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LANDSCAPING: Water Requirements and Irrigation System Management

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Lawn irrigation accounts for nearly half of homeowner water usage. Many homeowners irrigate too often and for too short a period to meet lawn and especially landscaping (tree and shrub) needs and often compromise the health and vigor of their landscape's plant community. Others tend to leave the water running too long resulting in wasted water and high water bills. Properly adjusting automatic watering systems is an important practice generally overlooked or often incorrectly done.

Factors Affecting Proper Irrigation Scheduling

Irrigation requirements are a function of four things: plant adaptation, soil properties, precipitation, and evapotranspiration rate. Any of these factors can become the most critical component of an irrigation strategy's success or failure.

Plant adaptation: There are plants adapted to dry environments while others are adapted to more moist environments. Homeowners who have implemented a xeriscape strategy will generally have reduced irrigation requirements. More traditional home landscapes are composed of plant species with higher water requirements and lower tolerance for drought. Those more traditional home landscapes will thrive given the irrigation strategy suggested here.

Soil properties: Soils can vary tremendously in their effective depth and composition (of clays, silts, sands, and organic content). These factors affect the amount of water holding capacity. Coarse (sandy or gravelly) soils do not hold as much water as finer (silt or clay) soils. Water infiltration is quicker, and water may move beyond root zones in the coarse soils. Water holding capacity determines the relative length of time between irrigations. Infiltration rate affects the speed at which we can effectively apply water.

Table 1. Available soil moisture holding capacity for various soil textures

Soil texture	Available moisture (inches of water / foot of soil)
Coarse sand and gravel	0.2 to 0.7
Sands	0.5 to 1.1
Loamy sands	0.7 to 1.4
Sandy loams	1.3 to 1.8
Fine sandy loams	1.7 to 2.2
Loams and silt loams	2.0 to 2.8
Clay loams and silty clay loams	1.7 to 2.5
Silty clays and clays	1.6 to 2.2

Adapted from
www.ag.ndsu.edu/pubs/ageng/irrigate/eb66w.htm

Table 2. Infiltration rates for common soil textures

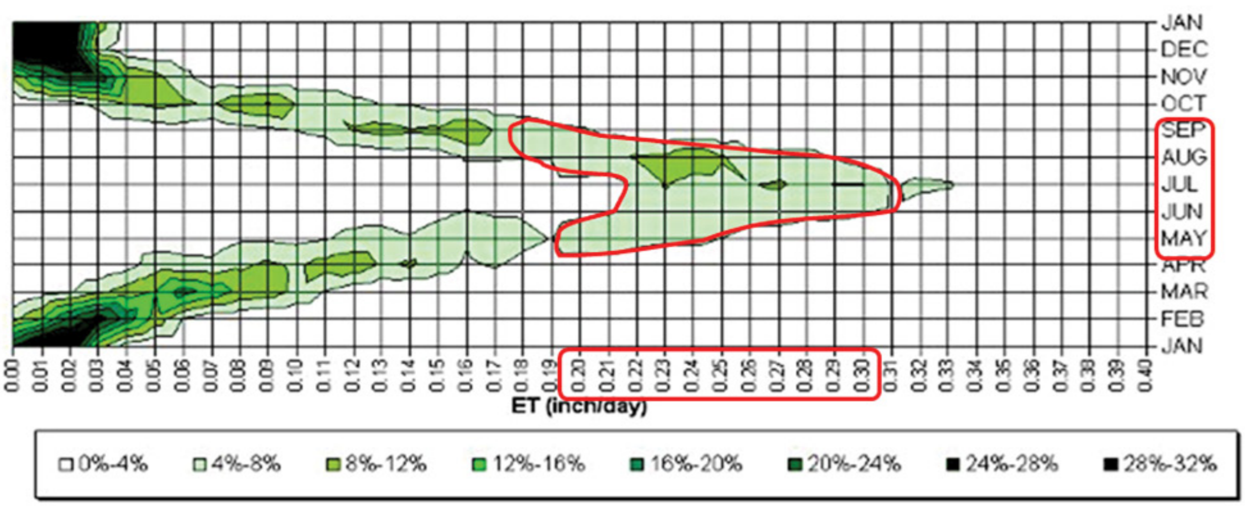
Soil texture	Infiltration rate (inches of water / hour)
Coarse sand	0.75 to 2.0
Fine sand	0.50 to 1.0
Fine sandy loam	0.50 to 0.75
Silt loam	0.25 to 0.4
Clay loam	0.10 to 0.25

Adapted from
http://extension.oregonstate.edu/catalog/html/pnw/pnw287/#table1

Precipitation: Regardless of whether irrigation is viewed as supplemental to precipitation or vice versa, precipitation and irrigation constitute water applied to the soil. Rains can and should enter into the decision process regarding the need to irrigate. Homeowners often overestimate the amount received if they do not have a means to measure precipitation. Rain gauges are inexpensive and can provide information critical in properly scheduling irrigation.

