

Cultural Practices

Turfgrass cultural practices influence water-use rates and efficiency. Mowing, fertilization, and irrigation are primary cultural practices superintendents can use to control water loss and to encourage conservation.

Mowing

Mowing practices can impact turfgrass water use. Managers should mow turf at the higher end of the optimum mowing height range. Higher mowed turf results in a deeper and denser root system that can extract water from a larger volume of soil. Lower mowing heights initially reduce water use because leaf surface area is reduced and remaining leaves are more compact. Initial water savings are later negated because root depth and density are proportionately reduced by the lower mowing height. Lower-mowed turf tends to require more frequent but shallower water applications than those mowed higher.

Turf managers also should mow frequently and only use sharpened mower equipment. Dull or improperly adjusted mower blades tend to shred turf leaf tips. This results in poor recuperation. Mutilated leaf tips also results in ragged turf appearance.

Nutrition

Nitrogen influences turf plants in terms of color, shoot and root growth, and water use. In general, enough nitrogen should be applied to turf to meet its nutritional needs for maintaining growth, recuperative ability, color and quality. Nitrogen generally increases shoot growth, shoot density, and leaf width which increases leaf area exposed to the atmosphere. Shoot growth also occurs at the expense of root depth and density. Thus, excessive nitrogen generally reduces root growth, which may adversely affect water extraction.

Potassium levels and their effect on water use are generally opposite those for nitrogen. Potassium nutrition increases leaf turgor, and thus delays wilting. However, excessive nitrogen levels can negate the positive effect of potassium fertilization.

Foliar iron applications also have been shown to increase rooting of turfgrasses under certain environmental conditions. Increased rooting adds to the depth of available water and may reduce irrigation needs. Iron and manganese also can provide desir-

able turf color without excessive growth from excessive nitrogen use. Supplemental iron and manganese should be applied to encourage turf color and root growth without stimulating excessive shoot growth.

Turf managers should strive to maintain adequate nitrogen for desirable turf color and for recuperation from damage, but not to the extent that excessive shoot-to-root ratios occur. Adequate potassium (e.g., equal to nitrogen) should be provided, especially during stress periods such as drought.

Soil Compaction

Soil compaction increases a soil's bulk density and soil strength while decreasing aeration porosity. As soil compaction increases, turf roots cannot extract adequate oxygen to sustain root growth. As a result, reduced root and shoot growth occur. Soil cultivation or coring on compacted soils enhances rooting and turf quality.

Watering Practices

Irrigation practices, in terms of amount and frequency, can significantly increase drought tolerance by conditioning the turf. Irrigation schedules are often based on calendar dates such as three or seven times per week without regard to actual turf needs and soil moisture status and availability. Studies have shown that "calendar-based" irrigation may provide excessive moisture and lowers turf quality.

Determining When to Irrigate

Several irrigation scheduling methods are available. These range from visual symptoms to more precise soil moisture based irrigations. Watering heavily but infrequently is a commonly accepted turfgrass management practice. However, this can be an ambiguous approach if the exact amount or frequency of water application needed at a given time is not determined.

Visual Symptoms

A simple method used to determine when irrigation is needed is to water when there are symptoms of moisture stress. However, golf course managers should avoid prolonged moisture stress, especially on greens. Moisture-stressed grass appears blue-green or grayish-green in color, recuperates slowly (> 1 minute) after walking or driving across it, or wilts continuously. These symptoms occur when plant