

# ET-based irrigation scheduling of cool season vegetables: Results from 2012 irrigation trials at Spence Ranch

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Comm'l cooperators:  
Chiquita/Fresh Express  
Tanimura & Antle

Sponsor:  
Calif. Dept. Food Agric.  
(Specialty Crop Block Grant Pgm)



Special thanks:  
S. Benzen, USDA  
B. Farrara, UC Coop Ext

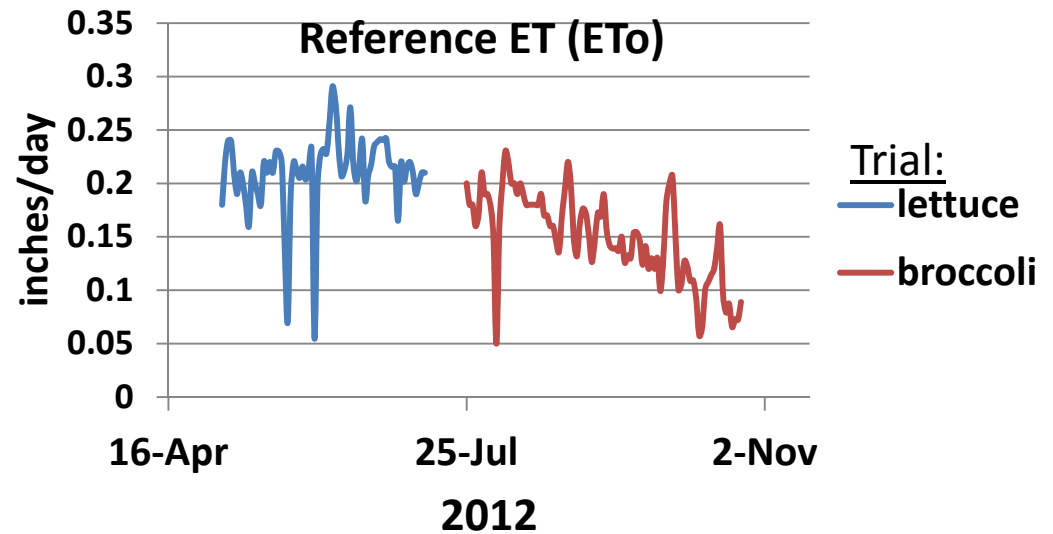
Irrigation & Nutrient Meeting, UCCE Salinas, 26-Feb-2013

# Project goals

- Irrigation trials for head lettuce & broccoli during 2012, 2013
- Demo use of CIMIS Reference ET data in support of irrigation scheduling for lettuce, broccoli
- Evaluate any tradeoffs of water reduction vs. yield/quality



# CIMIS Reference ET



“Spatial” CIMIS

CALIFORNIA THE GOLDEN STATE

CALIFORNIA IRRIGATION MANAGEMENT INFORMATION SYSTEM  
DEPARTMENT OF WATER RESOURCES  
OFFICE OF WATER USE EFFICIENCY

WELCOME INFO CENTER CIMIS DATA RESOURCE CENTER MY CIMIS SPATIAL CIMIS

General  
Spatial Overview  
Spatial Model  
View Maps  
ETo Map  
Solar Radiation Map  
Station Location Map  
ETo Zones Map  
Generate Report  
Logon  
Map Reports  
Map Reports Help

ETo Map  
The daily reference evapotranspiration (ET<sub>0</sub>) map is generated by coupling remotely sensed satellite data from the Geostationary Operational Environmental Satellites (GOES) with point measurements from the California Irrigation Management Information System (CIMIS) stations at a 2 km spatial resolution. ET<sub>0</sub> is calculated using the standardized American Society of Civil Engineers Penman-Monteith (ASCE PM) equation. Input parameters to the ASCE PM are either estimated from remotely sensed data or interpolated from point measurements (please refer to the Overview page for details). This page is intended for viewing the spatial distribution of daily ET<sub>0</sub>. To retrieve the data, click on the “Reports” link on the left side bar.

May 17, 2012

ET<sub>0</sub> View

10.0  
7.9  
5.8  
3.7  
1.6  
mm

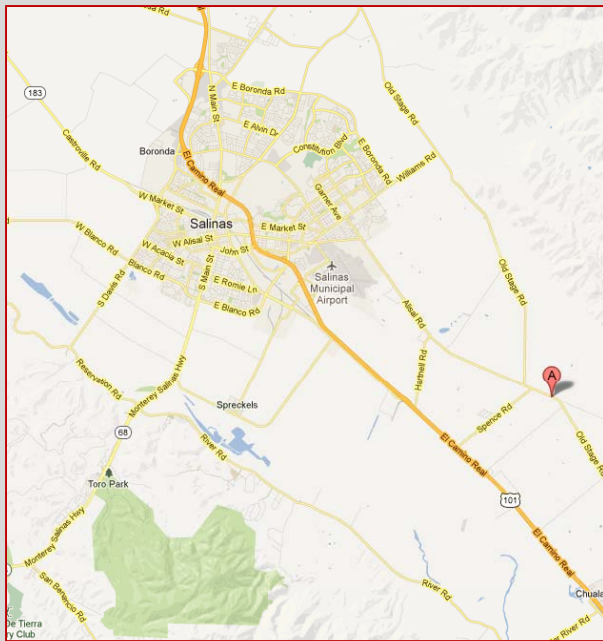
\*CIMIS ET<sub>0</sub> guides weather-based irrigation scheduling

# Strategy

- Lettuce, broccoli
- Crop establishment by sprinkler
- Treatments applied by surface drip
- Equal inputs other than water (ie, fertilizer, pest control, etc.)



# Study site



USDA Agricultural Research Station  
Spence Ranch

# Irrigation treatments

CropManage model (100% ET replacement)

SIMS model (100% ET replacement)

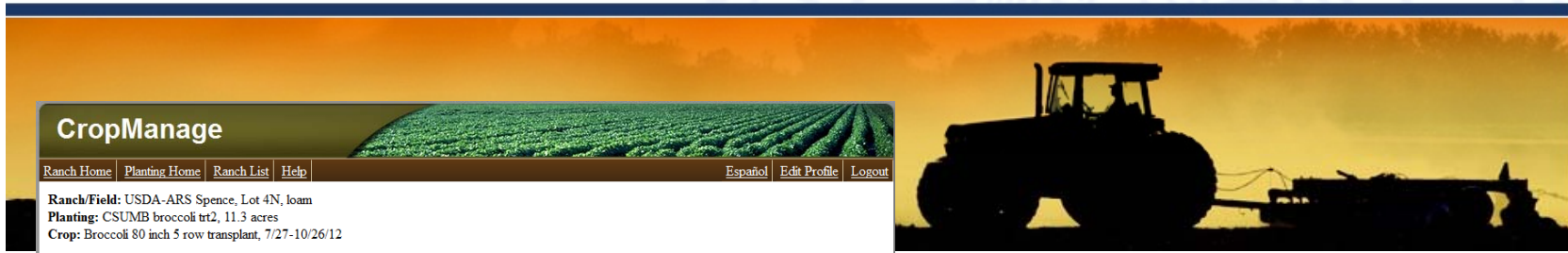
Standard practice (150% ET replacement)

{ET=water consumed by crop Transpiration & soil Evaporation}

# CropManage model

## CROPMANAGE

Help and User Instructions for Irrigation and N management tool



**CropManage**

[Ranch Home](#) [Planting Home](#) [Ranch List](#) [Help](#) [Español](#) [Edit Profile](#) [Logout](#)

