Maximize Plant Health with **Smart Irrigation Scheduling**

Presented by Andy Belingheri Husqvarna Water

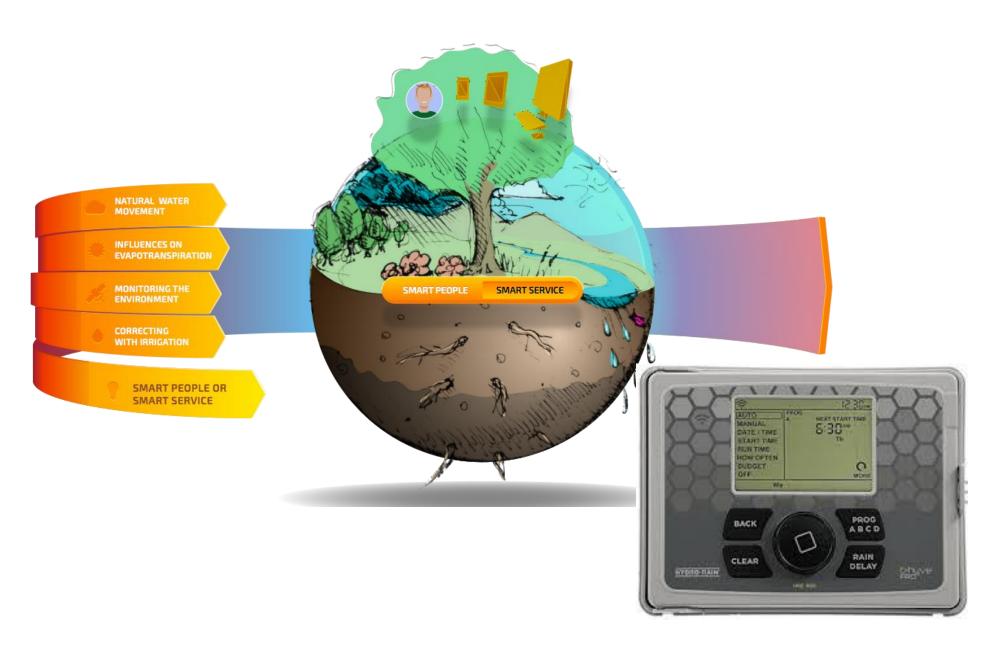








Use a Smart Controller



SMART IRRIGATION MANAGEMENT

- 1. What's the best way to irrigate my landscape?
- 2. How long should I run my irrigation system?
- 3. How often should I run my irrigation system?





GOAL:

Learn how to use water as efficiently as possible, as profitable as possible, and as sustainable as possible

- Maximize output (aesthetics, plant health)
- Minimize inputs (water, fertilizer, labor, etc.)



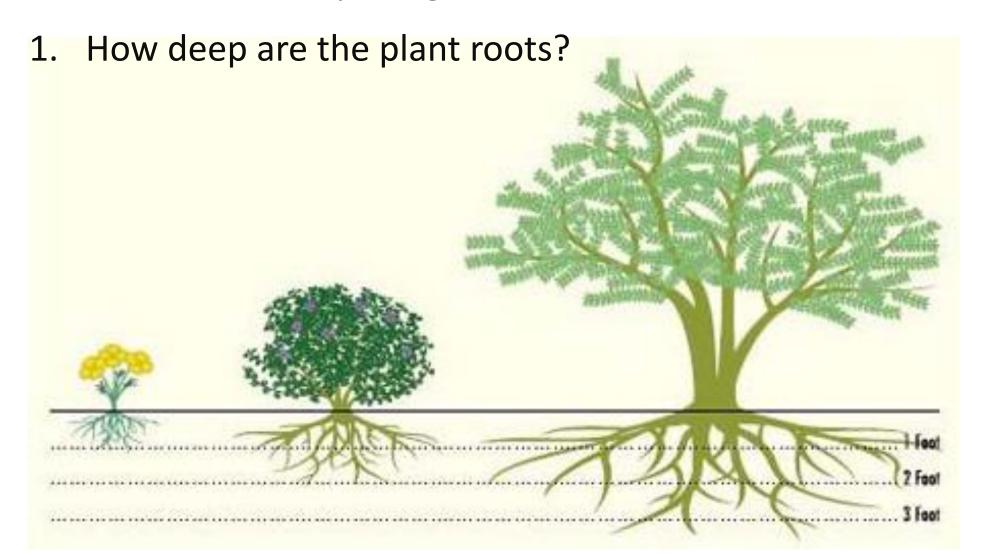
What is Needed:

- Method to measure precipitation rate
- Ability to measure Rain & Effective Rain
- Method to measure / monitor soil moisture levels
- Reliable data of how much water landscape used each day (real time, not historical average)
- Properly designed irrigation system



(Properly Designed Irrigation System)

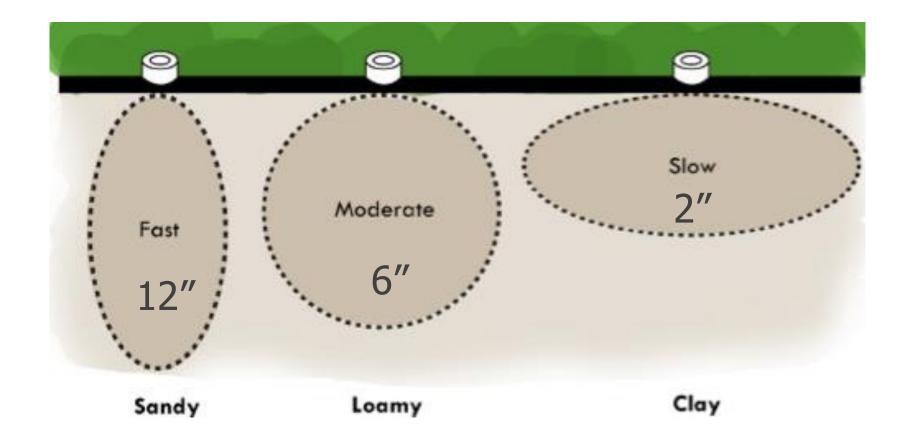
Need to know 2 key things in "The Dirt":



(Properly Designed Irrigation System)

Need to know 2 key things "The Dirt":

2. What kind of soil do I have? (Sand, Loam, Clay?)

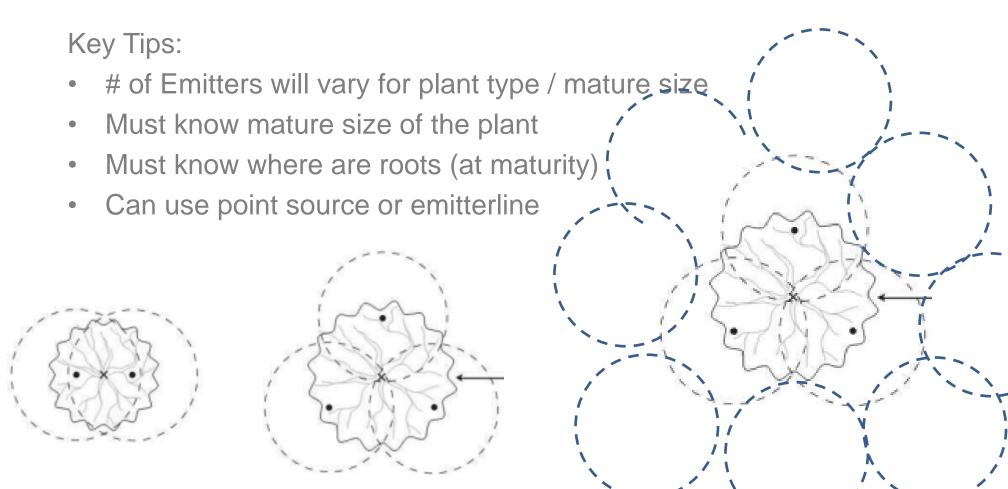






(Properly Designed Irrigation System)

EMITTERS PER PLANT



(Properly Designed Irrigation System)

A Tale of Two Trees: Both are Ash Trees, planted in 2008





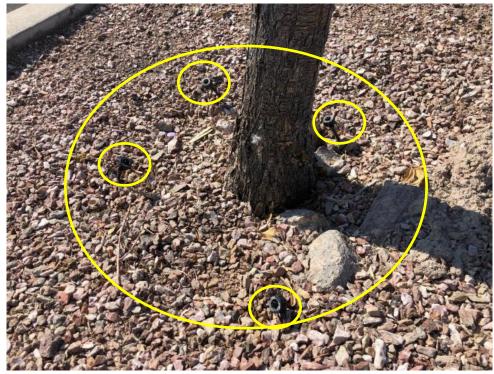
How Do I Irrigate That? (Properly Designed Irrigation System)

