Irrigation – ornamental nursery production

2010 Horticulture Course for Nursery and Landscape Industry

October 5, 2010

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2 types of ornamental nurseries

Field nursery

Container nursery

Each has unique irrigation needs and a different water balance system

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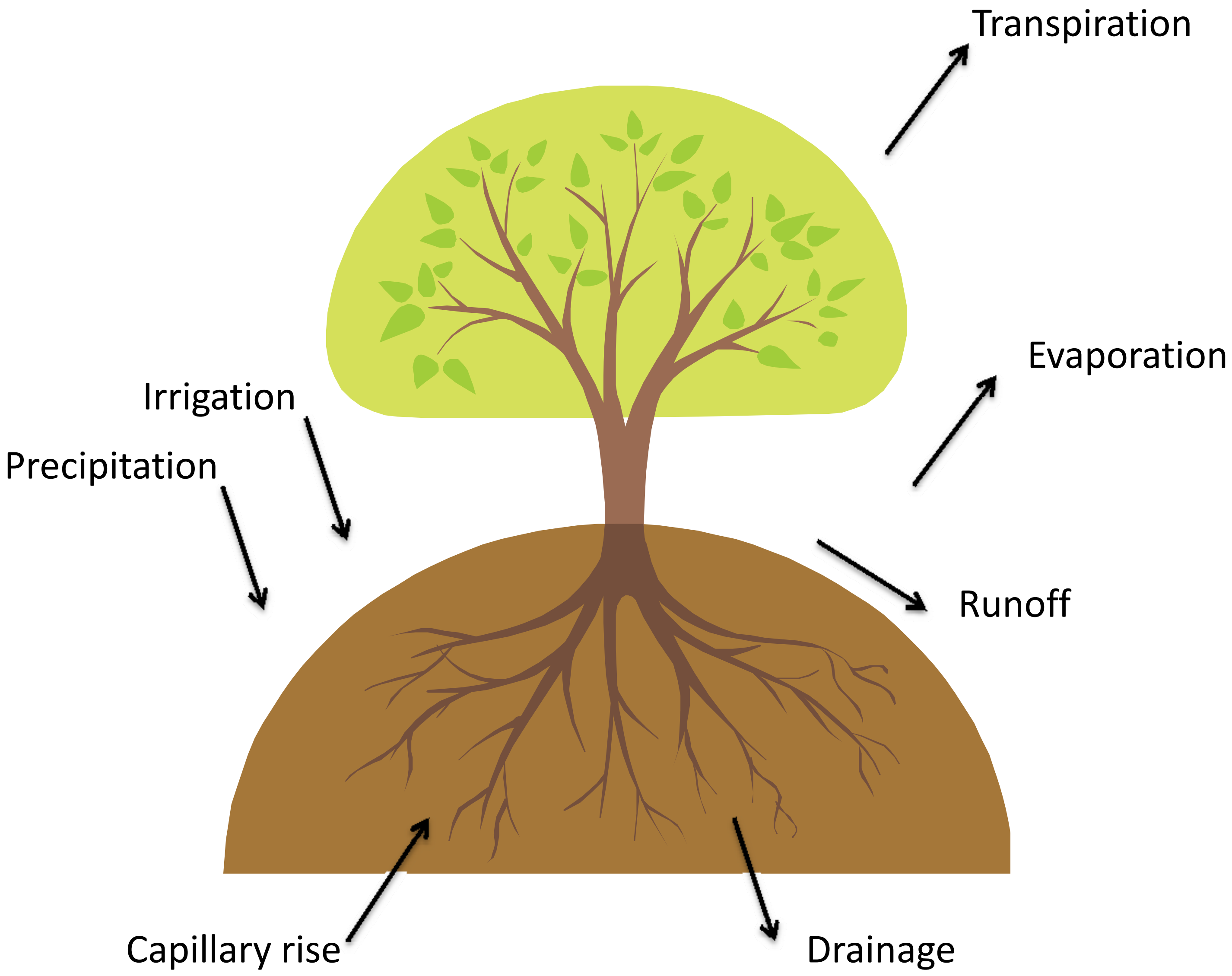
Field nursery water balance



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Field nursery water balance: irrigation

Once the desired soil water status is achieved for **a given soil type**, the following equation can be used:

$$I = T + E + D + R - P - CR$$

I = irrigation

T = transpiration

E = evaporation

D = drainage

R = runoff

P = precipitation

CR = capillary rise

$$I = ET - P$$

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Evapotranspiration data

- FAWN
- http://fawn.ifas.ufl.edu

I = ET- P


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Florida Automated Weather Network

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Report

All observation times are local standard time for each station (without daylight saving time).