Ranch/Field: USDA-ARS Spence, Lot 4N, loam  
 Planting: CSUMB broccoli tr2, 11.3 acres  
 Crop: Broccoli 80 inch 5 row transplant, 7/27-10/26/12

**Planting**

**Soil Summary**

[Show / Hide Columns](#)

Sample Date	Crop Stage	Sample Reading (ppm)	Sample Depth (ft)	Sample Analysis	Soil Nitrate-N (ppm)	Soil Mineral N (lb/acre)
9/17/12	2nd drip fertigation	25	1	Quick Strip	11.90	45.23

[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
9/7/12	1st drip fertigation	N/A	N/A	20.20	UAN32	40.0	11.3 gallons/acre
9/18/12	2nd drip fertigation	11.90	61.9	35.03	UAN32	40.0	11.3 gallons/acre
<b>Totals</b>			61.9			80.0	

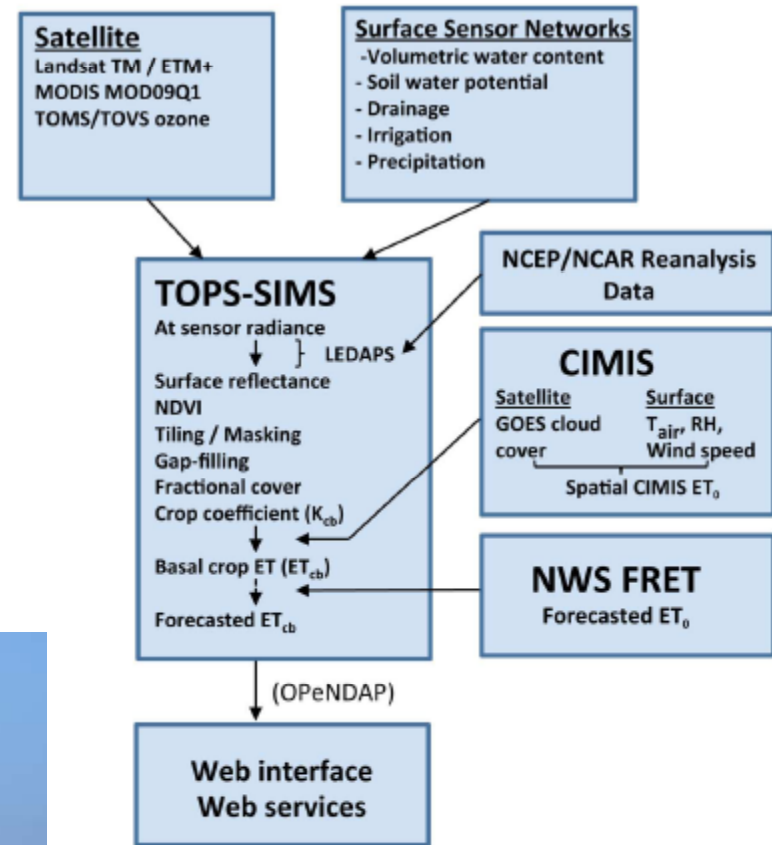
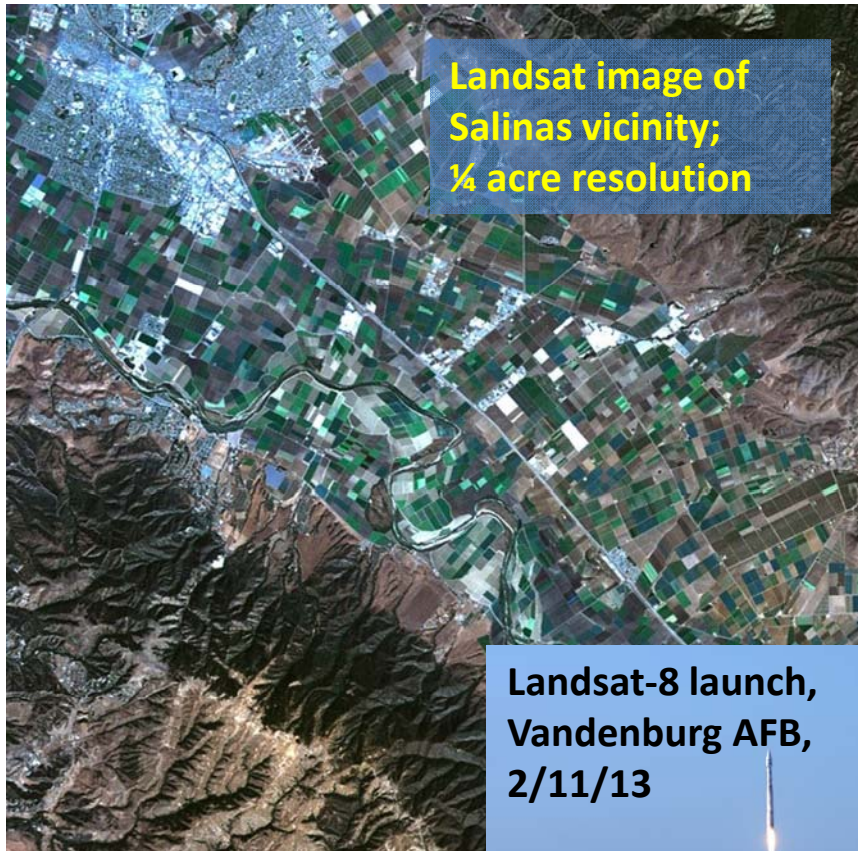
**Irrigation Summary**

[Show / Hide Columns](#) [Reset Column Order](#) [Show Previous Columns](#) [Show Next Columns](#)

Water Date	Irrigation Method	Canopy Cover (%)	Daily Precipitation (inches/day)	Cumulative Irrig. Water & Rain (inches)	Irrigation Interval (days)	Rooting Depth (feet)	Allowable Depletion (inches)	Applied Water Flow Meter (inches)	Flow Meter (gallons)
7/27/12	sprinkler	0	0.00 in	1.52 in	0	0.30	0.00	1.52	65,180
7/29/12	Sprinkler	1	0.00 in	2.29 in	2	0.30	0.14	0.77	33,050

