

Irrigating home lawns

Proper knowledge of one's lawn and irrigation system can be used to apply the correct amount of water, which not only keeps lawns healthy, but also saves money and water in the long run. Over-watering of lawns is unnecessary and expensive, plus it leads to unhealthy turf. Yet overwatering is a widespread problem with automatic irrigation systems. Both frequency and amount of irrigation will change across seasons with temperature and depth of rooting, so irrigation practices should be adjusted throughout the year. The following guidelines describe the necessary steps for maintaining a healthy lawn while minimizing water use.

Why irrigate

Water is essential for all plants and is necessary for rigidity and structure of the plant, photosynthesis, movement of nutrients, and cooling. Water moves through plants from the soil to the atmosphere. Since water is abundant inside a leaf (relative humidity is 100 percent), water moves out of the leaf to areas where water concentration is lower (air has less than 100 percent humidity on even the most humid day). This overall process of water movement from the roots upward and out of the leaves is called *transpiration*.

Summary:

- Lawns perform best when slightly dry.
- Deep, infrequent irrigation at first sign of drought stress is best.
- Early morning is the best time to irrigate.
- Soil type, slope, and turfgrass species and cultivars can affect water use and irrigation schedule.

A plant needs approximately 60 to 70 gallons of water to produce 1 pound of dry matter (Emmons, 2000). Plants use as much as 90 percent of this water for transpiration. Additional water is lost directly from the soil due to evaporation. The combined loss of water from transpiration and evaporation is called *evapotranspiration*, or ET. As much as 85 percent of the water in the soil is lost from evapotranspiration (Emmons, 2000).

When to irrigate

Several methods exist for determining when to water your lawn. The simplest method is by visual estimation. When symptoms of moisture stress appear—wilted grass will turn blue-gray or grayish-green in color—it is definitely time to irrigate. Additionally, footprints remaining visible in the lawn after walking on it is a sign of early drought stress (Figure 2), and it should be watered that evening or the next morning. Another method is by digging into the soil with a



Automatic irrigation is never maintenance free. Irrigation heads break, lose their aim, jam on or off, etc., all resulting in inefficient irrigation and a waste of water.

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knife or similar probe. Irrigate if the soil is dry to 2-3 inches deep (it will appear lighter in color), as most of a grass plant's root system is located in this region.

A thorough irrigation once or twice per week is best. In simple terms, lawns should be irrigated "deep and infrequently." Irrigate to wet the soil to the depth of rooting and then do not irrigate again until the lawn shows the first signs of drought stress. This wilt-based approach increases rooting depth of turf and water-use efficiency (Fry and Huang, 2004). Daily watering is not recommended for lawns, as this can lead to thatch, increased disease and weed problems, and shallow rooting.

Time of day to irrigate

The best time to irrigate is when there is little wind, high relative humidity, and lower temperatures, as these will reduce evaporative water loss. These conditions typically occur at night or early morning. As much as 50 percent of the water applied during a midday irrigation may evaporate before it even reaches the ground (Emmons,

2000). Nighttime irrigation is impractical, and disease problems can arise if grass remains damp overnight. Therefore, the best time to irrigate is early morning.

How much to irrigate

Maintain adequate moisture to the depth of rooting, usually the top 2 to 3 inches of soil. Since this region of soil loses water due to ET, it is necessary to replace the amount of water lost, either through natural rainfall or irrigation. The simplest method is to irrigate for a given time (20 minutes, for example), and then check to see how deep the water has infiltrated into the soil. Monthly values of typical home lawn water requirements in Nebraska are listed in Table 1.



Figure 1 (Left) Footprints remain visible in mild drought-stressed turf. (Right) Footprints and wheel paths are highly visible in more severe cases of drought-stressed turf.

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Water lost from the soil can be estimated more accurately using an evaporation pan filled with water in a sunny location. The amount of water that evaporates from the pan is similar to that lost from turf due to ET. Usually, the amount of irrigation water applied is 75 to 85 percent of the amount lost from the evaporation pan. For example, if 1 inch of water evaporated from the pan in 1 day, then 0.75 to 0.85 inches of water should be applied by irrigation and rainfall.

The best way to determine the amount of water to apply is by measuring the amount of water a sprinkler delivers in a given time over the area. Place at least five shallow cans of equal diameter (tuna cans work great) at various distances from the sprinkler or throughout the lawn with automatic sprinklers. After 1 hour, combine the water from the cans, measure the depth, and then divide the total depth by the number of cans used. For example, if the five cans collected 2.5 inches of water from a sprinkler or system after 1 hour, the *average precipitation rate* is 0.5 inches per hour (2.5 inches per can / 5 cans = 0.5 inches). Therefore, as in the previous example, the evaporation pan lost 1 inch of water in 1 day. To replace 0.75 inches of water, the sprinkler system should be run for 1.5 hours (0.5 inches per hour x 1.5 hours = 0.75 inches). Correct calculation of irrigation applications helps to maximize water use while maintaining a healthy lawn and minimizing water loss.

