EB1280

TURFGRASS

SOIL-WATER RELATIONSHIP

INTRODUCTION

Research has been done to try and provide specific water requirements of the different species of grasses and soil-water-plant relations of grasses. Water-use rates of grasses are very similar and require an understanding of the physical sciences before proper irrigation practices can be applied.

SOIL-WATER

Water-holding capability varies with differences in soil particle size. The smaller sizes have greater usable water-holding capacities. Plants use water from the film of water surrounding the soil particles and not from the pores in a well-drained soil. The higher the silt and clay content, the higher the water-holding capacity, and available water, except in extremely high clay content soils. Although soil structure generally does not affect water-holding capabilities, layering and changes of soil texture can indirectly affect usable water by delaying internal drainage.

- Coarse soils—may store from about .5 to 1.5 inches of usable water for each one-foot depth of soil.
- Medium-textured soil—may store from 1.5 to 2.5 inches of usable water per one-foot depth of soil (fine sandy loam–silt loam).
- Heavy soils—may store up to 3 inches per foot of soil depth.

Organic Matter

Materials such as peat moss, well-decomposed sawdust or suitable composts can be used to improve soil-water conditions. Adding these materials *will* increase the readily available water content somewhat. These materials often *do improve* infiltration rates which get the water into the soil. Too much organic material near the surface can also *decrease* the wettability which causes slow infiltration. Care must also be taken when choosing organic amendments. Materials with too many fine particles can actually clog the soil pores and restrict water infiltration. The ideal soil for turfgrass growth should be a sandy loam which contains a maximum of 20% fine particle organic matter by volume.

Soil Depth

In addition to texture, the ability to store water can be limited by depth of the soil or of the roots of the plant. Depth of both can be dictated by hard pans, cemented layers, compaction, and bedrock.

PLANT-WATER USE

The rate of plant-water use depends not on soil type but is governed by weather conditions and plant materials. Temperature, humidity, sunlight, and wind are the primary factors of plant-water use. Soil-water depletion is a combination of transpiration (water which comes from the soil and evaporates from the leaf stomata) and evaporation from the soil itself and through the leaf cuticle.

Research is being done on soil-water levels for best results. Quality is most affected and it is difficult to

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measure this value. A maximum of 50% moisture depletion in the rooting zone is a current recommendation. Weather data can be used to predict plant-water requirements. Weather records over long periods of time can be used as a rough guide to plant needs, but day-to-day information is needed where better water management is desired. Daily evaporation from U.S. Weather Bureau evaporating pans is usually published under "Weather Reports" in most newspapers daily and can be used to evaluate plant-water use. Ratios of plant-water use to evaporation for most lawn grass species is estimated to be 0.8:1. Therefore, turfgrasses that are normally maintained will utilize about 80% of open-pan evaporation. Unclipped grasses have a higher ratio of use of evaporation. A table of water use rates and recovery characteristics of grasses in western Washington is shown below.

DETERMINING FREQUENCY OF IRRIGATION

The following factors are involved:

- Water-holding capacity of the soil
- Effective rooting depth of grass
- Weather condition
- Quality of grass desired
- Other management problems

Example:

Effective rooting depth:	2'
Water-holding capacity:	2" per ft.
Safe removal:	50%

2' x 2" x 50% = 2"
(safe amount to remove between irrigations)

Very few systems apply water uniformly, and a 70% estimated efficiency factor is recommended unless a specific test has been made. When using evaporation data at a ratio of 0.8:1 and a 70% efficiency, 1.14 inches of water should be applied when one inch has evaporated. When all or part of the irrigation requirements are met by precipitation, less should be applied.

Evaporation at Selected Locations for 1994

	Apr	**May**	**June**	**July**	**Aug**	**Sept**
Location			*Inches*			
Whitman	4.83	6.89	8.46	11.09	9.71	5.31
Yakima	5.66	8.03	9.10	12.26	9.88	6.58
Puyallup	*	*	*	6.83	5.99	3.80
Wenatchee	5.75	*	8.89	12.41	9.07	4.89

*Data not taken.

Other methods of determining when to irrigate include soil sampling, use of tensiometers, and resistance blocks. Each system has its advantages and disadvantages but all are reliable when used

Water Use Rates and Recovery Characteristics of Turfgrass Adapted to Western Washington*

Relative Ranking	*ET Rate (Inches/Day July 1–Sept. 1)*	*Turfgrass Species*	*Deficit Irrig. Requirement (%)*	*Drought Injury Rating*
Medium	.08–.15	Hard fescue	00–50[1]	Very low
Medium	.11–.18	Chewings fescue	00–60[1]	Low
Medium	.11–.18	Creeping fescue	00–60[1]	Low
High	.14–.23	Perennial ryegrass	60–80[2]	Med/high
High	.12–.23	Colonial bentgrass	40–80[3]	Med/low
High	.12–.23	Kentucky bluegrass	60–80[4]	Medium
Very high	.15–.26	Annual bluegrass	90–100[5]	Very high
Very high	.15–.26	Tall fescue	20–80[6]	Low

1. Will turn brown when deficit irrigated, but will come back in following spring; however, these do not withstand or recover quickly from wear when stressed.
2. Does not persist below 60% in uniform stands on shallow soils. Related to fertility levels.
3. Recovers well.
4. Doesn't persist below 60%.
5. Not very persistent, although this winter annual will seed prolifically and germinate early. Does not withstand wear but may recover quickly by reseeding.
6. This is potentially very persistent, although research is still underway; the dwarf varieties of this type appear to be preferable. Easily invaded by annual bluegrass.

*Data provided by Dr. Stanton E. Brauen, WSU Puyallup.

properly. Feel the soil. If it is moist at the 3-inch depth, delay irrigation.

IRRIGATION MANAGEMENT

Other than matching applications to plant needs, one of the main problems involved is applying water faster than the soils can absorb it. Apply water slowly to allow penetration. Grasses often develop a high surface tension due to thatch layers, etc., and infiltration rates are slow. It is best to apply one-third the total amount of water for a single irrigation to break the surface tension, turn the system off for approximately one hour and then apply the remainder of the water. A single irrigation can be applied in as many as 3 or more cycles. This is especially important on uneven or sloping ground.

The following formula can be used to determine the total amount of water applied.

$$\frac{\text{gpm per sprinkler} \times 96.3 \times \text{hrs.}}{\text{spacing of sprinklers}} = \text{inches applied}$$

Example:

$$\frac{4 \text{ gpm} \times 96.3 \times 1 \text{ hr.}}{10' \times 10'} = 3.85 \text{ inches}$$

If a uniformity of 70% is used, 3.85 x .70 = 2.7 inches is the amount that could be expected to be applied over the entire area.

Overirrigation can leach plant nutrients, especially nitrogen, and in extreme cases can cause lack of oxygen and limited rooting of the grass.

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