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Texas A&M AgriLife Extension

PREVENTING RUNOFF WITH CYCLE AND SOAK IRRIGATION

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Runoff from landscape irrigation systems is a major source of water loss in Texas. Runoff is most common in compacted and clay soils, and on slopes, but it may occur on any soil if the irrigation system is run too long or if it applies water faster than it can infiltrate into the soil. Research has shown that as much as 30 to 40 percent of all irrigation water applied could be lost to runoff if the system is ran for too much time. Runoff also can carry fertilizer, pesticides, and silt—negatively impacting the water quality of local creeks, rivers, and lakes. Many cities have landscape irrigation ordinances that make irrigation runoff a finable offense.

CYCLE AND SOAK

The best approach to landscape watering is deep and infrequent. The goal is to promote a deep rootzone, which will make the turf more resistant to stress and drought, enabling the landscape to maximize the use of any rainfall that does occur. Normally, just one or two irrigation days per week is needed for most Texas lawns. A comparable analogy is like the gas tank in a car: The car can drive further by completely filling up its tank, rather than only putting a couple of gallons in the tank every few days. However, landscapes may require long irrigation runtimes to be able to apply the water needed, particularly during the summer. To control runoff, cycle and soak irrigation is used.

Cycle and soak irrigation is the practice of dividing the irrigation runtime into multiple shorter irrigations throughout the day. After each irrigation (or cycle), the water is allowed to infiltrate into the soil and make its way into the root zone where it can be used by the plant. The minimum time between irrigation cycles will vary from 30 to 60 minutes. Usually, heavy soils like clays require at least 60 minutes between cycles for best retention or the soaking of irrigation water into the root zone. Cycle and soak schedules will vary at each site based on soil type, slope, and sprinkler precipitation rate.

Most landscapes in the North, Central, and Eastern regions of Texas consist of clay soils, with lighter soils like sandy loam being more common in the Western and Southern regions. Figures 1 and 2 provides a guide on estimating the maximum runtime per irrigation cycle for clays and sandy loams. The majority of residential yards

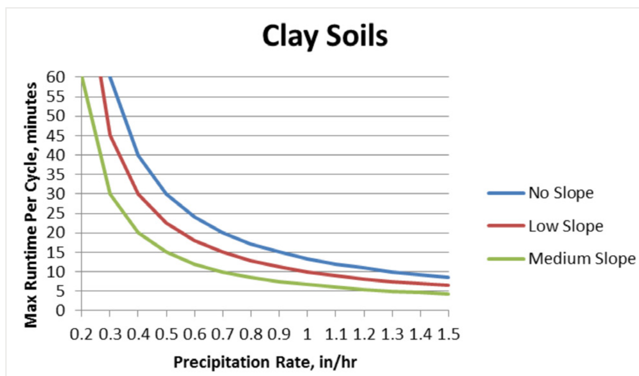

Figure 1. Maximum runtime per cycle graph for clay soils.

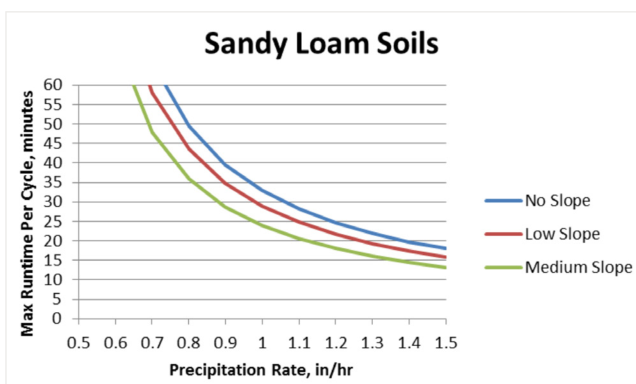

Figure 2. Maximum runtime per cycle graph for sandy loam soils.

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are relatively flat and have minimum to no slope. A slope will generally not affect the runtime until an elevation drop of 1 foot or more is observed at distances less than 20 feet. If the residential landscape does have a 1-foot drop of elevation in less than 20 feet, use Figure 3 to determine if the landscape is classified as a "Low Slope" or "Medium Slope."