A Tale of Two Trees:

A closer look at where water is being applied is very telling



150 sq ft of root zone watered

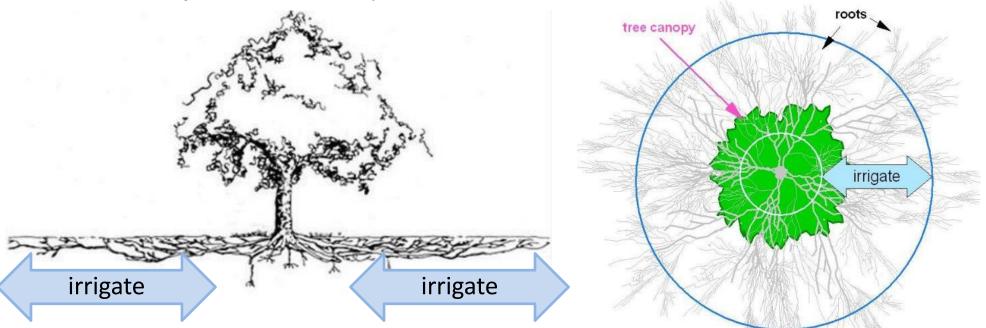


4 sq ft of root zone watered

(Properly Designed Irrigation System)

Key Tips:

- Install irrigation for FUTURE tree growth (or return every year to expand the irrigation system)
- Must know mature size of tree & growth characteristics
- Tree roots can extend over 4x the tree canopy
- Minimum 75% of tree potential root zone should be irrigated (turf to xeriscape conversions)



Lesson #1:

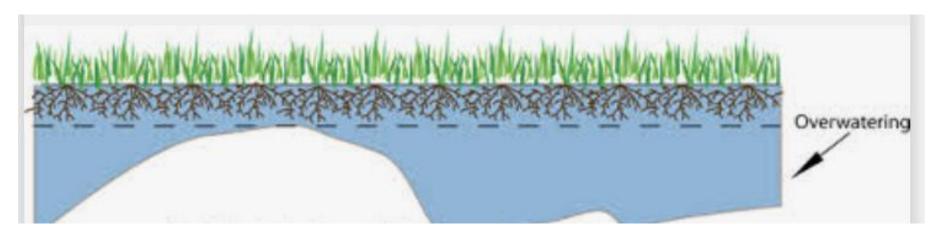
Smart Irrigation means applying water to the root zone, in terms of width and depth . . . no more, no less

Things You Have to Know

(once you have a properly designed irrigation system that applies water to the width and depth of the root zone)

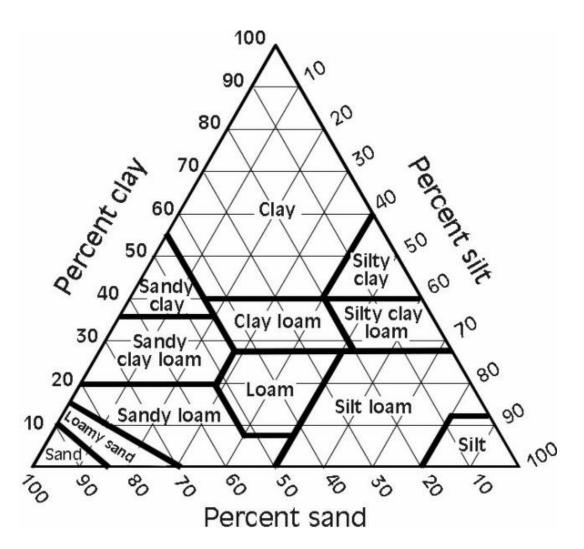
- Soil Texture
- Soil Water Infiltration Rate
- Precipitation Rate
- Soil Water Content
- Plant Available Water (PAW)
- Saturation

- Field Capacity
- Permanent Wilting Point
- Minimum Allowable Balance (MAD)
- Evapotranspiration (ET)
- Distribution Uniformity (DU)



