



Establishment Irrigation and Pre-Plant Fertilizer Application Methods on Strawberry Production

Andre Biscaro,
UC ANR, Ventura County

Project collaborators:
Oleg Daugovish, Gina Ferrari,
UC ANR Ventura

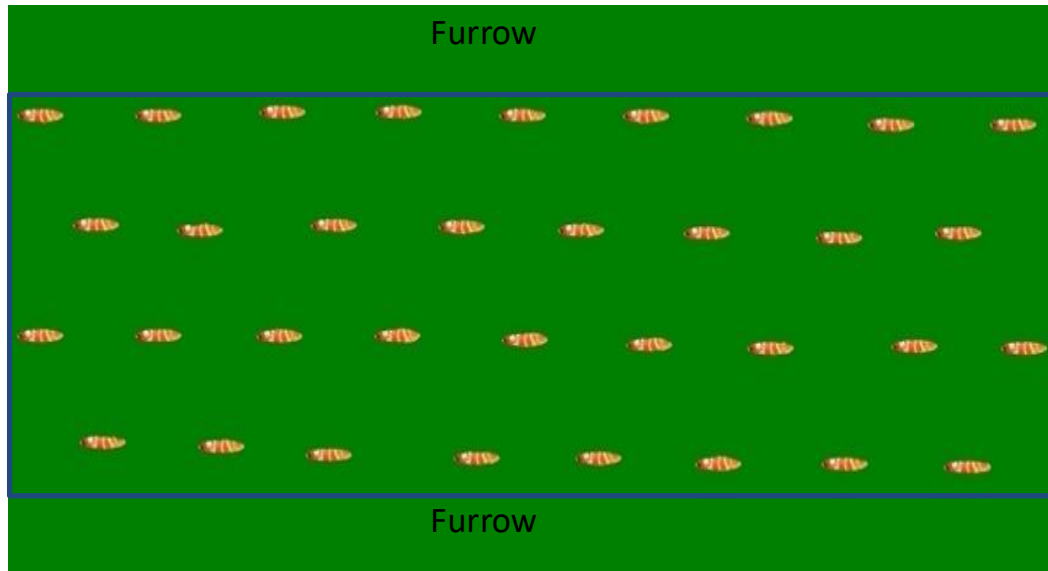
Strawberry Establishment



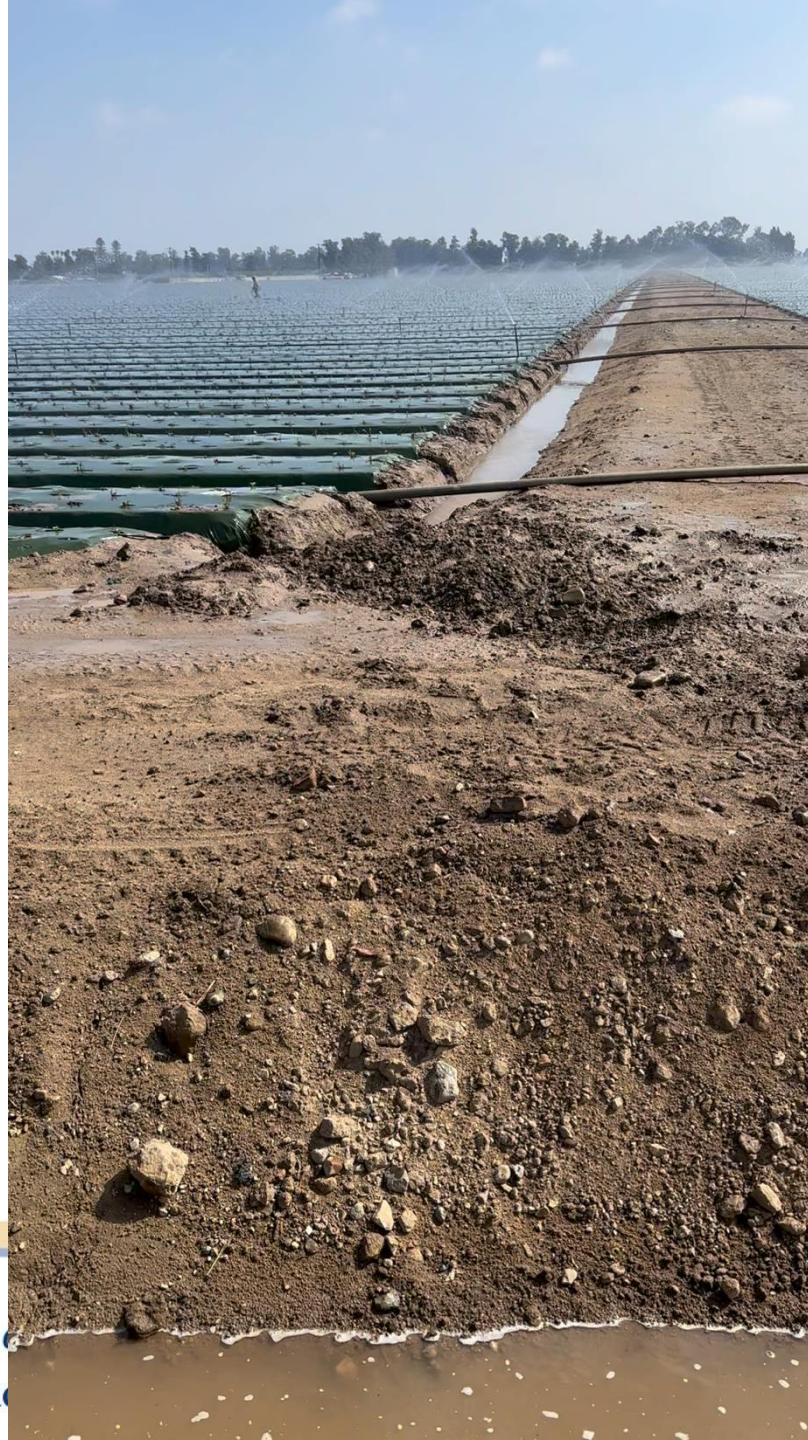
- Lasts between 4 and 6 weeks after planting
- Crop water use is very low – irrigation well-exceeds crop needs
- There is a lot of room to conserve water

