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

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Chiquita/Fresh Express
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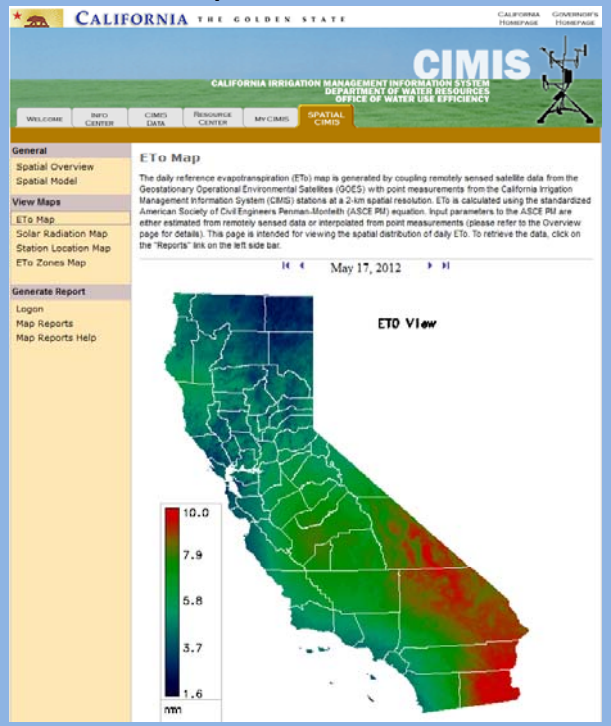
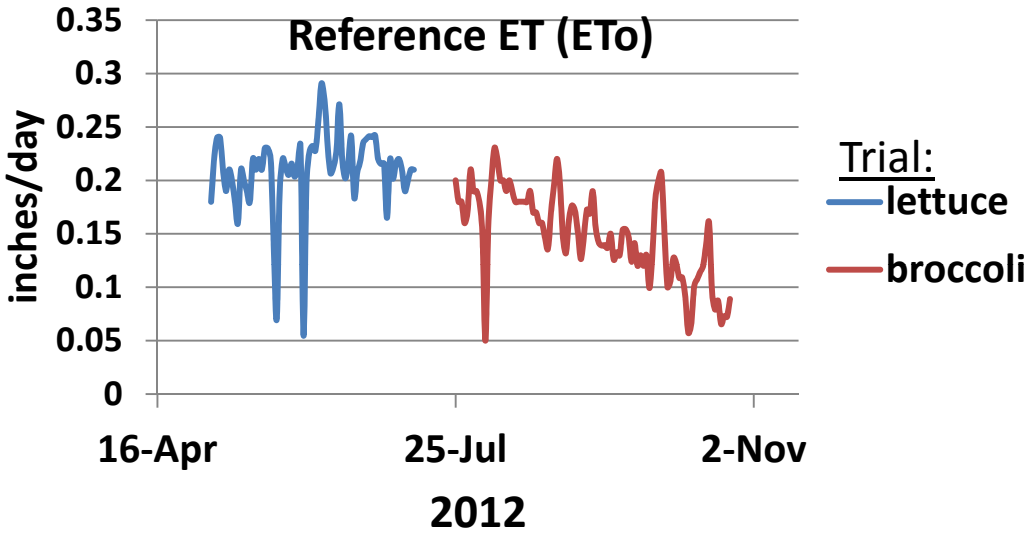
Project goals

- 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



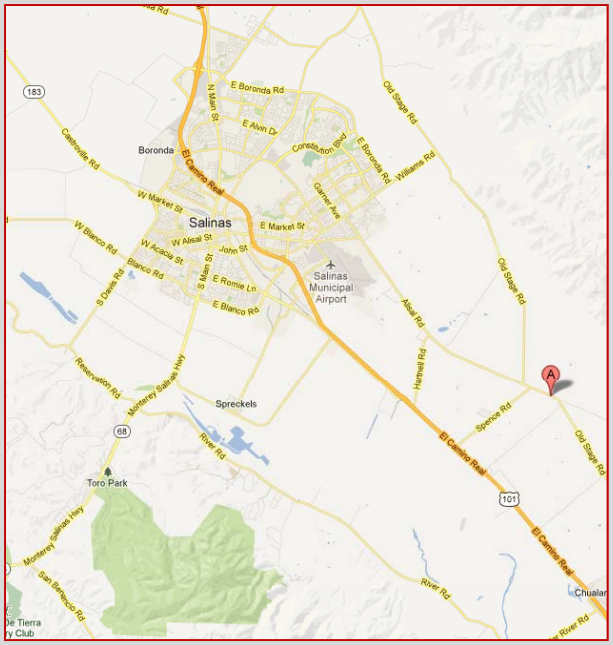


*CIMIS ETo guides weather-based irrigation scheduling

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

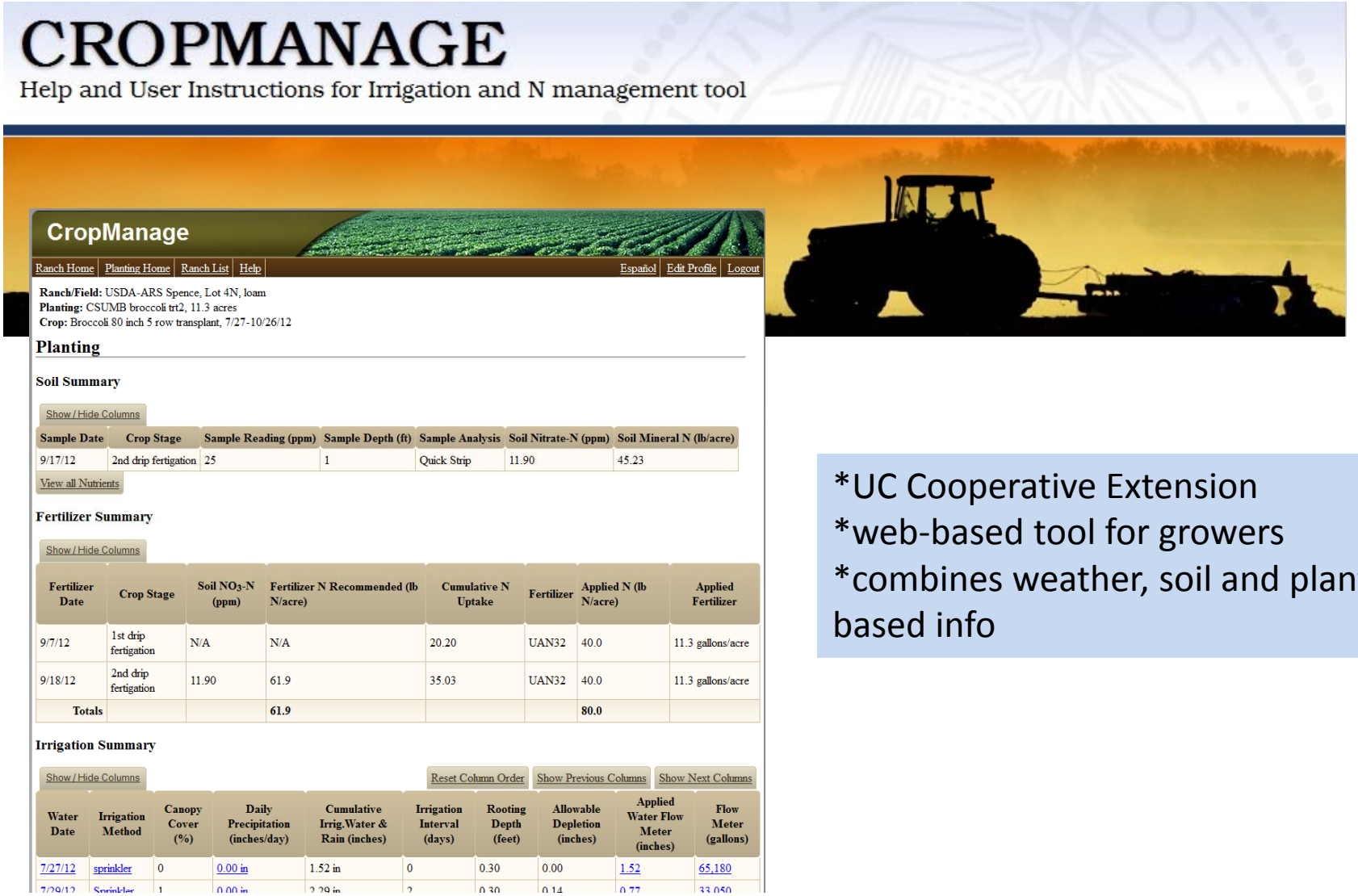
CropManage model (100% ET replacement)