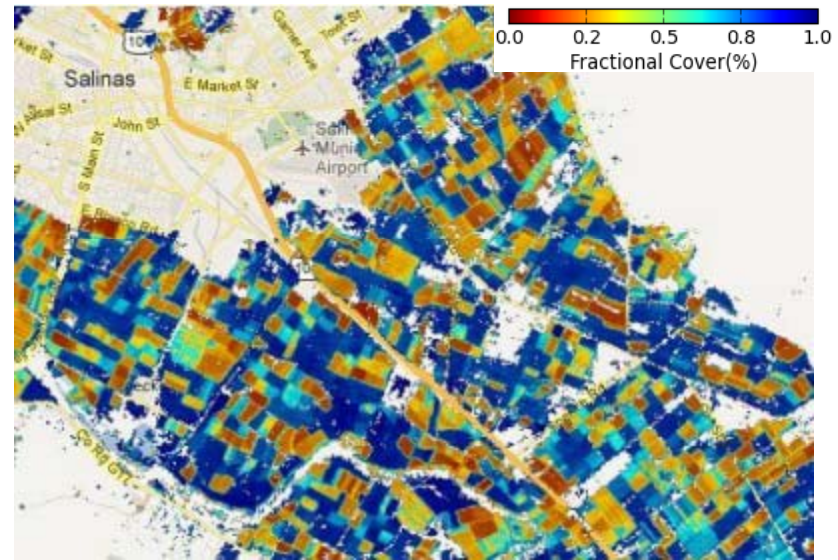
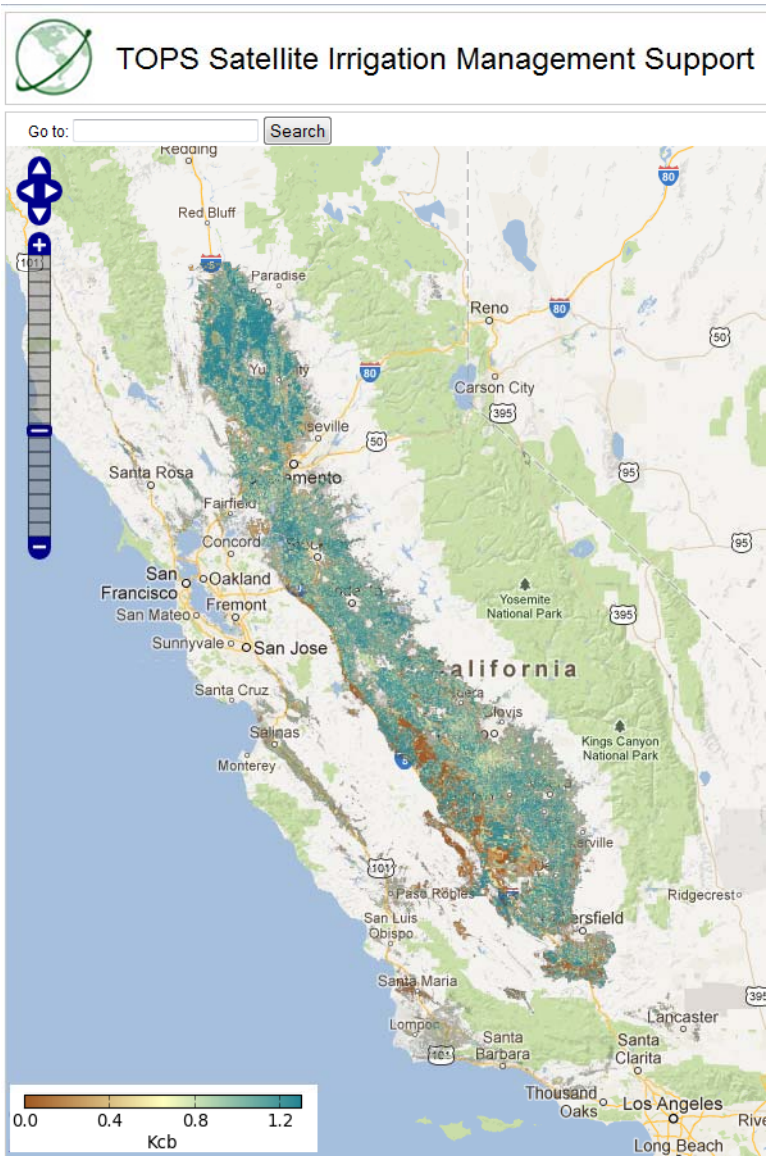
- \* UC Cooperative Extension
- \* web-based tool for growers
- \* combines weather, soil and plant-based info