Limited Efficiency of Overhead Irrigation

Aerial view of a strawberry bed section



- Planting holes represent 2.4% of the field (average of five images)
- The majority (~80-90%?) of the sprinkler-applied water is lost through runoff, deep percolation and evaporation.



Irrigation Water Costs Are Rising While Availability is Declining

**CALIFORNIA DEPARTMENT OF
WATER RESOURCES**

Water Basics

What We Do

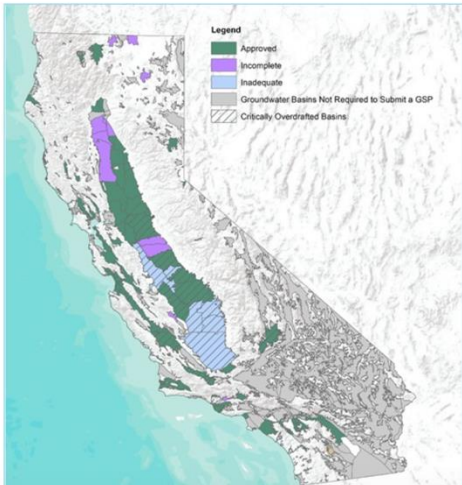
Programs

Work with Us

News

Library

Search

**GSP**
GSP Reporting System

Previous study results and other regions

- A series of field trials conducted in Oxnard, Santa Maria and Watsonville between 2009 and 2014 (Daugovish et al., 2016):
 - ✓ Water use reduction of 24 to 78% with the use of drip tape compared to overhead sprinklers during strawberry establishment
 - ✓ Plant size, root biomass and yield were similar between the two irrigation systems, suggesting great suitability for adoption of such method
- Many operations in Baja and other regions in California don't use sprinklers/microsprinklers

Summary of Results from Previous Seasons

1st Season (2023/2024):

- 3 treatments: drip tape, micro-sprinkler and alternating drip/micro-sprinkler
- Very similar yield and water use among treatments
- Greater canopy size and root depth for drip tape up to end of Dec

2nd Season (2024/2025):

- 2 treatments: drip tape and micro-sprinkler
- Very similar yield between treatments and 43.1% less water use with drip tape
- Salinity effect from high concentration of pre-plant fertilizer next to plant rows compromised plant health and crop establishment

40 days after planting





Root Depth



2024/2025

2023/2024

2025/2026

Project objectives:

- 1) Compare drip tape vs. micro-sprinkler irrigation methods during crop establishment.
- 2) Assess pre-plant fertilizer placement methods on crop performance.

Treatments:

Irrigation:

1. Drip tape
2. Micro-sprinkler (grower standard)

Pre-Plant Fertilizer:

1. Banded
2. Broadcast
3. No pre-plant

Parameters assessed:

Marketable and unmarketable yield, water use, canopy coverage, root depth and leaf nutrient analyses.