Soil Texture

- percent sand, silt clay
- Sandy soils have few but larger pores, hold less water
- Clay soils have more but smaller pores, hold more water



Soil Water Infiltration Rate

The velocity at which water enters the soil, expressed in inches per hour. If precipitation rate exceeds infiltration rate runoff (waste) occurs

Primary factors affecting Infiltration Rate:

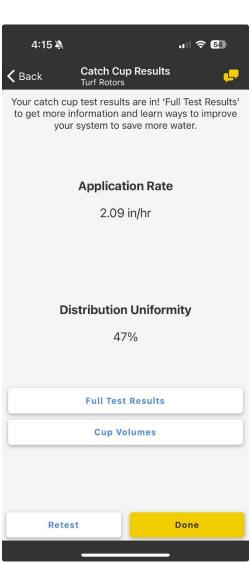
- 1. Soil characteristics (texture, porosity, compaction)
- 2. Soil moisture content
- 3. Slope



Precipitation Rate

Average rate at which water is applied, expressed in inches per hour



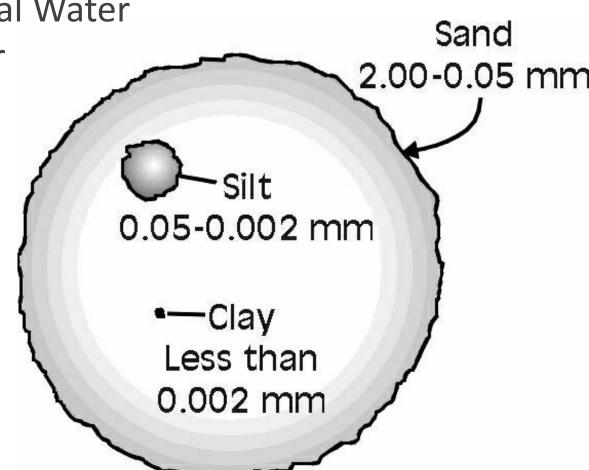


Soil Water

- how much water a soil can hold
- determined by physical properties / soil texture

3 Categories:

- 1. Excess or Gravitational Water
- 2. Plant Available Water
- 3. Unavailable Water