# SIMS model

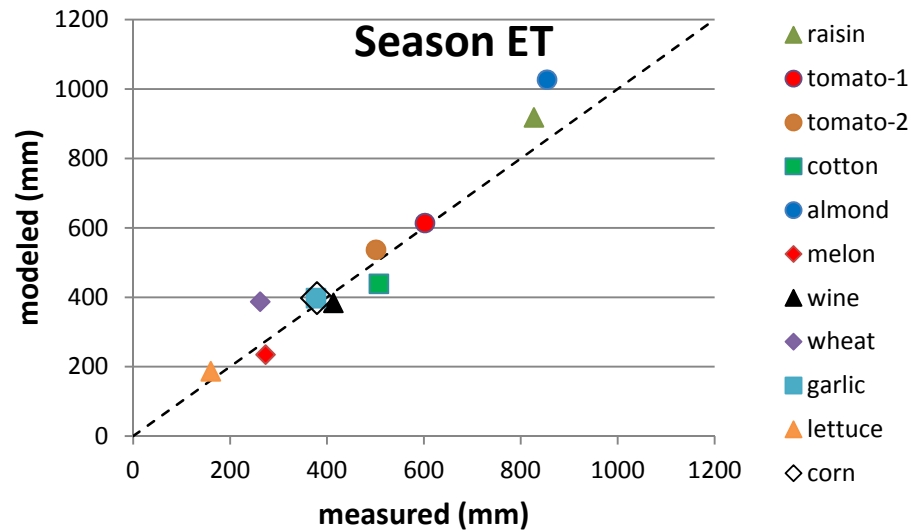




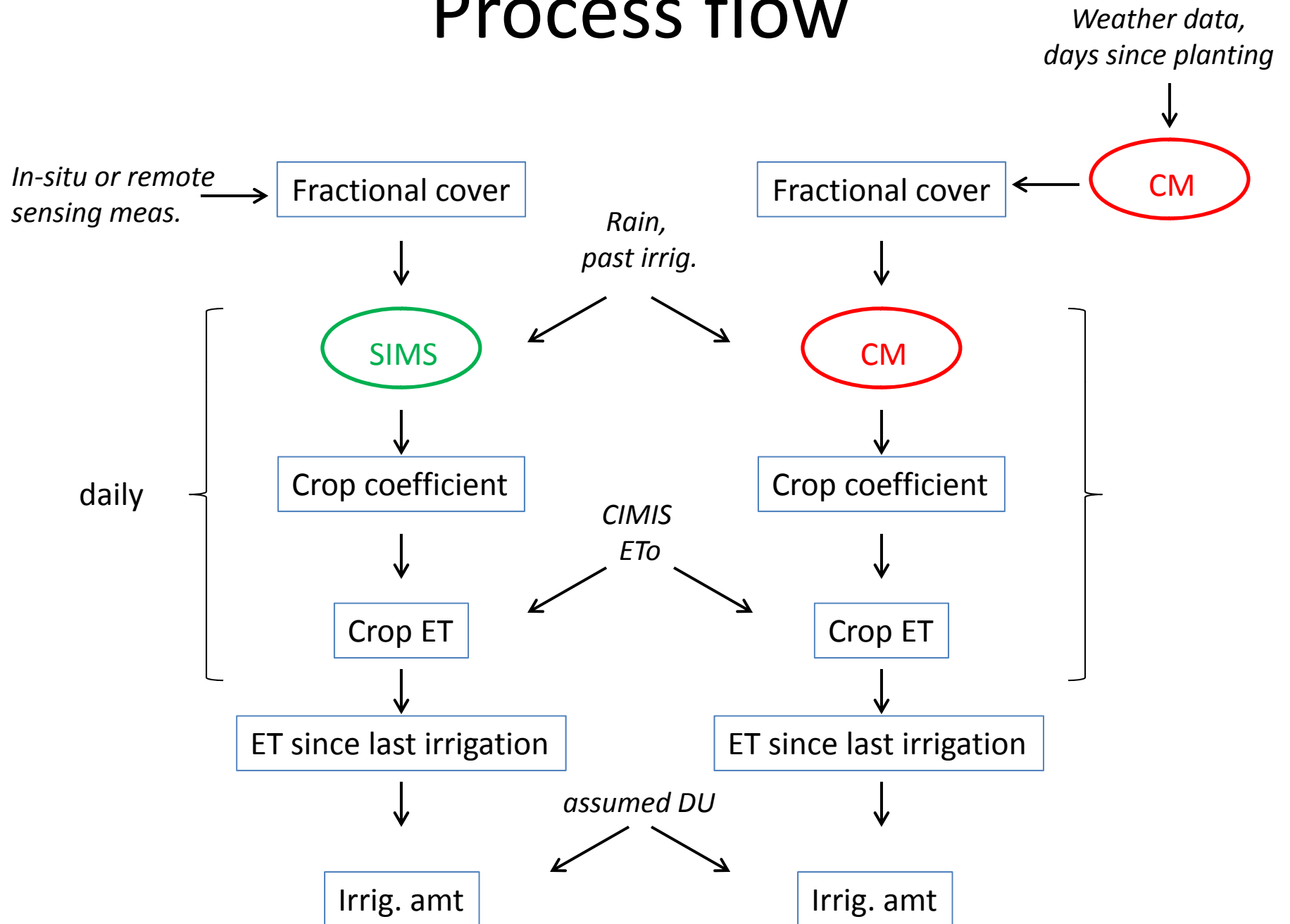
# SIMS model



Fractional cover,  
7/28-8/4, 2011



# Process flow

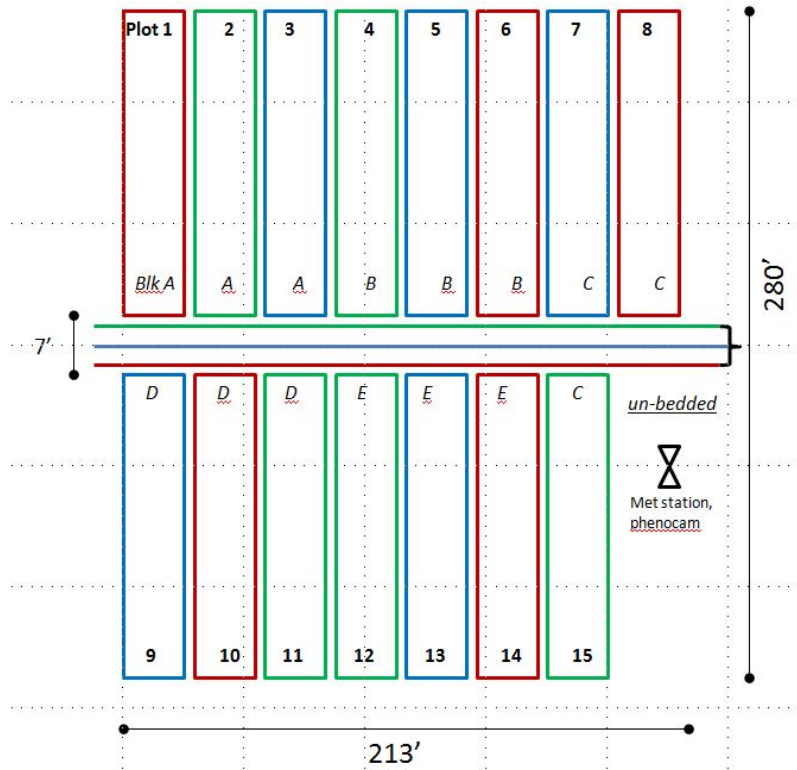


# Standard practice

- 150% of full ET replacement as determined by CM
- Applied water for Central Coast summer on drip:
  - Lettuce = 12-18"
  - Broccoli = 20"

# Lettuce trial

May 2 – July 11, 2012



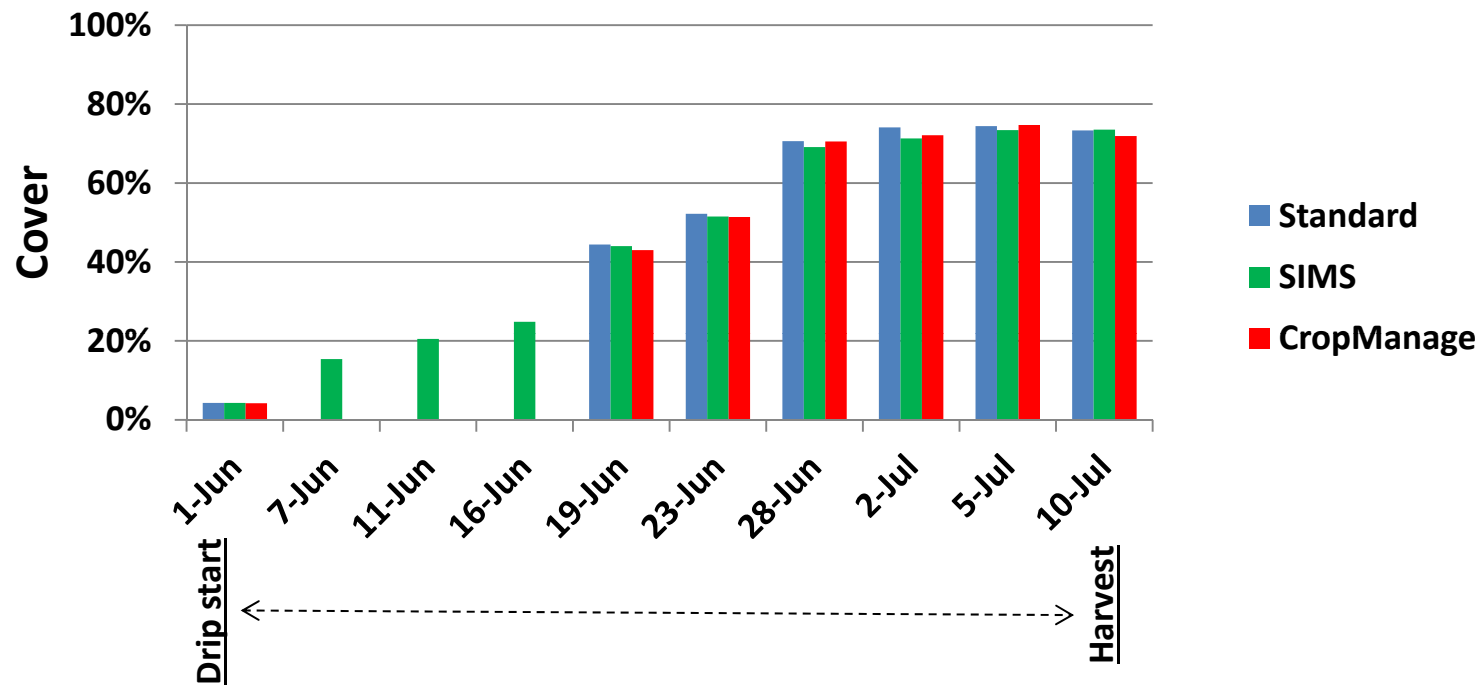
## Treatments:

- Standard practice
- SIMS
- CropManage

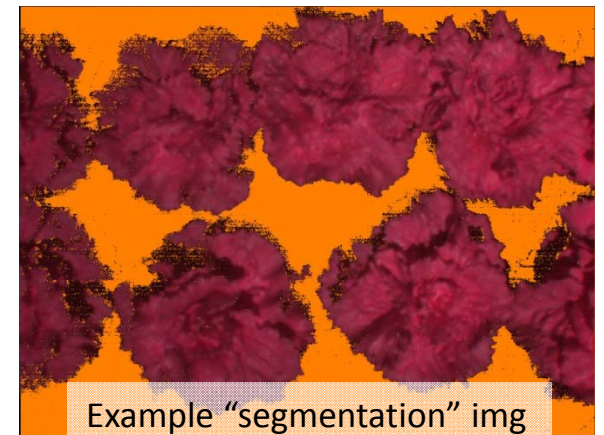


- \*3 tmts, 5 reps, block randomized design
- \*total area: ~1.4ac (0.57 ha)
- \*variety: Gabilan