SIMS model (100% ET replacement)

Standard practice (150% ET replacement)

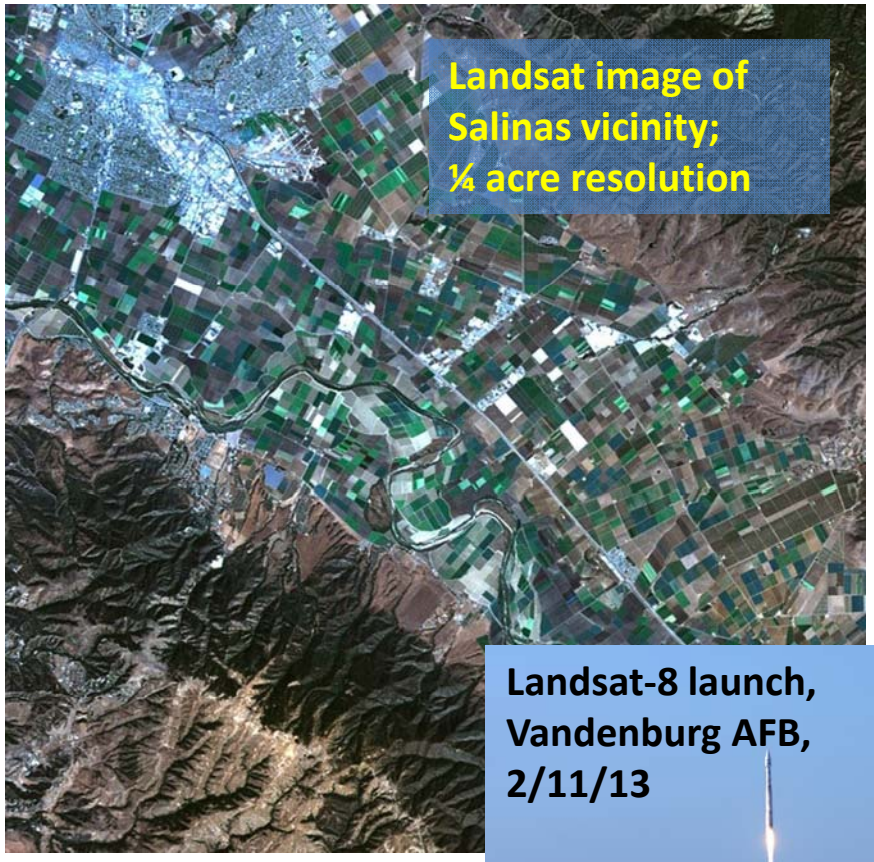
{ET=water consumed by crop Transpiration & soil Evaporation}

CropManage model

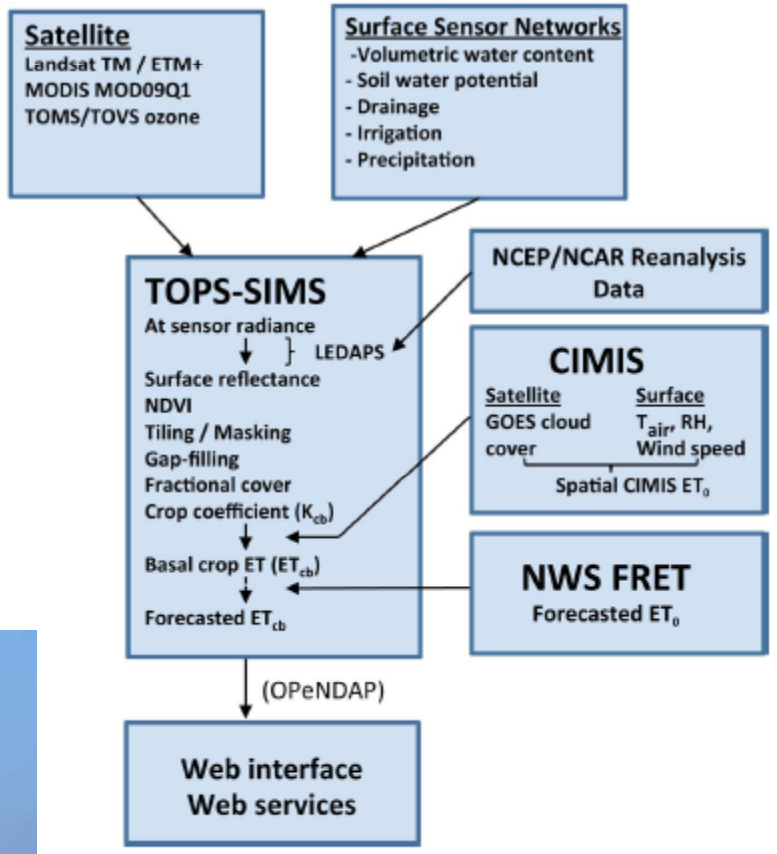


*UC Cooperative Extension
*web-based tool for growers
*combines weather, soil and plant-based info