Homestead

Period	$SolRad_{avg}$ 2m (w/m^2)	N (# obs)	ET_{avg} (in)
Jan 2009	128.34	2976	0.07
Feb 2009	184.08	2688	0.09
Mar 2009	203.91	2973	0.12
Apr 2009	260.64	2877	0.16
May 2009	226.06	2969	0.16
Jun 2009	205.18	2866	0.16
Jul 2009	209.65	2972	0.16
Aug 2009	224.83	2860	0.17
Sep 2009	185.64	2787	0.14
Oct 2009	189.27	2969	0.12
Nov 2009	158.29	2880	0.08
Dec 2009	125.2	2976	0.06

Back

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Precipitation data

- Use a rain sensor (not perfect, but cheap alternative)
- Manual estimation (not perfect, takes time and effort)
- Don’t recommend using historic data for precipitation of commercial production due to variability

Irrigation scheduling for field nursery

- Consider plant needs (each plant has a different crop coefficient [k])
- Multiple 'k' by the ET (from FAWN) and determine an irrigation rate in inches
- Determine the rate of delivery [D] of the irrigation system (inches of water / minute)
- Irrigation time = k* ET / D

Think about irrigation days - time

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Measuring irrigation delivery

Big question??? How to find ‘k’?

- This may be difficult for your plant
  - Ask an extension agent such as Henry or Mary
  - Look on the internet for values or in EDIS (http://edis.ifas.ufl.edu/)
  - Use professional judgment, adjusting as needed

Example problem

- Palm tree in a field nursery k = 1.1
- Irrigation system delivery rate = 0.25 in/hr (determined using catch cans)
- ET for October (from FAWN) = 0.12 in/day

$$Time = \frac{(1.1)(0.12in)}{0.25in/hr} = 0.53hr$$

$$0.53hr \frac{60\,min}{hr} = 32\,min$$

Complement with a rain sensor

Your turn!!

