Irrigating Lawns When Water Supply is Reduced

Howard Neibling, Extension Water Management Engineer, University of Idaho

Several approaches can be taken to maintain an attractive lawn with reduced water supply: 1) apply only the water needed when it is needed, 2) water deeper and less frequently, 3) apply water as uniformly as possible, and, if required, 4) systematically stress lawn and trees.

Apply water only the water needed when it is needed

Figure 1 shows the seasonal variation in daily evapotranspiration (ET), the water use that must be supplied by a lawn irrigation system, in the Magic Valley. In areas of higher elevation, the peak use is similar but the length of growing season is shorter. Grasses have a longer water use season with lower peak use relative to vegetable crops. For example, turf water use starts by about April 1, and continues until killing frost or as late as mid-October, while most vegetable use does not start until mid to late May. Peak turf use occurs from mid-June through the first part of August, with peak values of about 0.26 inches/day. From **Figure 1**, the depth of water to add on a 2-day interval ranges from about 0.3 inches in late April to a peak of about 0.5 inches in July and then drops off to about 0.3 inches again by mid-September.

The right-hand axis on Figure 1 shows the percent of maximum ET for any date. Some lawn sprinkler controllers have a “% ET” setting that allows just that number to be changed throughout the season rather than having to re-program the irrigation time for each zone for each irrigation day. Changing the “% ET” setting periodically allows the irrigation system to apply the average water requirement for that time during the year. If observation shows that too much or too little water is being applied for the actual conditions, the application rate can be changed easily.

The seasonal water use pattern and peak water use for most trees on a unit area basis is about the same as that for grass. The area usually considered is the area shaded by the tree when the sun is directly overhead. Because ET is limited by incoming solar energy, water use in an area with a tree and grass underneath is not the total of both tree and grass ET but is limited to potential ET (about 1.25 times either grass or tree ET). Cumulative water stress over a period of time can weaken or kill large trees. This can happen as a result of watering frequently but shallowly, which allows grass to out-compete the deeper tree roots for the applied water. In times of water shortage, California data for intermountain conditions similar to Southern Idaho suggest that most deciduous and conifer trees can be irrigated at about 40-60% of potential ET (about ½ to 3/4 of the water required by grass) without undue loss of appearance or decrease in health.

Water deeper and less frequently

Watering every two or three days rather than every day saves water in several ways. Water on plant leaves and from very wet surface soil evaporates easily and is lost without benefit to the plant. If water is applied daily, about 15% of water applied is lost in this way. If water is applied every two days, losses are about 8%, and, if once in 3 days, about 5%. About a 10% reduction in evaporation loss can be achieved by watering once in 3 days rather than daily. The reduction for alternate day watering vs. daily watering is about 7%.

Watering deeper also encourages deeper rooting and moves more water past grass roots to be available for trees. A deeper root system for grasses and trees provides a larger “water reservoir” to help minimize stress during exceptionally hot windy periods and provides access to a larger volume of soil for macro and micro plant nutrient availability. If some water is available for plant use (even at less than optimum rate) in the deeper portion of the root zone, the plant will be less water stressed than when almost all water is used from a shallow root zone and less “reserve” is available.

Watering at night reduces irrigation losses in several ways. First, since wind speed is usually lower at night, irrigation losses due to wind drift are reduced. Second, evaporation rates are lower at night so less water evaporates as water droplets fall to the ground. Also, higher wind speed distorts the water application pattern and leads to more areas of over or under-irrigation.

Apply water as uniformly as possible – keep your system well maintained

The more uniformly water is applied; the less total water is required to give most of the lawn a desirable appearance. For example, in a system with poor application uniformity, about 34% of the irrigated area will be significantly over-watered, with an equal area under-watered by the same amount. Only 10% of the irrigated area will receive near optimum irrigation. In contrast, a system with high water application uniformity will significantly over or under-water only 9% of the area, while 34% of the area will receive optimum irrigation (UI Bulletin 824 “Irrigation Uniformity” King, et al., 2000).