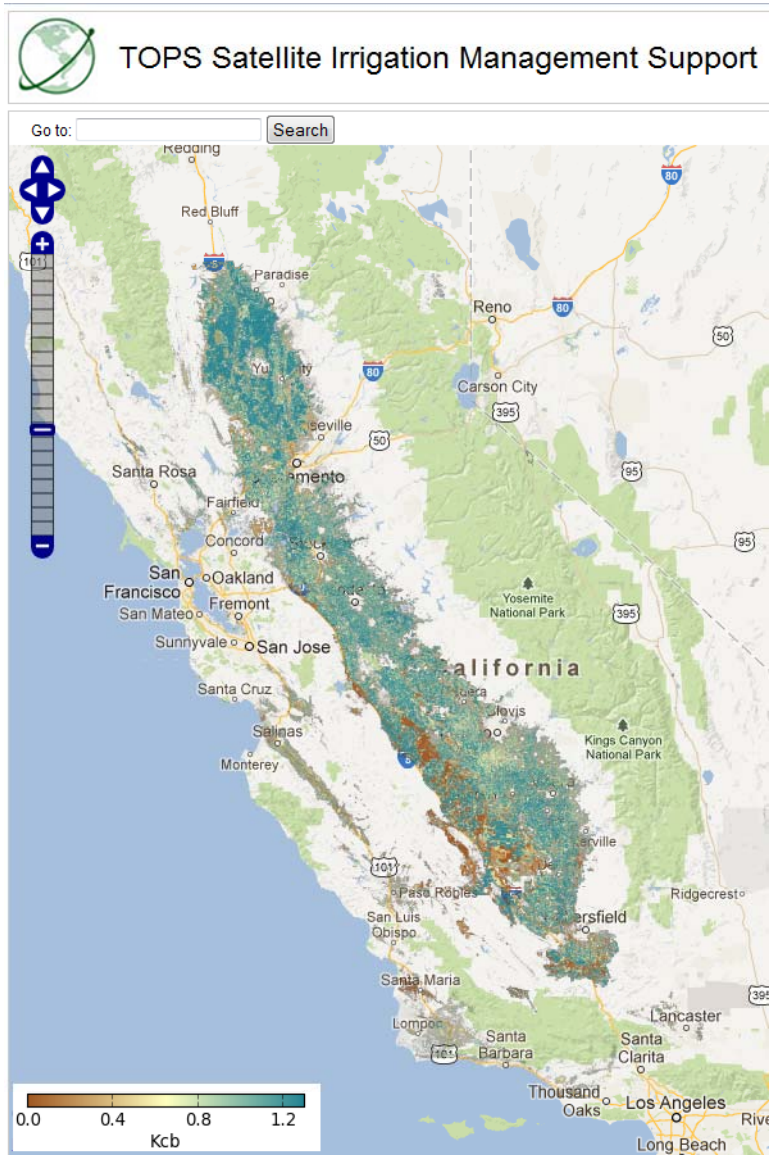
SIMS model


Landsat image of
Salinas vicinity;
¼ acre resolution

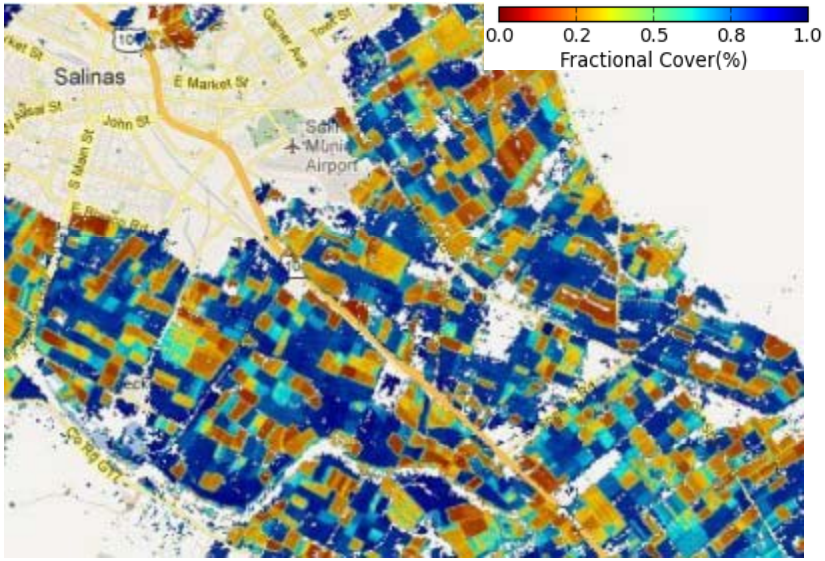

Landsat-8 launch,
Vandenburg AFB,
2/11/13


Satellite
Landsat TM / ETM+
MODIS MOD09Q1
TOMS/TOVS ozone
Surface Sensor Networks
-Volumetric water content
- Soil water potential
- Drainage
- Irrigation
- Precipitation
NCEP/NCAR Reanalysis Data
TOPS-SIMS
At sensor radiance
LEDAPS
Surface reflectance
NDVI
Tiling / Masking
Gap-filling
Fractional cover
Crop coefficient (K_{cb})
Basal crop ET (ET_{cb})
Forecasted ET_{cb}
CIMIS
Satellite
GOES cloud cover
Surface
T_{air}, RH, Wind speed
Spatial CIMIS ET_o
NWS FRET
Forecasted ET_o
(OPeNDAP)
Web interface
Web services