- k= 0.9
- ET for Nov = 0.08 in/day
- Irrigation rate (D) = 0.5 in/hr

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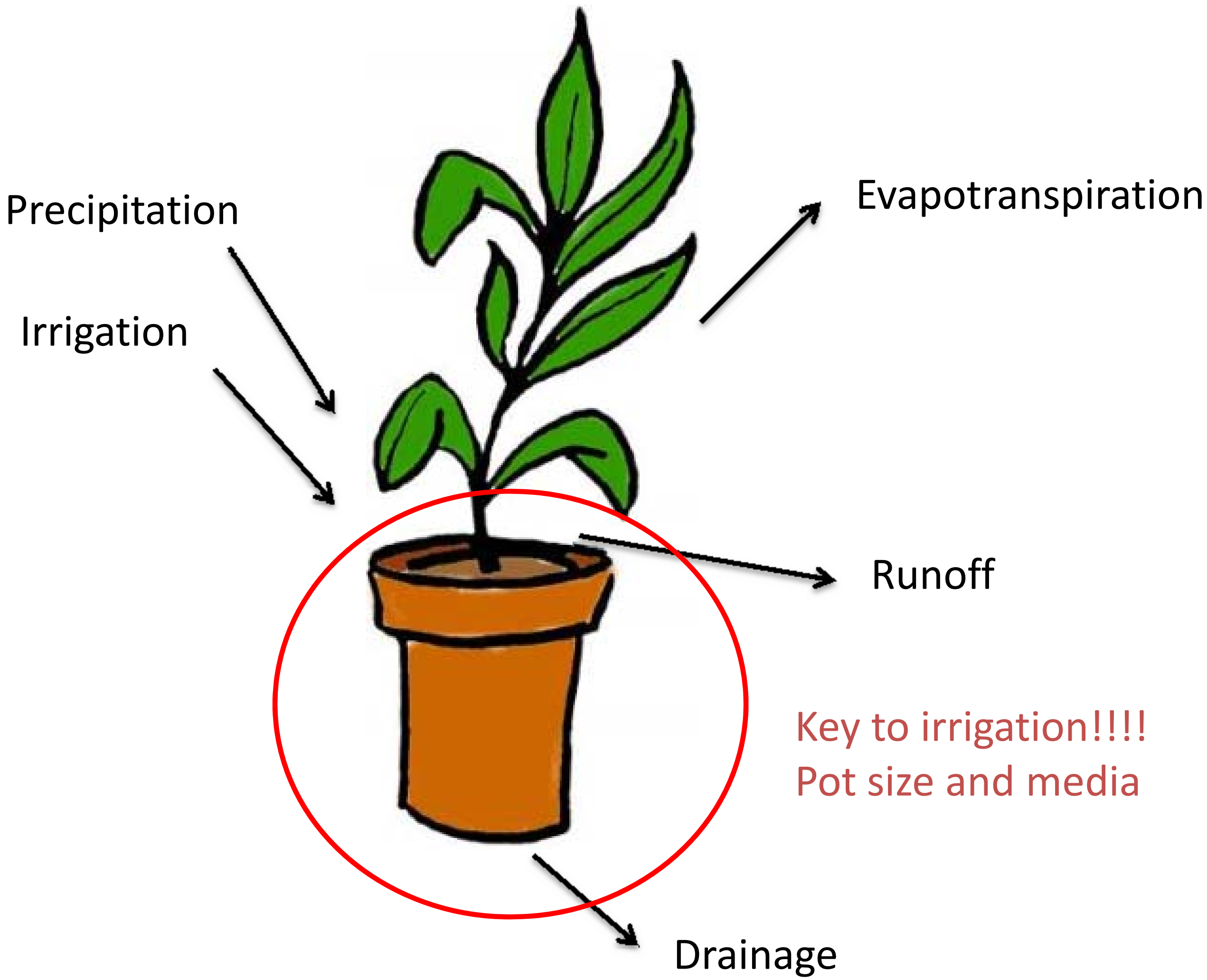
Answer

$$Time = \frac{(0.9)(0.08in)}{0.5in/hr} = 0.14hr$$

$$0.14hr \frac{60\,min}{hr} = 9\,min$$

Container nursery water balance



Key to irrigation!!!!
Pot size and media

Start demonstration

- 4 different media, same irrigation rate

Why does pot size matter?

- ½ gal, 1 gal, 5 gal, etc.
  - Less volume, less media/soil, less water holding capacity
  - WHAT??? Is water holding capacity??
- Water holding capacity – increases with organic matter and small particles; decreases with larger pore sizes (bark mixes, sands, gravely soils)
- Water holding capacity – is water ‘held’ by soil once gravity drained

