Optimizing Water Management in Celery using Weather Based Scheduling

Michael Cahn, UC Cooperative Extension
Lee Johnson, CSUMB/NASA
Sharon Benzen, USDA-ARS

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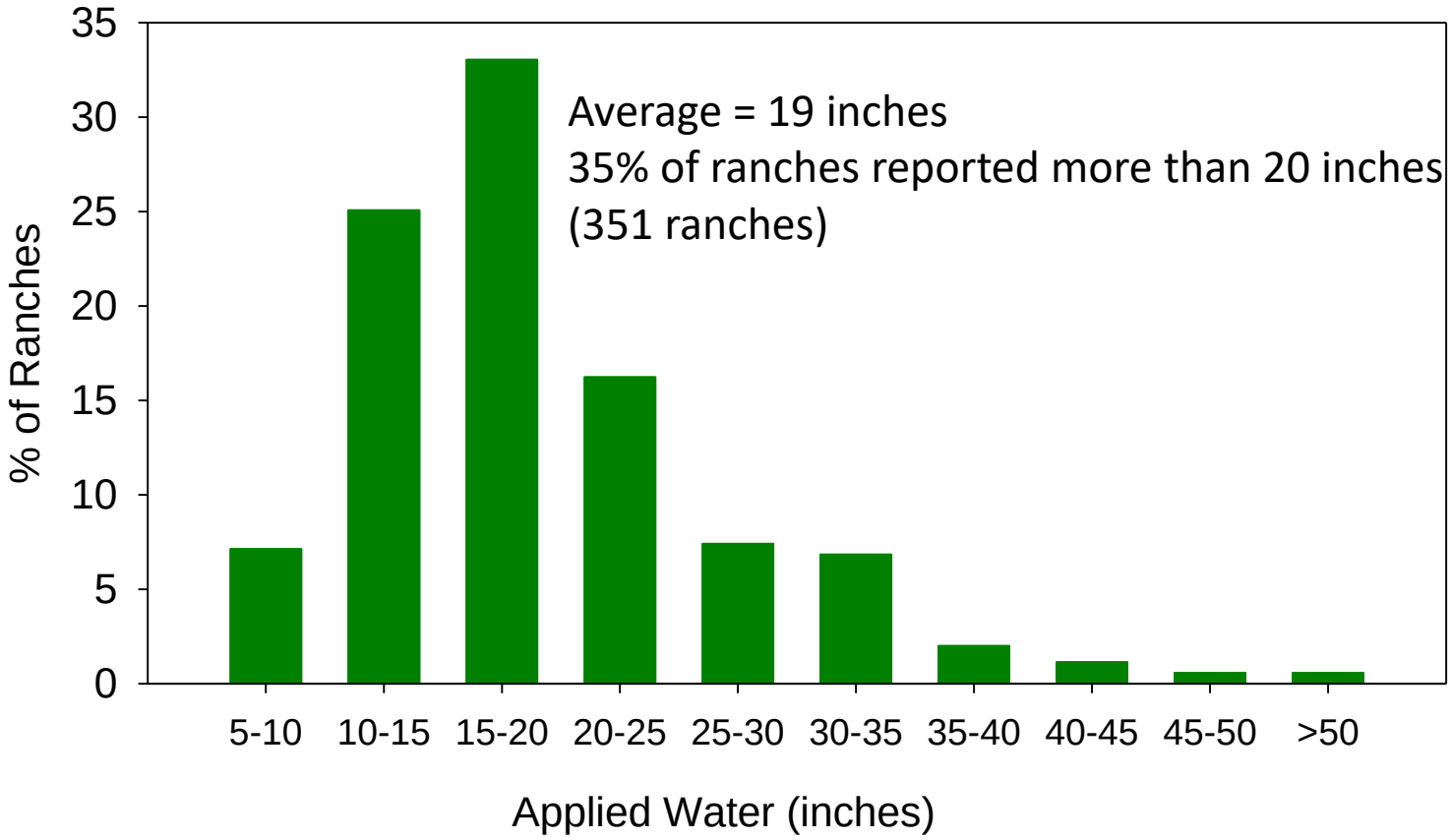
Why an irrigation trial in celery?

- Water sensitive crop often irrigated by a combination of methods (drip, furrow, sprinkler)
- Water supplies may become more limited in the Salinas Valley: Sustainable Ground Water Management Act
- Better water management would help improve nitrogen use efficiency of celery
- Calibrate ET based irrigation scheduling in celery

Reported water use of celery in region 3* (2017)



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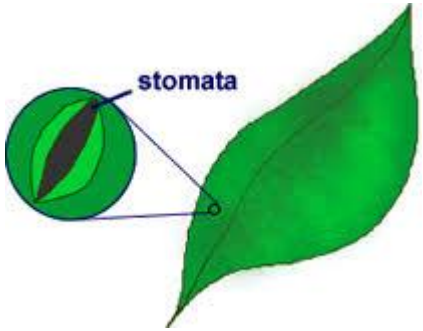
What is Evapotranspiration?