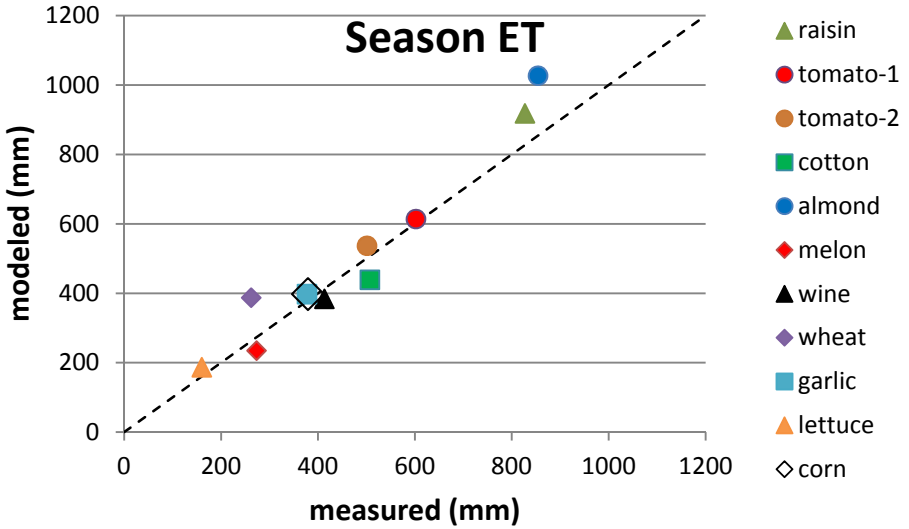
SIMS model



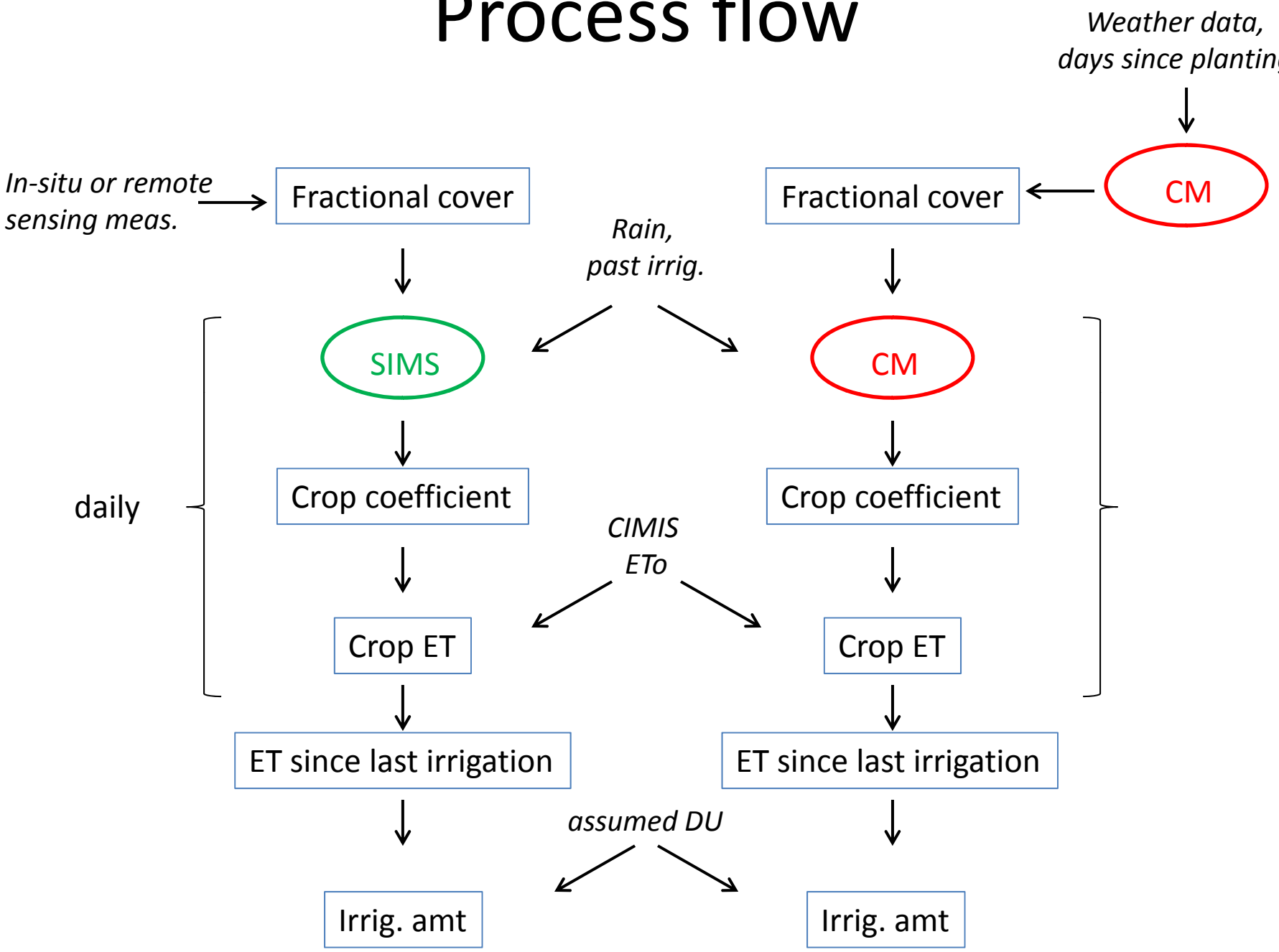
Basal crop coefficient
7/28-8/4, 2011



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



Process flow

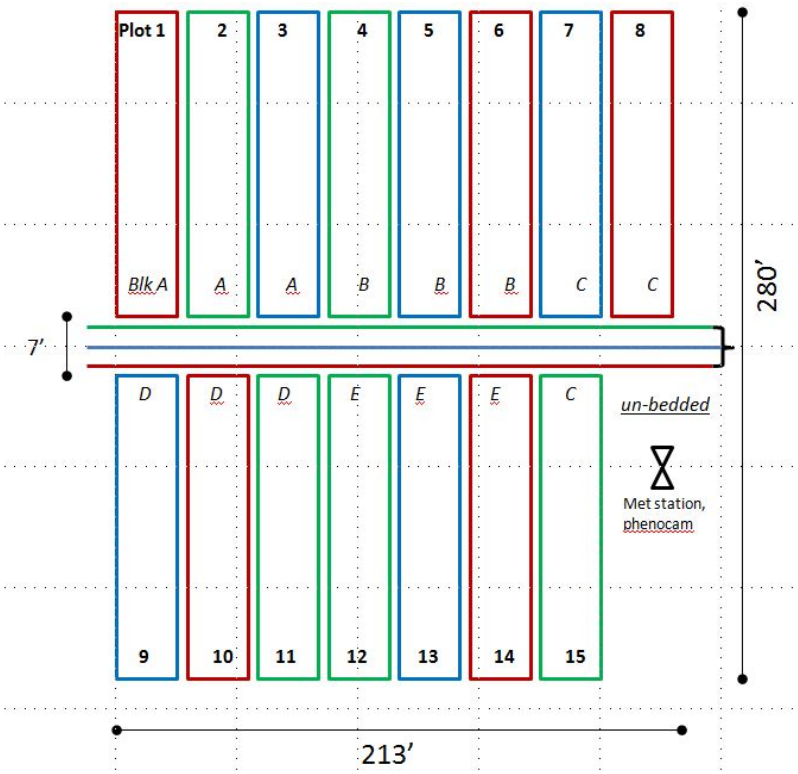


Standard practice

- 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

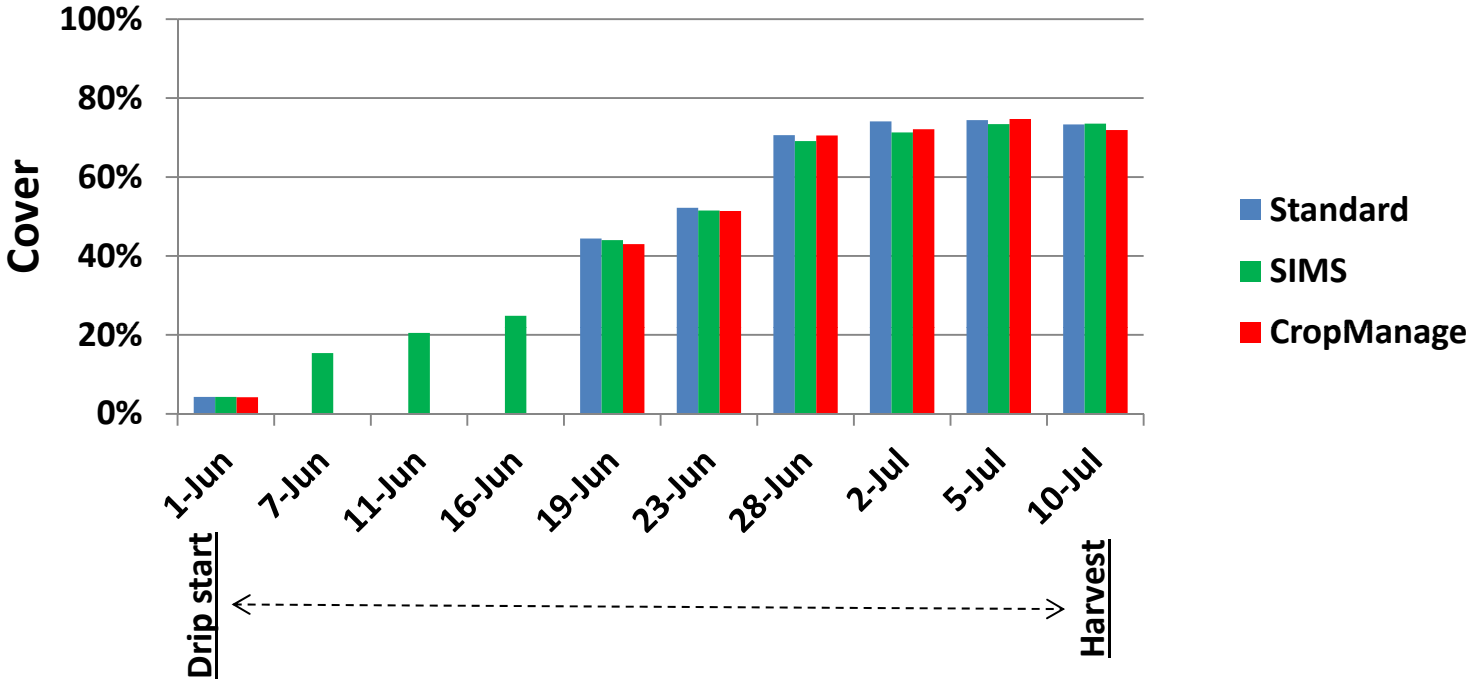


Treatments:

- Standard practice
- SIMS
- CropManage

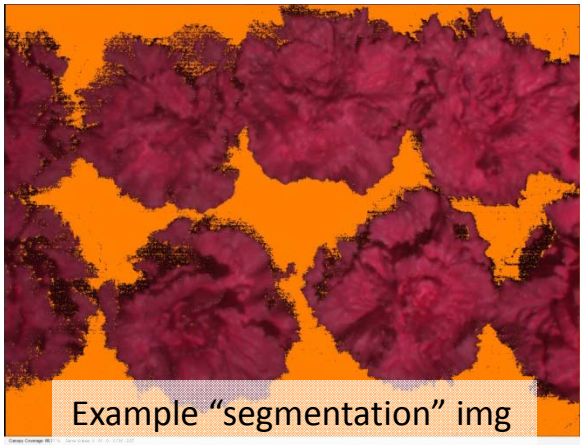
*3 tmts, 5 reps, block randomized design
*total area: ~1.4ac (0.57 ha)
*variety: Gabilan

Fractional cover

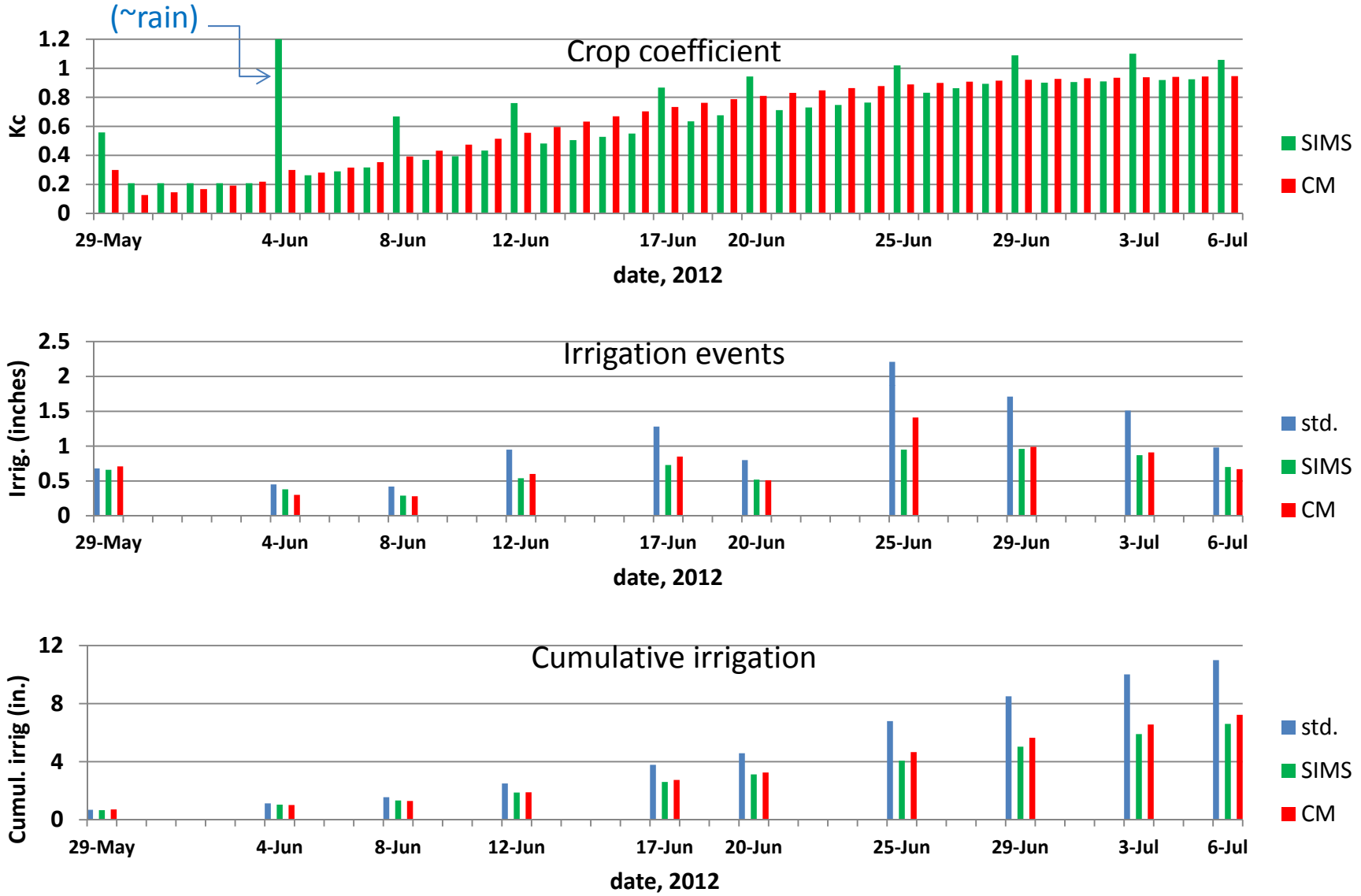



Tetracam meas. 19-June

*similar crop development across treatments

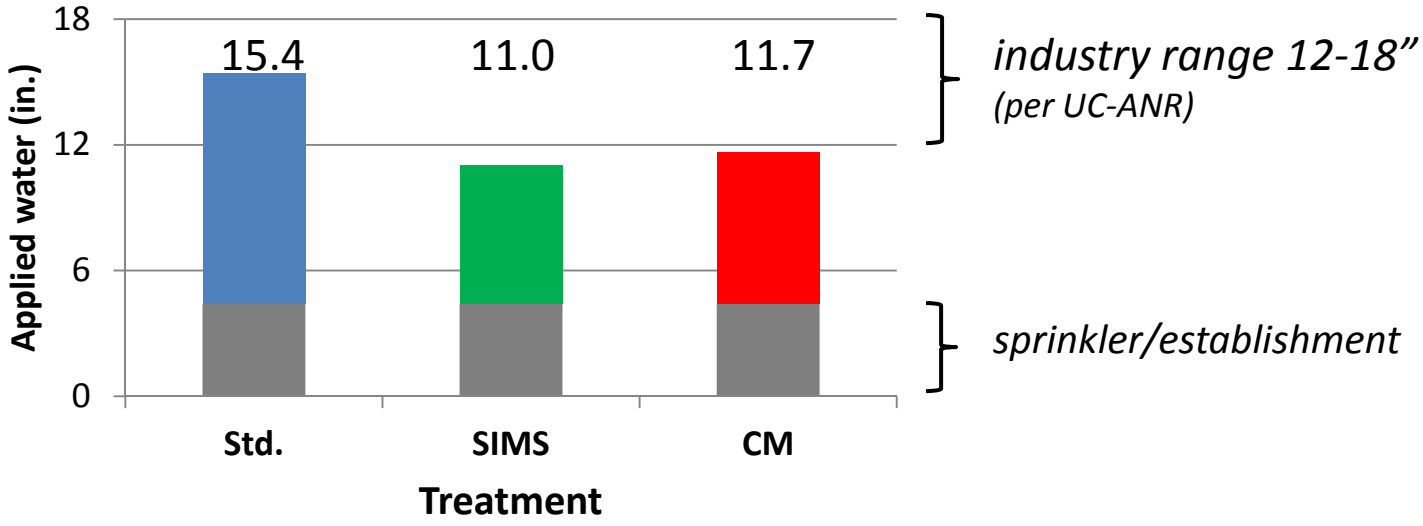

Example “segmentation” img

Crop coefficients & irrigation during drip treatment period