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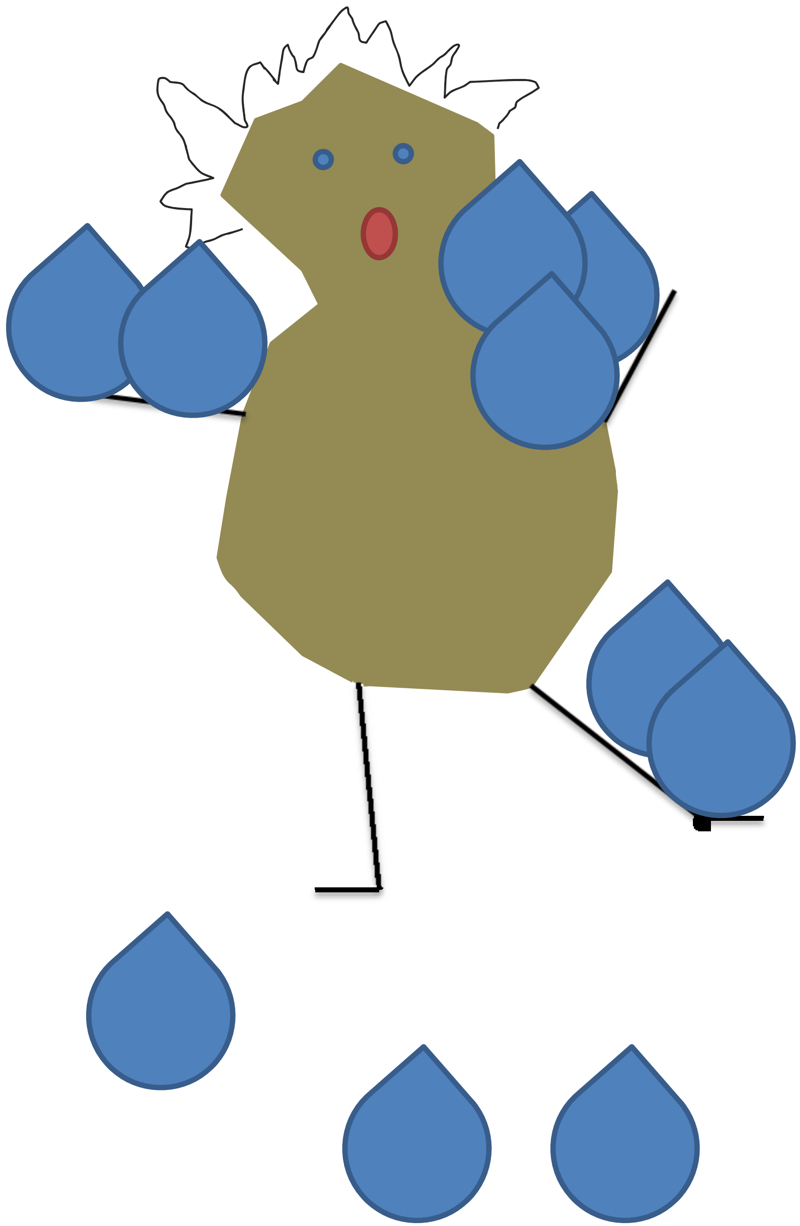

Why does media matter?