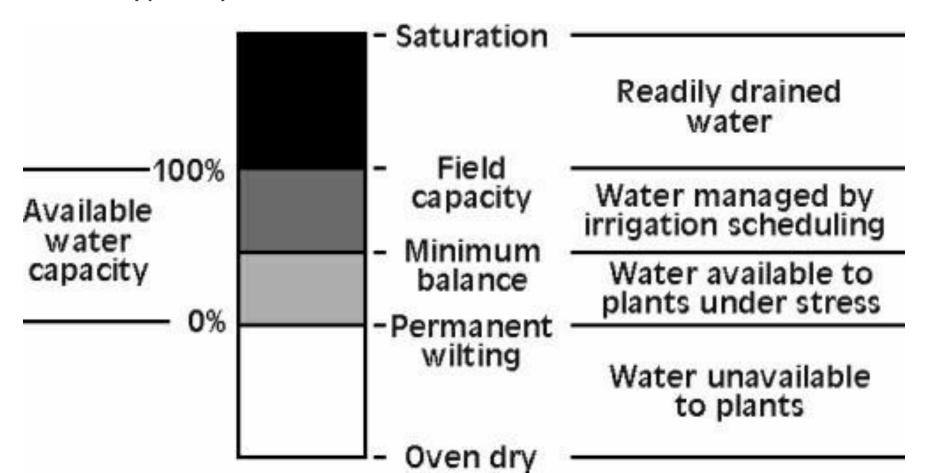


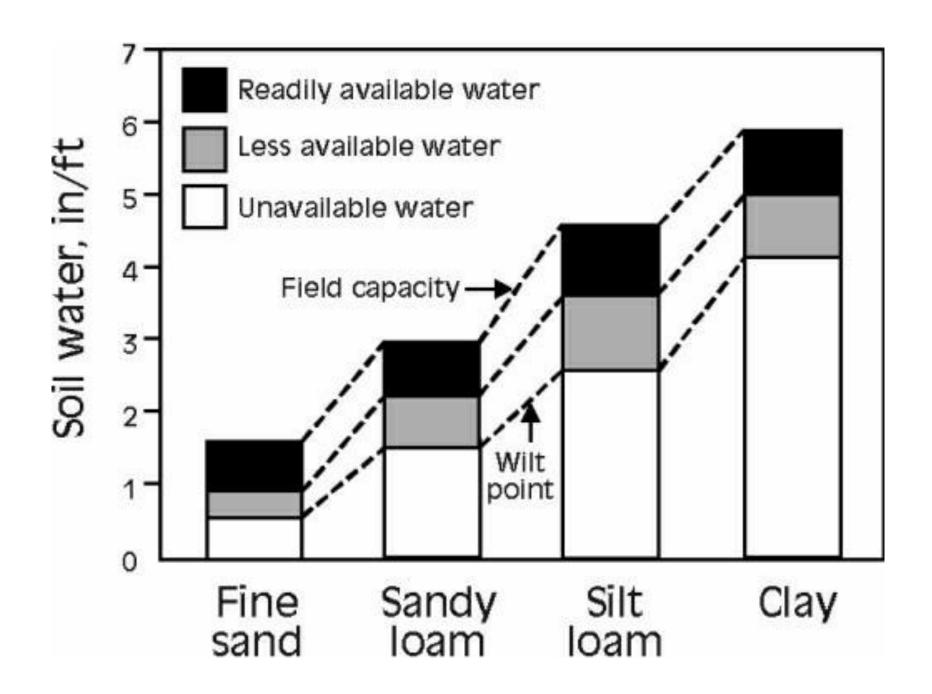
Plant Available Water

The difference between permanent wilting point and field capacity. This is the zone where plants thrive

Minimum Allowable Balance

Soil water content before which plants begin to experience water stress, typically 50%