Water Vapor
Oxygen

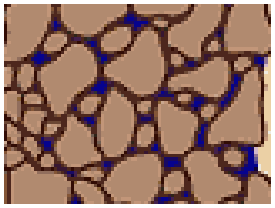
Carbon dioxide
Net Radiation (Sunlight absorbed)
Air Temperature
Wind
Humidity



Transpiration

+

Soil Evaporation



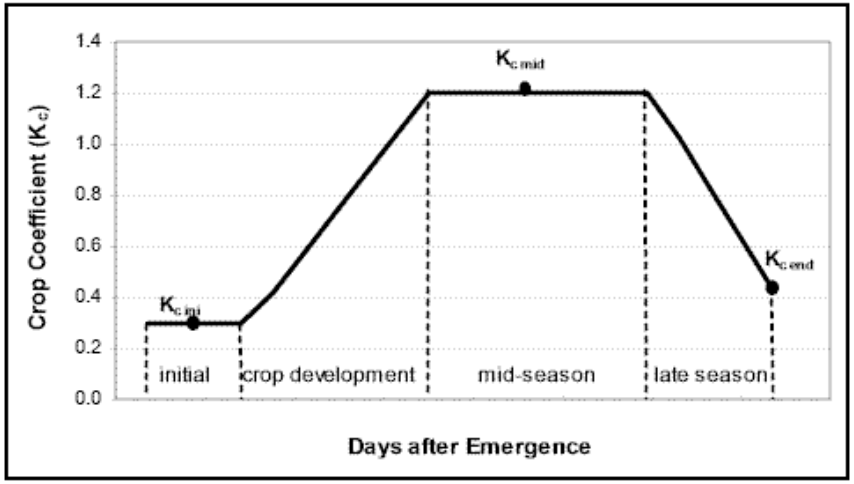
Soil Moisture

Weather-based irrigation scheduling

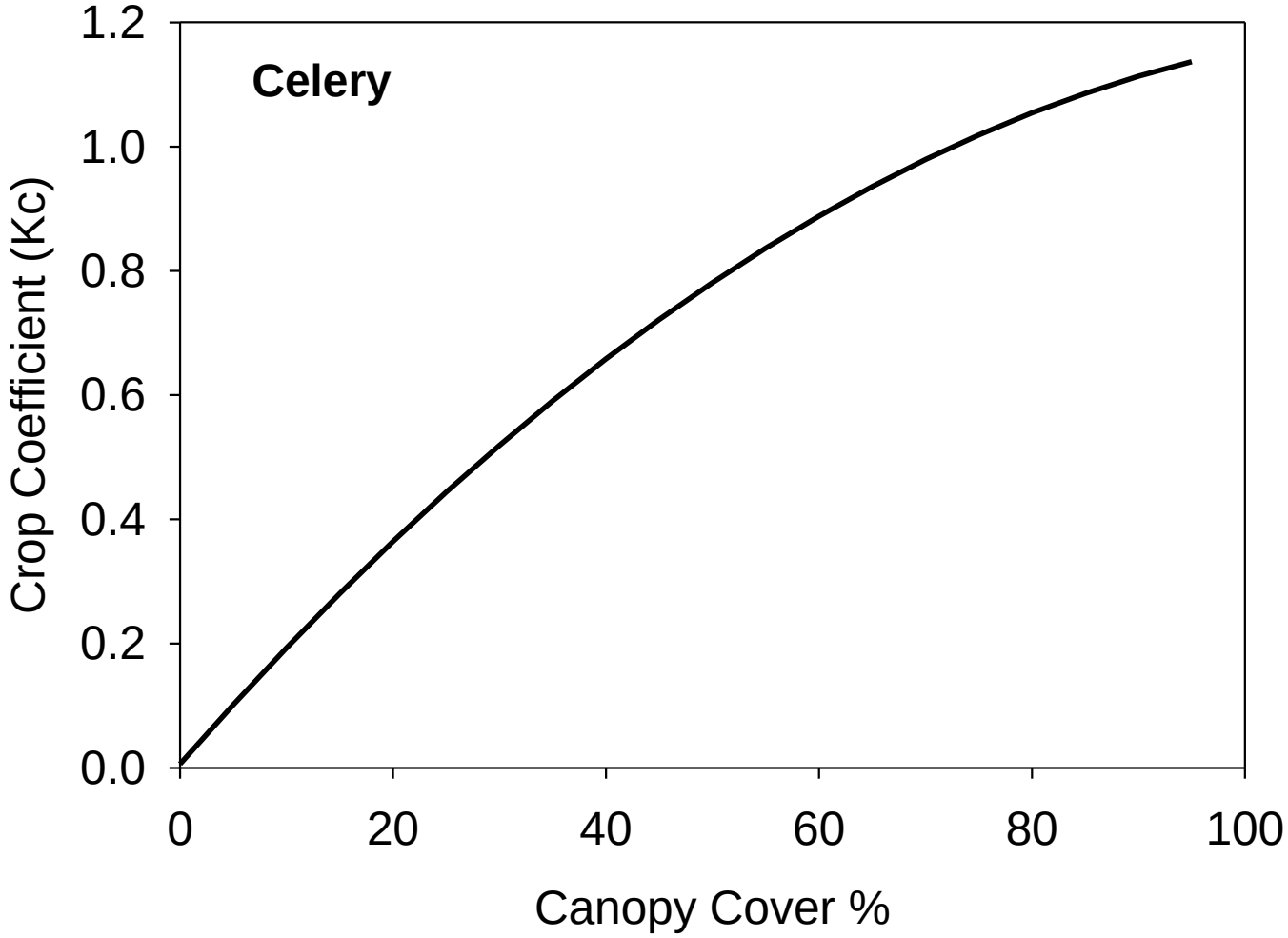
Converting Reference ET to Crop ET:

$$ET_{crop} = ET_{ref} \times K_{crop}$$

K_c can vary from 0.1 to 1.2



Crop Kc can be based on canopy cover



Objectives

- Determine water requirement of drip irrigated celery for optimizing yield and quality
- Determine if the crop coefficient (ET) model for celery is accurate

Experimental Approach

- Apply different rates of water based on ET model
- Evaluate yield, quality, soil moisture, crop development of water treatments

Procedures

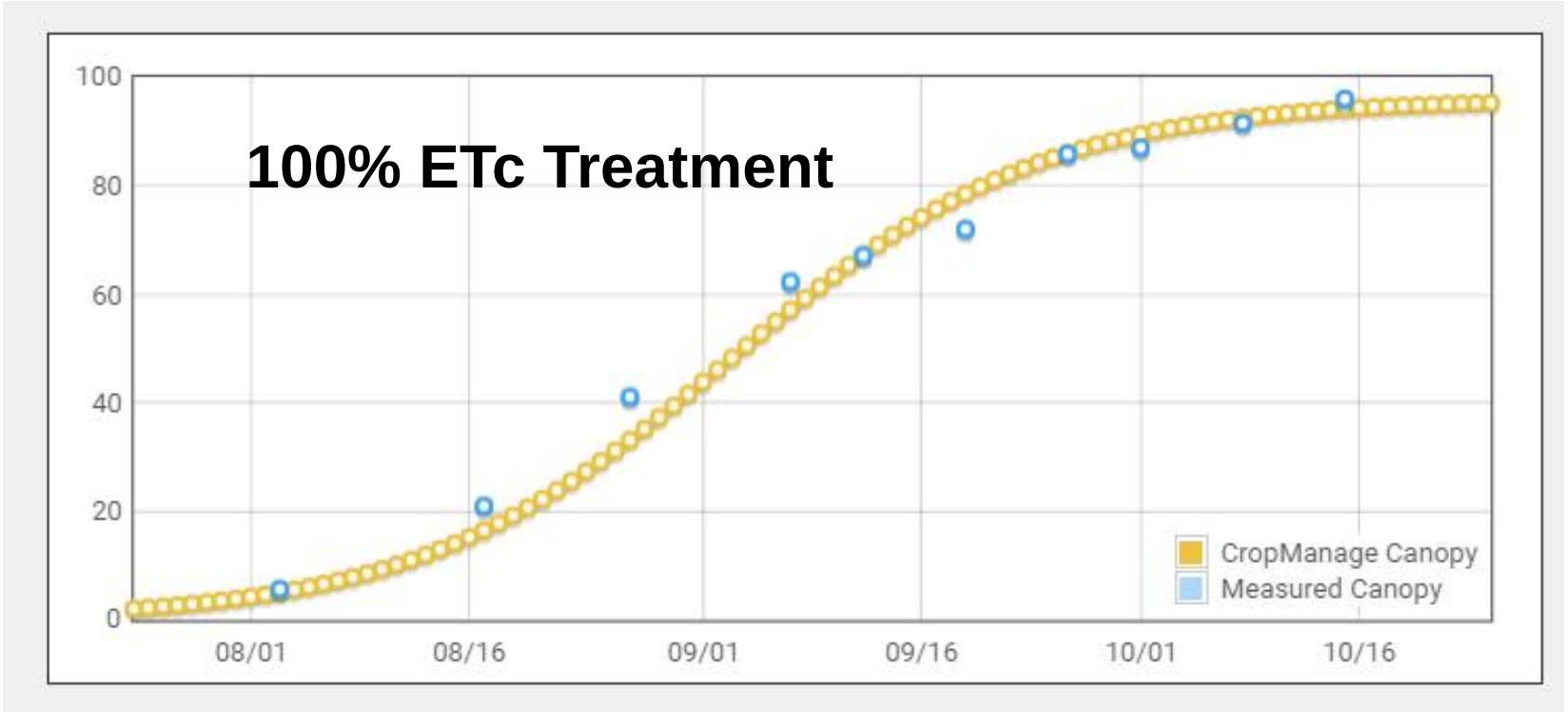
- Soil: Chualar sandy loam
- Cultivar: Dole BSM2
- Transplanted July 24 2018
- 2 rows on 40-inch wide beds, 6.5 inch spacing
- Plots measured 135 ft x 5 beds
- 6 replications of drip irrigation treatments
- Transplants established with sprinklers (3.5 inches)
- Fertilizer: preplant 300 lbs/acre 6-20-20, by drip 339 lbs N/acre, 82 lbs K/acre