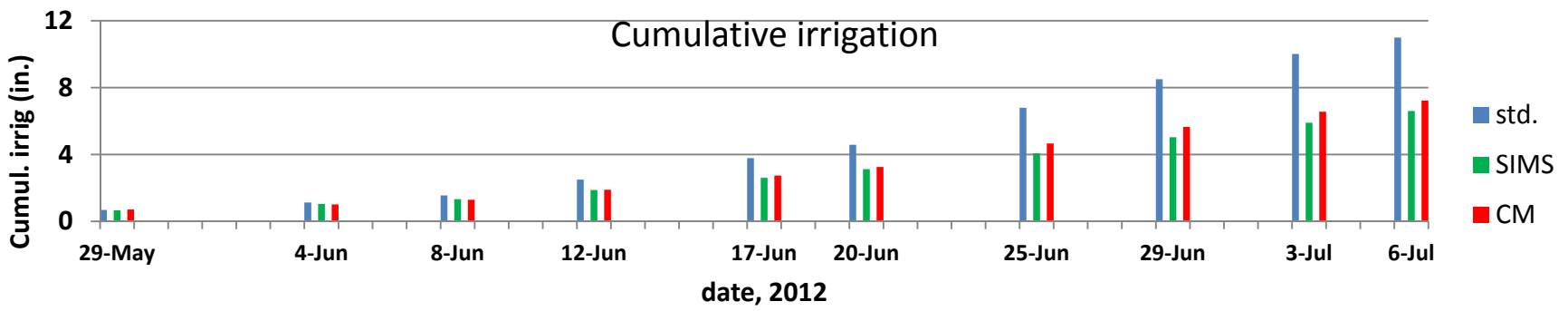
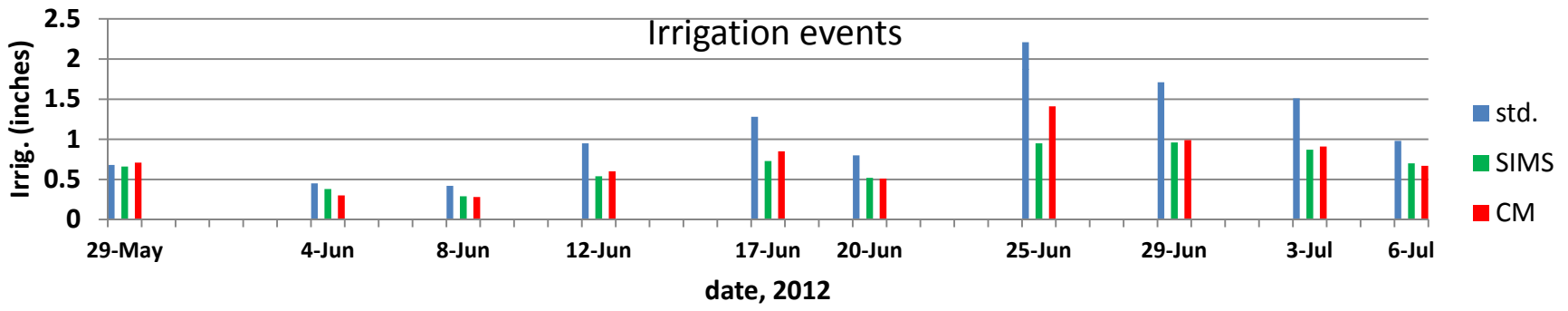
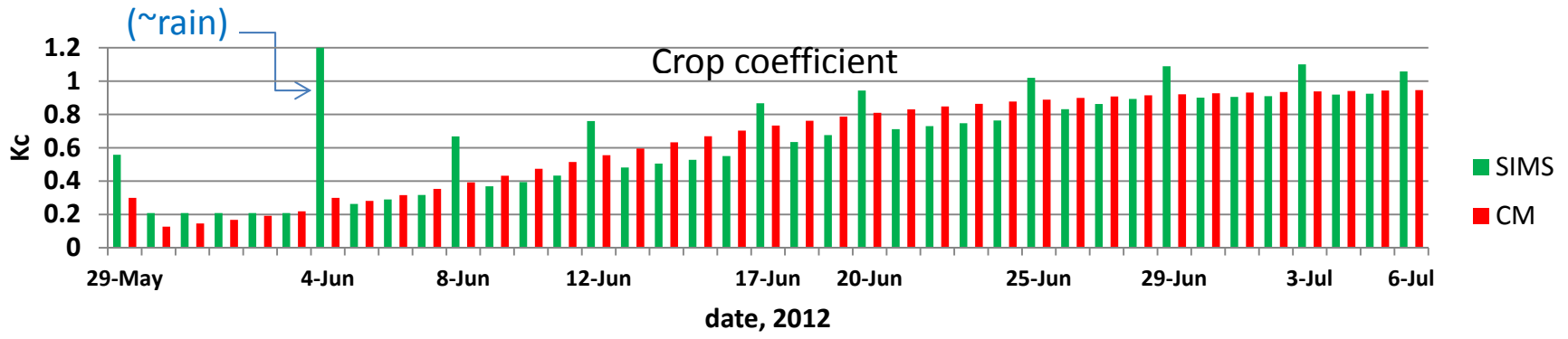
# Fractional cover



