# Irrigation and Salinity Management In a Dry Year(s)

Terry Prichard
UC Davis
Dept Land, Air, and Water Resources

# Stretching Water Supplies

- Application Efficiency
  - System Design/ Uniformity
- Runoff Collection and Reuse
- Reduce Evaporation
  - Targeted Application / micro irrigation / buried drip
- Proper Irrigation Scheduling
- Reduce Transpiration- water stress


Evaluate and upgrade irrigation systems improve distribution uniformity
Pressure variation
Nozzle size uniformity

# Surface Irrigation

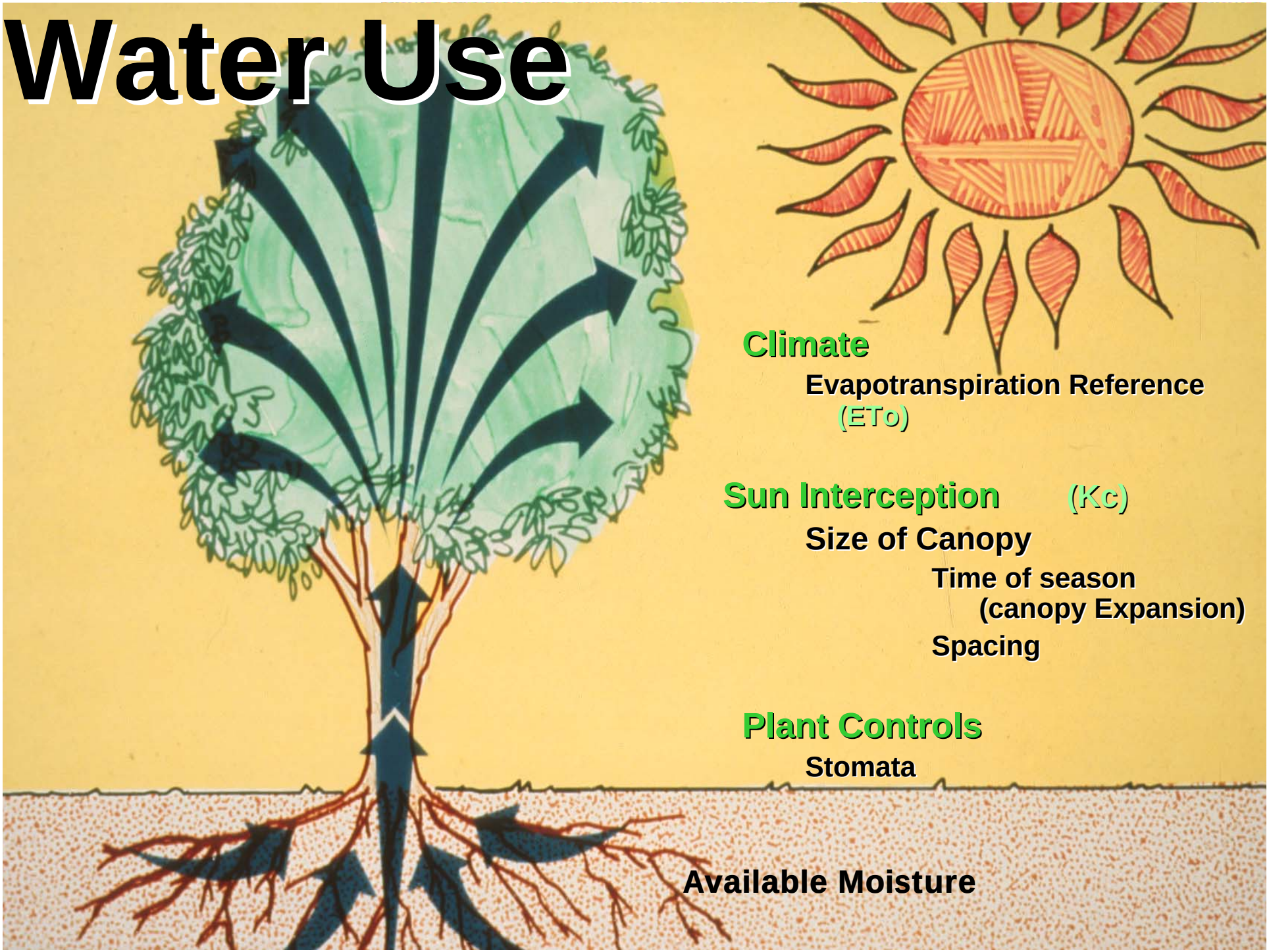
- Runoff
  - All soils
- Deep percolation
  - Sandy soils


