Lawn Irrigation: How, When and Where to Water!

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Turfgrass and Water Mgmt.
During the summer, it is estimated that 25 to 60 % of the water used by residential customers is applied to the landscape.
Developing an irrigation program—you need to address these five questions!

- **What factors** need to be considered?
- **How often** should irrigation water be applied?
- **How much** irrigation should be applied?
- **When** should irrigation be applied?
- **How long** does my system need to operate to apply the right amount of water?
Factors To Consider For “Proper Irrigation Management”

- Soil type and depth
- Turf and landscape species selection
- Mowing and pruning practices
- Cultivation practices
- Fertilization practices
- Weed, disease, and insect management
- Efficiency of the irrigation system

Other factors, include:
1a. Species Selection for Drought Survival

Buffalograss
Bermudagrass
Zoysiagrass (japonica)
Tall Fescue
Zoysiagrass (matrella)
Centipedegrass
St. Augustine
Creeping bentgrass
Kentucky Bluegrass

Drought Survival

Highest

Lowest
1b. SHADE TOLERANCE

Ranking of Turfgrasses

- Fescue, Red
- St. Augustinegrass
- Tall Fescue
- Zoysiagrass
  - Seashore Paspalum
  - Buffalograss
  - Centipedegrass
    - Bentgrass, Creeping
    - Bluegrass, Kentucky
    - Ryegrass, Perennial
      » Bermudagrass

Highest

Lowest
Rainfall events occur sporadically during the year. Periodic droughts do occur in Texas and will enhance the need for supplemental irrigation in landscapes.
3. What **soil type** and **soil depth** do you have?

“Clay, Silt, Sand, Loam, Clay loam, Sandy loam, etc.”

“Do you have a deep soil or a very shallow soil” (i.e. Hill Country)

“Soils vary in Texas—Is your soil suitable to grow plants?”
Plant Available Soil Moisture

Water Holding Capacity

✓ Sand = 0.8 to 1.2 inches per foot
✓ Loam = 1.8 to 2.4 inches per foot
✓ Clay = 2.2 to 3.2 inches per foot

**How much is available water?**
## Approximate Infiltration Capacities For Various Soil Textures and Slopes

<table>
<thead>
<tr>
<th>Soil Texture</th>
<th>Level</th>
<th>Sloping</th>
<th>Steep</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
<td>1.0</td>
<td>0.5</td>
<td>0.3</td>
</tr>
<tr>
<td>Sandy loam</td>
<td>0.5</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>Loam</td>
<td>0.25</td>
<td>0.18</td>
<td>0.12</td>
</tr>
<tr>
<td>Clay loam</td>
<td>0.15</td>
<td>0.1</td>
<td>0.07</td>
</tr>
<tr>
<td>Clay</td>
<td>0.10</td>
<td>0.08</td>
<td>0.06</td>
</tr>
</tbody>
</table>
4. Water quality issues (salt)!!!!
5. Zoning Issues!
6. Do Trees and Shrubs Influence Water Use?

✓ In typical clay-loam soils, most tree roots are usually located less than 8 to 12 inches below the surface and grow outward far beyond the branch tips of the tree. (Perry, 1982)
The root extraction pattern shows the percentage of moisture that the plant withdraws from each quarter of the total root depth. This pattern is typical, regardless of the root depth. Deep-rooted plants require less-frequent irrigation than shallow-rooted plants because the roots can withdraw moisture from a larger reservoir.

Technical credit: Soil Conservation Service.
Irrigation Frequency, Root Growth and Turf Health

**Ideal Situation**
1. Adequate air-pore space, with moisture at all depths. As moisture is lost it is replaced.

**Saturation**
2. When soil becomes saturated with moisture, movement of air is blocked. Grass blades tend to become limp with roots ceasing penetration and remaining near the soil surface.

**Lack of Moisture**
3. As drying out occurs, plant growth is stunted and tips brown. Feeder roots near the surface are first to succumb and gradually die back to lower depths. Roots thrive only at lower depth where moisture may be available.

**Light Watering**
4. Plant obtains slight, temporary relief with shallow roots absorbing moisture at the surface. Normal surface drying with inadequate deep rooting leaves plant in depleted condition and can result in severe damage.
Look for Signs of Water Stress

✔ Visual Assessment for Stressed Turf & Other Plants:
  - Leaf rolling
  - Lack of turgor pressure in the plant causes wilting
  - Leaving footprints in the turf
  - Blue/purple areas in the turf

➢ Turfgrass, as well as most landscape species, can withstand short periods of water stress without permanent damage to the plant.
Water Management Tools

- Weather Station Data Produces:

  *Potential Evapotranspiration (PET)*

  - the maximum amount of water lost from the soil by evaporation and through the plant growing on the soil by transpiration

  - Factors affecting PET are: solar radiation, wind speed, relative humidity, and temperature

  [http://texaset.tamu.edu](http://texaset.tamu.edu)
Water Management Formulas

- ET (warm season grasses) = 0.6 x PET
- ET (cool season grasses) = 0.8 x PET
- ET (Landscape-turf, trees and shrubs) = 0.7 x PET

- All of these coefficients depend on plant species, soil type, soil depth, rainfall patterns, season of the year, irrigation frequency, etc.
Talking in “inches of water” can be confusing, but did you know that:

- One acre = 43,560 square feet
- One acre-inch of water = 27,154 gallons

Every time you apply one inch of water to your landscape, you apply 0.62 gallons of water per square foot of landscape area.
How much water should you be putting out when you apply **one inch of water**?

