

# Using Web-based Software for Irrigation and Nitrogen Management in Onion Production: our Research Plan for 2013

*Andre Biscaro, Farm Advisor  
UCCE Los Angeles County*

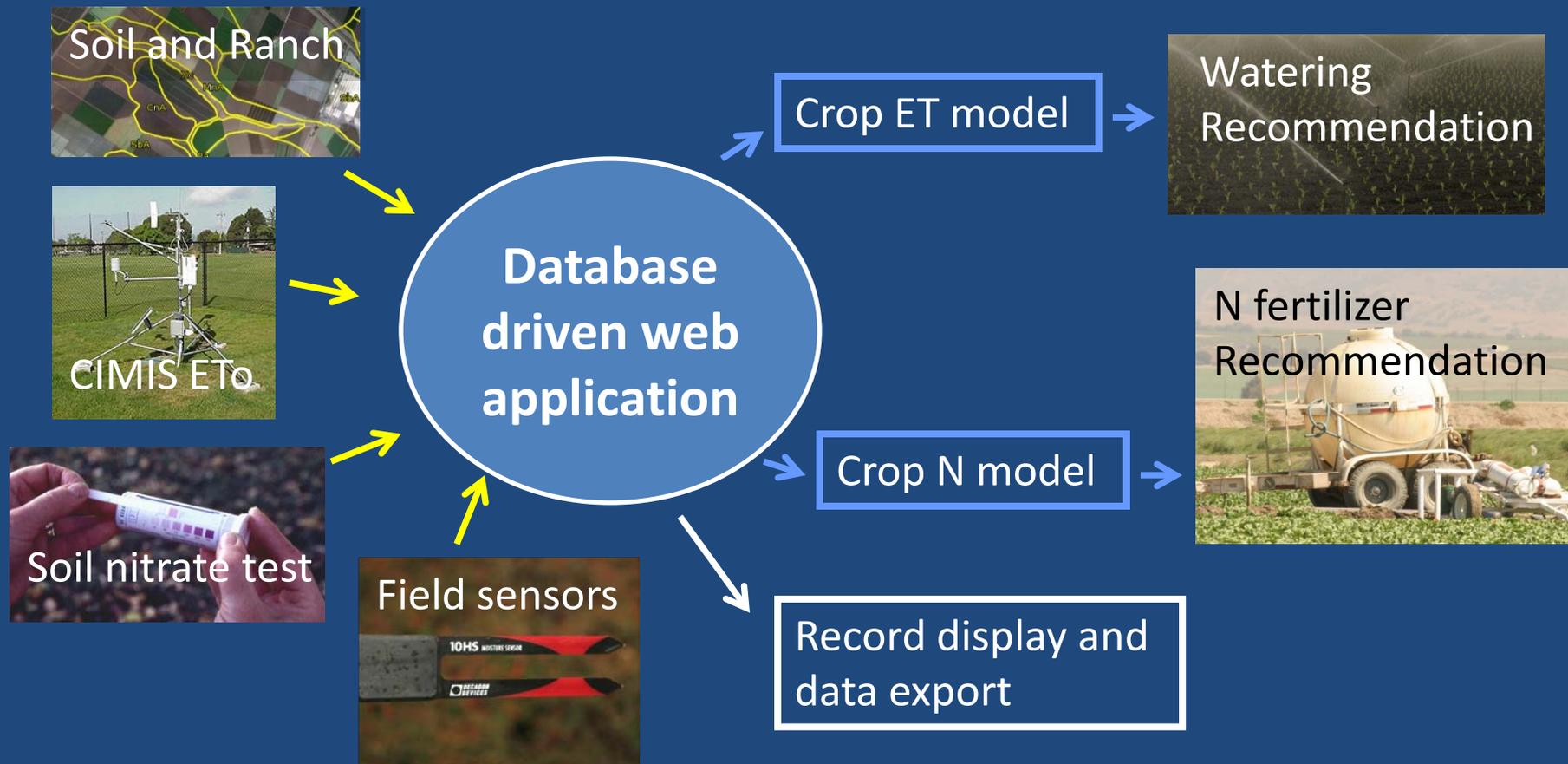
*Michael Cahn, Farm Advisor  
UCCE Monterey County*

# Presentation Outline

- How CropManage works
- Water and N recommendation
- Using CropManage
- Monitoring SWT
- Research plan for 2013

# CropManage

Integrate information from multiple sources



# Why adapt CropManage to onions production?

- Management of N and water is a big part of onion crops success
- Brilliant idea – integrates the most pertinent info in a simple way; accessibility
- Growers and managers can spend more time making use of the data than creating the data

# Onions require frequent irrigation

- Shallow root system
- Stimulation of new root growth
- High sensitivity to mild water stress

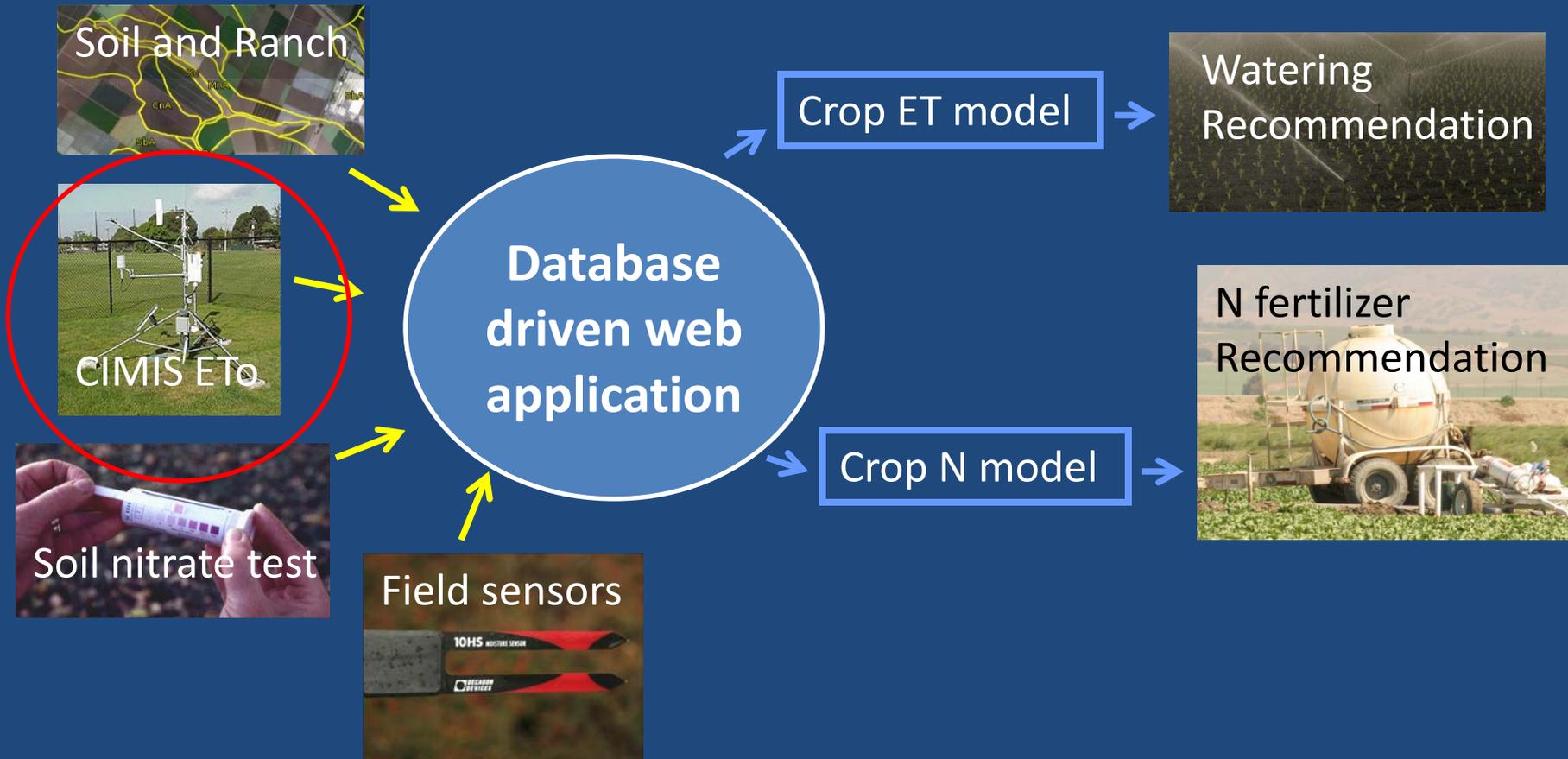
# Irrigation Scheduling

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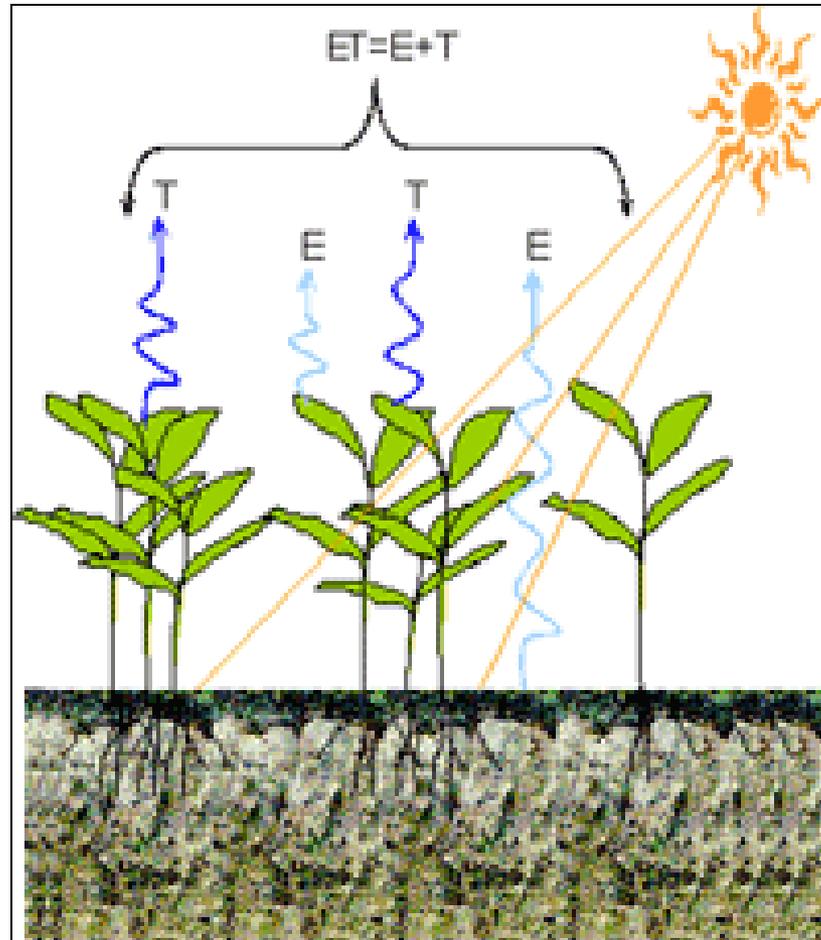
Correct frequency and duration of watering