Plot map:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
B1						B2						B3						B4					
sprinkler			drip			drip			sprinkler			sprinkler			drip			drip			sprinkler		
ban	bc	np	bc	ban	np	bc	np	ban (dow)	bc	ban	np	bc	np	ban	np	bc	ban	bc	np	ban	np	ban	bc

Main-plot treatments (irrigation):

- Micro-sprinkler
- Drip tape

Subplot treatments (fertilizer):

- Banded (ban)
- Broadcast (bc)
- No pre-plant (np)

Material and Methods (2025/2026 Season):

- 64-in bed, three medium flow tapes, Plant Sciences cultivar planted on Oct 10.
- Experimental design: split-plot randomized complete block, replicated four times.
- The irrigation of the drip tape treatment was guided by Hortau[®] tensiometers installed at 4-in depth under the plants, in addition to field observations.
- The irrigation of the micro-sprinkler treatment was determined by the irrigator (grower standard).
- Irrigation treatments were applied from planting until Nov 12, when drip irrigation became the only irrigation method.

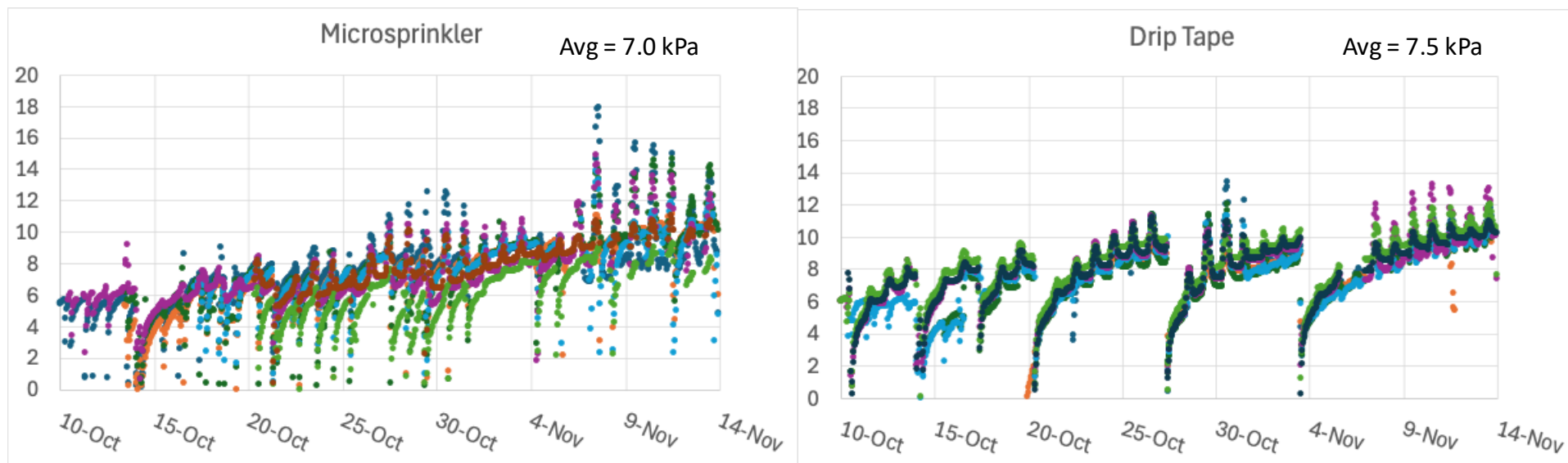
Material and Methods (cont.)

- Pre-plant fertilizer treatments were implemented at bed up, with 850 lb/ac of 22-8-13 applied to both banded and broadcast treatments.
- All other cultural practices remained the same.
- Total season precipitation: 17.6 inches, with 1.1 inch during crop establishment (Oct 14).
- Core soil parameters: sandy loam, pH 6.4, ECe 2.5 dS/m, exch-K 205 ppm, P 61 ppm, CEC 15 meq/100g.