Procedures continued

- Drip irrigation treatments: 50, 75, 100, 125, and 150% of Crop ET (began on 8/15)
- Irrigation requirement based on 90% distribution uniformity
- Drip irrigated 3 times per week
- Above ground biomass evaluated on Oct 19
- Sub plots (10 ft x 25 ft) commercially harvested by Dole on October 17 and 25 (85 and 93 DAP)

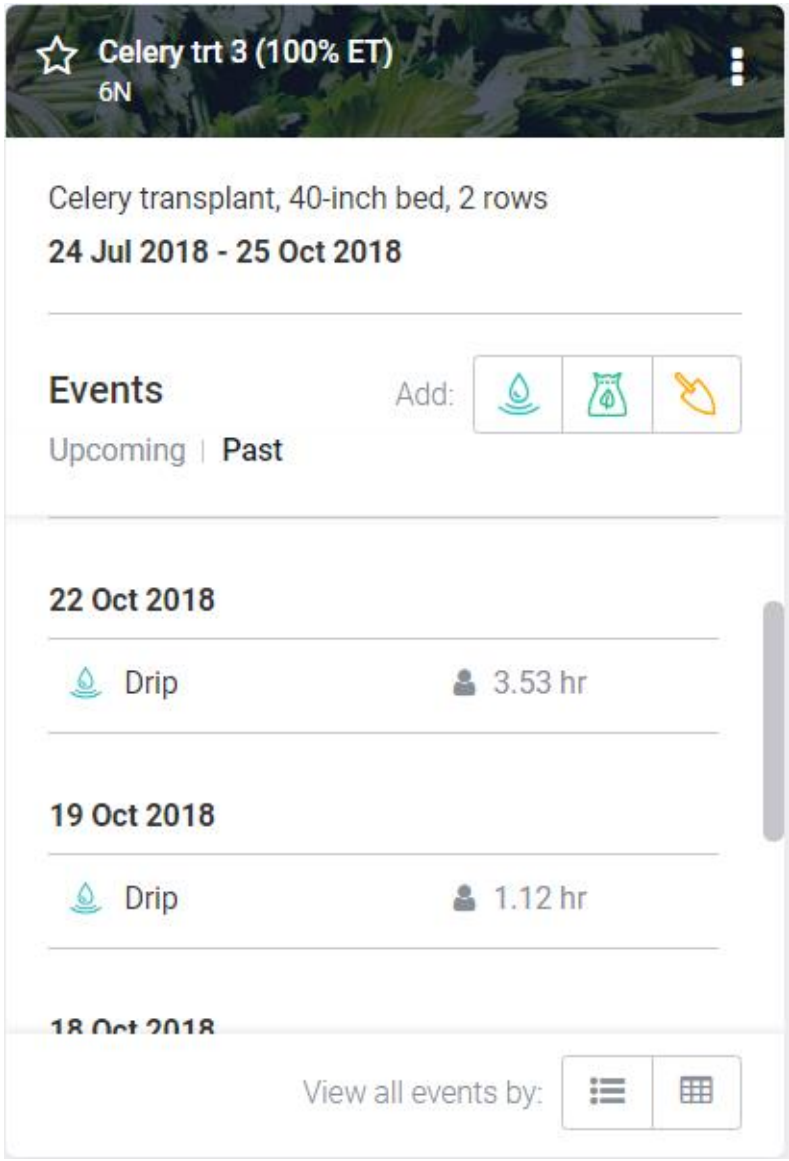
Digital Infra-red camera was used to monitor canopy development