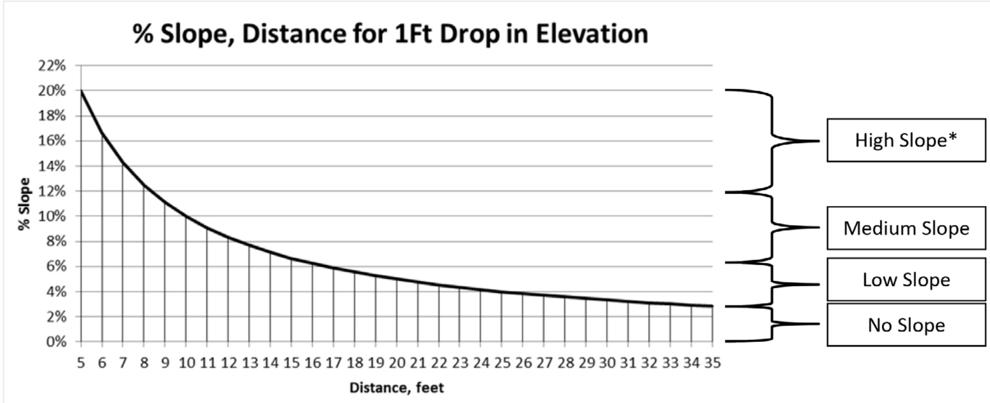

Figure 3. How to determine a slope. *(*Note: Landscapes classified as "High Slope" are difficult to irrigate without runoff or causing erosion. Drip irrigation is recommended for such areas.)*

DETERMINING SOIL TYPE

Fine textured soils (i.e., clays) have low infiltration rates, while coarse-textured soils (i.e., sands) have high infiltration rates. The "feel method" may be used to determine the soil type, which is done by taking a small sample of soil in the hand and observing its behavior (damp soil works the best for this). Use Table 1 to match the soil type. If still unsure about the soil type, contact a local county Extension office for assistance.

Table 1. Description of Common Soil Types

Soil Type	Description
Clay	Fine textured soil that is sticky when wet. A long ribbon can be formed when rolled.
Clay Loam	Breaks into clods that are hard. When rolled in the hand, it can be rolled into a compact mass.
Silty Loam	Feels smooth and has a moderate amount of fine sand with a small amount of clay, but will not form a ribbon when rolled.
Loam	Contains a mixture of sand, silt, and clay that when wet can be handled without breaking.
Sandy Loam	Contains a fair amount of sand but the silt allows it to stay formed with careful handling.
Sand	Feels very gritty. Will form a cast when squeezed but crumbles when touched.

PRECIPITATION RATE

Irrigation systems apply water at different speeds, which is called the "precipitation rate." Factors such as sprinkler type, pressure, and spacing determine the rate at which water is applied (Fig. 4). The precipitation rate is measured in "inches per hour," and rates can vary from 0.5 to more than 1.5 inches per hour. Knowing the

Figure 4. Different types of sprinklers: A) spray head, B) multi-stream rotary, C) rotary, and D) hose-end.

precipitation rate is necessary to determine how long to run the system. Manufacturers performance charts can also provide an estimate of the precipitation rate. However, it is usually more accurate to measure the precipitation rate by conducting a catch can test.

EXAMPLE PROBLEM 1

- You receive a turfgrass watering recommendation for 30 minutes of irrigation for the spray head sprinklers in your front yard.
- You know from conducting a catch can test that these sprinklers have a precipitation rate of 1.5 inches per hour.
- Using the "feel method," you know you have a heavy clay soil.

Using the Maximum Irrigation Cycle Runtimes table, the maximum runtime that should be applied to the turfgrass is 5 minutes per cycle. This requires at least 6 cycles to be ran throughout the day to meet the irrigation recommendation of 30 minutes.

Typical Precipitation Rate Range for Hose-End Sprinklers

Typical Precipitation Rate Range for Rotary and Multi-Stream Rotary Sprinklers

Typical Precipitation Rate Range for Spray Head Sprinklers

Maximum Irrigation Cycle Runtimes*			
Precipitation Rate (in./hr.)	Clay Soil	Loamy Soil	Sandy Soil
0.1	60	60[1]	60[1]
0.2	36	60[1]	60[1]
0.3	24	60[1]	60[1]
0.4	18	60[1]	60[1]
0.5	14	60[1]	60[1]
0.6	12	60	60[1]
0.7	10	51	60[1]
0.8	9	44	60[1]
0.9	8	39	60[1]
1	7	35	60[1]
1.1	7	32	60
1.2	6	30	59
1.3	6	27	54
1.4	5	25	51
1.5	5	24	47
1.6	5	22	44
1.7	4	21	42
1.8	4	20	39
1.9	4	19	37
2	4	18	35

* Assumes minimum 1 hour between irrigation cycles on non-sloped landscapes.