<table>
<thead>
<tr>
<th>Landscape size (square feet)</th>
<th>Water/sq. ft./inch (gallons/sq. ft.)</th>
<th>Total Water (gallons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>0.62</td>
<td>310</td>
</tr>
<tr>
<td>1000</td>
<td>0.62</td>
<td>620</td>
</tr>
<tr>
<td>2000</td>
<td>0.62</td>
<td>1240</td>
</tr>
<tr>
<td>3000</td>
<td>0.62</td>
<td>1860</td>
</tr>
<tr>
<td>4000</td>
<td>0.62</td>
<td>2480</td>
</tr>
<tr>
<td>5000</td>
<td>0.62</td>
<td>3100</td>
</tr>
<tr>
<td>6000</td>
<td>0.62</td>
<td>3720</td>
</tr>
<tr>
<td>7000</td>
<td>0.62</td>
<td>4340</td>
</tr>
<tr>
<td>8000</td>
<td>0.62</td>
<td>4960</td>
</tr>
<tr>
<td>9000</td>
<td>0.62</td>
<td>5580</td>
</tr>
<tr>
<td>10000</td>
<td>0.62</td>
<td>6200</td>
</tr>
</tbody>
</table>
Water Management Tools

✓ Soil Moisture Sensors

- used for monitoring volumetric soil moisture content
- can help determine when supplemental irrigation is needed
Water Management Tools

- Soil Probes
  - used to determine soil moisture levels through a “seeing and feeling” assessment process
  - helps to analyze thatch buildup and soil layering—having different types of soils stacked on top of each other (both of which hinder water movement in soils)
When and how much should I water?

- The best time to water is in the early morning (4:00 - 6:00 am) when wind is low, water pressure is highest, demand is low, evaporation rates are low.
- Watering in the evening places water droplets on the leaves for extended periods of time, which enhances disease.
- Water deep and infrequent!!!! If possible, water to a depth of 6 to 8 inches into the soil. You may have to use additional cycles on the irrigation system to achieve this so as to avoid runoff. Use a soil probe or screwdriver to check your watering depth.
Can you say ‘Oops!’?
So how do we evaluate an irrigation system? Answer: Irrigation Audit!

- A method for evaluating the performance of a irrigation system.
- Used to assess the uniformity of distribution by the sprinkler heads.
- Used to determine an irrigation system’s application rate.
- Vital for proper irrigation management.
Arrangement of Catch Cans
Irrigation Audit: *Data Analysis*

- You can obtain an average application rate and average zone rate by performing an irrigation audit.

\[\begin{align*}
0.25" + 0.30" + 0.40" + 0.50" + 0.25" + 0.30" &= 2.0" \\
2.0" / 6 &= 0.33" \\
\text{average application rate in 15 minutes in zone 1} \\
\text{(Application rate per hour} &= 0.33" \times 4 = 1.3" \text{ per hour})
\end{align*}\]
Irrigation Audit: *Basic Steps*

**Record Application Rates**

**Allows you to determine the areas in your landscape receiving too little or too much water (i.e. distribution uniformity)**

<table>
<thead>
<tr>
<th>10ml</th>
<th>30</th>
<th>70</th>
<th>48</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>70</td>
<td>30</td>
<td>75</td>
<td>60</td>
</tr>
</tbody>
</table>

**Average Application Rate = 0.55” per hour**

**34% DU**
To Be a Water-Wise Irrigator:

✓ Scout, Identify and Repair Irrigation System problems!
✓ Evaluate Irrigation System performance with a water audit.
✓ Irrigate based on the weather, not a clock.
Irrigation in the rain?

“It’s Irrigation Malpractice”
To Be a Water-Wise Irrigator:

- ✓ When possible, plant grasses and other landscape plants that will meet your needs and survive extended droughts.
- ✓ Reduce the irrigated acreage, if possible.
- ✓ Use drip or tape irrigation when possible in the landscape.
To Be a Water-Wise Irrigator:

✓ Use mulch extensively in plant beds.
✓ Use reclaimed water if available.
✓ Water deep and infrequent!!!!!!!!!!
✓ Use PET and other tools to assist you.
✓ Use sound turf & landscape management practices.
“XERISCAPE”

Smart way to conserve water?
Need to Consider:

“Landscape design and irrigation zoning, especially when xeriscaping”

(It’s an effective way to apply water only to those areas in need of supplemental irrigation)
WaterWise Landscape Rebate Program

PROGRAM GOALS

• To Replace water-thirsty turf with trees and shrubs
• To save time by installing low maintenance shrubs and mulch
• To choose the right plant for the right place
• To reduce future demand on the water utility and create beautiful, drought tolerant landscapes.