- See demonstration

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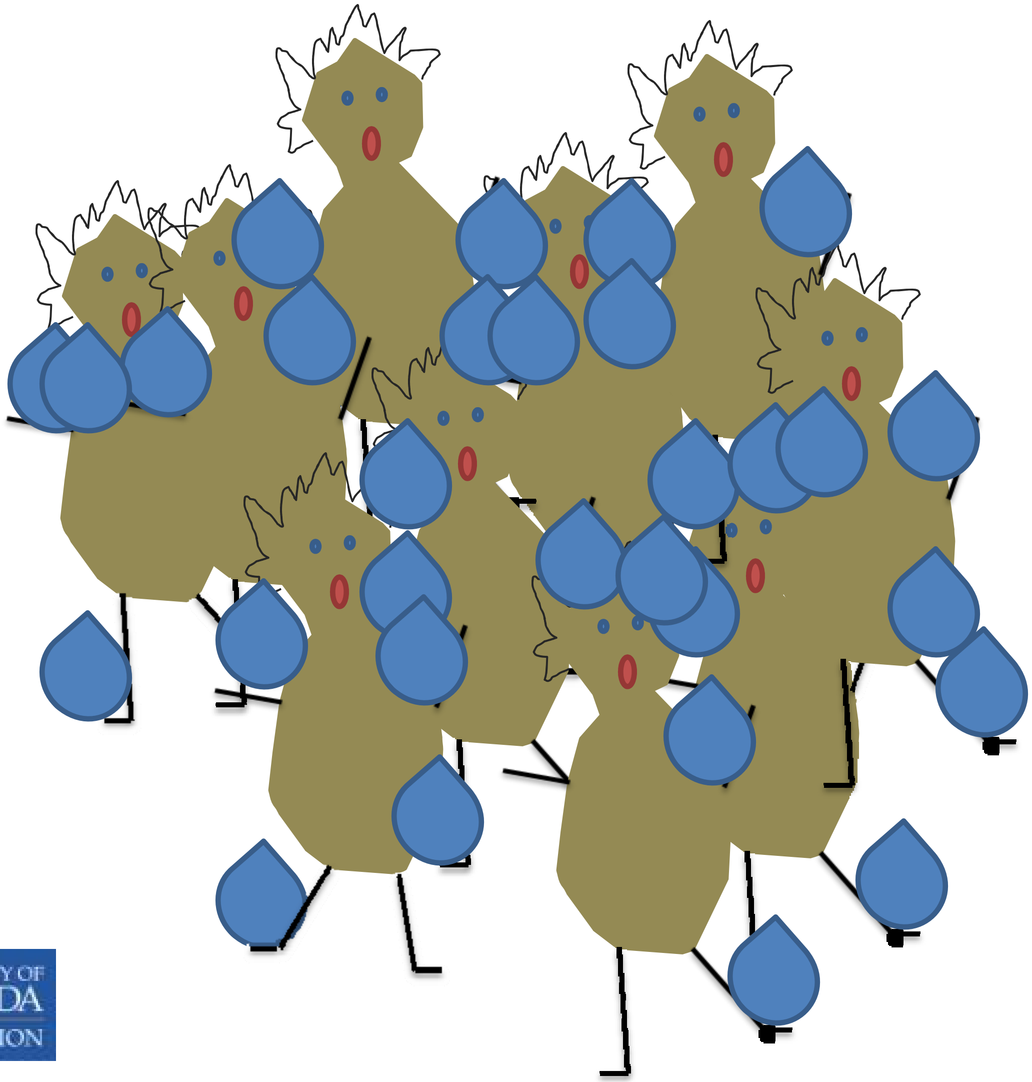
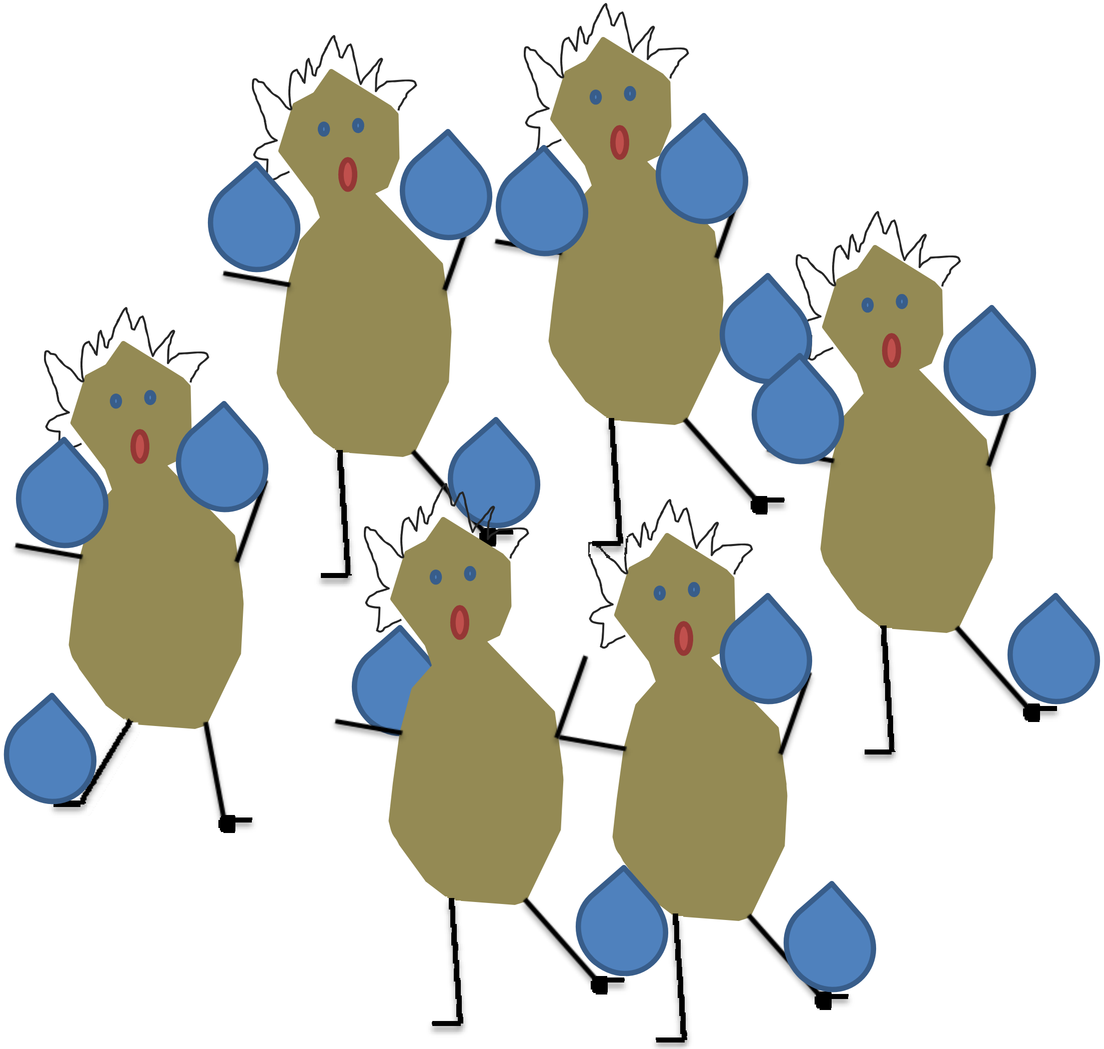
Small pore spaces / organic material