Evapotranspiration: Evapotranspiration is a combination of the disappearance of moisture from the soil through surface evaporation and the consumption of soil moisture by plant transpiration. Evapotranspiration is affected by many factors including temperature, wind, slope, aspect, and relative humidity. Evapotranspiration rates will vary over the course of the year. Evapotranspiration rates for Afton, Wyoming, are presented in Figure 1.

Figure 1. Afton Daily Evapotranspiration Frequency (1988 – 2002)



From www.wrds.uwyo.edu/sco/climateatlas/evaporation.html#104

Maintaining Soil Moisture

The amount of moisture available in the root zone (0-12 inches) of most small-stature landscape plants, when balanced against the evapotranspiration rate, indicates most lawns only require irrigation once every four to eight days to stay healthy. This prediction should be periodically fine-tuned depending upon observed weather conditions and, particularly, sprinkler zone variations in aspect, slope, shading, and distribution efficiencies. Severe conditions could double evapotranspiration rates. Providing periodic irrigation sufficient to thoroughly wet the top 12 inches of the soil profile guarantees deep percolation sufficient to meet the needs of large-stature landscape plants like shrubs or even trees. Allowing depletion of water in the soil profile (not quite to the point of wilting small-stature plants) provides oxygenation to the soil's micro-flora and fauna and encourages plants to extend root systems deeper into the soil.

The resulting balance of the important irrigation factors might look something like this:

$$\binom{Soil\ moisture\ availability}{(From\ Table\ 1)} = \binom{Precipitation}{Measured} + \binom{Irrigation}{Scheduled} - \binom{Evapotranspiration}{(From\ Figure\ 1)} - \binom{Percolation}{beyond\ roots}$$

For example, 12 inches of a well-wetted, sandy loam soil should hold between 1.3 and 1.8 inches of moisture (Table 1). Assuming no rainfall, the water in the soil should be sufficient to last five to seven days in an average July when evapotranspiration is 0.25 inches per day. Setting the program to apply 1.25 inches on five-day intervals will meet needs while a four-day interval provides extra insurance.

Programming The Automatic Irrigation System

Many water-related landscaping issues can be traced back to the settings programmed in the automatic watering system. Often, the contractor sets up the system to irrigate for a few minutes every morning. Sometimes it is programmed to irrigate several times a day for newly seeded or sodded lawns. These strategies please the homeowner who has invested in a system with such capabilities. The strategy is great for establishing turf from seed. It is, however, absolutely the incorrect program for established plants. The installer's error is in not encouraging the landowner to alter the schedule to a more proper regime. In addition, many systems will revert to some default program after power outages requiring a homeowner to periodically check the current program for correctness.

Shallow-rooted plants result from irrigating every day. Irrigating less often and applying more water per irrigation results in deeper-rooted plants and healthier turf. Plant roots grow deeper into the soil and the plants become more vigorous if enough water is applied when you do irrigate. Deeper-rooted plants use water and nutrients from a larger volume of soil and are well-prepared to withstand occasional neglect and short-term drought conditions (or system outages). As a guide, if Kentucky Bluegrass doesn't spring back after being stepped on, it's probably time to irrigate. Moisture-stressed grass often takes on a duller blue-green color indicating the need to adjust watering schedules.

