatic system provides the flexibility to fit most watering needs.

The precise control and accurate application make this management tool a substantial factor in water management. For, when water is used judiciously and applied as needed, the control, and possibly under many conditions, the elimination of weeds becomes a definite possibility. And, a sound, healthy, vigorous turf remains the first line of defense against attacks by pests.