- When to irrigate
- How much to irrigate

# CropManage



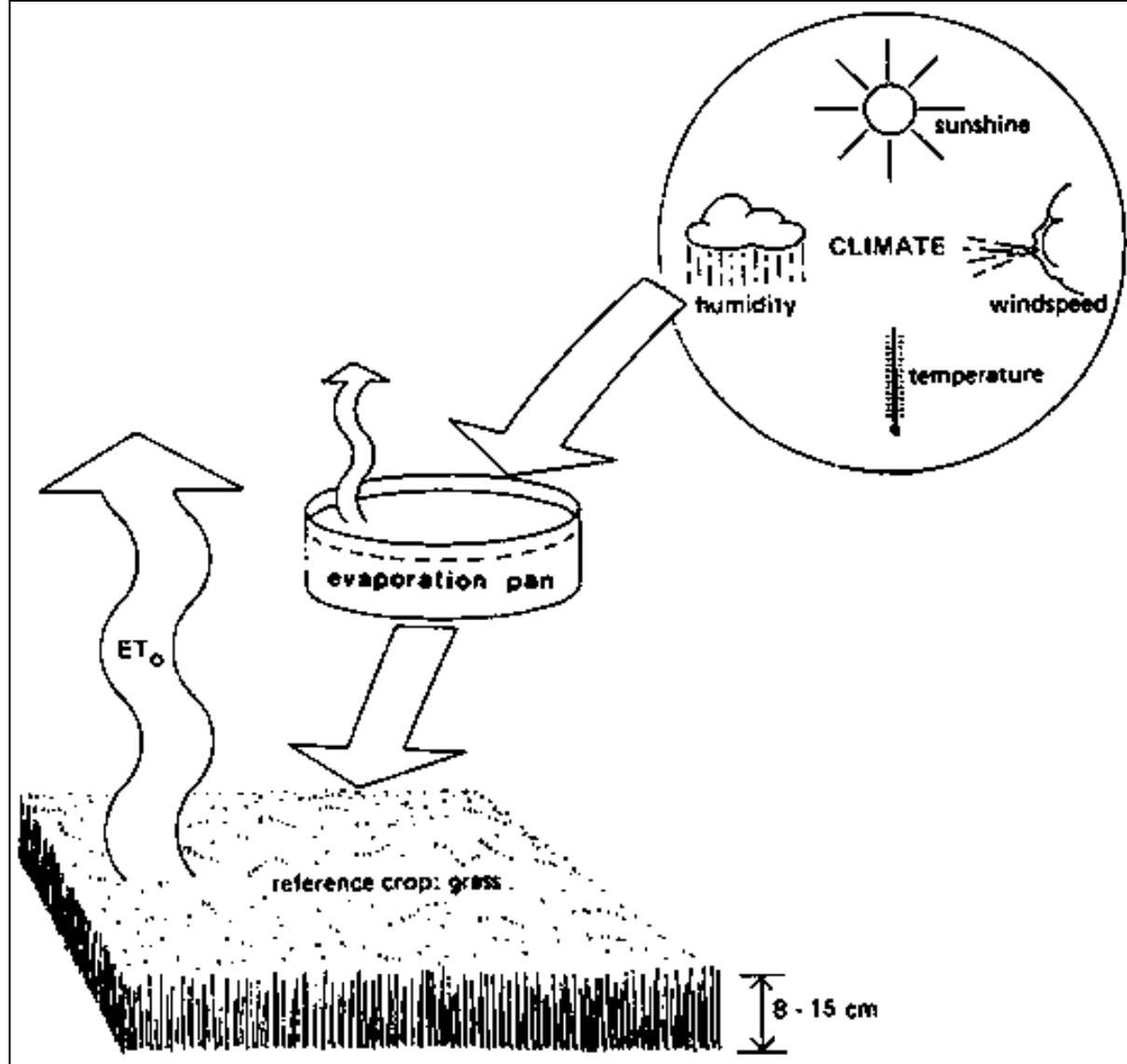
# Evapotranspiration (ET)