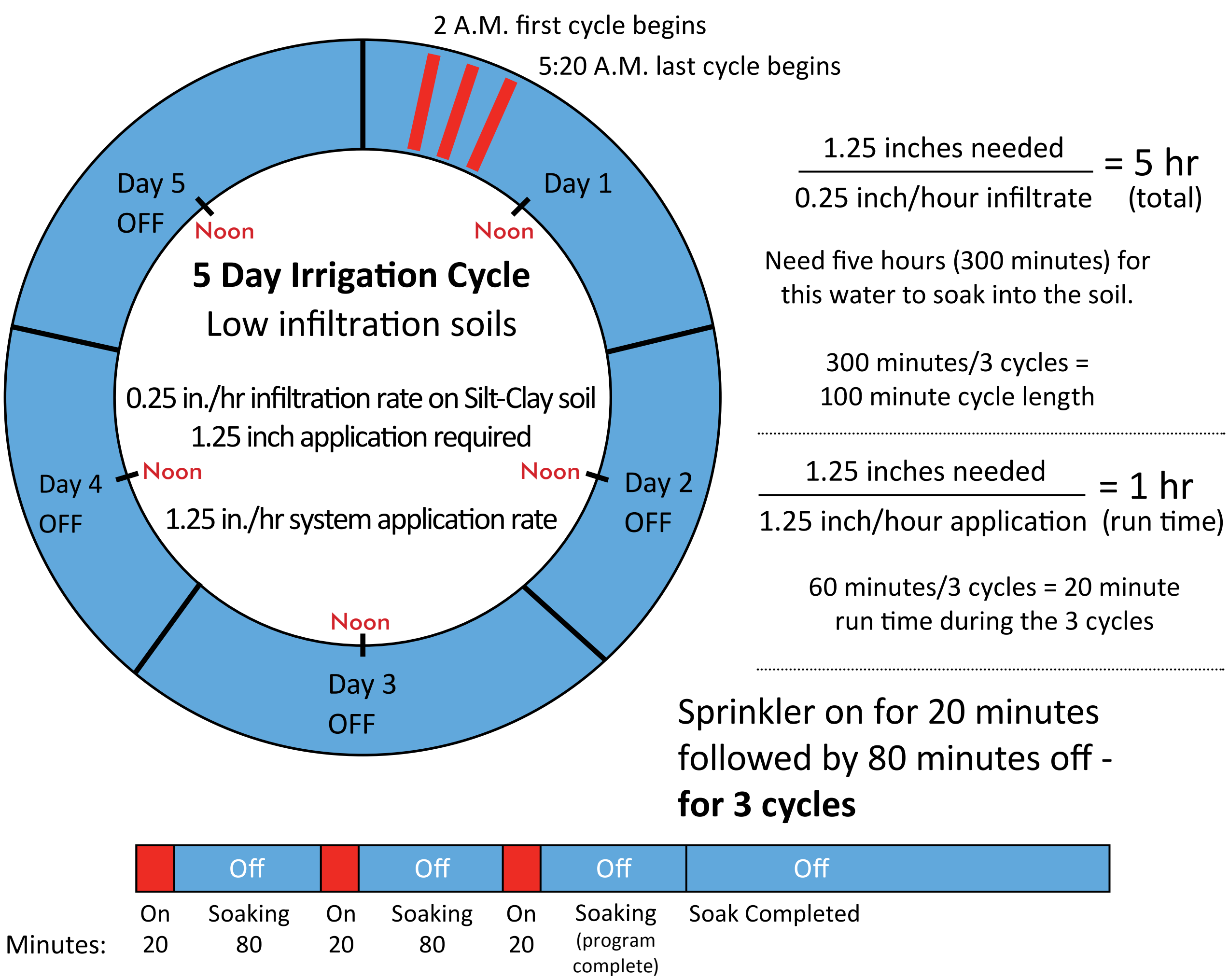
The system's application rate is easily determined by placing something as simple as empty soup cans in the sprinkler zone and measuring the time taken to accumulate a measured depth of water. If soil properties are such they aren't capable of absorbing recommended irrigation volumes (Table 2), runoff will occur. Runoff water is wasted water, and the rate of application must be managed. One strategy is to change to smaller, lower-output sprinkler nozzles and longer run times. A more practical solution is to split irrigation into shorter time segments and alternating run time with soak periods to accommodate application of the proper irrigation volume during the scheduled irrigation day (Figure 2).

Automatic irrigation system owners and managers should change controller run times to meet seasonal plant needs. Plants require less water in cool spring and fall periods and more water in the heat of summer. For example, bluegrass lawns may require 0.6 to 0.9 inches of water per week in spring and fall but need 1.25 to 1.5 inches per week in midsummer. Some controllers allow watering a percentage of peak summer run time settings. With one setting change, systems can easily be reset to 60 percent for spring and fall watering.

Practicing seasonal adjustments conserves water and results in healthier plants by matching water application to plant needs. Too much water is often applied to clay soils depriving plant roots of the oxygen needed to function. Excess watering also tends to leach available nitrogen through and beyond the root zone. Applying the right amount of water produces healthier roots.

Observing plant conditions and using judgment is very important. A shady or northern exposure sprinkler zone will likely require only half the water of a level, sunny landscape. A south- or west-facing slope may require two times the water of a level landscape area. Adjust zone run times on the controller accordingly.

Figure 2. Alternating apply/soak cycle example for a low infiltration silt-clay soil



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