*daily ET estimates drive irrigation treatments

Irrigation totals

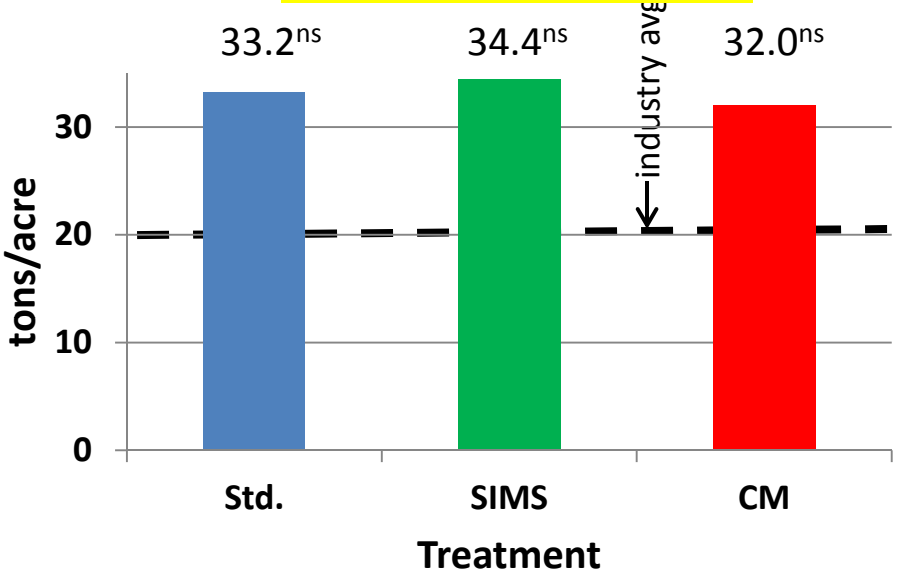


drip irrigation manifold

*~4” water reduction

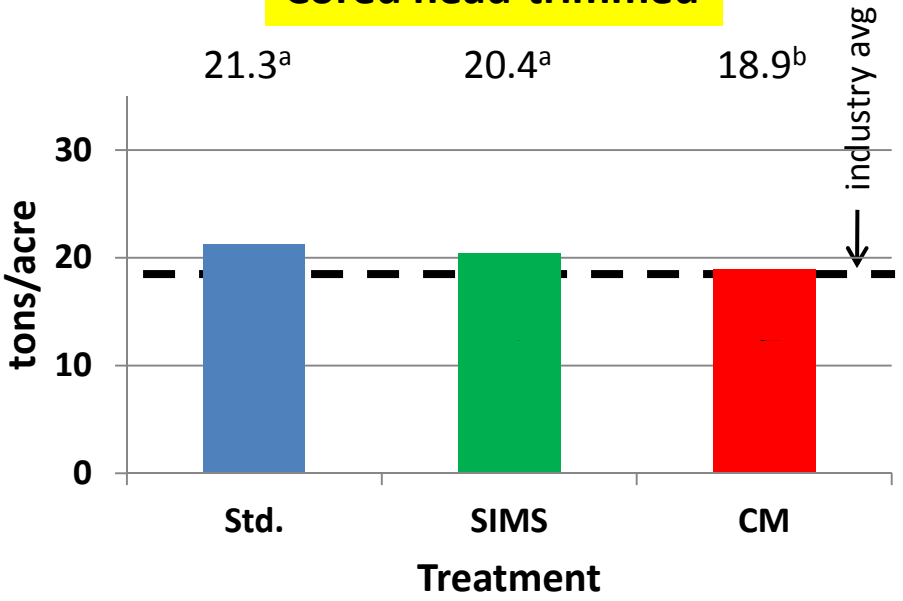
Yield, marketable

Whole head-trimmed



*all tmts well above industry avg
*no treatment difference

Cored head-trimmed



*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"