[1] As a water conservation practice, it is not recommended to irrigate for more than 1 hour at a time.

PROGRAMMING CONTROLLERS FOR CYCLE AND SOAK

Setting up the controller for multiple irrigation cycles per zone can be intimidating. Below are instructions that apply to most controllers. However, always reference the controller's manual—particularly, look for instructions on how to navigate the controller's settings that may involve using a dial and/or arrow buttons.

Most irrigation controllers are capable of having multiple programs, which are typically labeled by a letter (e.g., Program A, B, C). This programming allows the operator to specify start time(s) and frequency for each zone. Most residential irrigation controllers allow for at least 3 to 4 start times per day.

EXAMPLE PROBLEM 2

- You want to program 45 minutes of irrigation into three 15-minute cycles on your irrigation controller for Zone 1.

Step 1: Start by picking a controller program for Zone 1 (such as Program A).

Step 2: Set Zone 1 runtime to 15-minutes.

Step 3: Set Start Time 1 to begin irrigating (such as 5:00 a.m.).

Step 4: Set Start Time 2—determine by adding 1 hour to the ending runtime of Start Time 1.

(Example: 5:00 a.m. + 15-minute irrigation cycle + 1-hour soak time = 6:15 a.m.)

Step 5: Set Start Time 3—determine by adding 1 hour to the ending runtime of Start Time 2.

(Example: 6:15 a.m. + 15-minute irrigation cycle + 1-hour soak time = 7:30 a.m.)

IMPORTANT NOTES:

- Only assign additional zones that require three cycles to Program A. These zones will water automatically after each Zone 1 cycle during its soak time. Subsequent start times may need to be adjusted if the combined cycle runtime of the additional zones is greater than the soak time.
- If you have local watering restrictions that prevent irrigation during the day, adjust start times so irrigation does not occur during restricted times.

RUNOFF MANAGEMENT

Having a properly designed, installed, and maintained irrigation system—along with following good agronomic practices—will help reduce the runoff potential of the landscape. Always make sure all sprinklers are working properly and adjusted to not throw water onto hardscapes (e.g., driveways, sidewalks, and roads) (Figs. 5a and 5b). Aerating soils, topdressing, and applying compost will increase soil health and reduce soil compaction, allowing for greater infiltration of irrigation water. Mowing turfgrass at a higher setting and applying mulch in bedded areas will also create a buffer in the landscape, allowing more water to be captured for infiltration.

Figure 5a. Runoff from a broken rotary sprinkler.

This guide will help to estimate the maximum runtime before the irrigation runoff could become possible. However, always verify the runtimes by observing the system and timing when runoff occurs to fine-tune cycle and soak for each yard and its site conditions.

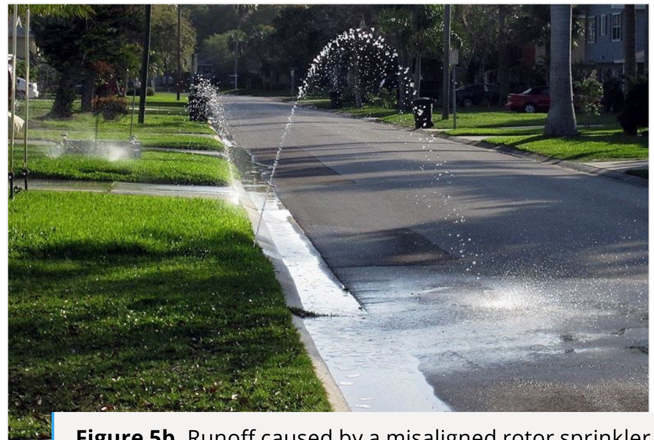

Figure 5b. Runoff caused by a misaligned rotor sprinkler