Poor uniformity can be caused improper spacing between heads, by rotating spray heads that no longer turn, by pop-up heads that are no longer vertical when in operation, or by improper system pressure. Correctly matching the system operating pressure to the optimum pressure range for the sprinklers used is essential for good water application uniformity. Poor uniformity can be produced by either insufficient or excessive system pressure (**Figure 2**). Optimum pressure for brass or plastic nozzles on gear-drive or impact sprinklers is about 40-60 psi, but some of the newer sprinkler head designs can operate well with less pressure. When water applied by nozzles operating in the optimum pressure range (**Figure 2**, center) is combined by overlapping patterns, the result is a relatively uniform depth of water applied. At lower pressures, more large water droplets are formed, producing the pattern shown in **Figure 2** (top) and **Figure 3**. Excess pressure produces more small droplets which are prone to wind drift and evaporation and produce the pattern shown in **Figure 2** (bottom). Water application uniformity resulting from overlapping patterns shown in the top or bottom part of **Figure 2** will be lower than that from overlapping the distribution shown for proper nozzle pressure. This poor distribution can result in areas of significantly higher or lower than average water application depths.

Systematically stress lawn and trees

Cool vs. warm-season grasses: Based on several studies, seasonal water use by warm-season grasses is usually about 70-80% of that from cool-season grasses under watering conditions giving acceptable appearance. However, part of the difference in water use is due to the fact that cool-season grasses green up earlier and have a longer growing season. In a New Mexico study under climate conditions similar to Southern Idaho, peak ET from warm-season grasses was about 86% of that from cool-season grasses while seasonal water use was about 80% of that for cool-season grasses. Cool-season grasses watered at 86% of the maximum rate still maintained acceptable appearance while warm-season grasses could be watered at 80% of maximum and still produce acceptable appearance.

Soil fertility also plays a major role in determining the minimum water needed for adequate turf appearance. For example, a 3-year study conducted in Jerome, ID showed that nitrogen fertility was a more significant factor in determining turf appearance than was irrigation. Grasses tested were Kentucky bluegrass, perennial rye and turf-type tall fescue. Under optimum N fertility conditions (2.2 lbs/1000 sq ft), perennial rye produced acceptable appearance with about 67% of full ET. With higher nitrogen application (4.4 lb/1000 sq ft), turf-type tall fescue produced adequate appearance at all ET levels. Based on clipping data, the rate of growth at the high N rate was unacceptable at the higher water levels but reasonable for lawn conditions at the 40% ET rate. Kentucky bluegrass produced a significantly lower appearance at all fertility and irrigation levels during mid-late summer. Perennial rye maintained adequate appearance for a longer portion of the growing season than either of the other two varieties.

Drought-tolerant trees, shrubs, perennial flowers and grasses: Information regarding irrigation water management in lawns and gardens is available from the University of Idaho Lawn Irrigation website (http://www.uidaho.edu/extension/lawn). One link from that site is to a website developed by Lamar Orton, with the City of Twin Falls. His site lists a number of drought-tolerant tree, shrub, perennial flower and grass species native to Southern Idaho. Pictures and additional information for most entries can be obtained by clicking on the plant name. Another site, developed by California extension personnel, rates the drought hardiness of a number of trees, shrubs and perennials according to climatic region. Many of the plants listed are not suitable for Southern Idaho. However, ratings for region 5, a high-desert environment, could apply to our conditions. The site is: http://ucce.ucdavis.edu/files/filelibrary/1726/15359.pdf.