Eliminate or minimize cover crops or weeds which can compete for water use
ROUNDUP
12 OZ
15 6 '94

# Reduce Water Use-- Transpiration

- Use ET estimates and reduce by a fraction of full water use
- Use Stem water potential measurements with thresholds for a particular stage of development
- Measure soil moisture and apply at a threshold value

# Water Use



**Climate**

**Evapotranspiration Reference (ETo)**

**Sun Interception (Kc)**

**Size of Canopy**

**Time of season (canopy Expansion)**

**Spacing**

**Plant Controls**

**Stomata**

**Available Moisture**

# Calculate Full Potential Water Use

- ETo x Kc = Full Potential Water Use
- Use weekly summed data

# Mature Almond Water Use

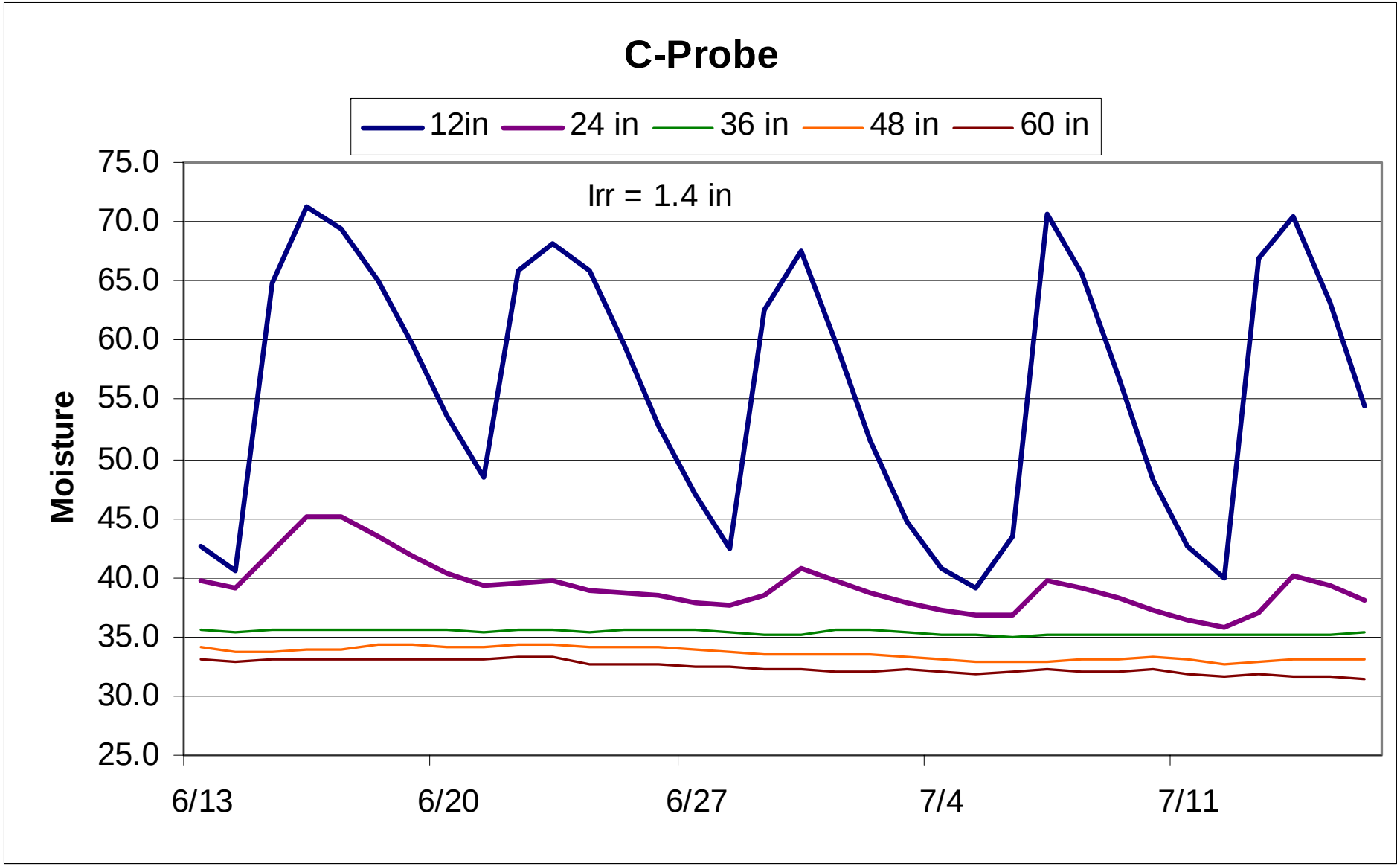
## Manteca Normal California, inches

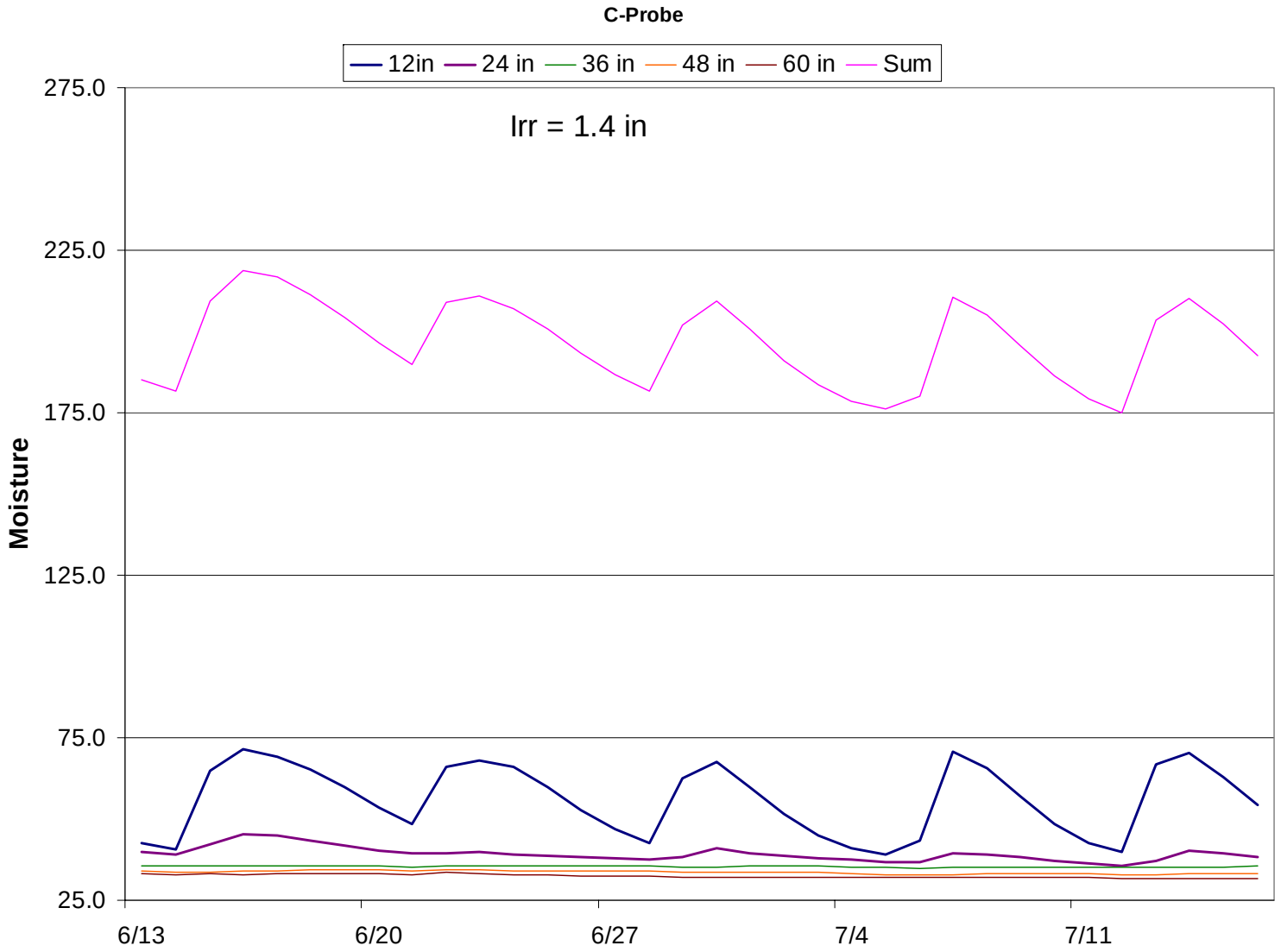
| | | | Historical |
|---|---|---|---|
| Date | ETo | Kc | ETc |
| March 16-31 | 2.32 | 0.54 | 1.25 |
| April 1-15 | 2.54 | 0.60 | 1.52 |
| April 16-30 | 2.88 | 0.66 | 1.90 |
| May 1-15 | 3.27 | 0.73 | 2.39 |
| May 16-31 | 3.65 | 0.79 | 2.88 |
| June 1-15 | 3.80 | 0.84 | 3.19 |
| | | | |
| March 16 - June 15th | | | 13.14 |