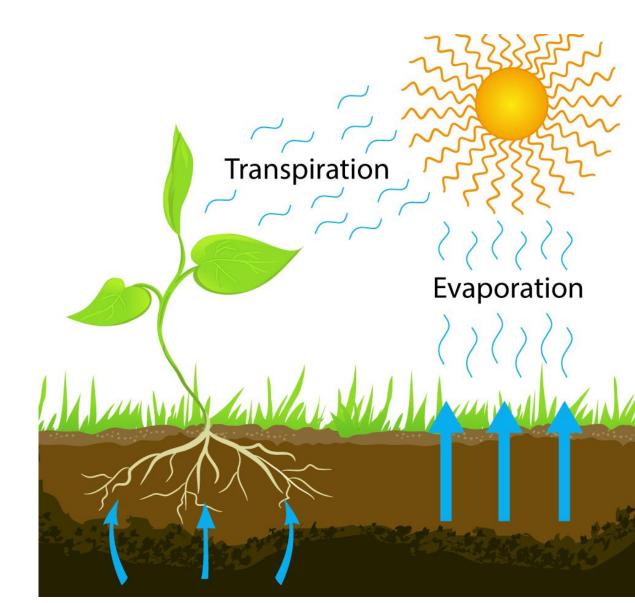


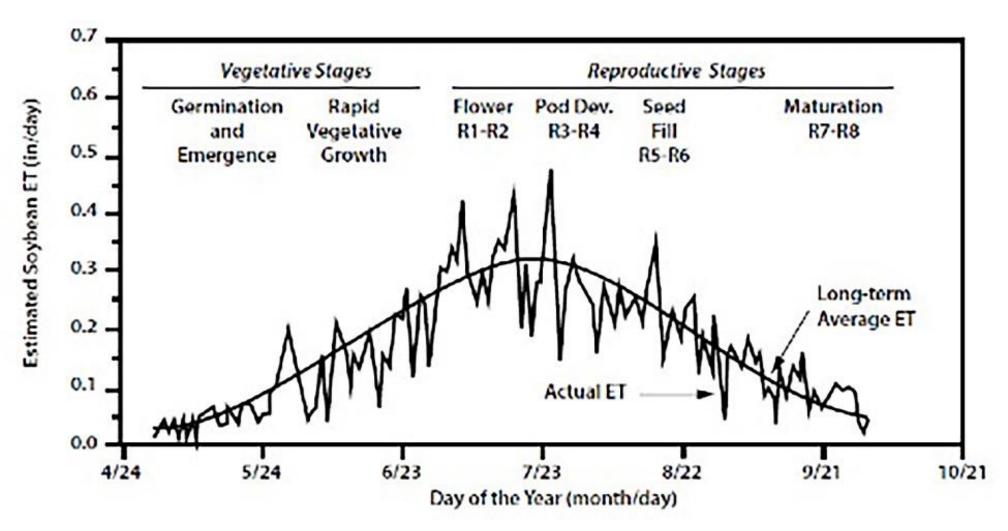
Evapotranspiration

Sum of water lost from the soil due to evaporation (20-30%) and transpiration (70-80%). Measured in inches of water.

A Few Factors:

- 1. Temperature
- 2. Humidity
- 3. Solar Radiation
- 4. Wind Velocity



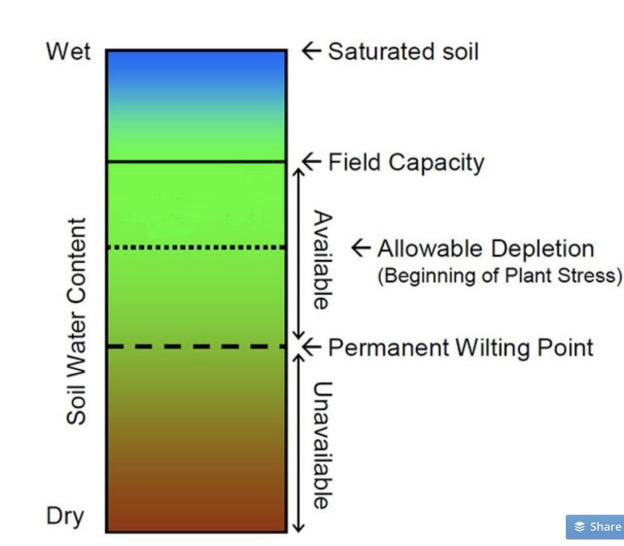


#2: How Long Should I Run My Irrigation System?

Answer: Only long enough to fill root zone to field capacity

Factors to consider:

- Soil texture
- Soil infiltration Rate
- Precipitation Rate
- Distribution
 Uniformity (DU) of irrigation system
- Root zone depth



How Long Should I Run My Irrigation System?

Formulas:

Run Time

$$RT = \frac{1 \times 60}{PR \times DU}$$

I = irrigation required to fill root zone, in inches

PR = precipitation rate

DU = distribution uniformity

Precipitation Rate

$$PR = 96.3 \times GPM$$

$$S \times L$$

GPM – gallons per minute applied to the area

S – spacing between sprinklers or emitters

L – spacing between rows of sprinklers or emitters

How Long Should I Run My Irrigation System?

If you have a loam soil (2" potential available water per foot of soil)

- ... And an 8" root zone (or 1.33" of potential available water in the root zone)
- ... And you have a 50% depletion trigger point
- . . . And you've calculated PR to be 2.14 inches / hour
- . . . And your distribution uniformity is 50%

Remember: Run Time = $I \times 60 / PR \times DU$

I = 1.33" x .5 or .665"

PR = 2.14"

DU = 50%

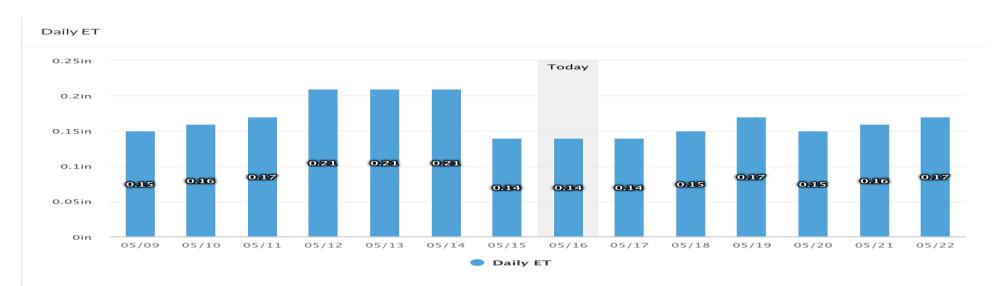
Then: Run time = $.665 \times 60 / 2.14 \times .5$ or 37 minutes to fill root zone to field capacity

#3: How Often Should I Run My Drip System?

