

This method indicates not only amounts being applied but also distribution pattern of the irrigation system.

Determining When to Water

Once the water delivery rate is known, determining when to water is the next important step. As discussed earlier, superintendents should not generally irrigate on a calendar-based time schedule. Irrigation should be based on ET rates and soil moisture replacement. Supplementing these measurements are the use of a rain gauge, soil moisture probe, visual turf wilting, and tensiometers.

Determining Application Rates

Determining water amounts to apply is the next step to water management. Enough water should be applied to wet the entire root zone of the particular turf. Wetting below the root zone is generally inefficient since this is beyond the use range of the plant. Too shallow irrigation encourages shallow rooting, increases soil compaction, and favors pest outbreaks. Generally, for golf greens and tees, the majority of roots are in the top six inches of soil. Therefore, irrigate to wet this depth unless the root zone extends deeper. For fairways and roughs, the top 12 inches of soil should become wet to supply sufficient water for the plant and to encourage deep rooting.

Amount of water required to wet these depths will depend on several factors including soil type, water infiltration and percolation rates, and soil slope. Figure 1 shows the approximate amount of water needed to wet various depths of clay, loam, and sand soils while Table 12 indicates conversion factors to determine gallonage required to irrigate various amounts. Managers should double check depth of moisture penetration by using a soil probe after irrigating. Once the time needed to moisten soil to the proper depth is determined, a turf manager will know how long to water an area in the future.

Soils that are severely sloped, compacted, clayey in nature, or have a cover of algae, may have low infiltration rates. Gusty winds also adversely affect uniform water distribution. As a result, soil may not be able to absorb the required amount of water at one time. The turf manager may, therefore, have to apply water gradually in multiple cycles by turning the sprinkler on and off several times until the required amount of water is applied.

Time of Day to Irrigate

As discussed earlier, water loss rates decrease with reduced solar radiation, little wind, high relative humidity, and low air temperatures. The superintendent can take advantage of these factors by irrigating when conditions do not favor excessive evaporation. Generally, irrigation should occur in early morning hours before air temperatures rise and relative humidity drops. Irrigating at this time also removes dew from leaf blades and allows sufficient time for infiltration into the soil but not encourage disease development.

A problem with this timing is that golfers often begin play early in the morning since it is generally cooler at this time of day. Therefore, superintendents may have to water at night. However, some evidence suggests that irrigating at night may increase the incidence of certain diseases. On most summer days, afternoon irrigation is not encouraged unless lowering canopy temperature is important, fertilizer or pesticide application must be irrigated-in, or overseeding and turf establishment are being conducted. Watering efficiency maybe reduced somewhat by mid-day irrigation. In addition, mid-day irrigation may result in compaction problems from concentrated play that normally occurs at that time. Therefore, superintendents should preferably irrigate in early morning, secondly at night, or least desirably, during the day. Irrigation during the day may be necessary to incorporate or activate fertilizer and pesticide applications, but these usually involve applying $\frac{1}{4}$ inch or less of water.