# Mature Almond Water Use

## Manteca Normal, California, inches

| | | | Historical |
|---|---|---|---|
| **Date** | **ETo** | **Kc** | **ETc** |
| June 16-30 | **3.98** | **0.86** | **3.42** |
| July 1-15 | **4.08** | **0.93** | **3.80** |
| July 16-31 | **3.94** | **0.94** | **3.70** |
| August 1-15 | **3.65** | **0.94** | **3.43** |
| August 16-31 | **3.49** | **0.94** | **3.28** |
| September 1-15 | **2.88** | **0.94** | **2.71** |
| September 16-30 | **2.38** | **0.91** | **2.16** |
| October 1-15 | **1.96** | **0.85** | **1.67** |
| October 16-31 | **1.56** | **0.79** | **1.23** |
| November 1-15 | **1.08** | **0.7** | **0.76** |
| June 16 – Nov 15 | | | 26.17 |
| | | | |


C-Probe
12in
24 in
36 in
48 in
60 in
Irr = 1.4 in
Moisture
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
6/13
6/20
6/27
7/4
7/11

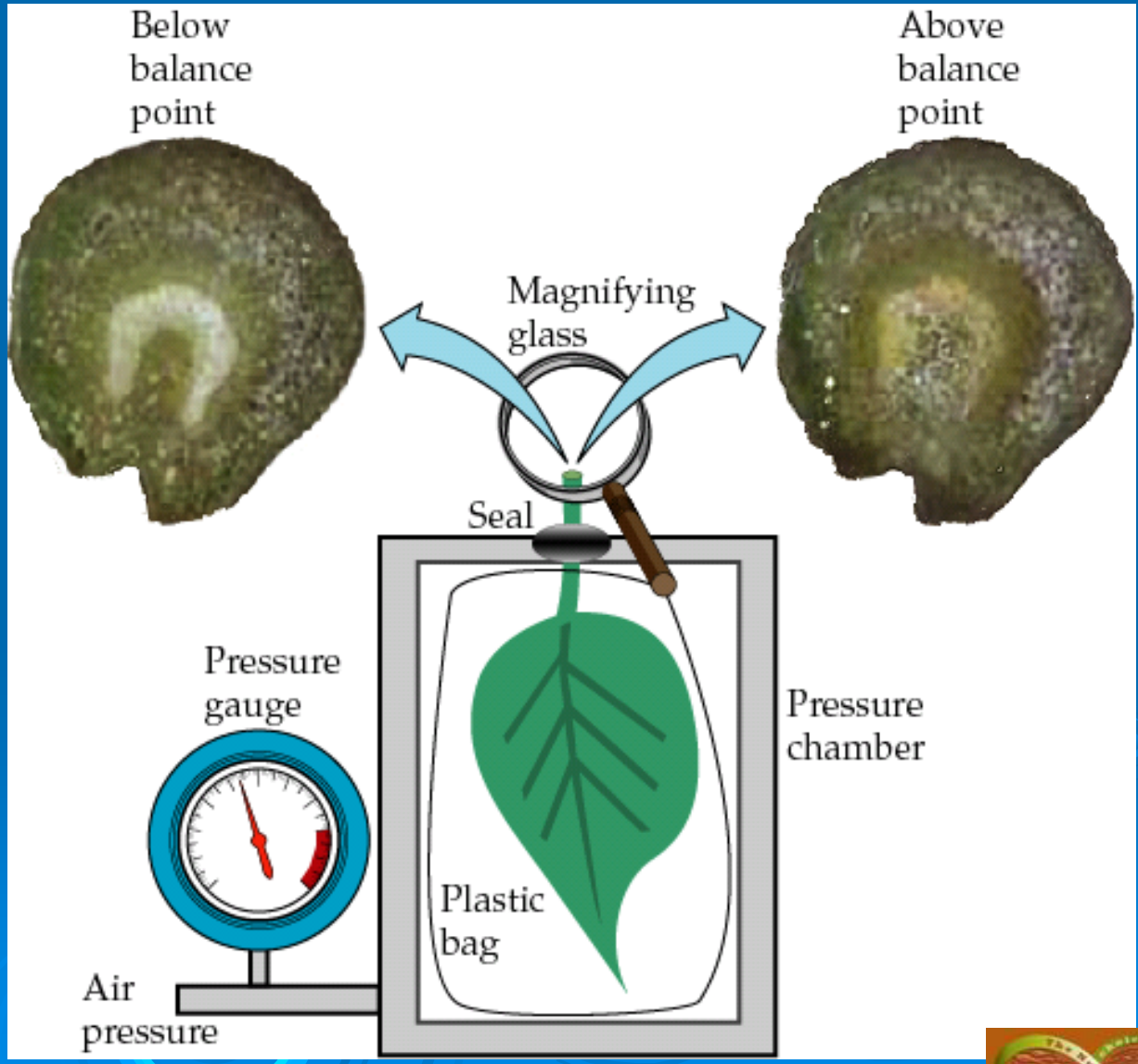

C-Probe
12in
24 in