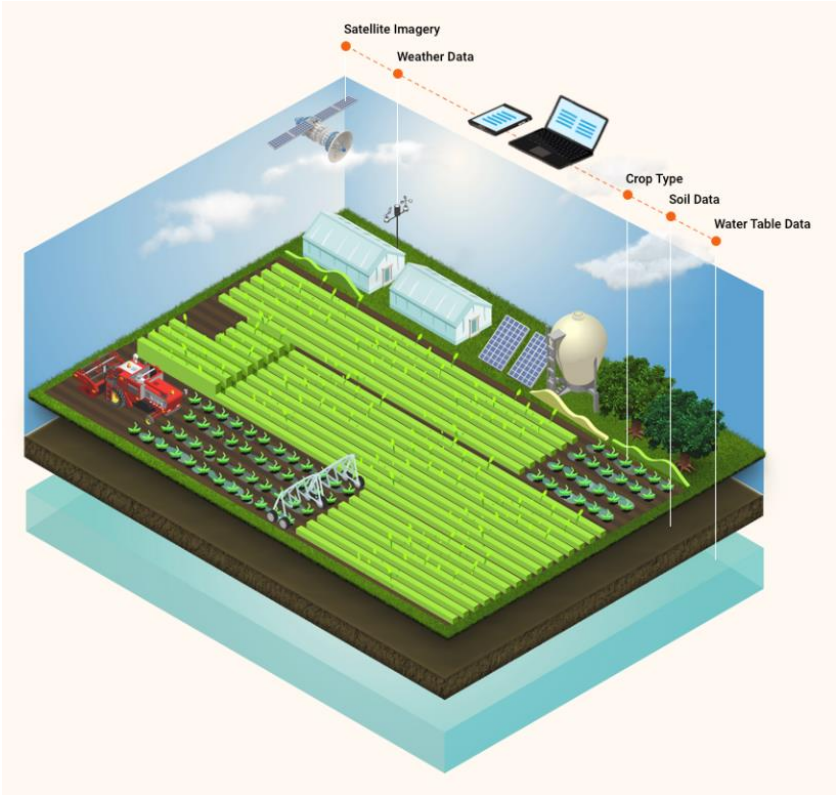
Canopy model for celery closely matched measured values



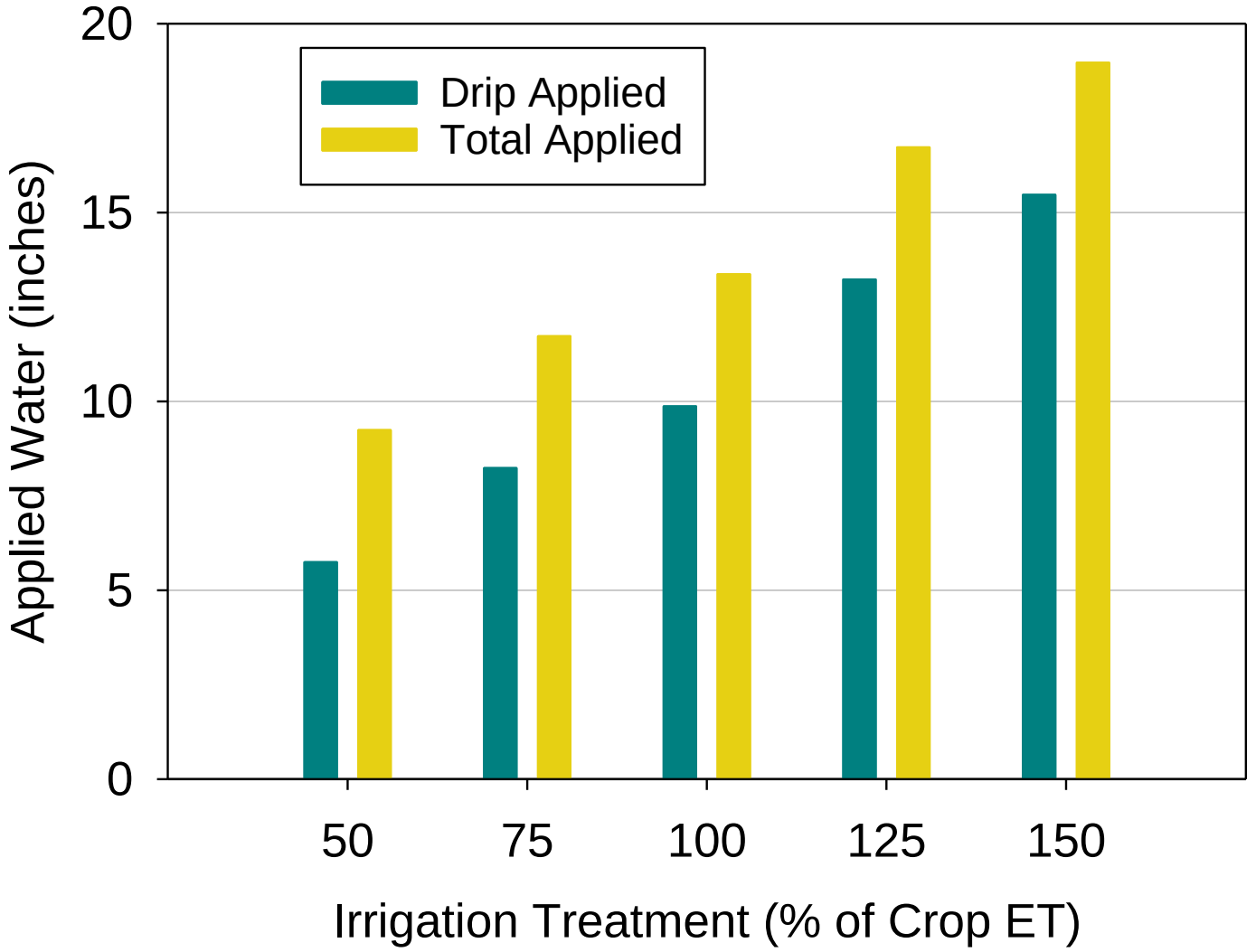
Manifold for Applying Irrigation Treatments