Broadcast fertilizer application

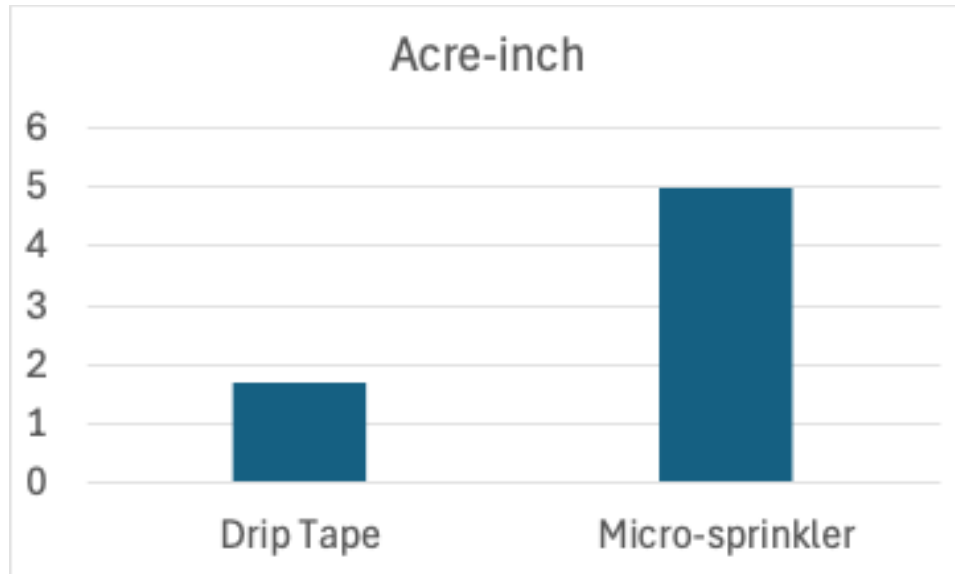


Soil Water Tension (kPa) – 4-inch depth

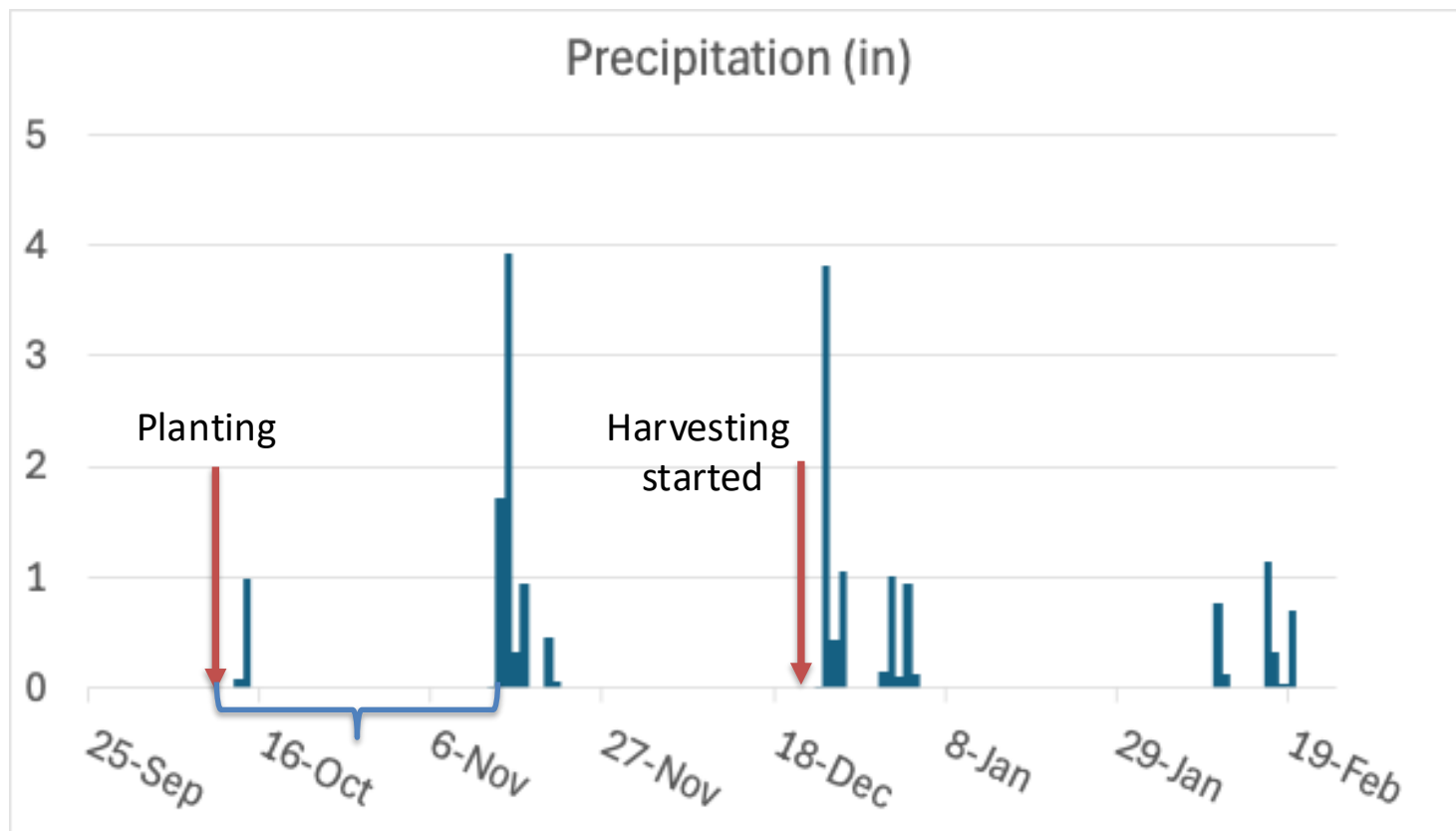


Over time, the grower standard has increasingly resembled the drip tape treatment, showing that irrigators are willing and often eager to adopt new practices.