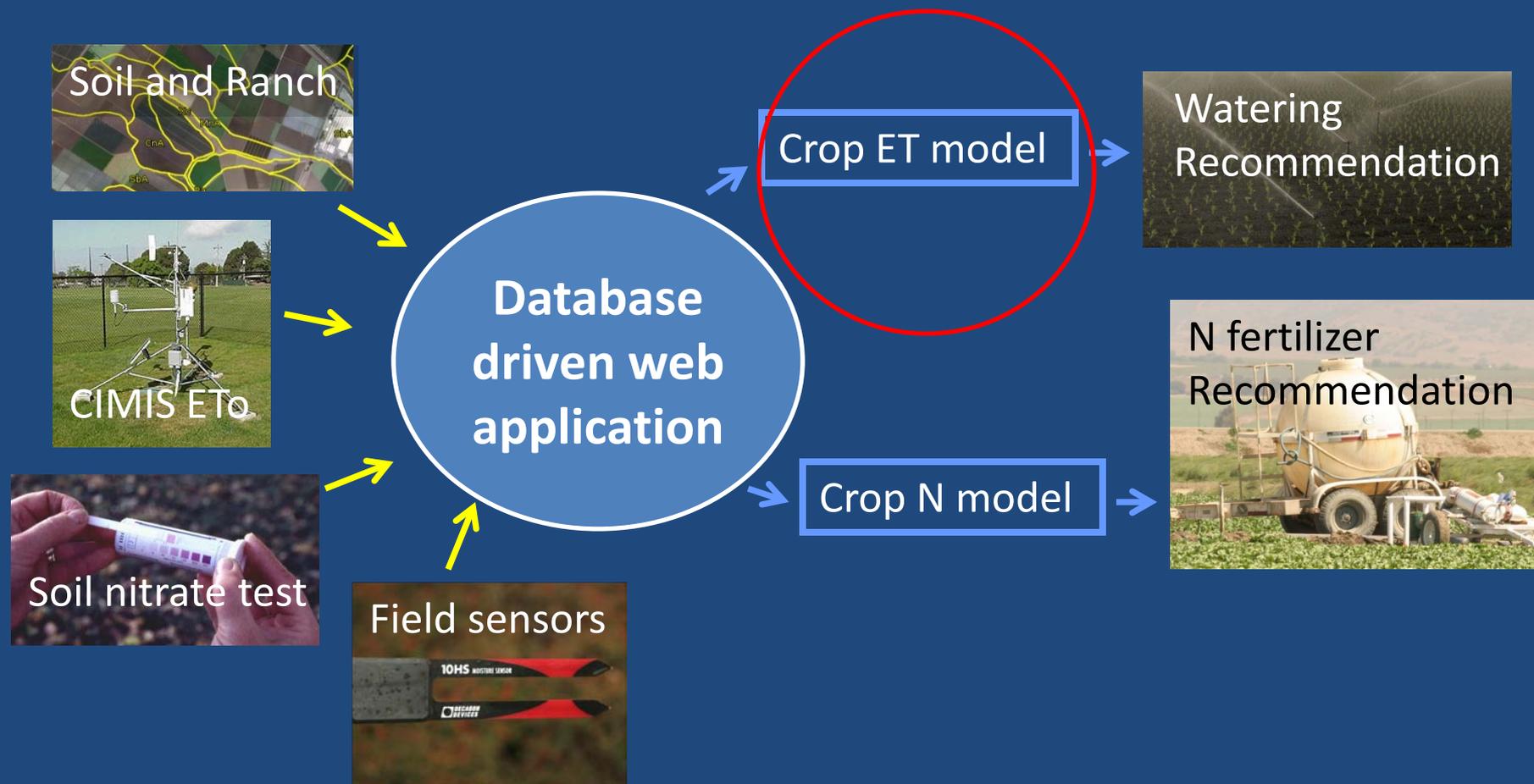
# ET<sub>o</sub>



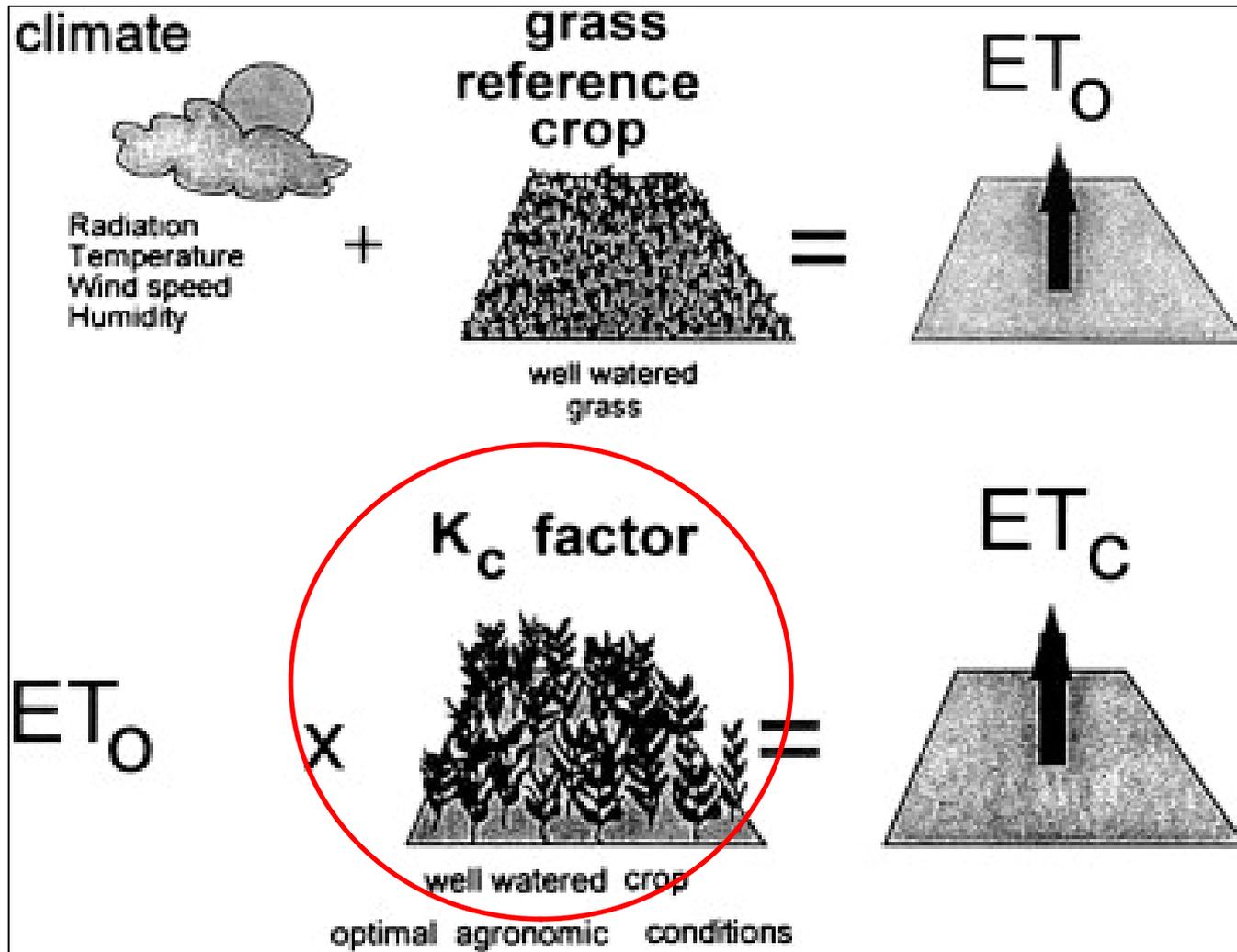
**CIMIS reference ET**



# CropManage



# ET<sub>o</sub> and ET<sub>c</sub>

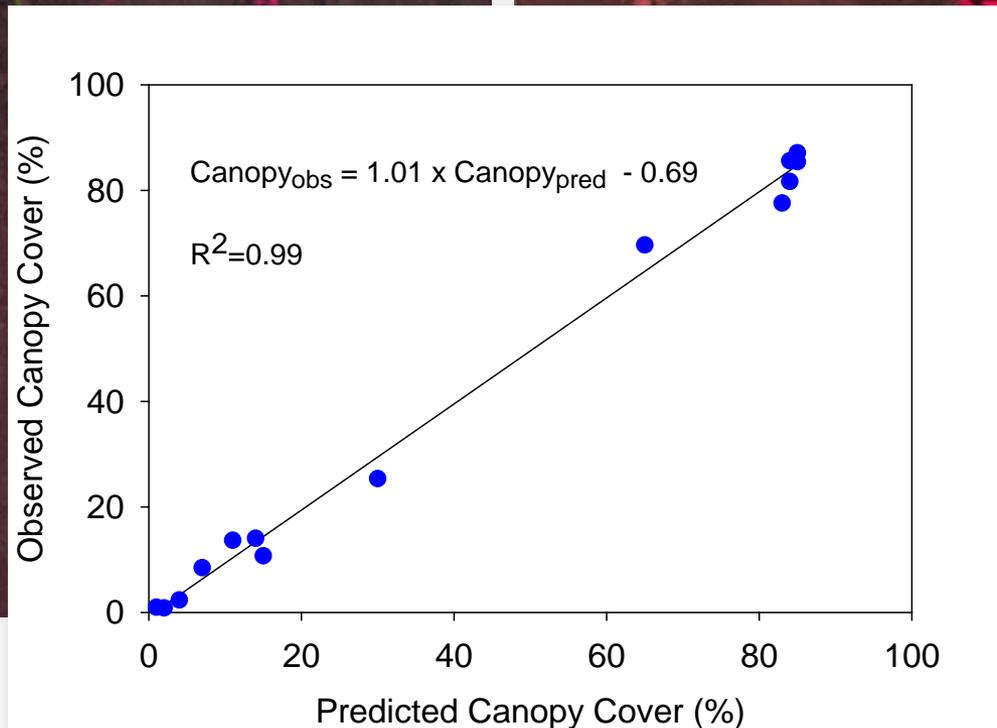