CropManage Used for Scheduling Irrigation Treatments





Applied Water for Irrigation Treatments
(July 24 – October 24)

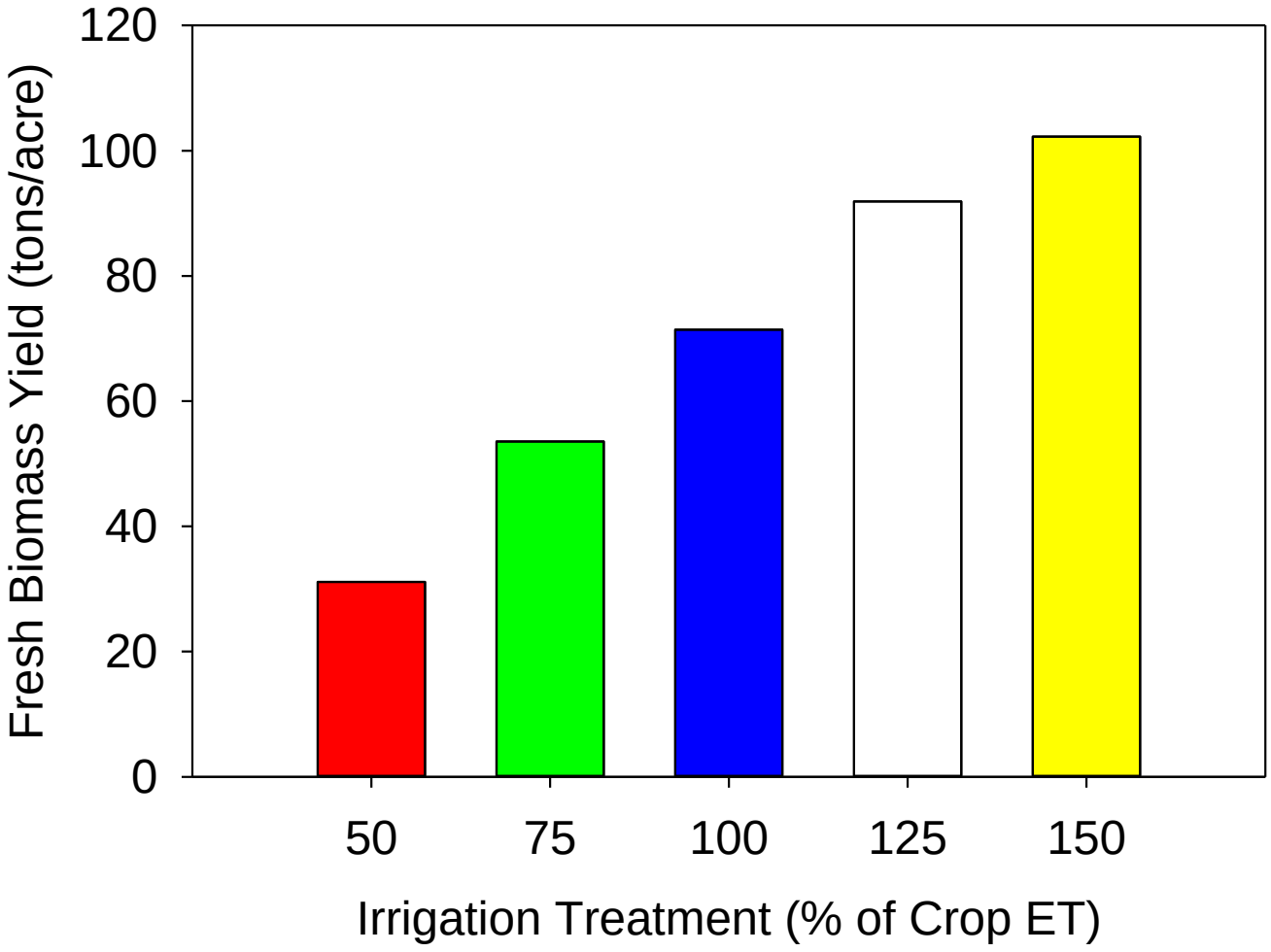