36 in
48 in
60 in
Sum
Irr = 1.4 in
Moisture
275.0
225.0
175.0
125.0
75.0
25.0
6/13
6/20
6/27
7/4
7/11

# Tree Water Stress

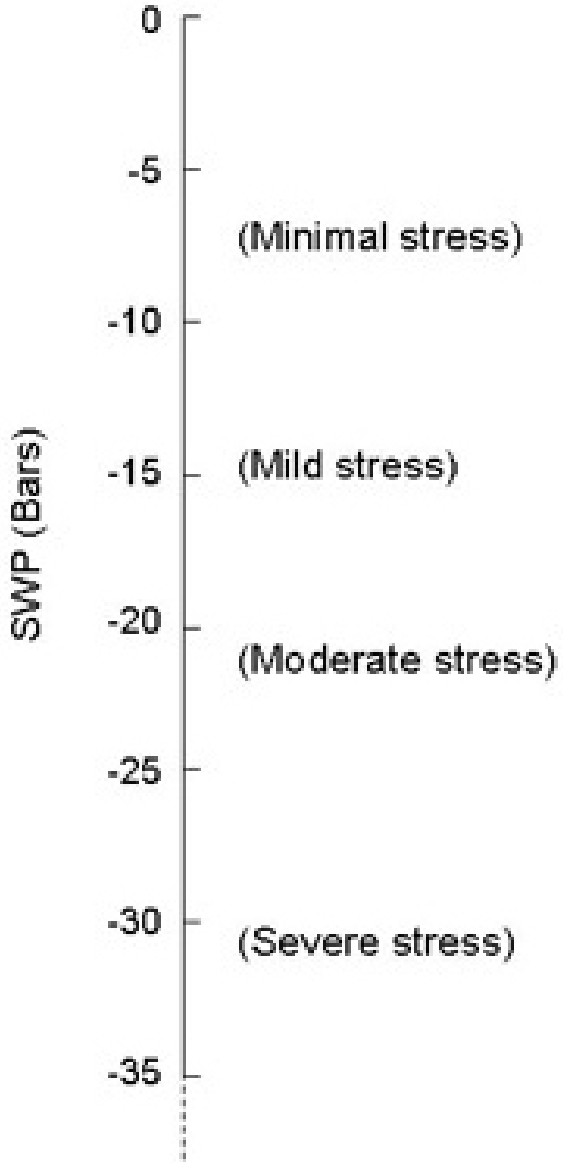
- Measured as midday *stem* water potential
  - Using a pressure chamber
    - aka pressure bomb


Lower scaffold limb
Fully expanded leaf
Bag for 15 minutes min

Measure it in a pressure chamber



# Midday SWP values in Almond




Expected range even under fully irrigated conditions

Will reduce overall growth of young trees, and shoot growth of older trees, but may also have some beneficial effects on older trees

Interior leaf yellowing and drop usually apparent. Not unusual to find under almond production conditions, but probably reduces tree productivity, particularly if these levels occur regularly

Leaf drop, flagging, wilting. Can occur under almond production conditions, particularly around harvest.