$$ET_{\text{crop}} = ET_0 \times K_c$$

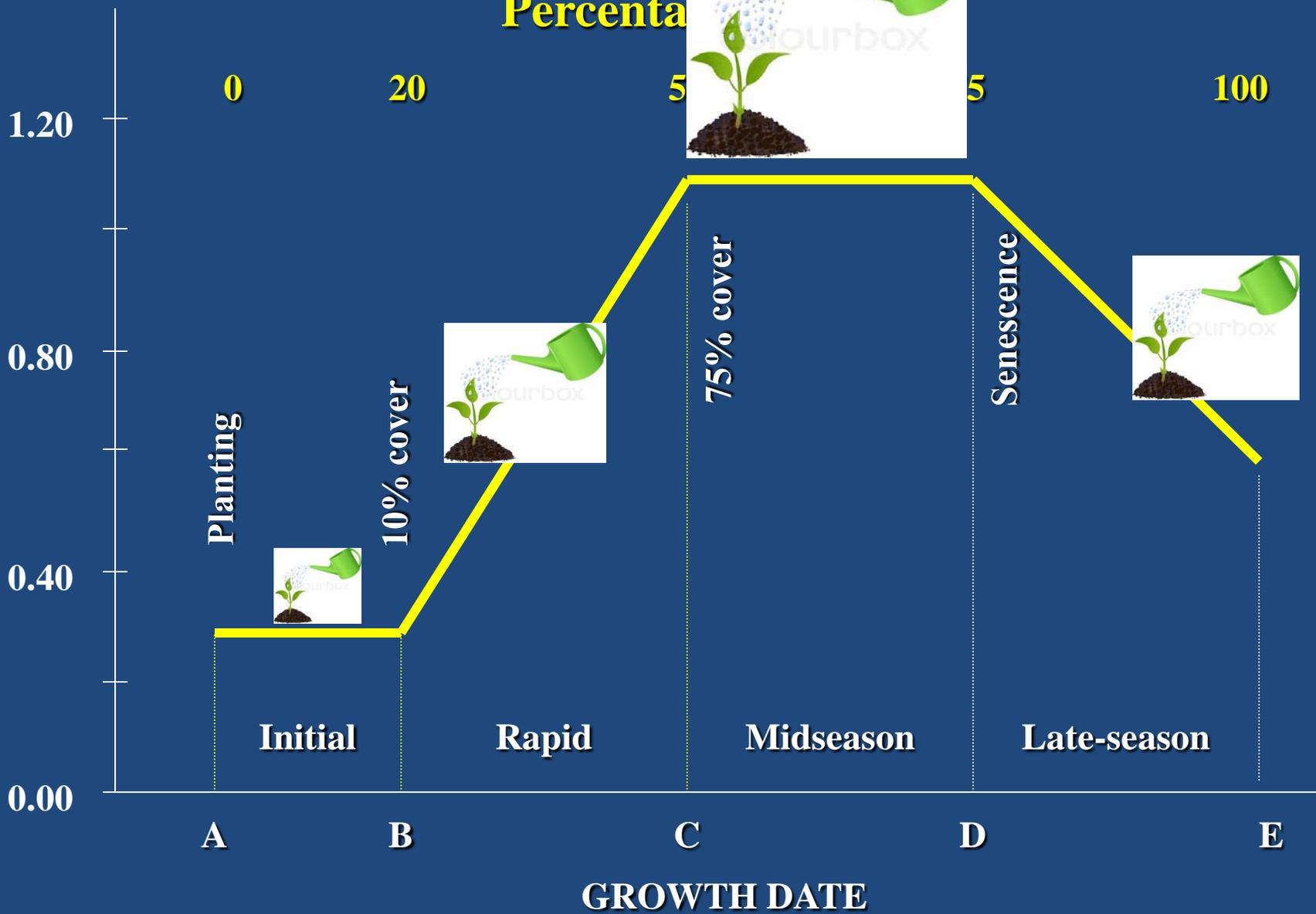
$K_c$  can vary from 0.1 to 1.2

7% canopy

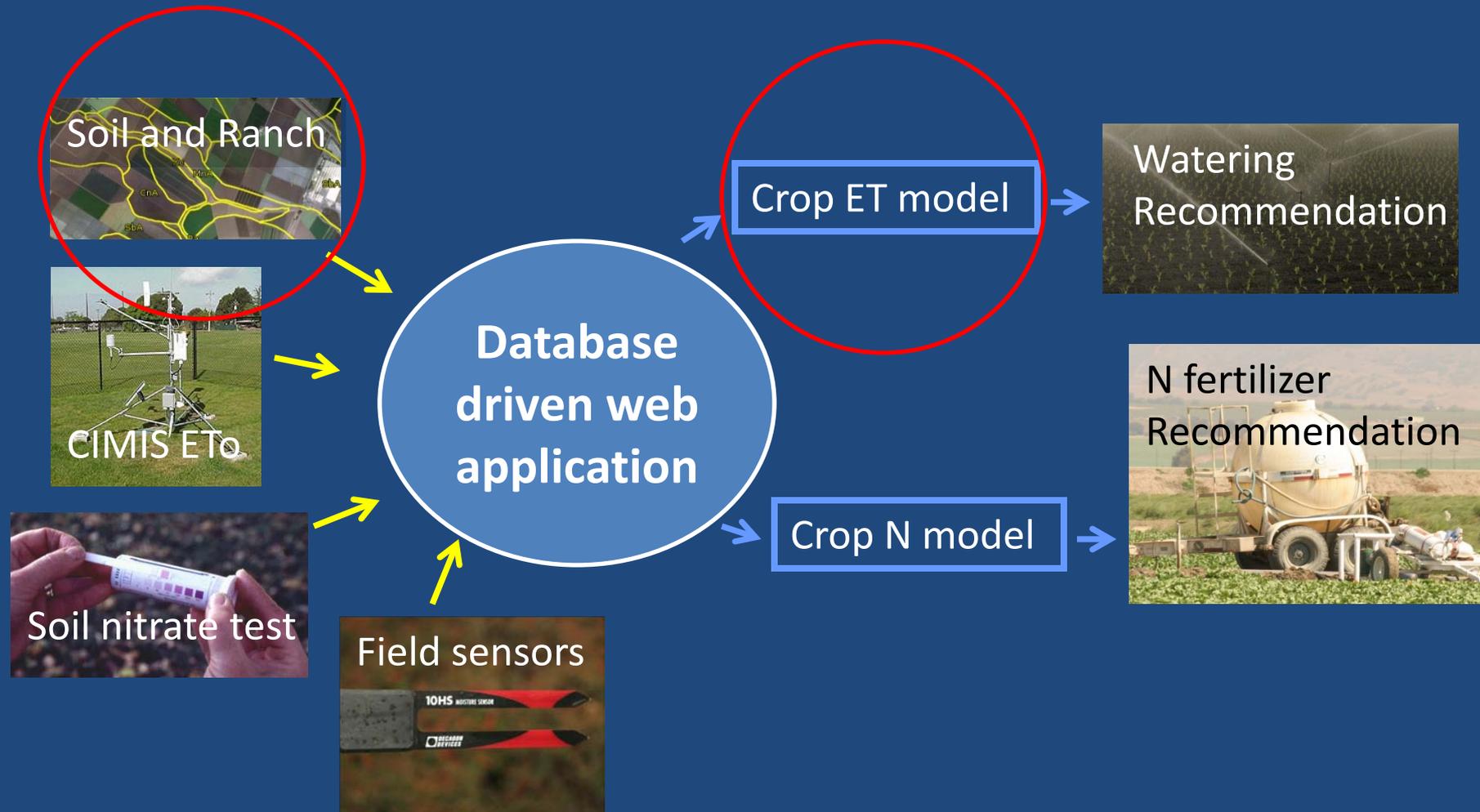
18% canopy



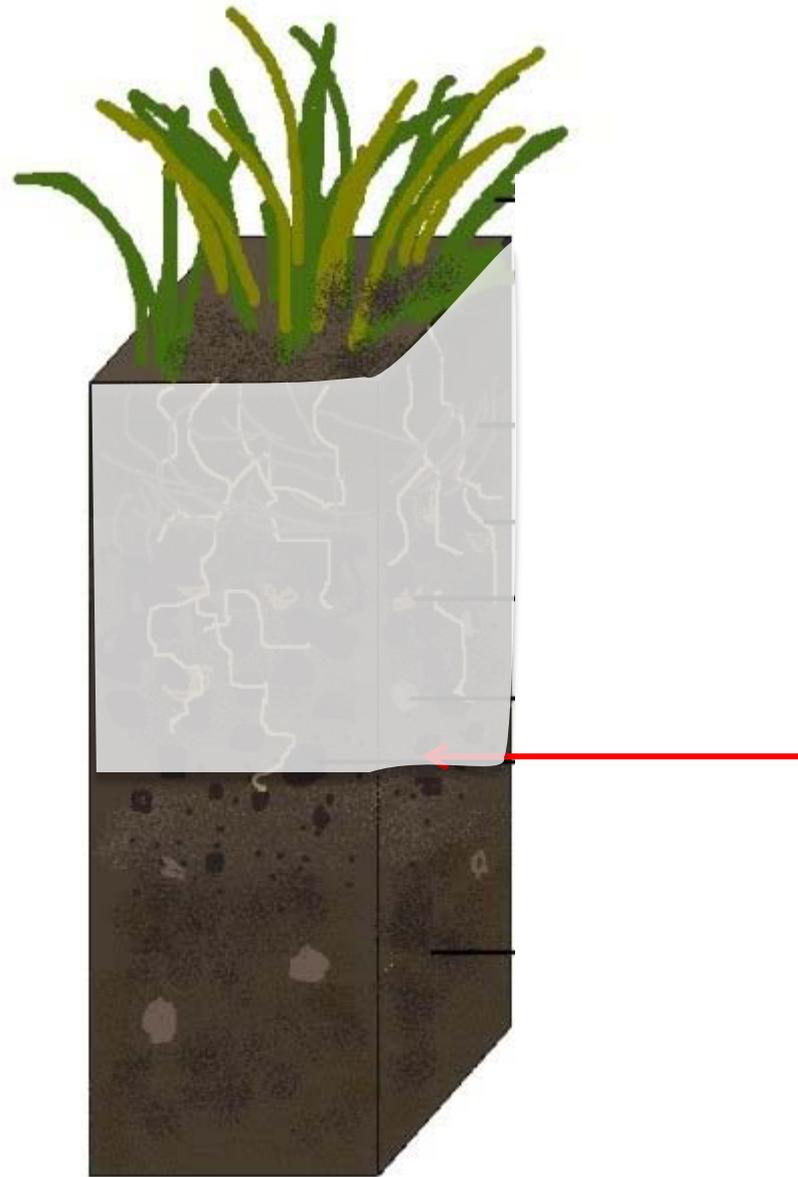
CROP COEFFICIENT ( $K_c$ )