\*similar crop development across treatments

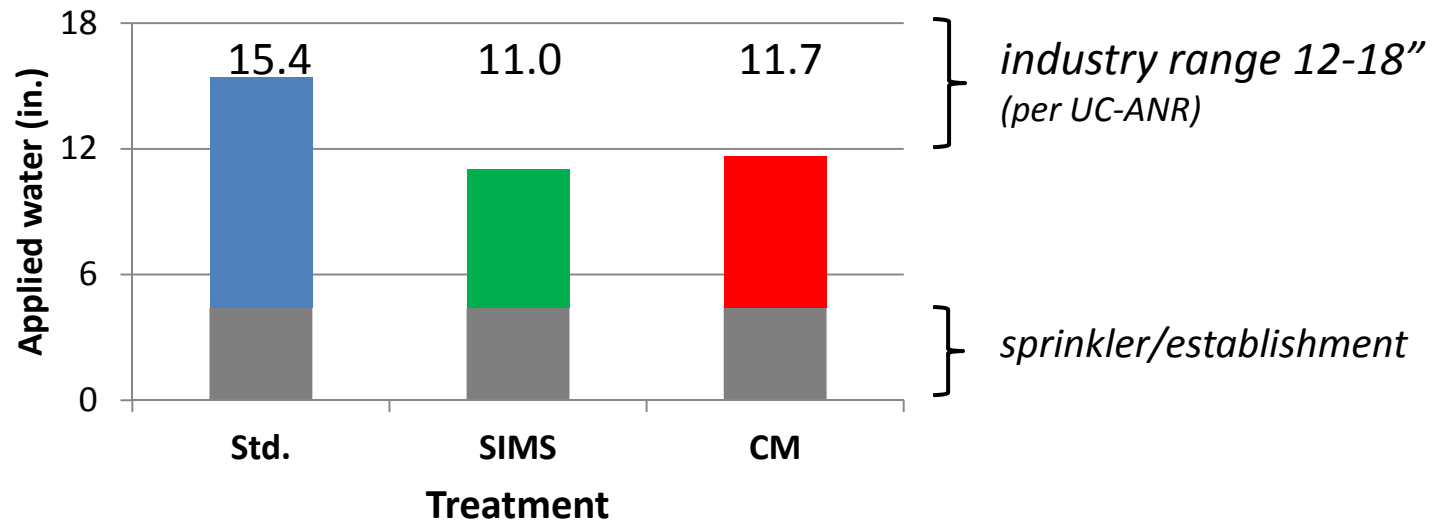


# Crop coefficients & irrigation during drip treatment period



\*daily ET estimates drive irrigation treatments

# Irrigation totals



\*~4" water reduction

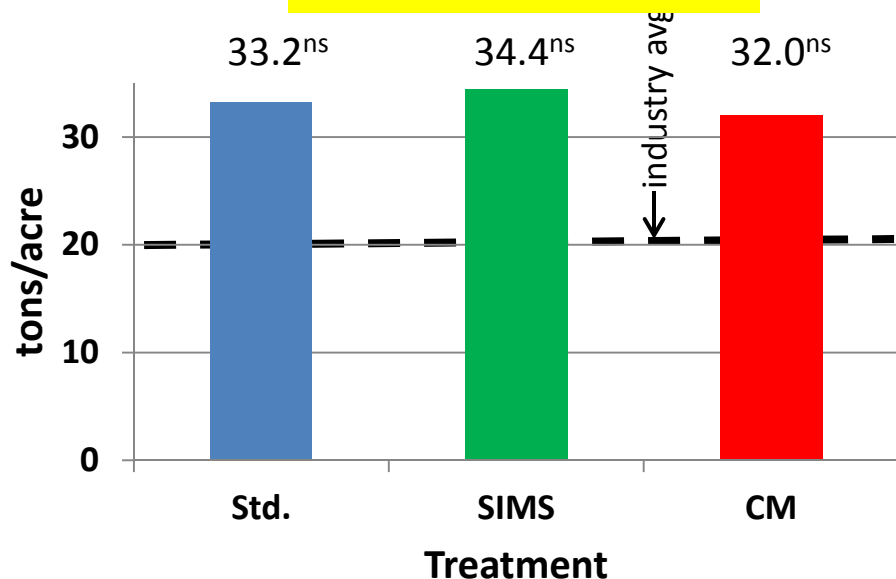




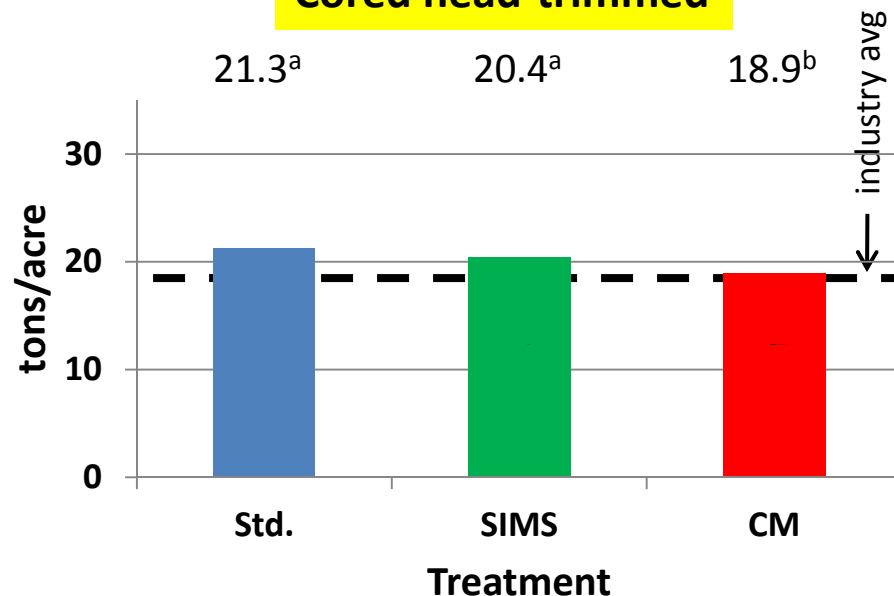
# Yield, marketable



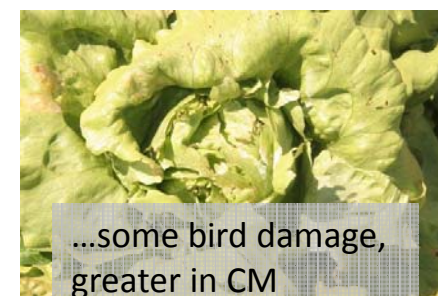
## Whole head-trimmed



## Cored head-trimmed



\*all tmts well above industry avg  
\*no treatment difference



\*all tmts somewhat above industry avg  
\*CropManage slightly below other tmts (probable bird damage)



# Quality metrics

- Commercial harvest 7/11/12 (cored in field)
  - Refrigerated 5 days @ 34F
- Processed/bagged in commercial facility 7/16/12
  - Stored @ 40F
- Evaluated 8/2/12
  - Flavor, physiological defects, decay, pinking, vascular discoloration, browning, tip burn, chunks
  - No significant difference between 100% & 150% treatments
  - “Ranges for all quality parameters tested met industry finished product standards for fresh-cut lettuce”