Austin, Texas
Research Materials and Methods

1. Texas ELITE Program

“Efficient Landscape Irrigation Through Education”

- Collaborative effort with Hidalgo Co. CEA-Hort and Master Gardener volunteers
- Evaluating actual water use by trained vs. untrained homeowners with xeric and mesic landscape types
1. Texas *ELITE* Program (cont.)

"Efficient Landscape Irrigation Through Education"

**Twelve (12) Landscapes**

- 6 xeric landscapes and 6 mesic landscapes
- 3 response unit sites (trained)
- 3 standard practice sites (untrained)
Comparison of Actual Water Use by Home Consumers for Xeriscape and Typical Landscapes (June - October 2003)
Comparison of Actual Water Use by Home Consumers for Xeriscape and Typical Landscapes (May - September 2004)
Soil Water Dynamics in a Landscape With Multiple Vegetation Types

- Location: Weslaco Ext. & Res. Center
- Soil type: Willacy fine sandy loam
- Nov. 2002: Installed 192 ECHO volumetric soil moisture sensors
  - 64 sensor locations—3 sensors/location
    - 0” – 8” depth (A)
    - 8” – 16” depth (B)
    - 16” – 24” depth (C)
Landscape Vegetation Types Evaluated

- Mature Walnut Tree/St. Augustinegrass
  - Measurements from 10’, 20’, and 30’ from the base of the tree
- Crape Myrtles/St. Augustinegrass
- St. Augustinegrass
- Rose Bushes
- Ficus Hedge
- Dwarf Yaupon Hedge
Research
Materials and Methods

Data Collection and Analysis

• Daily soil water content (inches)
• Daily soil water loss (inches)
  - Soil depths = A, B, C, A+B, B+C, Total
  - $L_c$ values = actual ET/potential ET
• Daily PET and rainfall data collected from nearby weather station
Comparison of Actual ET Among Different Landscape Species (July 2003)

Tukey's HSD (P< 0.001)
LSD= 1.336

Vegetation Types

Tree - 3 m  |  Tree - 6 m  |  Tree - 9 m  |  St. Augustine  |  Ficus  |  Dwarf Yaupon  |  Rose Bushes  |  Crape Myrtles  |  Landscape  |  PET

Mean Daily ET (mm)

bc  |  bc  |  bc  |  bc  |  a  |  b  |  a  |  c  |  L_c = .65

LSD = .65
Comparison of Mean Daily Landscape ET to PET

<table>
<thead>
<tr>
<th>Time (Months)</th>
<th>Daily Water Loss (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>February</td>
<td>.51</td>
</tr>
<tr>
<td>March</td>
<td>.59</td>
</tr>
<tr>
<td>April</td>
<td>.53</td>
</tr>
<tr>
<td>May</td>
<td>.58</td>
</tr>
<tr>
<td>June</td>
<td>.67</td>
</tr>
<tr>
<td>July</td>
<td>.65</td>
</tr>
<tr>
<td>August</td>
<td>.61</td>
</tr>
<tr>
<td>September</td>
<td>.53</td>
</tr>
</tbody>
</table>

PET
ET-Landscape
June 8, 2003

$S_w = 151$ mm

$ET_a = 4.32$ mm

$ET_p = 5.08$ mm

$L_c = .85$
June 9, 2003

$S_w = 146\ mm$

$ET_a = 4.57\ mm$

$ET_p = 5.59\ mm$

$L_c = .82$
June 10, 2003

\[S_w = 142 \text{ mm}\]

\[ET_a = 3.81 \text{ mm}\]

\[ET_p = 5.59 \text{ mm}\]

\[L_o = .68\]
June 11, 2003

\[ S_w = 138 \text{ mm} \]
\[ ET_a = 4.06 \text{ mm} \]
\[ ET_p = 6.35 \text{ mm} \]
\[ L_e = .64 \]
June 12, 2003

$S_w = 134 \text{ mm}$

$ET_a = 3.56 \text{ mm}$

$ET_p = 6.60 \text{ mm}$

$L_o = .54$
June 13, 2003

$S_w = 131$ mm
$\text{ET}_a = 3.05$ mm
$\text{ET}_p = 5.84$ mm
$L_c = .52$
Source of Information

The Irrigation Association

Document: “Landscape Irrigation Scheduling and Water Management”

http://www.irrigation.org
“Turf Web Sites”

✓ Aggie Turf:  http://aggie-turf.tamu.edu

✓ Texas ET Network:  
  http://texaset.tamu.edu

✓ Texas Cooperative Extension:  
  http://agextension.tamu.edu

✓ Aggie Horticulture:  
  http://aggie-horticulture.tamu.edu