# CropManage

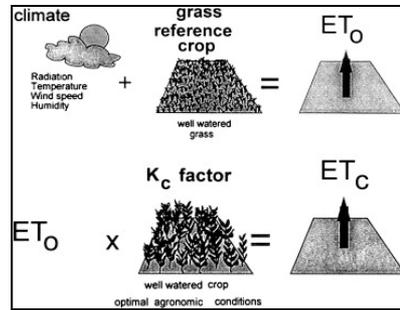


Know the root depth +  
soil type =  
storage volume



# Why its not easy to create an accurate irrigation schedule?

- Root depth
- Crop canopy
- Weather
- Soil moisture

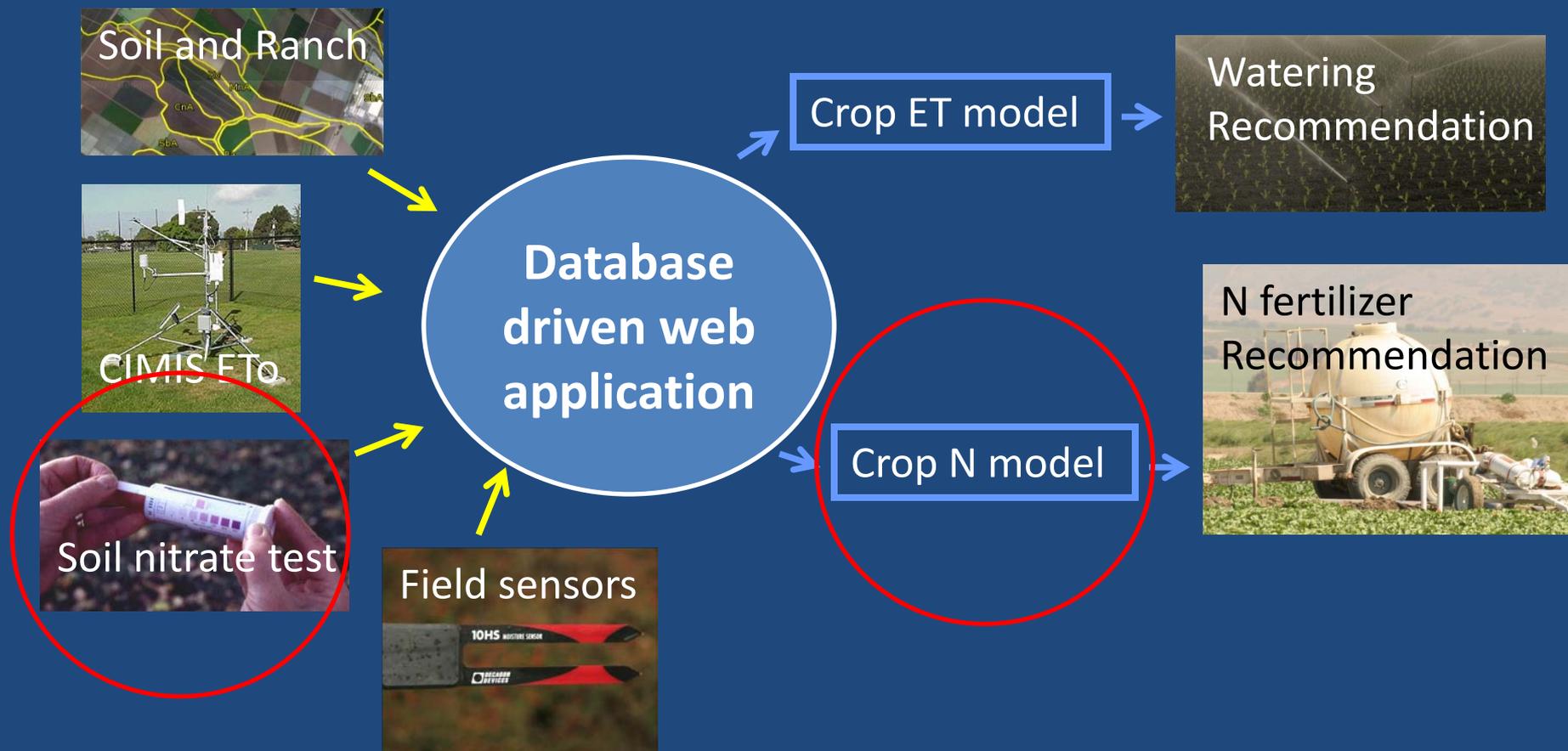


Water recommendation



- Allowable depletion
- Irrigation system application rate
- Irrigation system application uniformity
- Leaching fraction (water salinity)
- And more

# CropManage



# How is N fertilizer rate determined?

Fertilizer N = Crop N uptake – Soil N

Soil N:

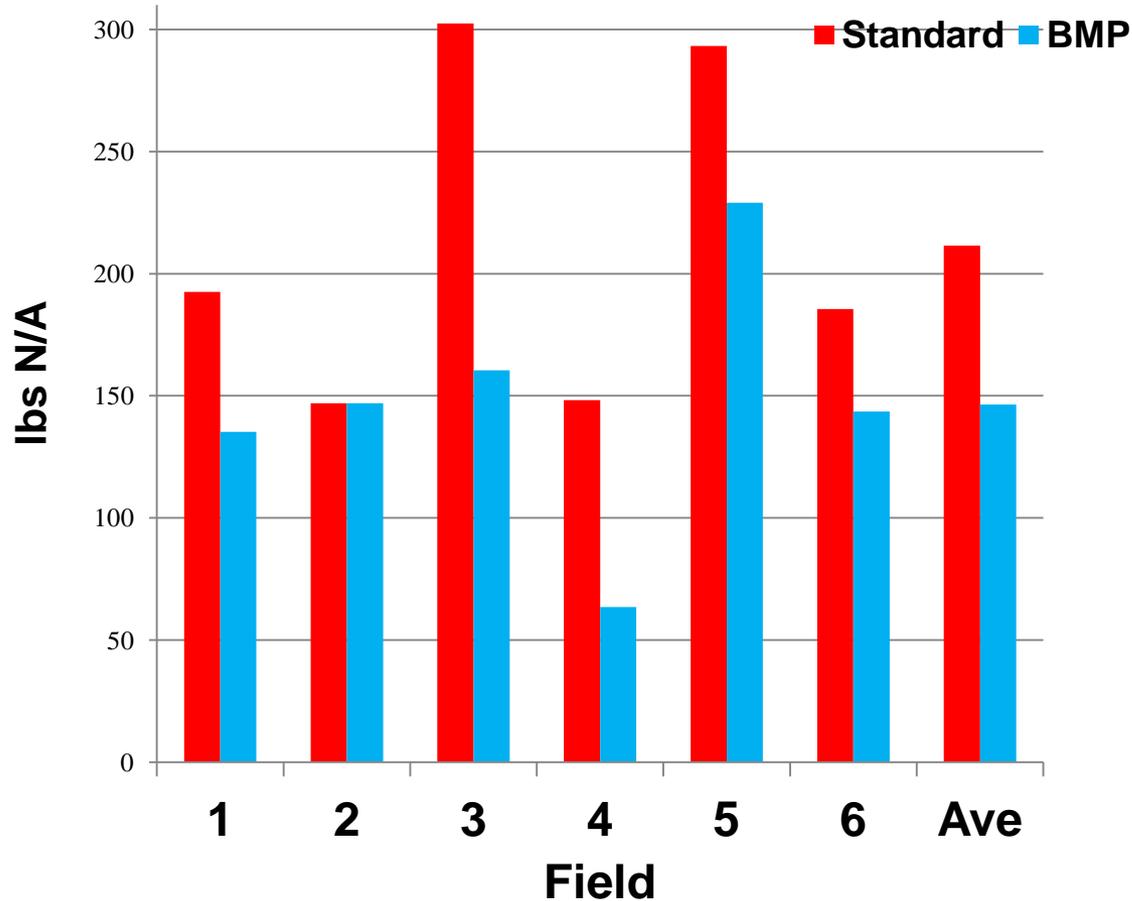
- Quick Test N (ppm  $\text{NO}_3\text{-N}$ )
- Soil mineralization N
- Plant residue N

# Tools for Managing Water and Nitrogen Fertilizer in Lettuce

- Quick nitrate soil test  
(20 ppm  $\text{NO}_3\text{-N}$  = 70 to 80 lbs of N/acre/ft)
- Weather-based irrigation scheduling



# Commercial Lettuce Nitrogen Fertilizer Trials



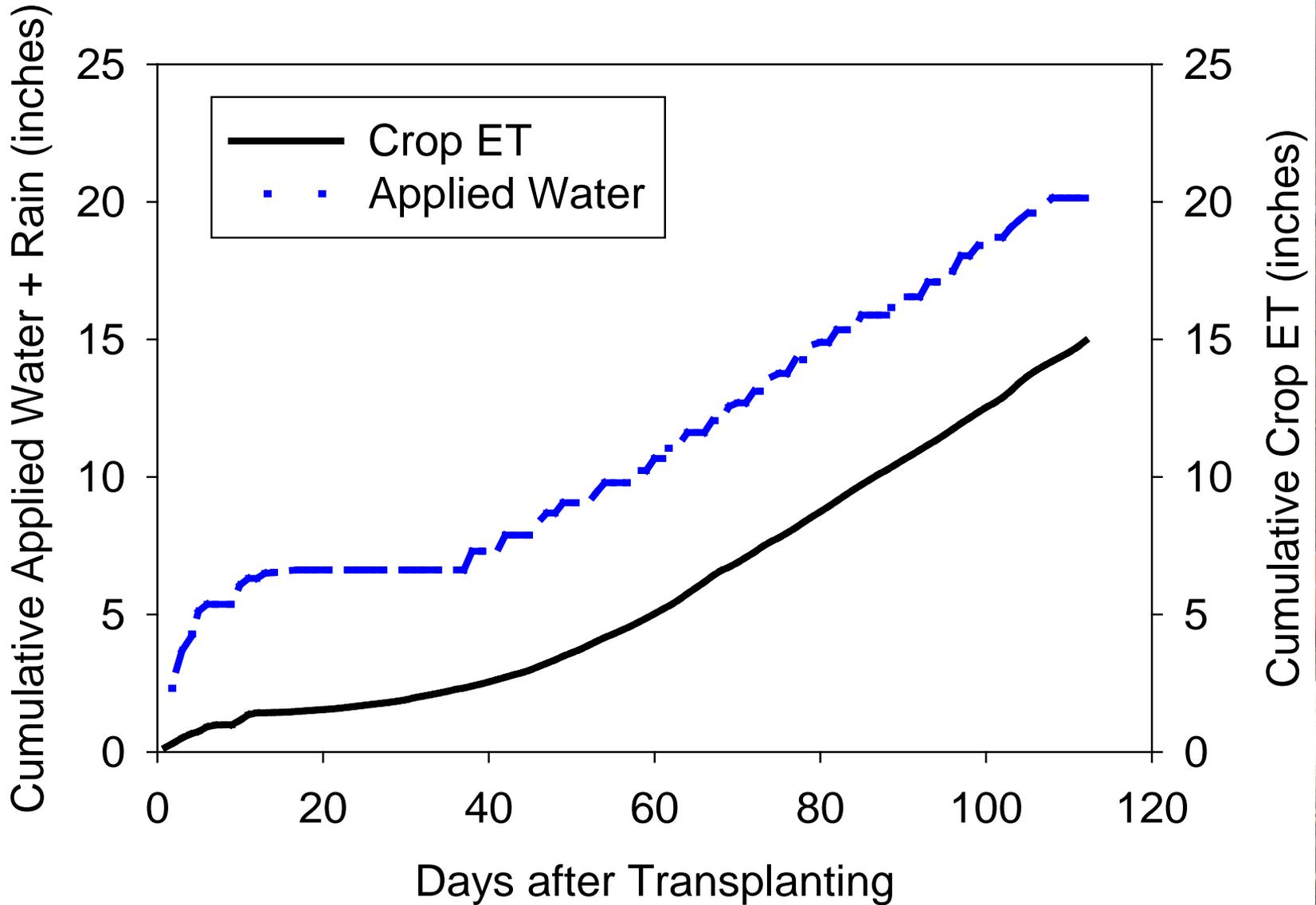
**Std: 212 lbs N/Acre**  
**BMP: 146 lbs N/Acre**