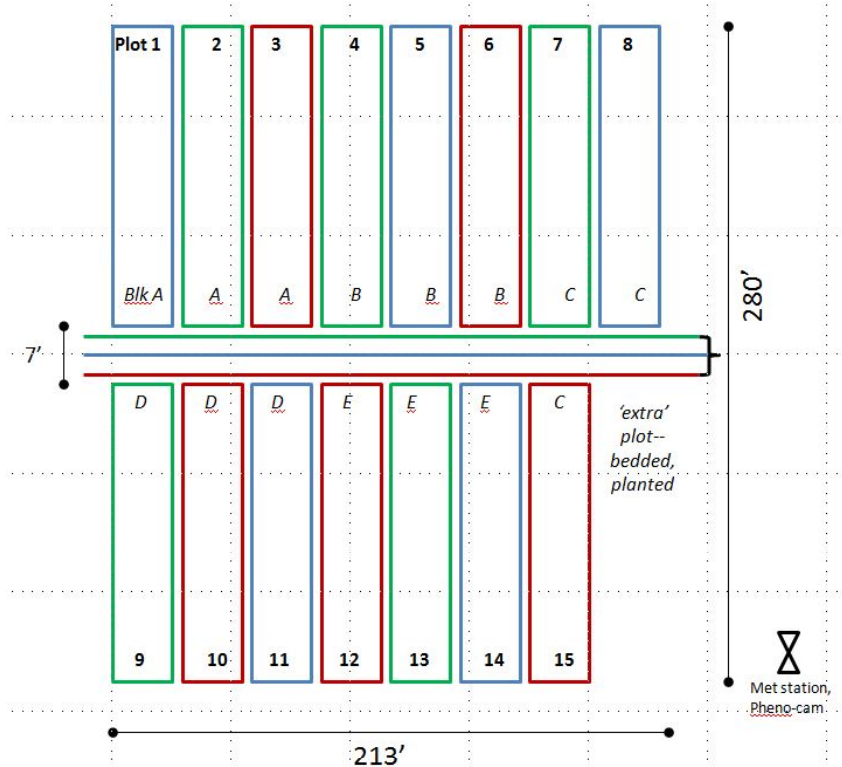
*Courtesy Fresh Express*

# Broccoli trial

July 25-Oct 29, 2012

## Treatments:

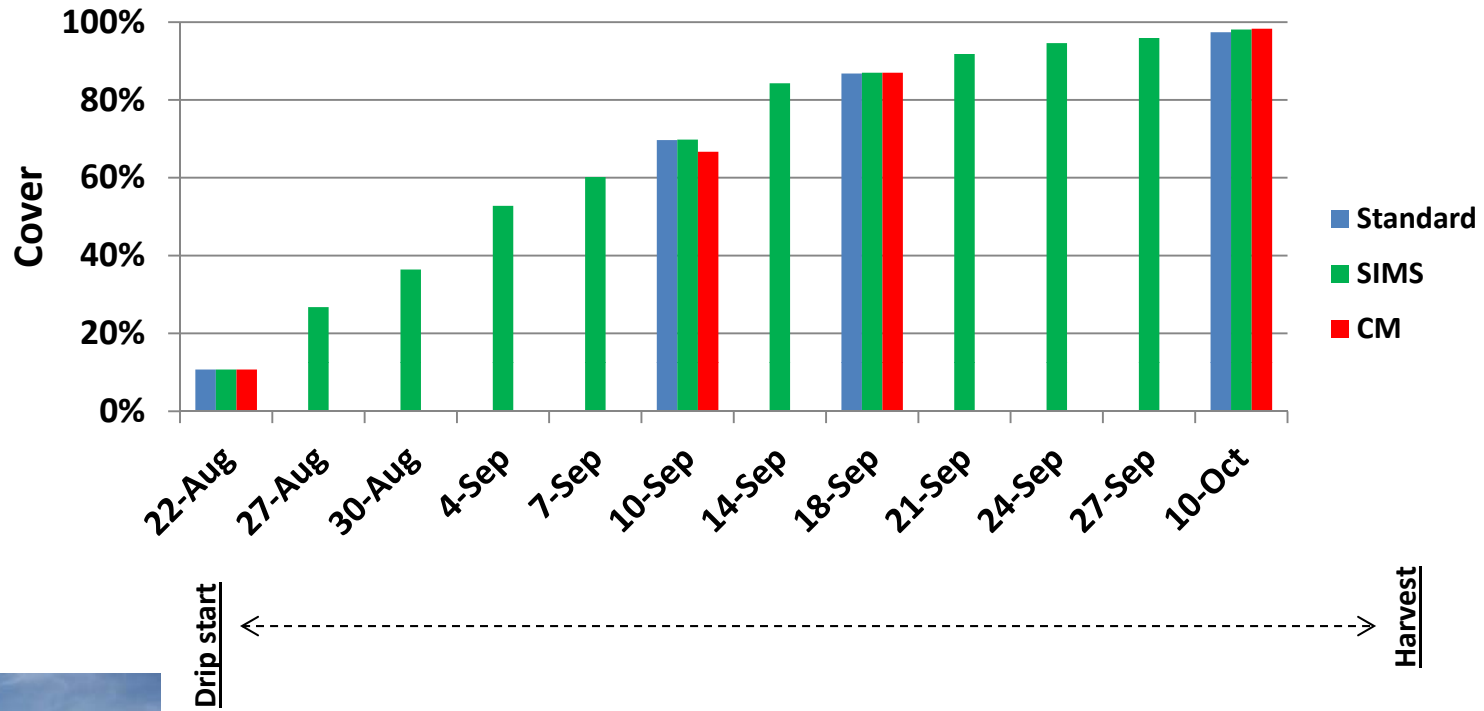
- Standard practice
- SIMS
- CropManage



- \*3 tmts, 5 reps, block randomized design
- \*total area: ~1.4ac (0.57 ha)
- \*variety: Patron