Factors affecting irrigation requirements

The lower the relative humidity and greater the air temperature and sunlight, the more water is lost. Additionally, higher soil temperatures contribute to increased water

Table 1 Estimated water requirement of typical home lawns in western and eastern Nebraska during select months (from Rodie et al., 1999)

Month	Water amount (inches/week)	
	Western Nebraska	Eastern Nebraska
April / May	1.0 - 1.25	0.75 - 1.0
June	1.25 - 1.5	1.0 - 1.5
July	2.0 - 2.25	1.5 - 2.0
August	1.25 - 1.5	1.0 - 1.5
September / October	1.0 - 1.25	0.75 - 1.0

loss. Wind also is a factor, with greater wind speed increasing transpirational water loss. Under hot, sunny, dry, windy conditions, such as those during the dog days of summer in Nebraska, an acre of turfgrass can lose more than 10,000 gallons of water a day to the atmosphere (Emmons, 2000).

Clay soils can hold approximately twice as much water as a loam and about four times as much as sand (Emmons, 2000). Also, sandy soils have higher infiltration rates than clay soils (Table 2). Slope also affects the rate of water absorption and infiltration. If precipitation rates (either from rainfall or irrigation) exceed infiltration rates, standing water can occur, or water can move downslope. If the site is sloped, water can move across the surface and be lost as runoff. If standing water or runoff occur during irrigation, total irrigation time should be divided into several shorter times. In this case, it is more beneficial to divide the irrigation time into three 30-minute sessions, spaced at least one hour apart.

Turfgrass species and cultivar also play a major role in irrigation requirements. For home lawns in Nebraska, the most common cool-season turf-type grass species used for lawns have relatively good drought tolerance. Performance data of turfgrasses commonly used in Nebraska lawns are summarized in Table 2.

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Water conservation tips

The following tips are some general techniques to reduce unnecessary water use and save money:

- Mow at 3.0 inches or higher year around. Turfgrass maintained at higher mowing heights has a deeper root system, and the deeper roots will be able to acquire water more easily.
- Keep your mower blade sharp. Using a dull blade can cause jagged wounds in the leaf blades and can result in 30-50 percent increased water loss (Emmons, 2000).
- Reduce nitrogen fertilizer rates. High nitrogen causes turfgrass to grow quickly, but it uses more water. As drought conditions set in, the lush leaves will be more prone to wilting.
- Do not let thatch get too thick (>0.5 inches). Deep thatch layers cause shallow rooting and slow water infiltration into the soil.
- Aerate your lawn to reduce compaction and minimize thatch. Aeration allows for greater water infiltration and reduces runoff.

- Reduce traffic on drought-stressed turf. Foot, lawn mower, or other vehicular traffic can cause serious injury to drought-stressed turf.
- If establishing a new lawn, use drought-tolerant species and cultivars.
- Do not irrigate when rain is predicted and shut off automatic irrigation after a rain.
- Water sensors and other tools are now available to turn off automatic irrigation systems after rains.

Unnecessary water use is a growing concern. With more and more homes being built, coupled with increasing water scarcity, proper water usage is of utmost importance. While it is important to maintain a healthy lawn, unnecessary water loss can be avoided while still maintaining a good quality lawn. Armed with the proper knowledge of your lawn and irrigation system, you can maintain a healthy lawn while minimizing cost and water use.

Table 2 Water-use rates of select turfgrass species suitable for home lawns in Nebraska († Zoysiagrass is not well-adapted for survival in western Nebraska; ‡ in adapted regions, zoysiagrass can survive with as little as 0.50 inches/week) (from Gibeault and Cockerham, 1895; Fry and Huang, 2004)

Species	Water use rate (inches/week)	Overall drought tolerance
Cool-season		
Kentucky bluegrass	1.0 - 1.8	Good
Perennial ryegrass	1.8 - 3.0	Fair
Tall fescue	2.0 - 3.5	Very good
Warm-season		
Buffalograss	0.25 - 0.75	Excellent
Zoysiagrass [†]	1.0 - 1.25 [‡]	Very good



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Table 3 Available soil moisture and infiltration rates for main soil textures (from Rodie et al., 1999; Emmons, 2000)

Soil texture	Soil type	Plant-available moisture per foot of soil depth (inches)	Depth (inches) penetrated by 1 inch of water	Infiltration rate (inches-/hour)
Light, sandy	Coarse sand	0.7	16	Fast (0.50 - 3.0)
	Fine sand	0.9		
Medium, loamy	Fine sandy loam	1.5	8	Moderate (0.25 - 0.50)
	Silt loam	1.9		
Heavy, clay	Clay loam	2.1	5 - 6	Slow (0.10 - 0.25)
	Clay	2.0		

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