Difference  
66 lbs/A

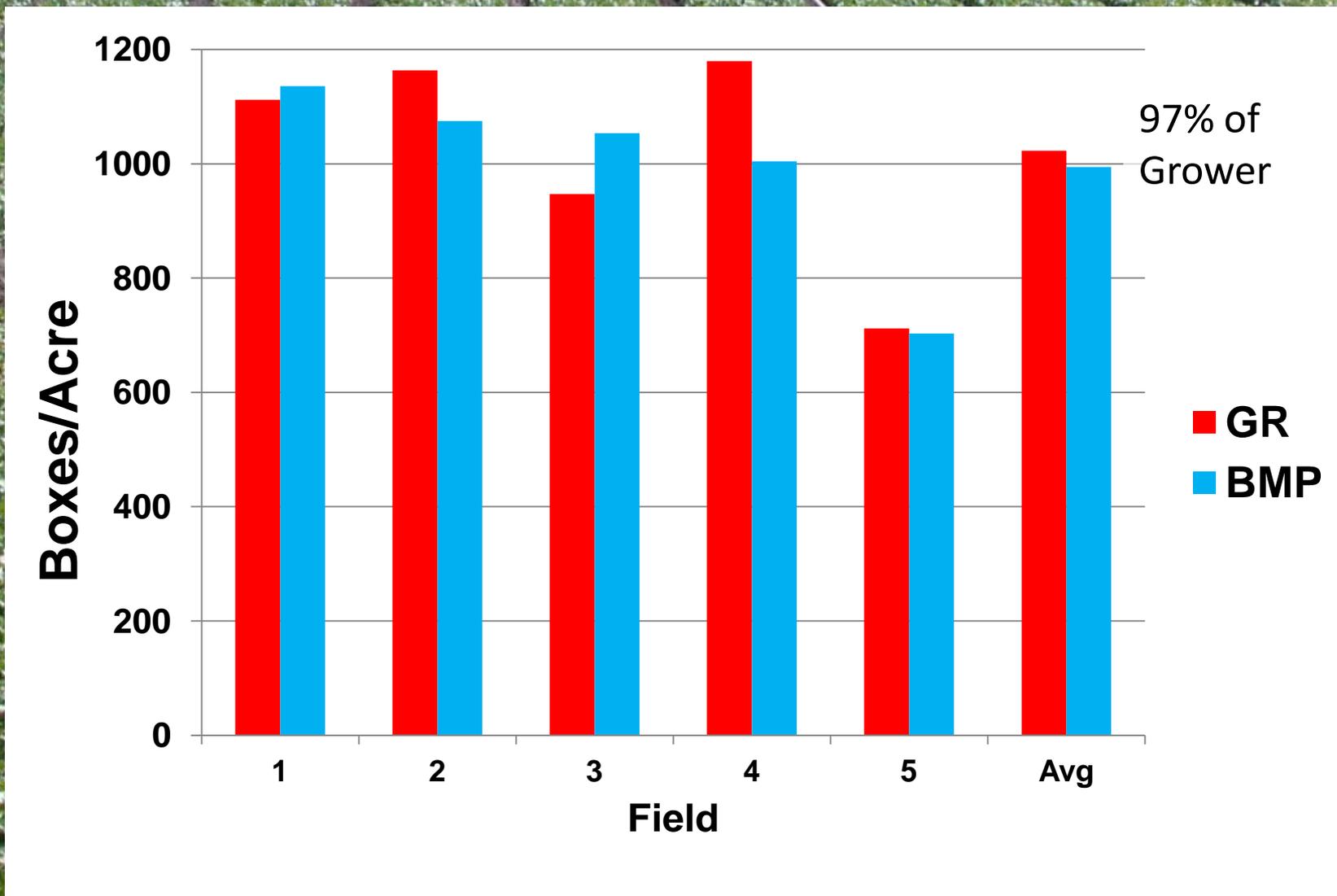
30% reduction in N  
fertilizer

(Cahn and Smith, 2011)

# Water applied vs. ET



# Commercial Yield



(Cahn and Smith, 2011)

CropManage



# Web-based Irrigation and N management software for lettuce

[ucanr.org/cropmanage](http://ucanr.org/cropmanage)

## Login

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To login enter your e-mail and password below.

E-mail Address

Password

Login

[Forgot Password](#)

[Create New Account](#)

## Ranch List

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Select a Ranch to work in from the list below.

- [Freyer](#)
- [Home](#)
- [Onion test](#)
- [test](#)
- [UCCE ranch](#)
- [USDA-ARS Spence](#)

[New Ranch](#)[Request Access to a Ranch](#)[Getting Started](#)

Ranch/Field: UCCE ranch

## Add Ranch

Info

[Options](#)

### Ranch Information

Ranch Name

Ranch Owner

Andre Biscaro

Acres

Soil Type

# Info for creating a ranch and field:

Location, soil type, crop, acreage, planting and harvesting dates, previous crop, previous harvest date, sprinkler application (in/h), sprinkler distribution uniformity (%), drip application rate (in/h), drip distribution uniformity (%), leaching factor, maximum crop N uptake, default days to next fertilization, flow meter data, coordinates;

**Ranch/Field:** UCCE ranch

## Plantings

Showing current Plantings

Planting	Wet Date	Harvest Date	Lot	Action
<a href="#">Iceberg</a>	2/9/2013	7/25/2013	1	<a href="#">View</a> <a href="#">Detailed View</a> <a href="#">Edit</a>
<a href="#">romaine 2</a>	1/1/2013	3/27/2013	1	<a href="#">View</a> <a href="#">Detailed View</a> <a href="#">Edit</a>
<a href="#">winegrapes</a>	12/26/2012	3/27/2013	1	<a href="#">View</a> <a href="#">Detailed View</a> <a href="#">Edit</a>
<a href="#">VEG/STRAW</a>	1/9/2013	5/4/2013	2	<a href="#">View</a> <a href="#">Detailed View</a> <a href="#">Edit</a>

[New Planting](#) [View All Plantings](#) [Import Export Options](#)

**Ranch/Field:** UCCE ranch, Lot 1, 0  
**Planting:** romaine 2, 5.0 acres  
**Crop:** Romaine 2 row, 40 inch bed, 1/1-3/27/13

## Planting - romaine 2

[Detailed View](#)

Crop: Romaine 2 row, 40 inch bed

January 1, 2013 - March 27, 2013

### Latest Events (by type)

- Soil Sample** [February 8, 2013](#) Soil N: 44.78 (ppm)
- Fertilization** [February 8, 2013](#) Applied Fertilizer: 0.0 gallons/acre
- Watering** [February 8, 2013](#) Rainfall: 0.05 (inches) Rain since last irrigation: 0.07 (inches)

### Last 5 Events (by date)

- February 8, 2013** Sample: [44.78 \(ppm\)](#)  
Fertilizer: [0.0 gallons/acre](#)  
Rainfall: [0.05 \(inches\)](#)  
Total Rainfall: [0.07 \(inches\)](#)
- February 5, 2013** Irrigation: [0.08 \(inches\)](#)
- January 25, 2013** Fertilizer: [14.0 gallons/acre](#)
- January 23, 2013** Sample: [50.88 \(ppm\)](#)
- January 22, 2013** Irrigation: [0.08 \(inches\)](#)

[Soil Samples](#) [Fertilization](#) [Irrigation](#) [New ▾](#)

[Advanced Settings](#) [Recalculate](#) [Refresh Weather Data](#)

[New Soil Sample](#)[View all Nutrients](#)

## Fertilizer Summary

[Show / Hide Columns](#)

Fertilizer Date	Crop Stage	Soil NO <sub>3</sub> -N (ppm)	Fertilizer N Recommended (lb N/acre)	Cumulative N Uptake	Fertilizer	Applied N (lb N/acre)	Applied Fertilizer
1/1/13	Planting	20.00	0.2	0.00	15-8-4	3.1	2.0 gallons/acre
1/25/13	Post-thinning	20.00	30.4	4.77	CAN-17	30.0	14.0 gallons/acre
2/8/13	1st sidedress	N/A	N/A	11.33	UAN32	0.0	0.0 gallons/acre
Totals			30.7			33.1	

[New Fertilizing](#)

## Irrigation Summary

[Show / Hide Columns](#)[Show Previous Columns](#)[Show Next Columns](#)

Water Date	Irrigation Method	Recommended Irrigation Interval (days)	Recommended Irrigation Amount (inches)	Recommended Irrigation Time (hours)	Irrigation Water Applied (inches)	Kc	Canopy Cover (%)	Average Reference ET (inches/day)	Total Crop ET (inches)
1/1/13	Sprinkler	N/A	N/A	N/A	1.20 in	0.00	0	0.00	0.00
1/5/13	rainfall	N/A	N/A	N/A	0.00 in	0.37	0	0.06	0.08
1/6/13	rainfall	N/A	N/A	N/A	0.00 in	1.00	0	0.05	0.05

**Ranch/Field:** UCCE ranch, Lot 1, 0  
**Planting:** romaine 2, 5.0 acres  
**Crop:** Romaine 2 row, 40 inch bed, 1/1-3/27/13

## Add / Edit Watering

### Irrigation Summary

[< Back](#)
[Go to: ▾](#)