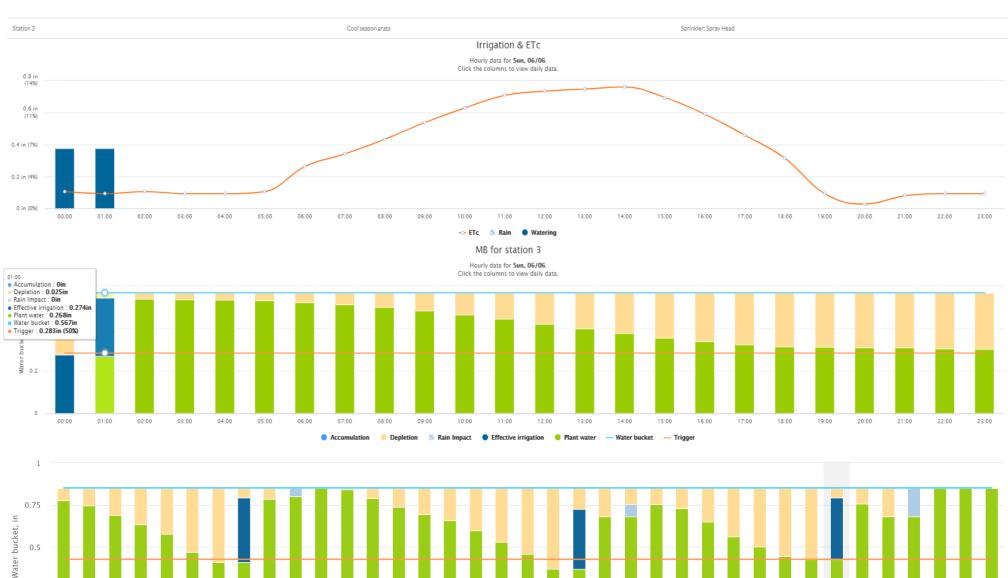
Answer: As often as it takes to refill soil root zone from Minimum Allowable Balance to Field Capacity

Factors to consider:

- Water balance currently (plant available water in root zone)
- Minimum water balance (trigger point)
- Forecasted plant water use
- Rain impact



How Often Should I Run My Irrigation System



0.25

How Often Should I Run My Irrigation System?

Formulas:

Frequency = WB - MB / ETc

WB = water balance in root zone currently

MB = minimum allowable water balance

ETc = forecasted plant water used based on ET (ETo x Kc)

How Often Should I Run My Irrigation System?

If you have a loam soil (2" potential available water per foot of soil)

- ... And an 18" root zone at field capacity (or 3" of potential available water in the root zone)
- ... And you have a 50% depletion trigger point (minimum balance of 1.5" available water)
- . . . And you know forecast ETc is .272"

Remember: Frequency = WB – MB / ETc

WB = 3

MB = 1.5

Etc = .272

Then: Frequency = 1.33 - .665 / .272 or you need to water every 5.5 days refill root zone to field capacity

SMART IRRIGATION MANAGEMENT

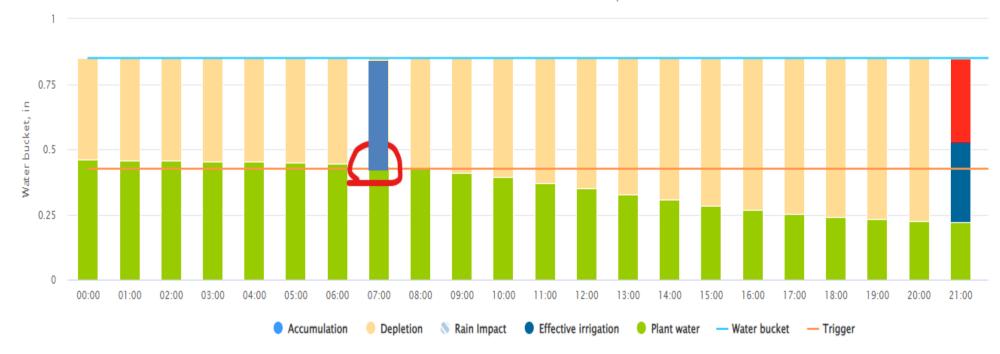
- How long should I run my irrigation system?
 Long enough to fill root zone with water (never changes*)
- How often should I run my irrigation system?
 As frequently as needed to refill root zone (always changing)



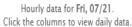


Dynamic Programming - Trigger Level & Irrigation Amount

Hourly data for Tue, 07/18. Click the columns to view daily data.

