TURFGRASS WATER USE

Only one percent of the water applied to turfgrass is used for growth. Scientists are studying 'water use rate' of some turfgrass species for improved water savings.

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With the onset of water shortages and a growing awareness that water is a critical resource needing careful management, turfgrass researchers have placed an increasing emphasis on this area of research. More information is available to turfgrass managers which allows them to deal with water shortages and drought stress.

In many parts of the country, water shortages are an annual event. In other areas, these conditions occur occasionally, and the need for water conservation is much less predictable than in areas of regular drought stress. Most turfgrass managers are aware of water stress conditions in their areas, but they may not be aware of the best turfgrasses and management procedures to deal with them.

The very nature of turfgrass water use and drought resistance is complex. Interactive plant management and environmental factors are involved.

With this in mind, some of the terms used in this article may be confusing to the reader. An attempt will be made to clarify terms that may not be commonly used or understood by the reader.

Water use by the turfgrass plant is dynamic and interactive with the plant, environment, soil and cultural practices. Turfgrass water use rate (WUR) is the amount of water needed for growth, plus that used in evapotranspiration. WUR is typically expressed as inches of water used per week. Research publications often report water use in millimeters per day (25 mm equal one inch). According to research by James Beard, Ph.D., at Texas A&M University, turfgrasses with very high WUR may use as much as 9.0 mm of water per day or 2.5 inches per week.

Those turfs with very low WUR may use less than 4.0 mm per day or less than 1.0 inch per week. Turfgrass species differ in their water use rates. For example, the Table 1 contains a relative comparison of nine cool-season turfgrass species water use rates.

Similarly, turfgrass cultivars differ in WUR. Studies at the University of Nebraska have shown as much variation in water use within cultivars of Kentucky bluegrass as between the nine cool-season turfgrasses evaluated. This variation is interesting because it demonstrates that cultivars can be selected which have lower water use rates. It also shows that turfgrass breeders have an opportunity to develop cultivars with inherently low water use rates.

Water loss through evaporation occurs from soil, thatch, plant surfaces and water surfaces.

Other studies have shown that tall fescue cultivars differ in WUR, particularly when forage-types are compared with the new, improved turf-types.

The term "water use rate" is often considered to be the same as evapotranspiration rate. An estimated 99 percent of the water taken up by the turfgrass plant is lost to the atmosphere by evapotranspiration. The remaining one percent is used by the plant for growth and development.

Evapotranspiration

When water vapor is lost to the atmosphere by evaporation from soil and plant surfaces and by transpiration from plants, it is called evapotranspiration (ET). Water loss through evaporation occurs from soil, thatch, plant surfaces and water surfaces. Evaporative losses are greater immediately after irrigation or rainfall. They become less important as soils and other surfaces dry down.

Under these conditions, transpiration becomes more of a contributing factor to water loss than evaporation. The turfgrass roots actively grow and extract moisture from the soil.

This water is transported in the liquid phase in the plant. It is subsequently lost to the atmosphere as water vapor through pores in the leaf blade (stomata). Evapotranspiration could be considered a highly inefficient system. However, it serves as a driving force for nutrient uptake, translocation of nutrients and a cooling mechanism in plants.

Water use efficiency

The amount of dry matter produced per unit of water lost by the plant is termed water use efficiency (WUE). This term has a very limited role in turfgrass management. In most cases, turfgrass managers are more interested in plant survival and maintaining turfgrass quality than in clipping yields or dry matter production.

Although, WUE could be used if efficiency was related to maintaining turfgrass quality. WUE in relation to turfgrass quality would vary for the particular turf. For example, the effi-

TABLE 1.

RELATIVE WATER USE RATES OF 9 COOL SEASON TURFGRASS SPECIES

SPECIES	WATER USE
Tall Fescue	
Forage-type	Very High
Turf-type	Medium to High
Perennial Ryegrass	Medium
Kentucky Bluegrass	Medium
Creeping Red Fescue	Medium
Chewings Fescue	Medium to Low
Hard Fescue	Medium to Low
Creeping Bentgrass	Medium to High
Rough Bluegrass	Medium
Annual Bluegrass	High

Comparisons are based on turfgrass evaluations conducted at the University of Nebraska ciency value for a golf green would be considerably different than that for a roadside utility turf.

Canopy resistance

The turfgrass canopy is the area of turf located from the thatch or soil surface to the tip of the blades. Canopy resistance is the mechanical impedence of water vapor and air movement by the configuration of the plants making up the canopy.

Evapotranspiration could be considered to be a highly inefficient system, but it can be a driving force for nutrient translocation and plant cooling.

Turfs with dense, tight canopies have greater canopy resistance than those with open stands. Once water leaves the leaf blade through the stomata, it travels as a gas in a path of least resistance to the atmosphere.

TABLE 2.

A COMPARISON OF RELATIVE WATER USE RATES OF TALL FESCUE CULTIVARS

CULTIVAR	TYPE	WATER USE
Kenhy	Forage	High
Pastuca	Forage	High
Kentucky-31	Intermediate	Very High
Houndog	Turf	Medium
Adventure	Turf	Medium to Low
Rebel	Turf	Low

Comparisons are based on evaluations conducted at the University of Nebraska.

TABLE 3.

WATER USE RATES OF KENTUCKY BLUEGRASS CULTIVARS AND THEIR CANOPY RESISTANCE ASSESSMENTS

CULTIVAR	WATER USE	CANOPY RESISTANCE
Park	High	Low
Aspen	High	Medium to Low
Ram I	Medium to Low	Medium
Touchdown	Low	High
Sydsport	Low	High

Relative values are based on studies conducted at the University of Nebraska

Water vapor gradients exist from the leaf surface, in the canopy, and to the atmosphere. Turfgrasses with low ET rates tend to be dense, low-growing types. Those turfs with high ET tend to have open canopies with a rapid vertical elongation rate. Canopy resistance plays an important role in water conservation of irrigated turfs.

Research from Texas A&M university has demonstrated the importance of canopy resistance in irrigated turfgrasses, especially with warm-season turfgrasses. Studies at Nebraska pointed out similar responses for Kentucky bluegrass turfs.

Turfgrass managers should be aware of the plant growth characteristics that influence a potential low water use rate:

- high shoot density
- high verdure
- dense leaves of narrow width
- horizontal leaf formation, and
- a slow vertical leaf elongation rate.

Selecting turfgrass species and cultivars with these characteristics can be helpful in water conservation. These characteristics can be manipulated with cultural practices. Depending on their intensity of use, they can benefit programs interested in reduced water use. **LM**