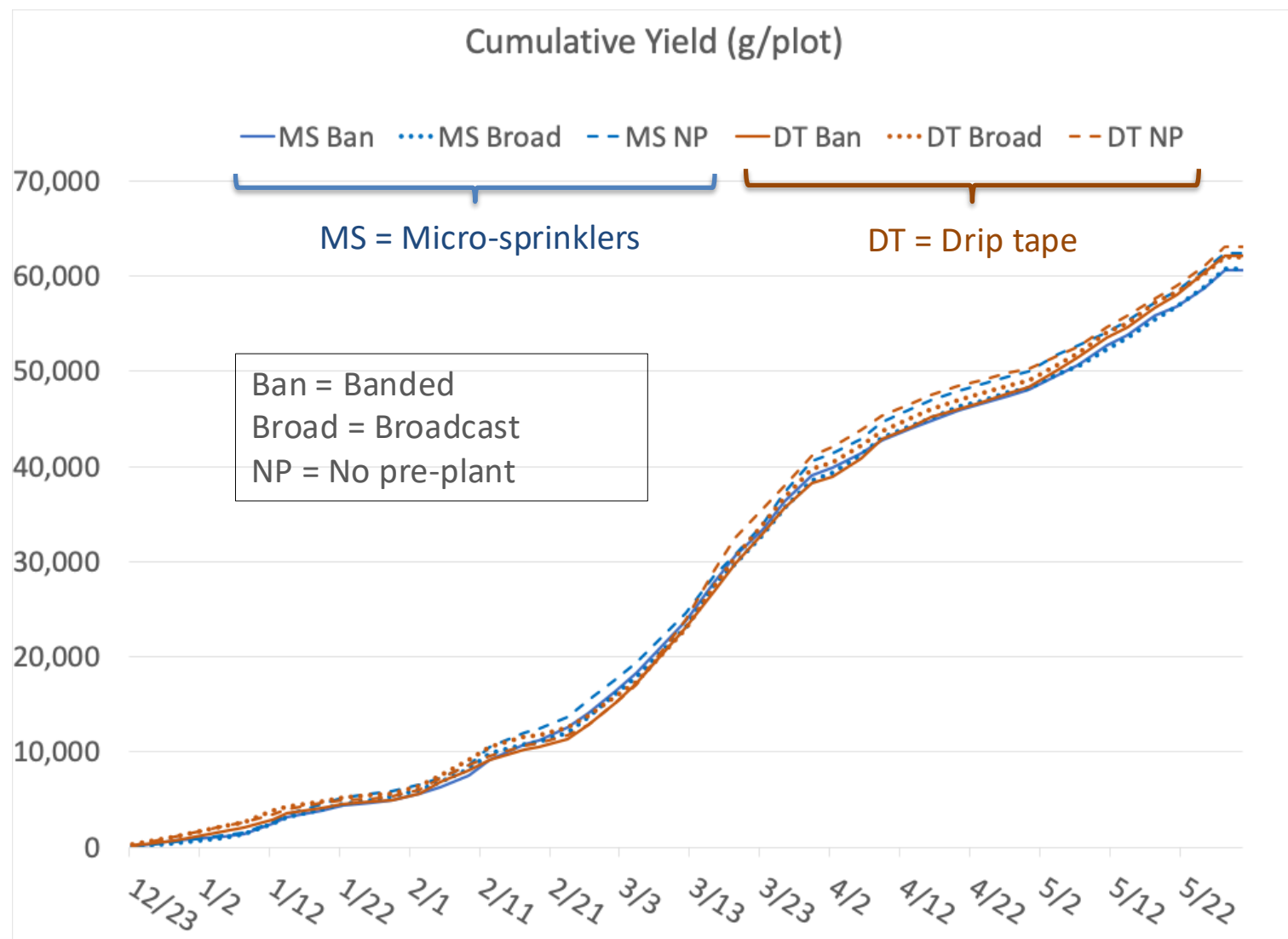
Irrigation Water Use (Establishment Only)