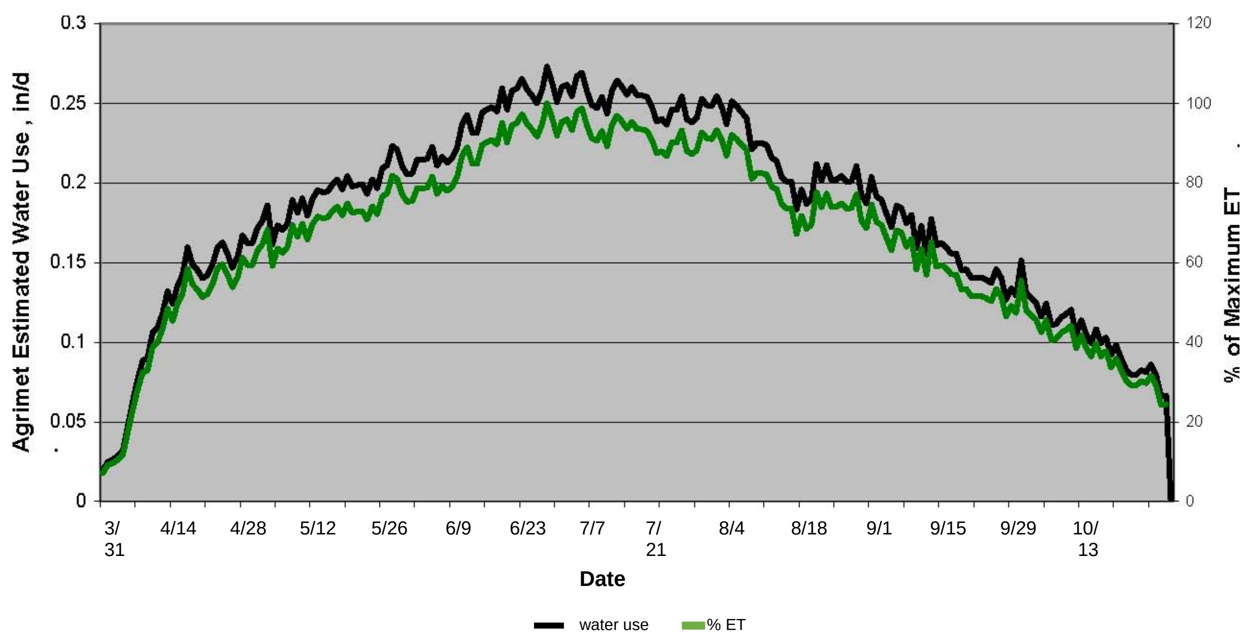

Figure 1. AGRIMET estimated water use in inches per day and % of maximum ET for Kimberly, ID. This figure can be used with lawns having a timer with a % ET setting. Enter the graph at the appropriate date, move up to intersect “% ET” line and read setting to meet ET on right axis.