# Plant pressure chambers are available from:

PMS Instruments in Albany, Oregon
(http://pmsinstrument.com/)

Soil Moisture Equipment Corp.in Santa Barbara, California
(http://www.soilmoisture.com/)

# Almond Deficit Strategies

- Moderate  30% savings
  - little effect on yield
- Severe 50% savings
  - Reduced yield due to smaller kernel size– current year
  - Reduced yield in subsequent year due to reduced nut number and kernel size
- Staying alive --12 inches water
  - No concern for yield current or subsequent year-
    - tree survives

# Moderate Deficit Strategy
# 30% savings

- Full Irrigation
  - Leafout to Mid June

- Deficit Irrigation
  - Mid June to harvest 50% of full irrigation

  Or
  - -20 to -22 bar threshold before irrigation

# Moderate Deficit Strategy
# 30% savings

- Deficit Irrigation
  - Constant reduction of applied water in relation to ET
    - 70% of full requirement

Calculate full crop water use-- then apply irrigation at 70% This method can be influenced by the amount of stored soil moisture and should be accounted for in the applied water

# More Severe Deficit Strategy
# 50 -60% Savings

- Deficit Irrigation
  - Leafout through mid June

    -12 to -14 bars mid-day stem water potential

- Deficit Irrigation
  - June 15th to harvest

    -20 to -25 bars  w/ 1 inch applied at hull split


22 9'95

# Keeping the Trees Alive

- This method does not consider growth or yield– just survival
  - estimated 12 inches applied water depending on stored soil moisture
- Deficit Irrigation
  - Leafout through May

    -16 bars mid-day stem water potential before application
- Deficit Irrigation
  - June to harvest

    -25 bars before application

    Until water supply is depleted

# Almond Salinity

- All soils and waters contain some salts
  - Soils with coast range parent material are higher as are waters from aquifers from same
- Salts accumulate in the soil rootzone as a result of applied water volumes and orchard transpiration