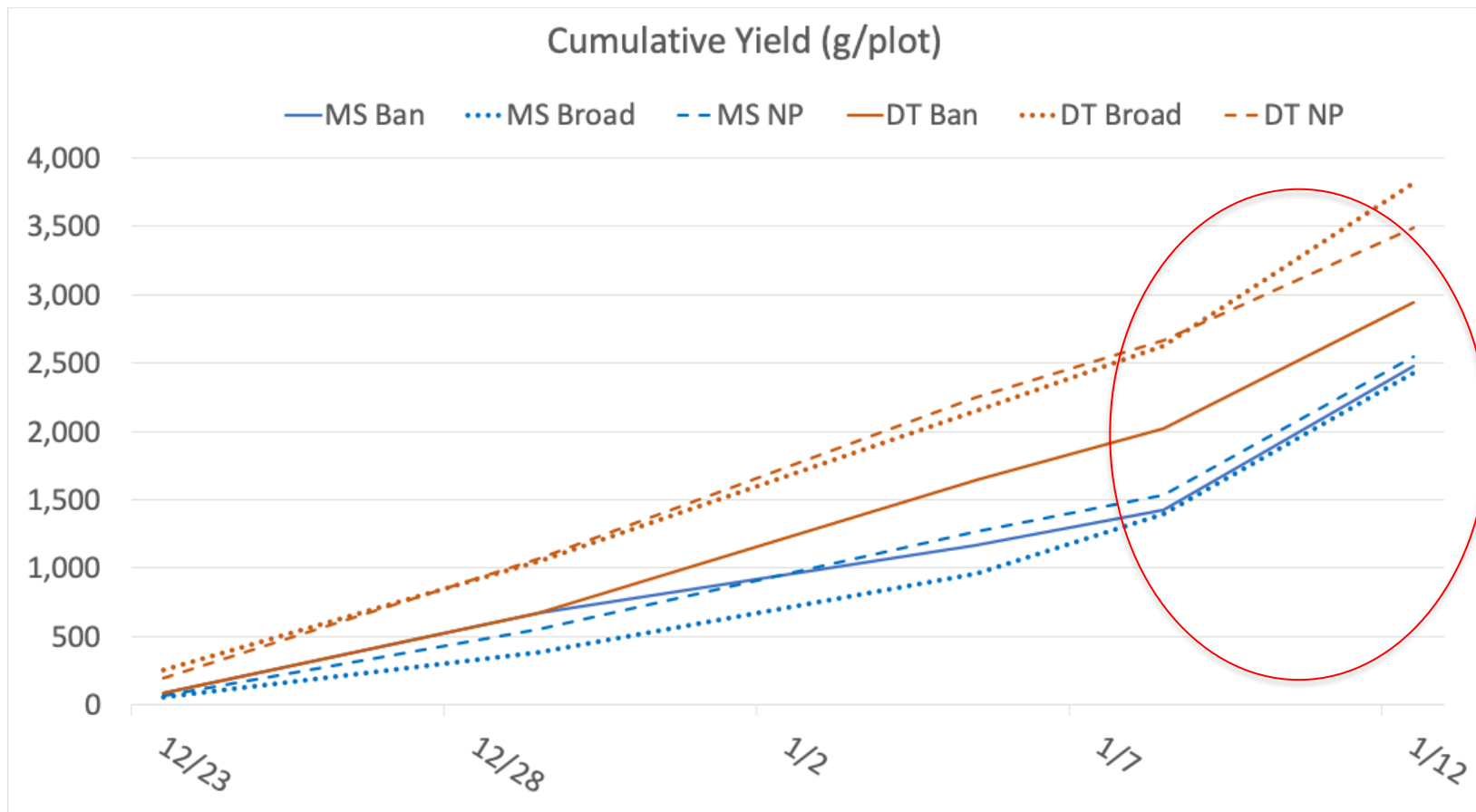


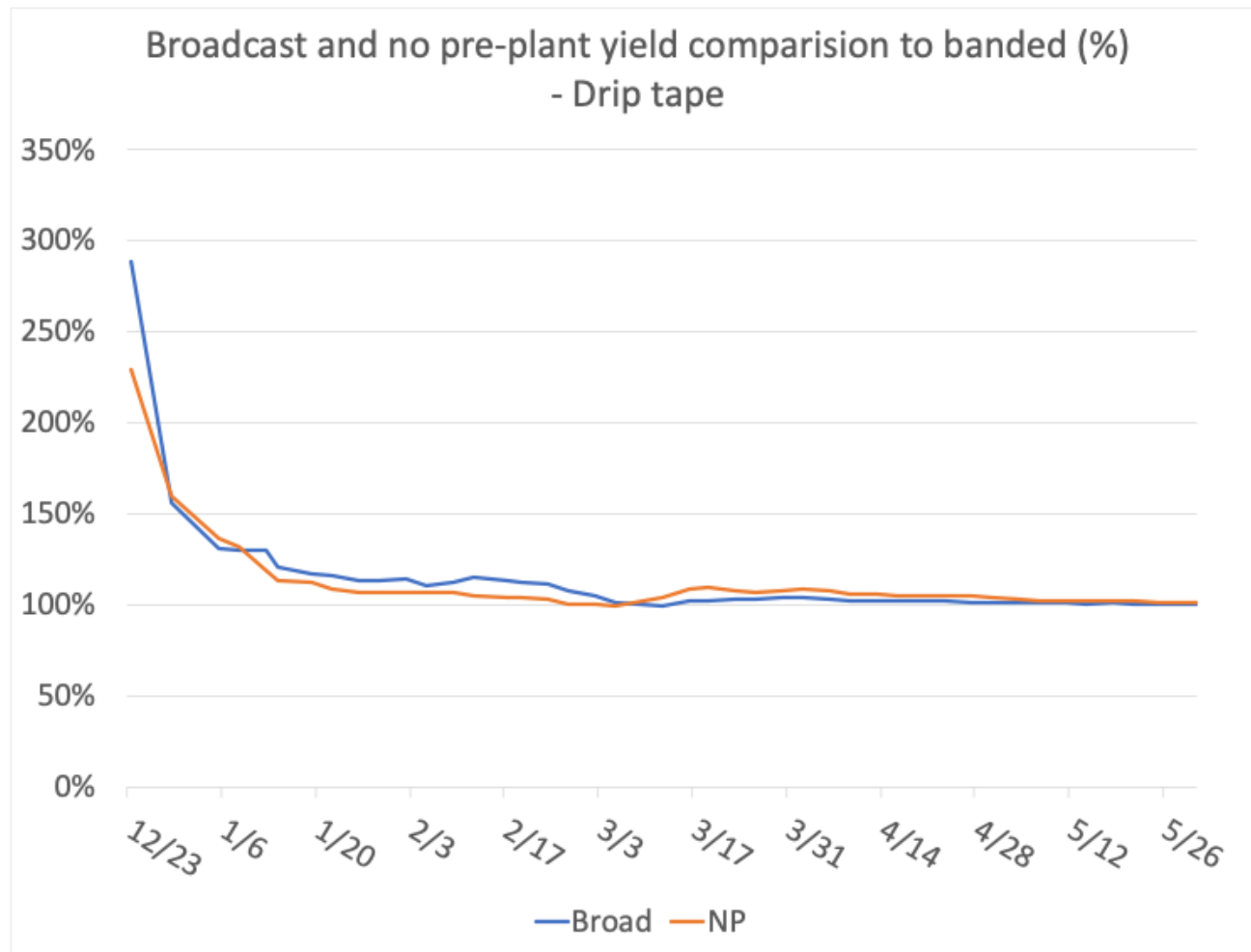
- 66% reduction in applied water
- Precipitation: 1.05 acre-in