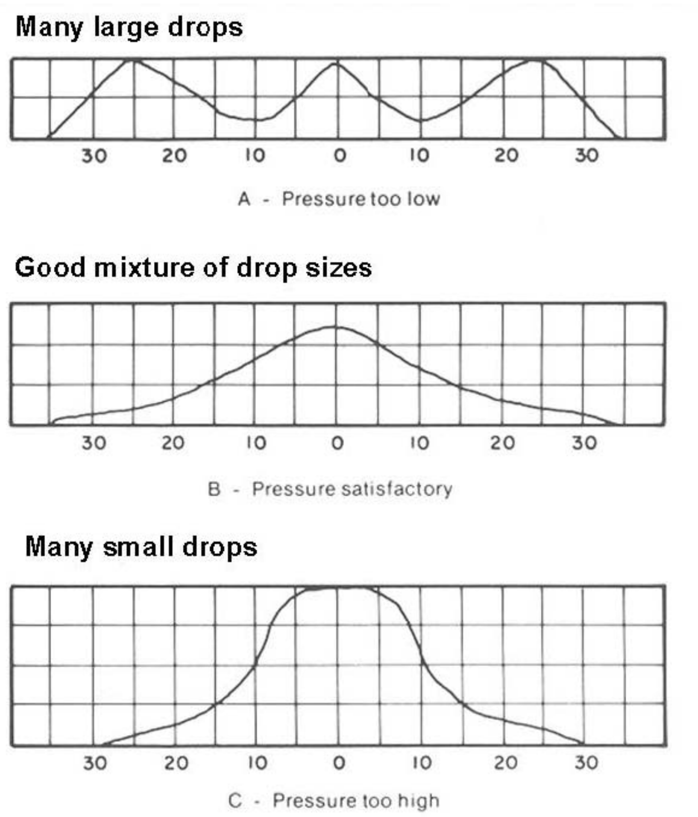

Figure 2. Variation in water application rate with horizontal distance (in feet) to the left and right of the sprinkler riser. The riser is located at distance “0”.

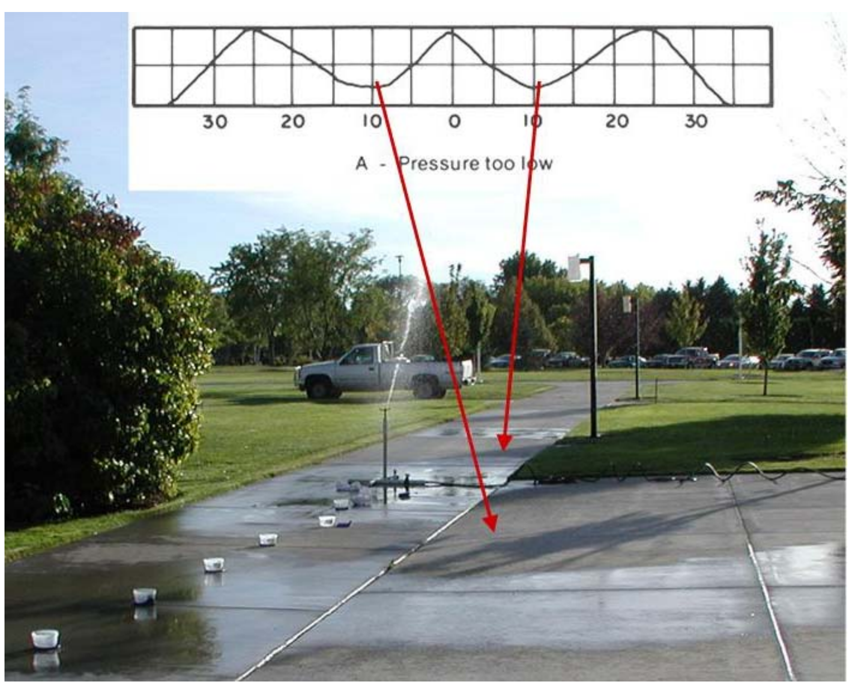

Figure 3. Water distribution from a sprinkler test using a brass nozzle at 20 psi system pressure for 20 minutes. Note the dry areas on the pavement corresponding to low areas in the theoretical distribution shown above.

Determining system run time based on catch can data

To check system application rate, set out a set of vertical-sided cans spaced between sprinkler heads, run the system until about an inch of water is present in most cans, average the depths and determine application rate by:

Application rate, in/hour = (average depth of water in inches)/(number of minutes run/60)

Time to run the system to meet ET is then:

Run time (hours) = irrigation water to apply (inches)/application rate, in/h

Example: depths of water in 6 cans after 50 minutes of running are: 0.75, 1.0, 0.75, 0.75, 1.25, 1.0. Average depth is (0.75+1.0+0.75+0.75+1.25+1.0)/6 = 0.92 inches.

Application rate = (0.92 in)/(50/60) **= 1.1 in/h.**

From the figure below, the **4-day** gross water to add (accounting for losses) during the first week of September is about 1 inch. To apply this amount, the system should be run for:

Run time = 1.0 inches/1.1 in/h = **0.91 hours or about 54 minutes every 4 days (or about 27 minutes every 2 days)**.