Celery Trial near Maturity

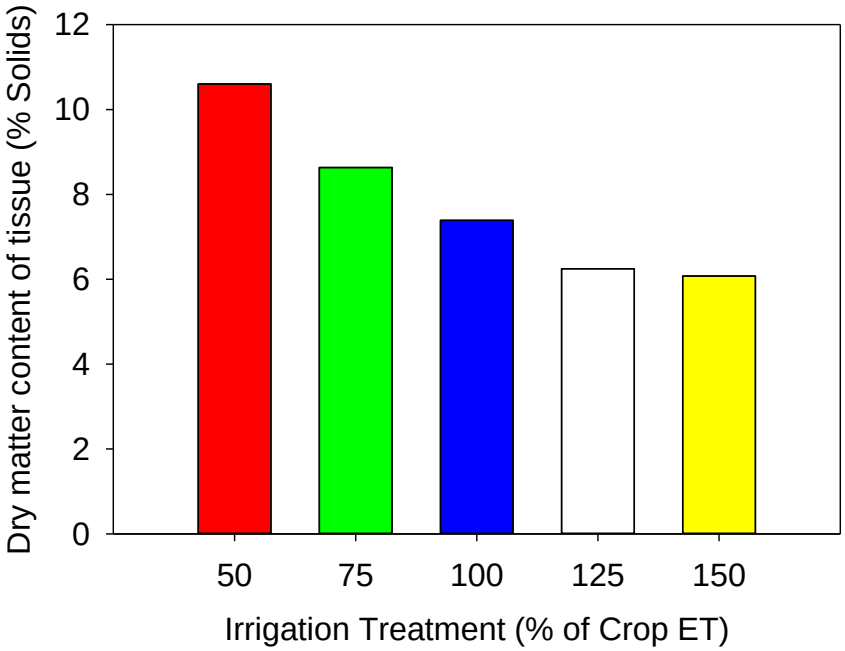
Field Day

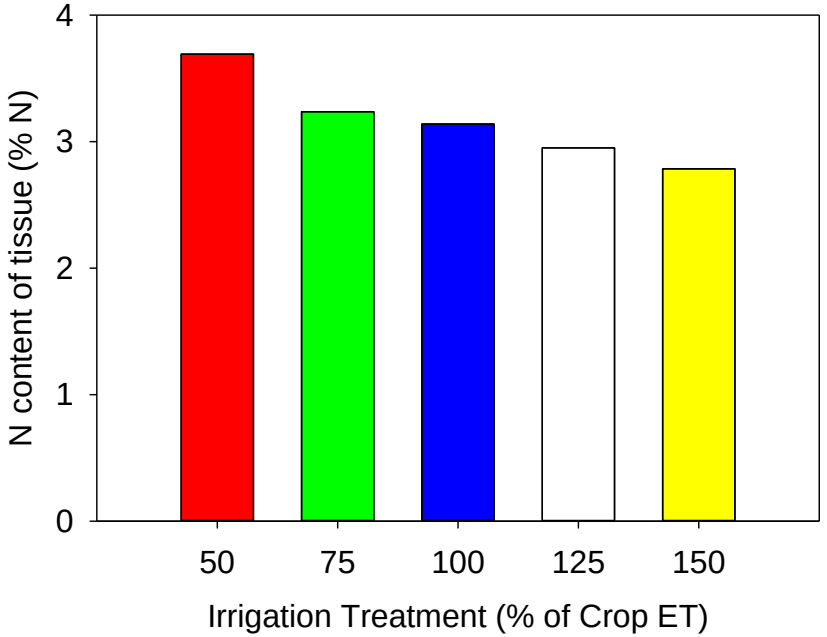
Above ground biomass was evaluated Oct 19