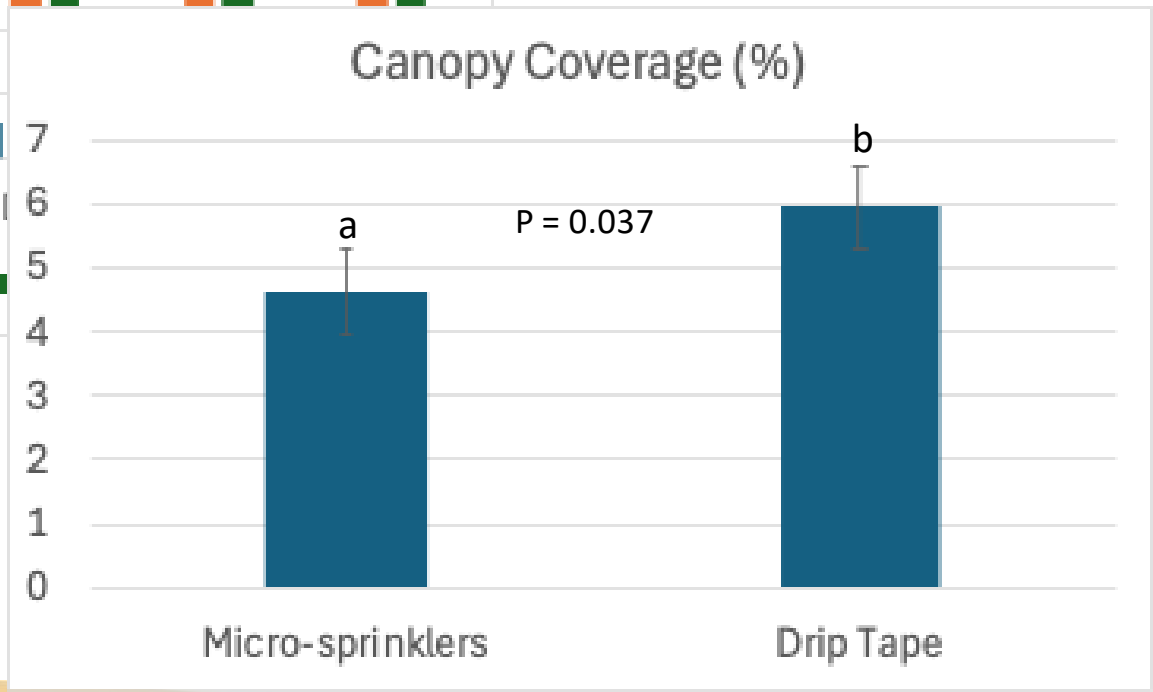
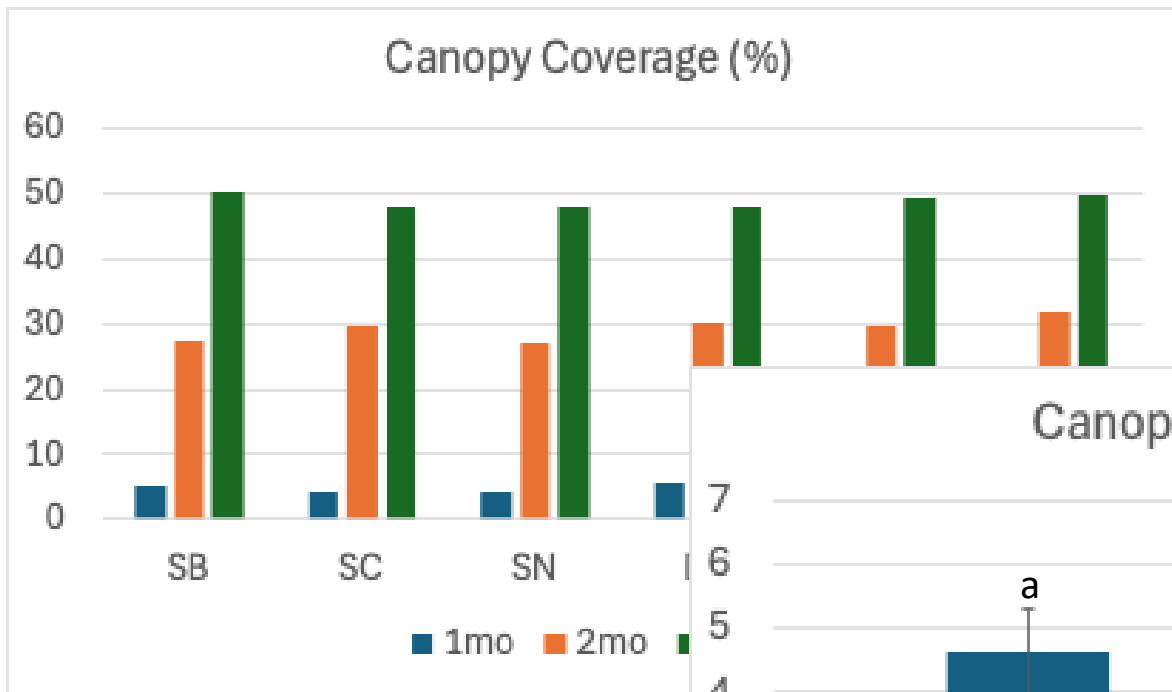


Results









Leaf Nutrient Analysis

- ✓ Leaf nutrient concentrations were not significantly affected by fertilizer placement method on either sampling date.

Feb 6:

	N (%)	Ca (%)	Mg (%)	Mn (ppm)	
Micro-sprinkler	3.47	1.01	0.318	352	(~2-5%)
Drip Tape	3.38	0.96	0.311	337	
P-value	0.031	0.018	0.044	0.009	

April 17:

	Zn (ppm)	Fe (ppm)	Mn (ppm)	
Micro-sprinkler	29.8	92	223	(~5-8%)
Drip Tape	28.4	86	207	
P-value	0.037	0.028	0.012	

Root Depth

- ✓ Treatments did not significantly affect root depth at 1 month after planting.

Irrigation	Root Depth (in)
Drip Tape	6.42
Micro-sprinkler	6.27
P-value	0.77

Fertilizer	Root Depth (in)
Banded	6.05
No pre-plant	6.52
P-value	0.236

Summary:

- ✓ Drip tape reduced establishment water use by 66% compared to micro-sprinkler (1.7 vs. 5.0 inches, respectively).
- ✓ Drip tape improved early crop establishment, resulting in 55% greater yield during the first month of production, and 28.6% greater canopy cover compared to MS.
- ✓ Irrigation method influenced early and mid-season yield, but final yields did not differ between drip tape and micro-sprinkler.

Summary (cont.):

- ✓ Leaf N, Ca, Mg and Mn were slightly higher with micro-sprinkler irrigation on Feb 8; leaf Zn, Mn and Fe were also slightly higher on April 17.
- ✓ Pre-plant fertilizer placement methods (banded, broadcast, or none) did not significantly affect yield, canopy coverage, root depth or leaf nutrient concentration.

Thank you!

Questions/comments?

asbicaro@ucanr.edu

(805)645-1465



Acknowledgements:

- Crisalida Berry Farms
- Thelma Hansen Funds
- Hortau®