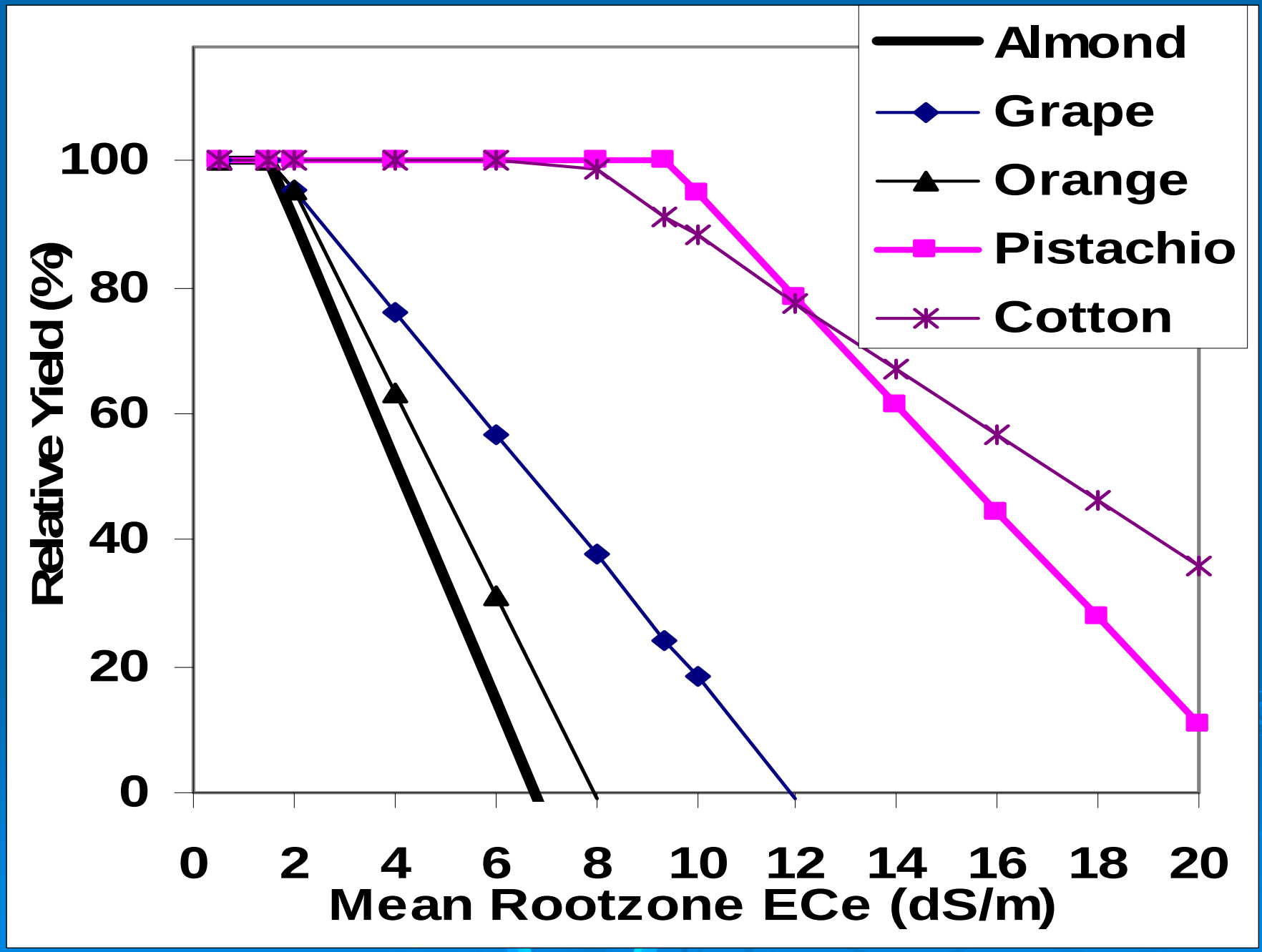
# Salinity Management

- Sample water
  - Total salts and constituents
- Soil Sample in depth increments
  - Total salts and constituents
    - Sodium, Chloride, Boron
- Tissue Samples
  - Sodium, Chloride, Boron

# Almond Salt Tolerance

- Water Salinity 1.0 dS/m or EC mmho/cm
- Soil Salinity 1.5 dS/m

- Relationship based on a 15% leaching fraction
  - 6/40 = 15%


Almond
Grape
Orange
Pistachio
Cotton
Relative Yield (%)
100
80
60
40
20
0
0
2
4
6
8
10
12
14
16
18
20
Mean Rootzone ECe (dS/m)

# Removing Salts

- Total salts and Chloride
  - Leaching with good quality water
- Sodium
  - Soluble Calcium or acid in calcareous soils
  - Leaching with good quality water

# Leaching Salts

- Planned leaching program
  - Apply water in excess of water consumption or off season
- Leverage Rainfall
  - Fill the profile after dormancy
  - Allow rain to move salts out of rootzone

# ucmanagedrought.ucdavis.edu

UC Drought Management

University of California
Agriculture and Natural Resources

- Home
- Contact Us
- Agriculture

## Introduction

When there is insufficient irrigation water to meet the water demands of a crop, the available irrigation water must be applied in the most efficient manner possible.

There are available strategies for maximizing irrigation water efficiency.

Contact us:
Lawrence Schwankl or Terry Prichard

## Agriculture

**Crop Irrigation Strategies**

**Irrigation Scheduling**

Temporary Irrigation Systems (coming soon)

## Urban

We are currently conducting research in this area and will present our research shortly.

Home
Contact Us
Agriculture
Crop Irrigation Strategies
Almonds
Pistachios

# Crop Irrigation Strategies

## Individual Crop Deficit Irrigation Information

For some crops, primarily perennial crops, there may be growth periods when the crop can be deficit irrigated with minimal impact on yield and quality. Taking advantage of these periods, irrigation systems such as micro precise systems can apply precise irrigations to deficit irrigate without overly stressing the crop.

Click below on your crop of choice for information on irrigation strategies. Each section provides detailed information on irrigation management for crops under drought conditions, as well as a list of resources.

ALMONDS

PISTACHIOS

STONE FRUIT

WALNUTS

# UC Drought Management

University of California
Agriculture and Natural Resources



## Irrigation Scheduling

Irrigation scheduling is determining when and how much to irrigate. This can be done by estimating how much water the crop has used (Evapotranspiration (ET) Scheduling), by monitoring the soil moisture, or by taking measurements on the crop itself (Plant-based Irrigation Scheduling). Using different irrigation scheduling techniques together can further improve irrigation scheduling.

Evapotranspiration Scheduling (ET)

Soil Moisture Monitoring

Plant-based Irrigation Scheduling