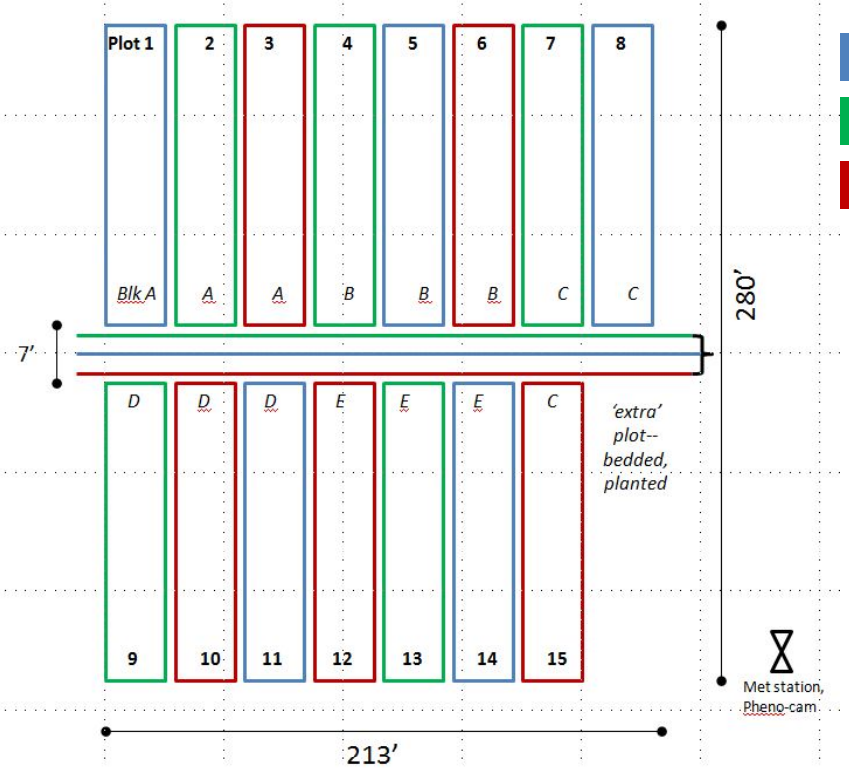
Courtesy Fresh Express

Broccoli trial

July 25-Oct 29, 2012

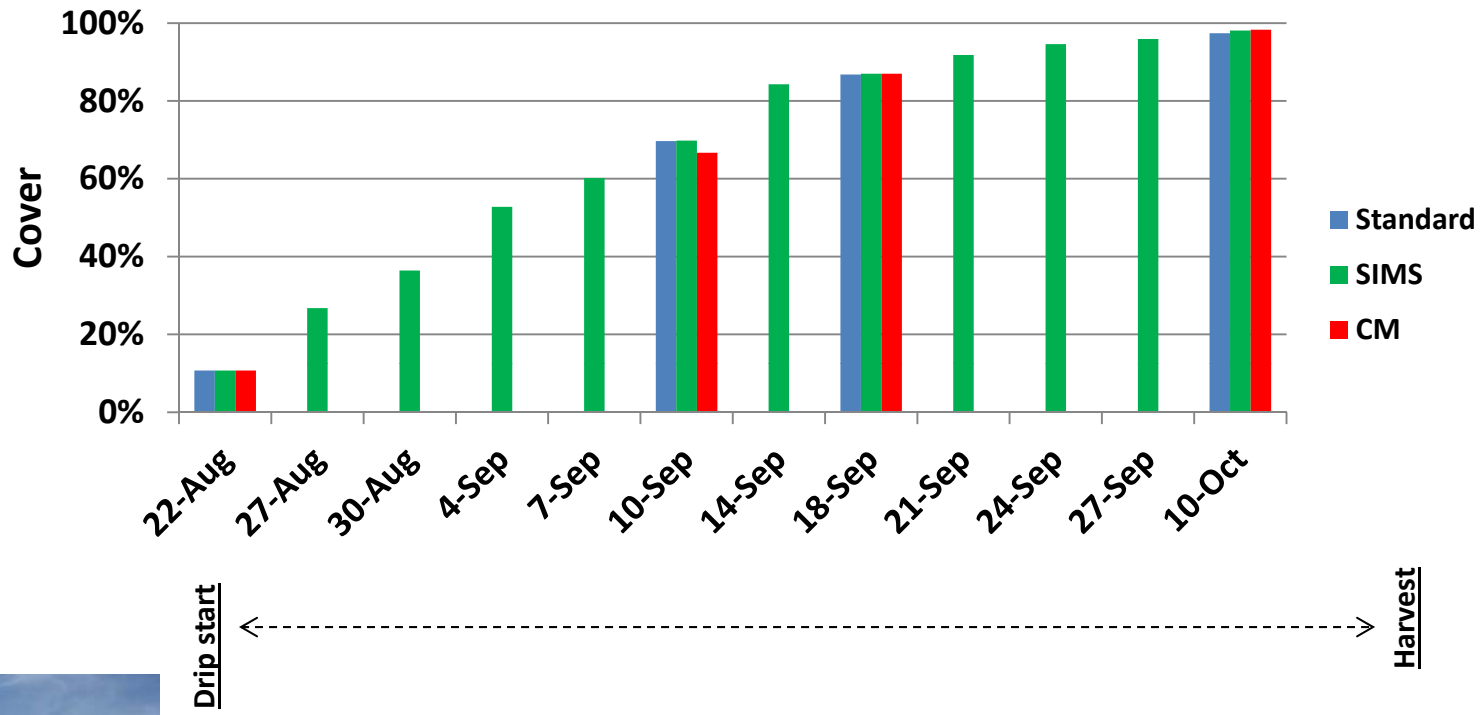
Treatments:

- Standard practice
- SIMS
- CropManage



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

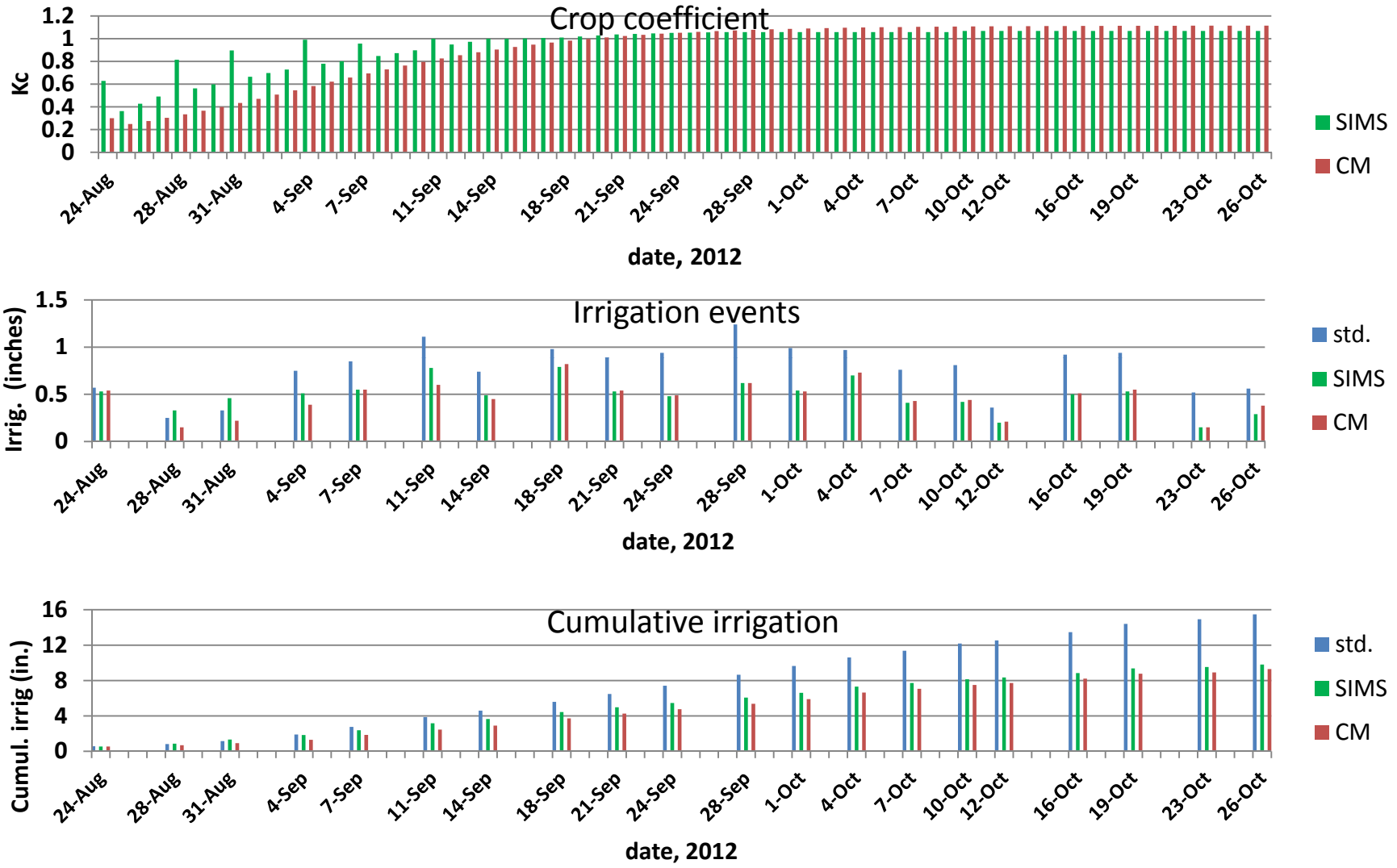
Fractional cover




Tetracam on 21-Sept

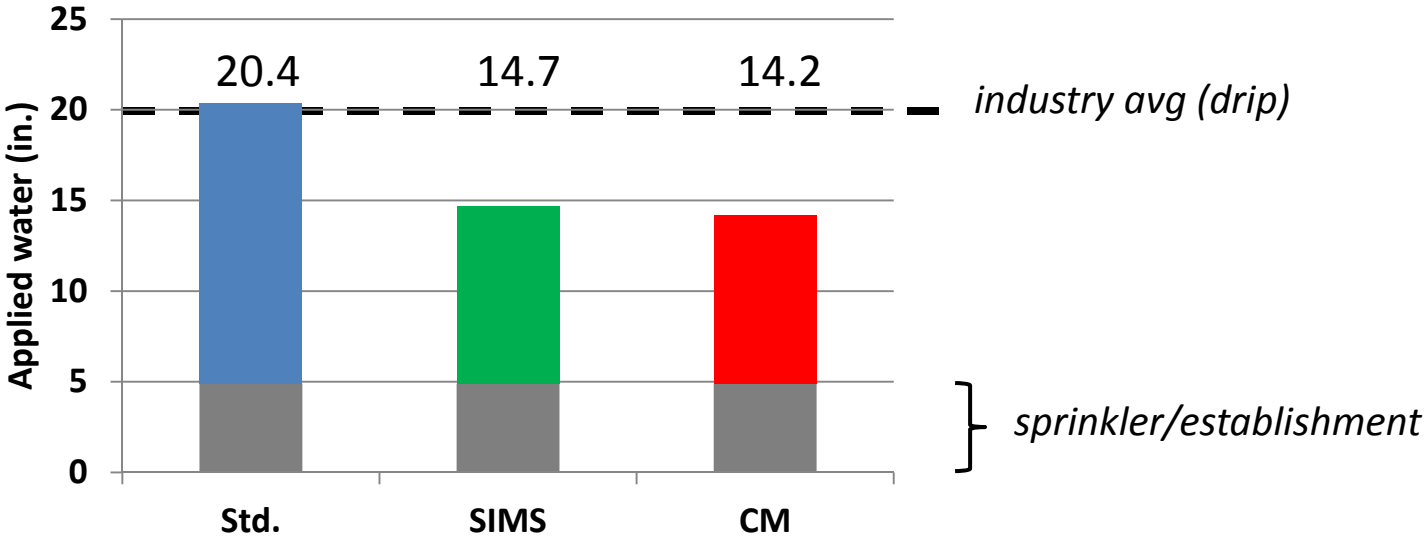
*similar crop development across treatments

Crop coefficients & irrigation during drip treatment period



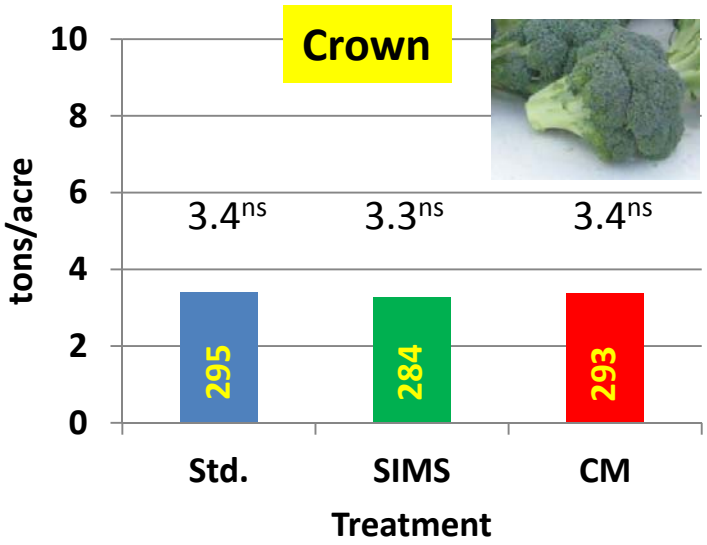
*daily ET estimates drive irrigation treatments

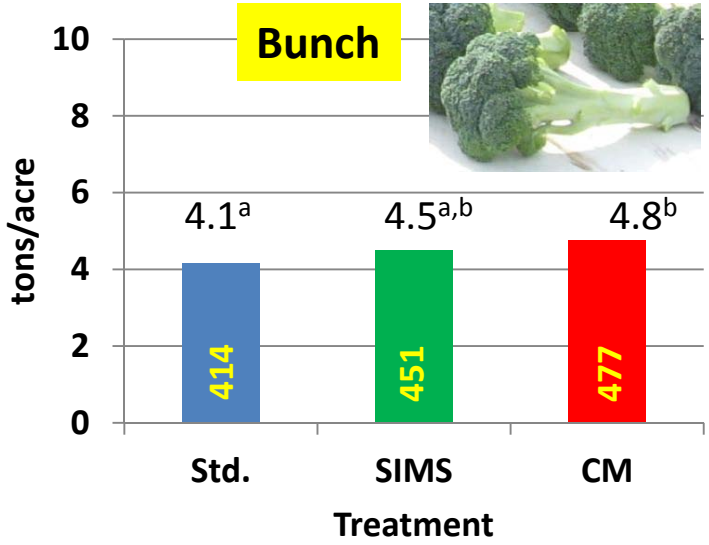
Irrigation

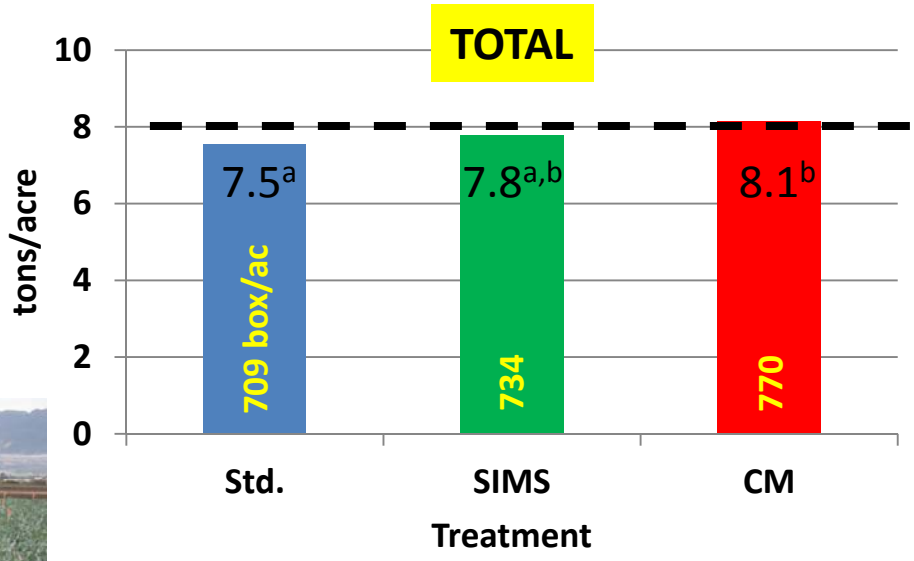


*5-6” water reduction

Yield, marketable







statewide avg

local industry range

Courtesy Tanimura & Antle

*yields well within industry range
*standard treatment slightly lower

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

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