Show / Hide Columns

Show Previous Columns

Show Next Columns

Water Date	Irrigation Method	Recommended Irrigation Interval (days)	Recommended Irrigation Amount (inches)	Recommended Irrigation Time (hours)	Irrigation Water Applied (inches)	Kc	Canopy Cover (%)	Average Reference ET (inches/day)	Total Crop ET (inches)
1/1/13	Sprinkler	N/A	N/A	N/A	1.20 in	0.00	0	0.00	0.00
1/5/13	rainfall	N/A	N/A	N/A	0.00 in	0.37	0	0.06	0.08
1/6/13	rainfall	N/A	N/A	N/A	0.00 in	1.00	0	0.05	0.05
1/11/13	Sprinkler	15.1	0.05 in	0.16 hrs	0.15 in	0.30	1	0.04	0.07
1/18/13	Drip	14.4	0.11 in	0.71 hrs	0.15 in	0.22	2	0.06	0.10
1/22/13	Drip	34.6	0.04 in	0.26 hrs	0.08 in	0.12	3	0.07	0.03

# Add / Edit Fertilizer

## Fertilizer Summary

< Back    Go to: ▾

Show / Hide Columns

Fertilizer Date	Crop Stage	Soil NO <sub>3</sub> -N (ppm)	Fertilizer N Recommended (lb N/acre)	Cumulative N Uptake	Fertilizer	Applied N (lb N/acre)	Applied Fertilizer
1/1/13	Planting	20.00	0.2	0.00	15-8-4	3.1	2.0 gallons/acre
1/25/13	Post-thinning	20.00	30.4	4.77	CAN-17	30.0	14.0 gallons/acre
2/8/13	1st sidedress	N/A	N/A	11.33	UAN32	0.0	0.0 gallons/acre
Totals			30.7			33.1	

Show / Hide Table ^

Fertilization Date

Days To Next Fertilization

Crop Stage  ▾

### Previous Fertilization

**Fertilization Date** 2/8/2013  
**Days To Next Fertiliz...** 10  
**Crop Stage** 1st sidedress  
**Soil Sample** N (avg): 0.00  
**Fertilizer Type** UAN32 - Liquid: 11.1 lbs/gallon  
**Fertilizer Applied** 0 lbs N/acre  
0.0 gallons/acre

Fertilization Date  ✓

Days To Next Fertilization  ✓

Crop Stage  ▼

Soil Sample  ▼

Fertilizer Type  ▼

[Save Fertilizer](#)

### Previous Fertilization

<b>Fertilization Date</b>	2/8/2013
<b>Days To Next Fertiliz...</b>	10
<b>Crop Stage</b>	1st sidedress
<b>Soil Sample</b>	N (avg): 0.00
<b>Fertilizer Type</b>	UAN32 - Liquid: 11.1 lbs/gallon
<b>Fertilizer Applied</b>	0 lbs N/acre 0.0 gallons/acre

## Previous Fertilization

**Fertilization Date** 1/25/2013  
**Days To Next Fertiliza...** 15  
**Crop Stage** Post-thinning  
**Soil Sample** 1/23/2013  
Pre-thinning, N (avg): 12.50  
**Fertilizer Type** CAN-17 - Liquid: 12.6  
lbs/gallon  
**Fertilizer Applied** 30 lbs N/acre  
14.0 gallons/acre

Fertilization Date

Days To Next Fertilization

Crop Stage

Soil Sample

Fertilizer Type

Fertilizer Details  
UAN32  
Formulation: Liquid  
Nutrients:  
Nitrogen, 32%

Recommended Fertilizer 43.0 lbs N/acre at 32.0% = 12 gallons/acre

Fertilizer Applied  lbs N/acre =   
gallons/acre

Save Fertilizer

Delete Fertilization

# Soil Water Tension Data

- Watermark sensors
- 2 onion fields in Lancaster
- 4 irrigation sections per field
- 2 depths (8 and 18 inches)
- Drip irrigated
- Mostly loamy sand and sand loam

# Sensors

## Watermarks



## Dielectric

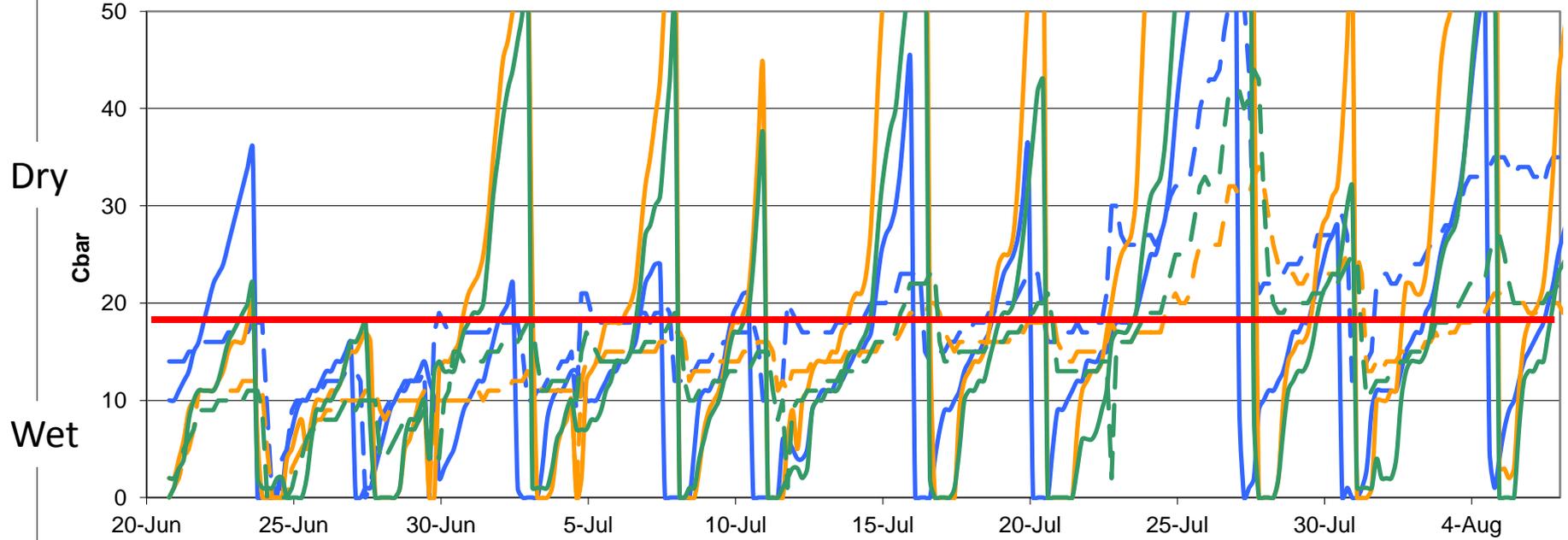


## Tensiometers

... a few questions if you don't mind:

- How many of you are growers or PCA's?
- How many of you have used soil moisture sensors for irrigation management before?
- What about ET data from CIMIS?