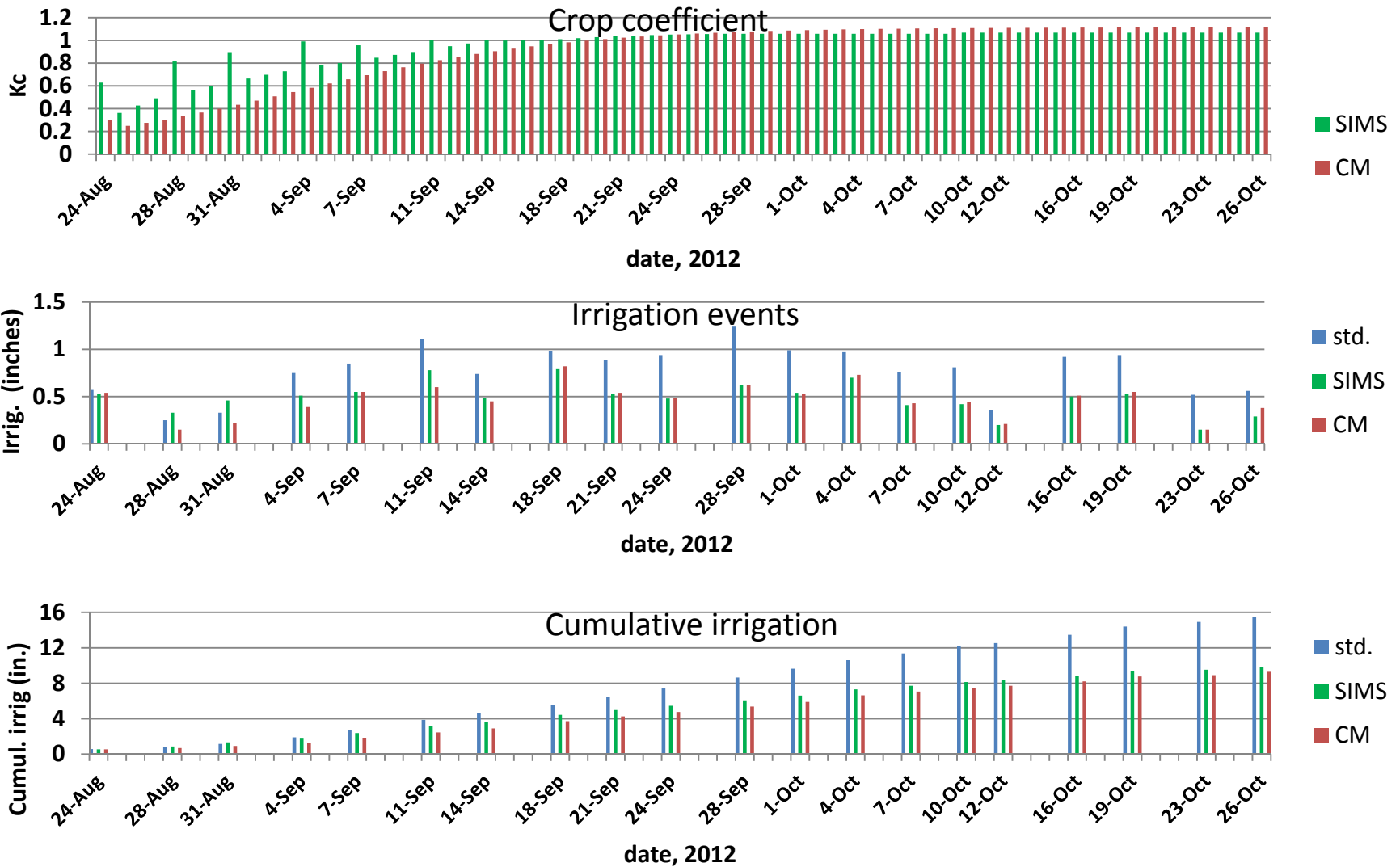
# Fractional cover



Tetracam on 21-Sept

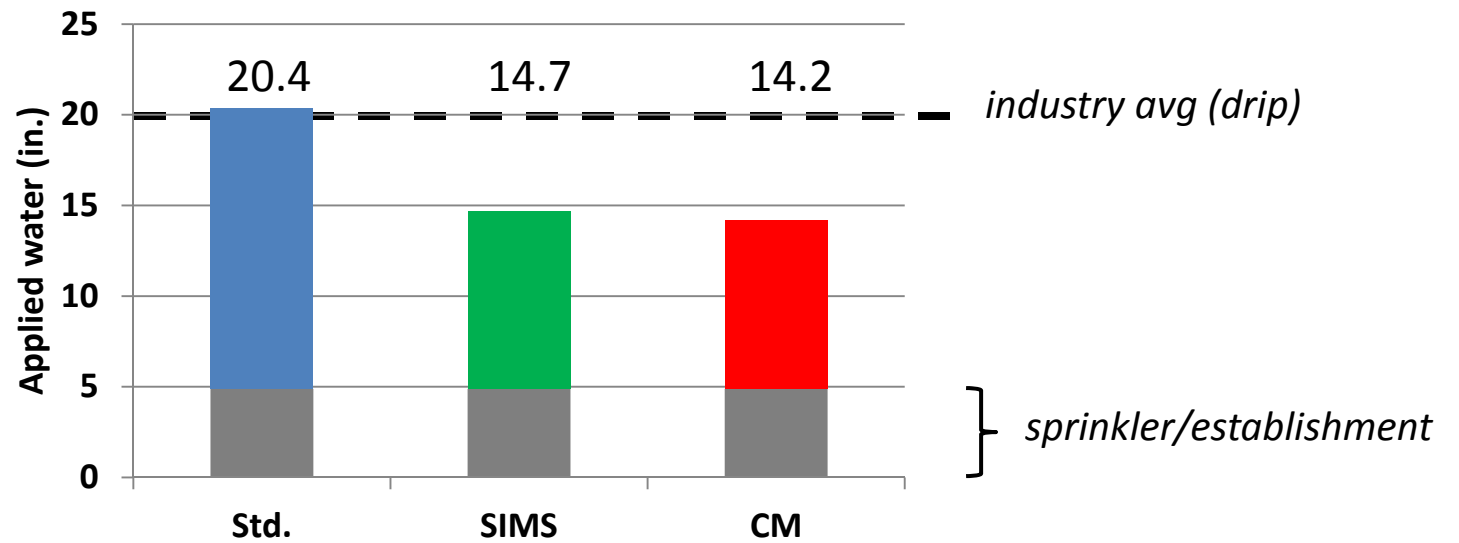
\*similar crop development across treatments

# Crop coefficients & irrigation during drip treatment period



\*daily ET estimates drive irrigation treatments

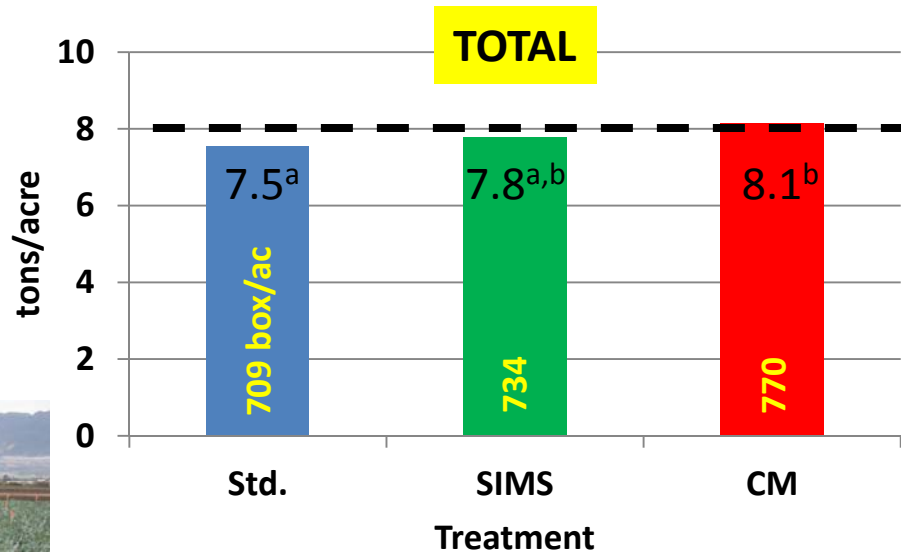
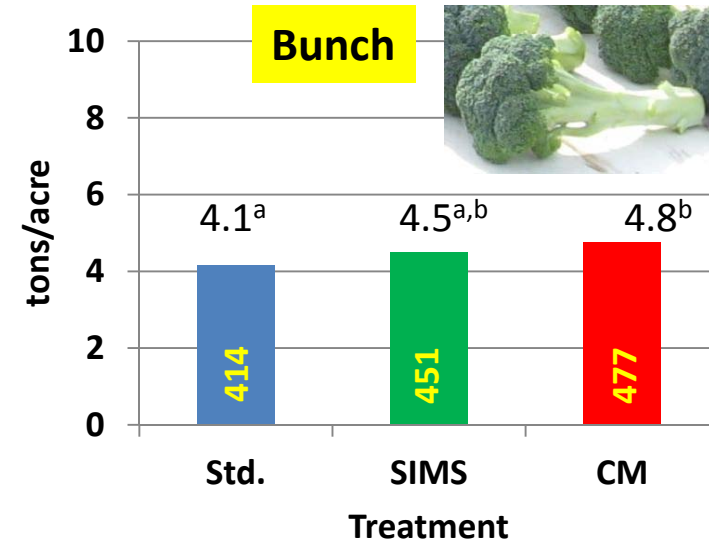
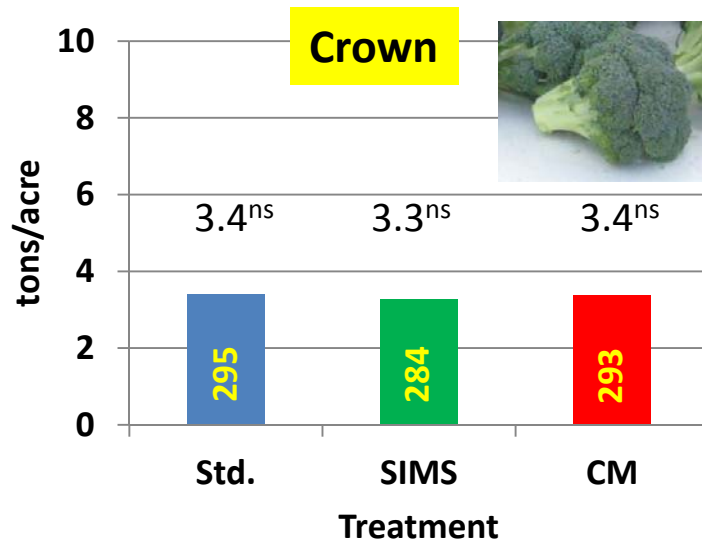
# Irrigation



\*5-6" water reduction



# Yield, marketable



local industry range



\*yields well within industry range  
\*standard treatment slightly lower

Courtesy Tanimura & Antle

# Summary

- Weather/plant based scheduling
- ET-replacement approaches represented  
~30% reduction in applied water
- Industry-average marketable yields realized throughout
- Experiments to be repeated in 2013
- Exploring CM-SIMS 'handshake'



# Acknowledgments

*D. Barsoom, T&A*

*W. Brandt, CSUMB*

*I. Harlen, CSUMB*

*S. Klose, FreshExpress*

*P. Krone-Davis, CSUMB*

*D. Lara, USDA*

*T. Lockhart, UCCE*

*L. Murphy, UCCE*

*G. Ochoa, USDA*

*W. Orth, USDA*

*K. Post, CSUMB*

*A. Purdy, CSUMB*

*C. Rosevelt, CSUMB*

*S. Rossi, T&A*

*J. Ruiz, T&A*

*J. Schrandt, USDA*