Larger pore spaces



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Container irrigation rates

- To optimize irrigation – must know water holding capacity of soil
  - Minimize energy losses
  - Minimize nutrient losses
  - Minimize water applications while maximizing water use efficiency

Super cheap method for determining water holding capacity

1. Fill a container will dry media and weigh (W1)
2. Apply water until saturated at night (after dark)
3. Immediately in the morning weigh the container (W2)
4. W2-W1 = weight of water held by the soil
5. 1 lb of water = 0.12 gallons of water = 0.45 liters of water

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Information from experiment

- Compare different media water holding capacities
- Develop irrigation schedules
- Pick media best suited for different plant needs

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Irrigation scheduling method 1

- Cheap/simple method
- Take plant/container and saturate with water … night before and weigh in … morning – 1st light (W1…
- Set pla… is expecte… greatest sun…
- At end of …
- W2-W1 = max i… …ed

Can become labor intensive if many different plants and container sizes

•No rain during experiment
•Repeat monthly and adjust schedule
…use a rain sensor

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Irrigation scheduling method 2

- Use method described for field nurseries
- Make sure that ET water volumes do not result in drainage
- If ET > water storage potential, multiple irrigation events needed

Other irrigation challenges

- LEAKS!!!!!!!!!!!!!!!!!!!!!!!!!!!!
- Improper zoning!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
- Unit conversions / doing the math

No longer a 4
letter word!!

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Units are the key

- 24 hr = 1 day
- 1 ft^3 = 7.481 gal
- 12 in = 1 ft
- 2.54 cm = 1 in
- 1 gal = 3.785 L = 231 in^3
- 1 lb of water = 0.12 gallons of water = 0.45 liters of water

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Micro sprinkler example

- Sprinkler flow rate = 2 gal/hr
- 1 sprinkler per container
- Container size = 18 in diameter
- ET = 0.11 in/day
- K = 0.95
  - What is the time required for irrigation?

Step 1: Determine water needed

- $ET_a = k*Et_o$
- $ET_a = 0.95 * 0.11$ in/day = 0.10 in/day

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Step 2: Convert gal flow rate to a depth measurement

- Divide volume by surface area of container
- Hint: surface area = 3.14 * (diameter/2)^2

$$\left(\frac{2gal}{hr}\right)\frac{1}{(3.14)(9in)^2}\left(\frac{231in^3}{1gal}\right)=1.8in/hr$$

$$\frac{gph}{diameter(in)^2}294=1.8in/hr$$

Step 3: Determine irrigation run time

- How much irrigation do you need?
  - 0.10 in/day
- What is the delivery rate of the system?
  - 1.8 in/hr
- Considering daily irrigation, the time would be?

$$\left(\frac{0.10in}{day}\right)\left(\frac{hr}{1.8in}\right)\left(\frac{60\,min}{hr}\right) = 3.3\,min$$

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Considerations

- How much time does it take water to reach the furthest point from the water source after irrigation starts?
- This values must be added to the irrigation time

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Good news!

- You now have the tools to develop an A+ irrigation schedule!!!
- You will be in great demand!!
- You can help people save $$ and produce better products!!
- You have a great support system if you have problems or questions.

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