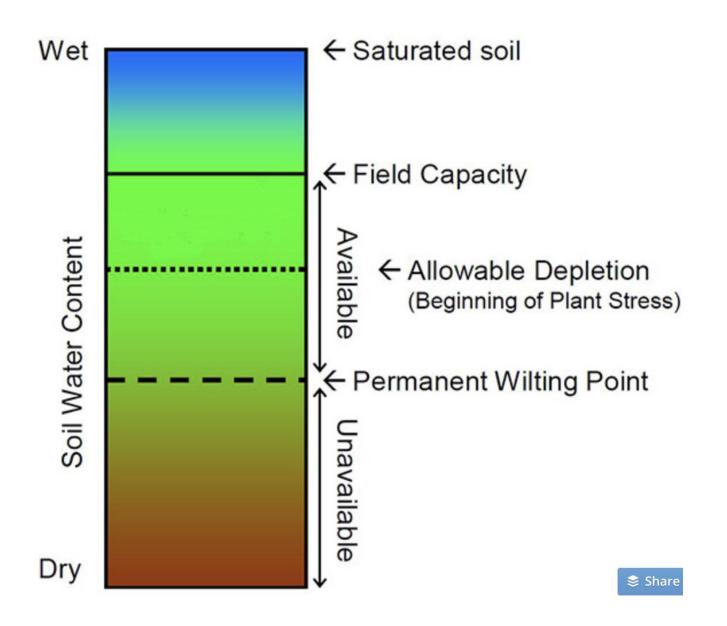


Dynamic Programming (Proactive) - Trigger Level & Irrigation

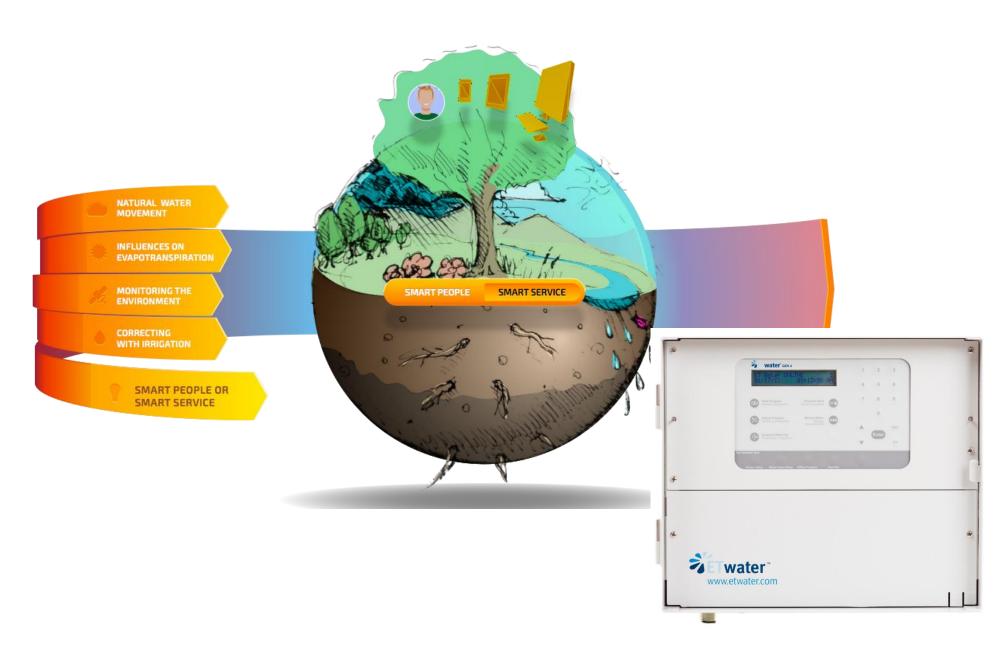




ETwater: The SMARTEST Irrigation Service



Or...use a Smart Controller





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