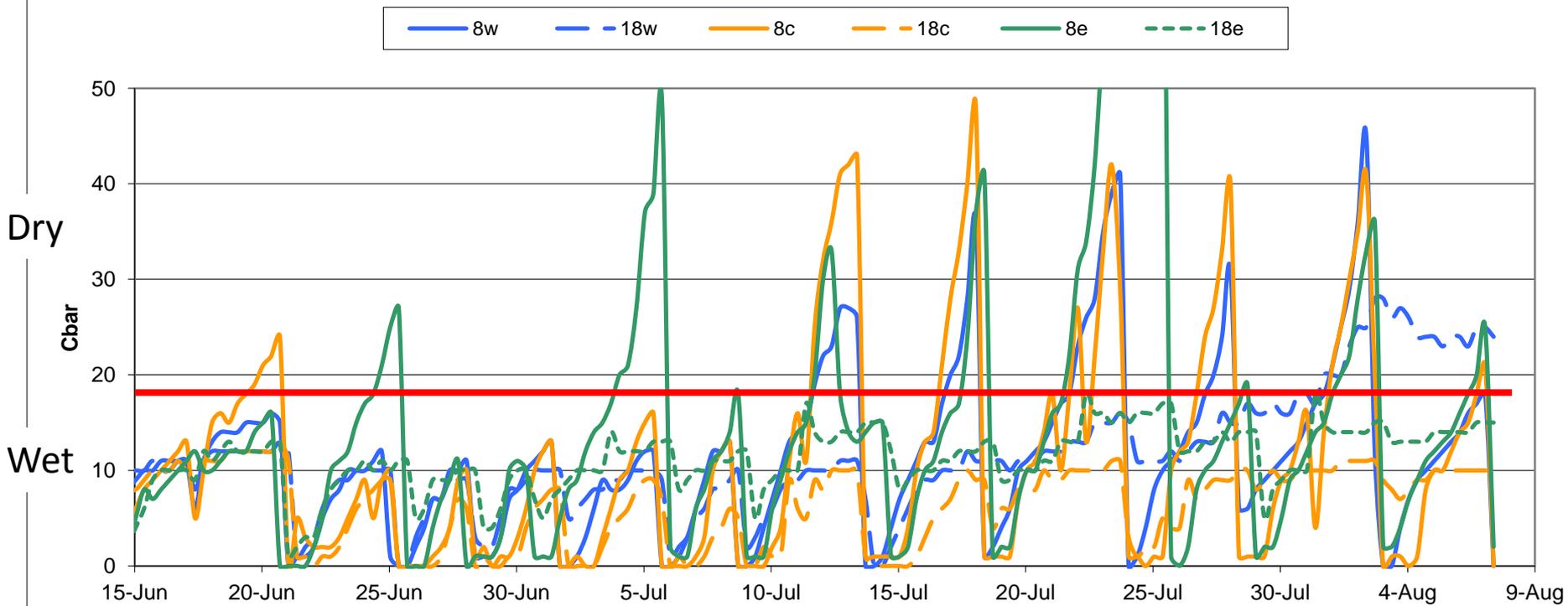
### Minn Sensor 4 - Sandy loam



### % time dry

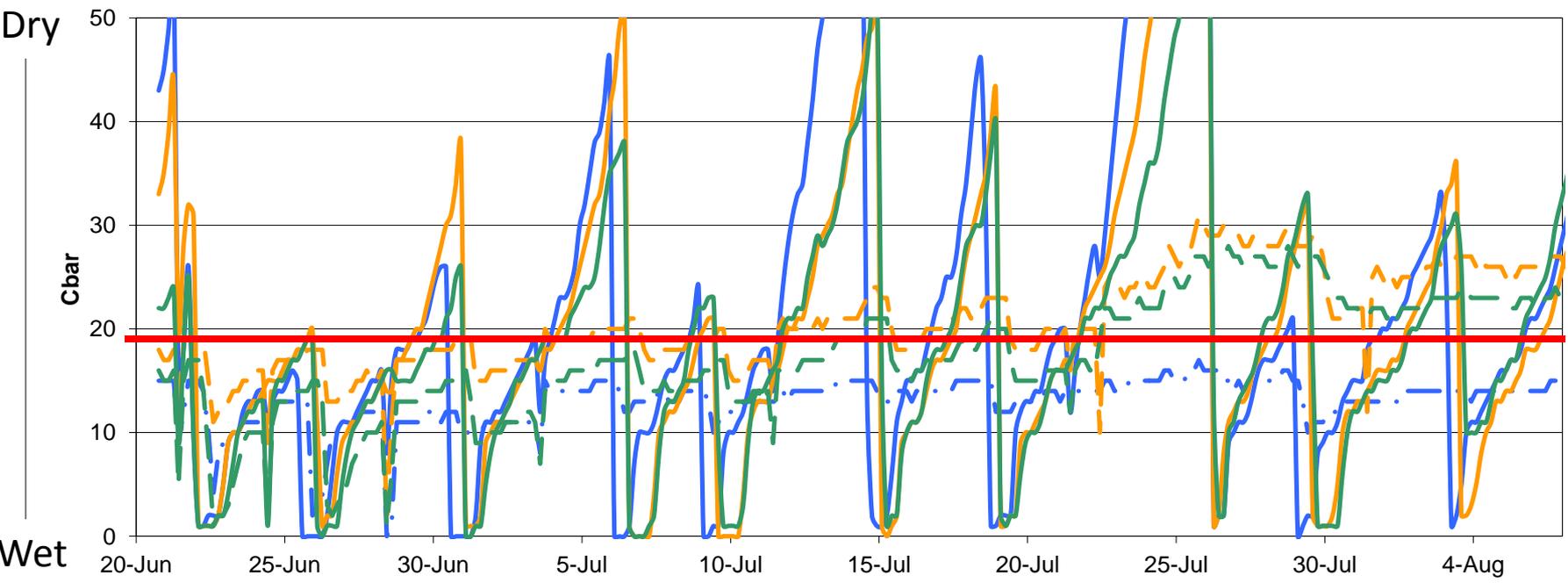
8W	8c	8e
25	40	29

### Minn Sensor 1 - Loamy sand



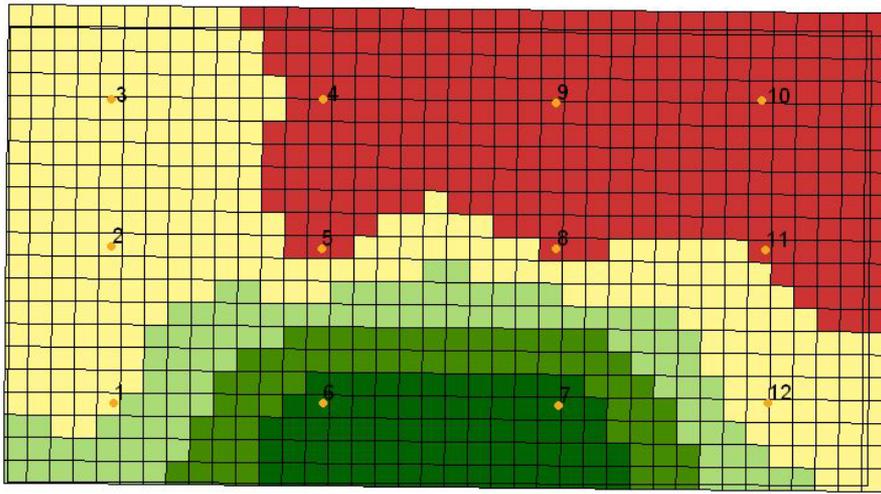
% time dry		
8w	8c	8e
<b>13</b>	<b>17</b>	<b>19</b>

### Minn sensor 2

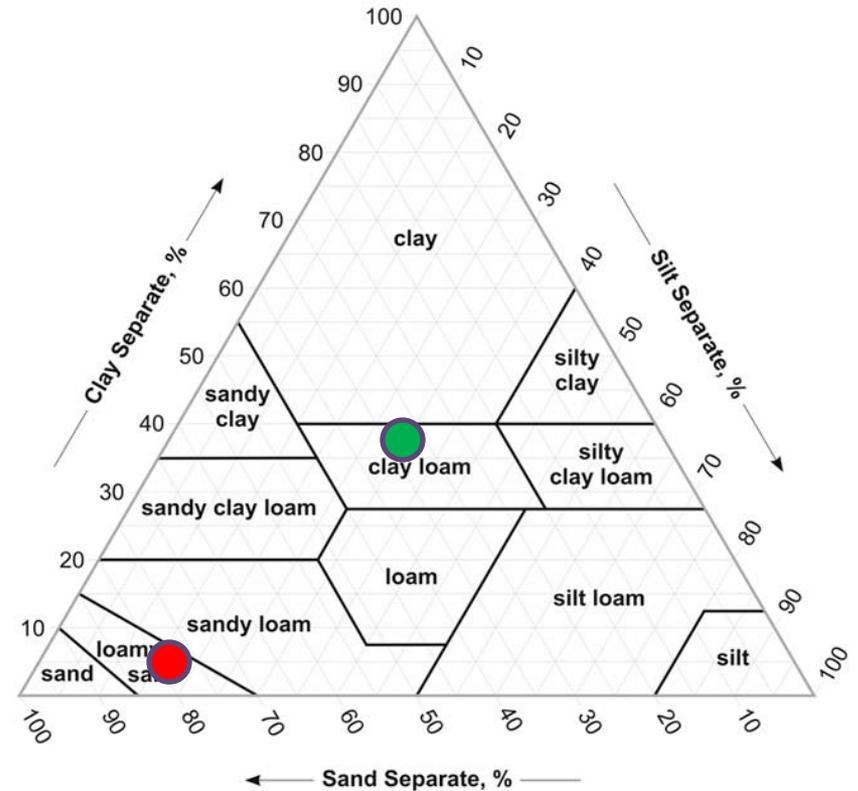


% time dry		
8w	8c	8e
<b>35</b>	<b>35</b>	<b>37</b>

# Be Aware of Soil Spatial Variability

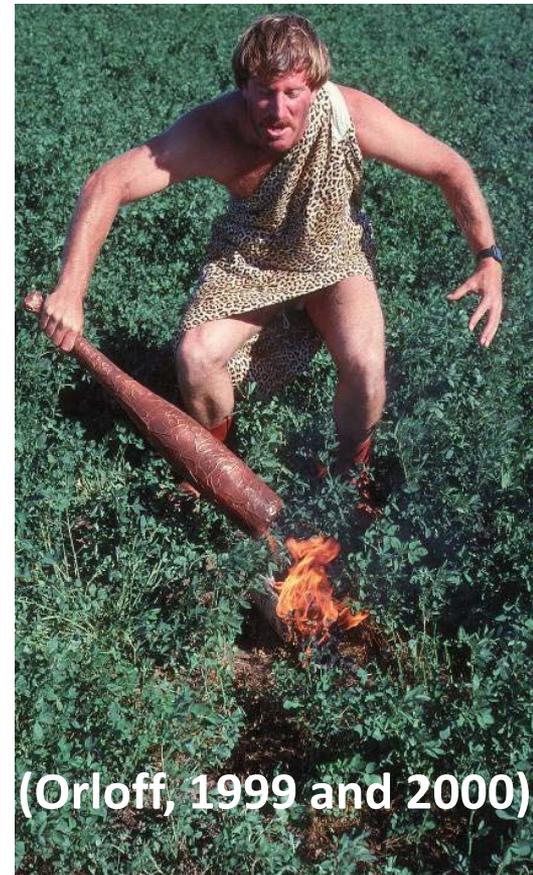


- (73.0ac.) Field Boundary
- Soil analysis
- Clay Surface**
- 4.1 - 9.3
- 9.3 - 14.4
- 14.4 - 20.1
- 20.1 - 27.0
- 27.0 - 33.2



# Conclusions from Scott and Shasta Valleys Study

- Summary of 85 alfalfa fields



**Over**

**Under**

**Over & Under**

**Ok**

**83% could be improved!**

# Research Plan for 2013

Monitor 3 onion fields devising algorithms for CropManage

Weekly measurements:

- Infra-red photos of canopy cover – Kc
- Rooting depth
- Biomass samples and total N analysis - N uptake curve
- Soil moisture release, bulk density

Also:

- Use CIMIS data and quick nitrate test
- Soil water tension
- Soil EC and texture maps
- Yield

# Summary

- Monitoring SWT and using CIMIS data are important irrigation scheduling tools for shallow rooted vegetables like onions
- Managing irrigation can be deceiving
- Water and N recommendation calculations can be complicated and time consuming
- *CropManage* can assist onion growers in improving management of nitrogen fertilizer and water

# Potential IPM Related Benefits?

- Reduce plant water stress
- Keep pesticides in the root zone

# Thank you note:

- Calandri Sunrise Farms
- Garlic and Onion Board
- Mike Cahn, UCCE Farm Advisor

Questions?