Above ground fresh biomass increased with higher ET water treatments

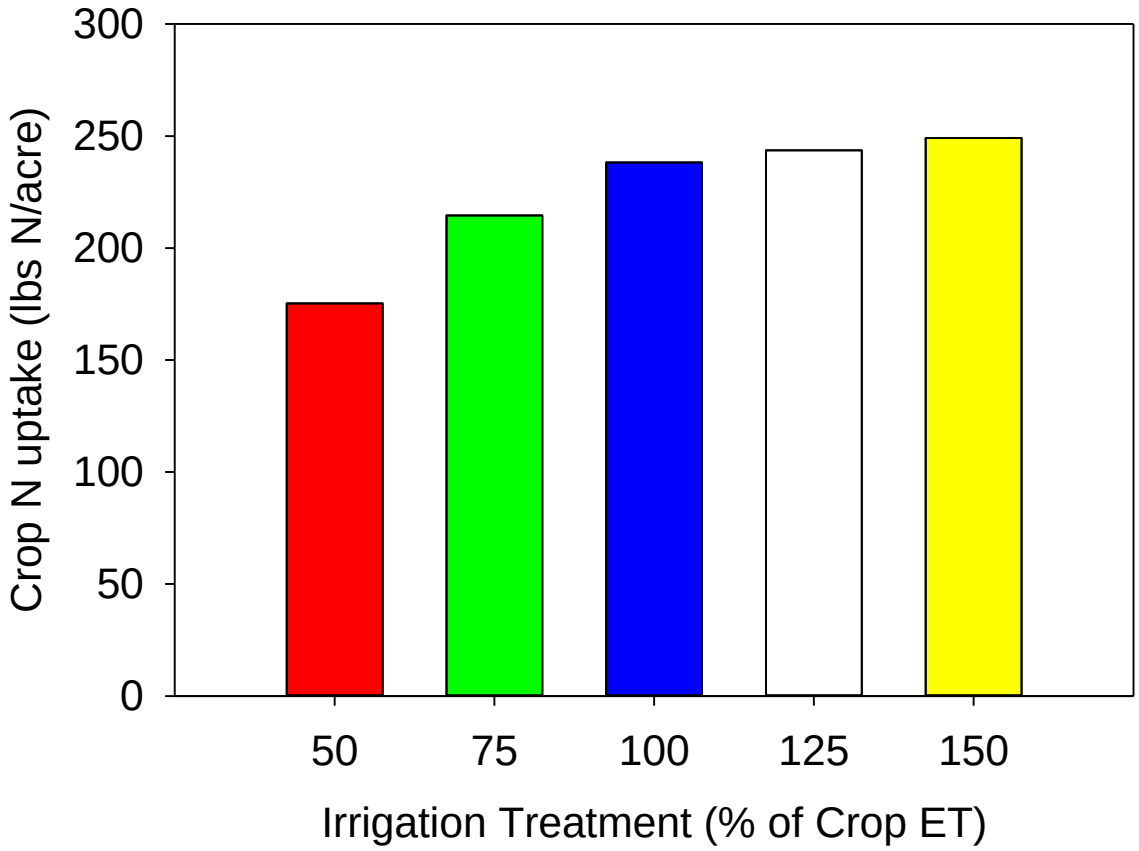


Dry matter and N content of tissue decreased with higher water treatments



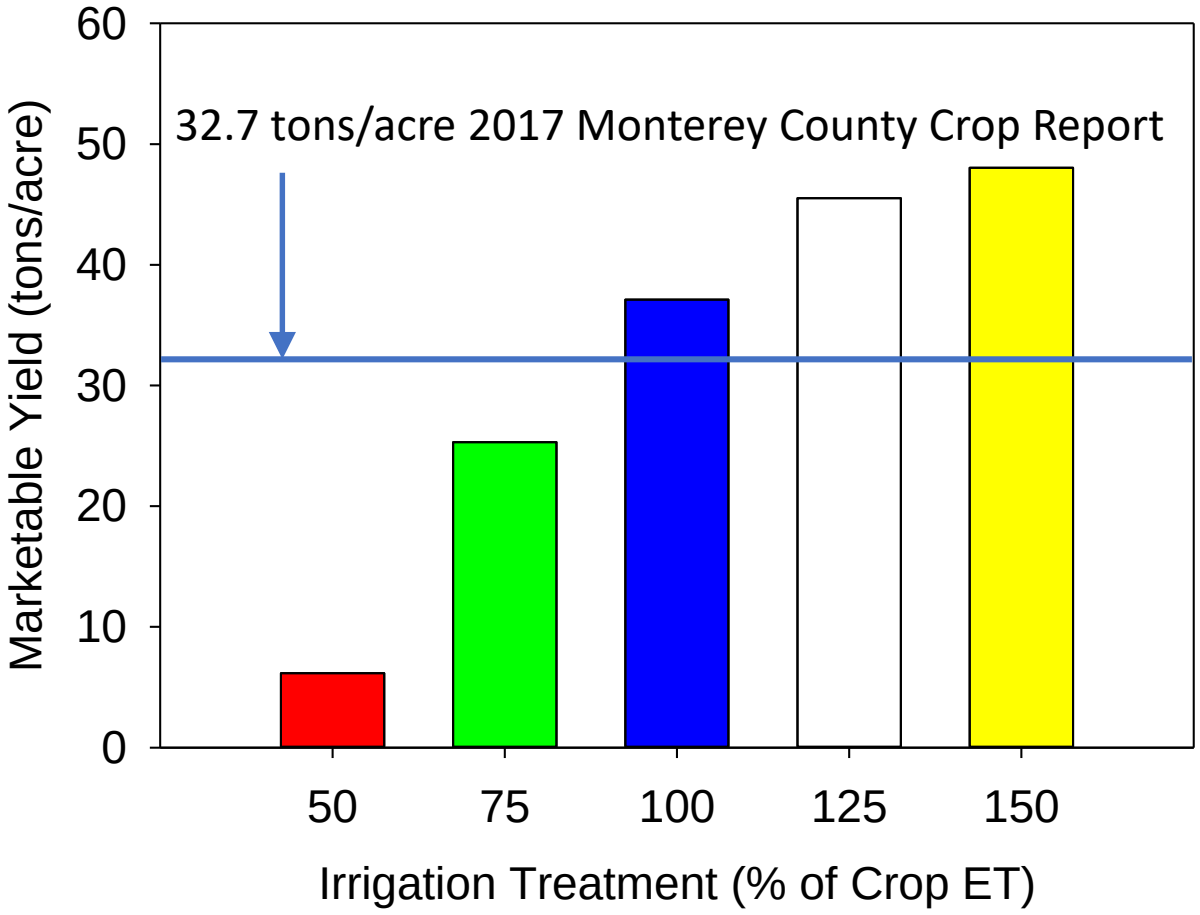


Crop N uptake of above ground biomass was similar for 100 – 150% ET treatments

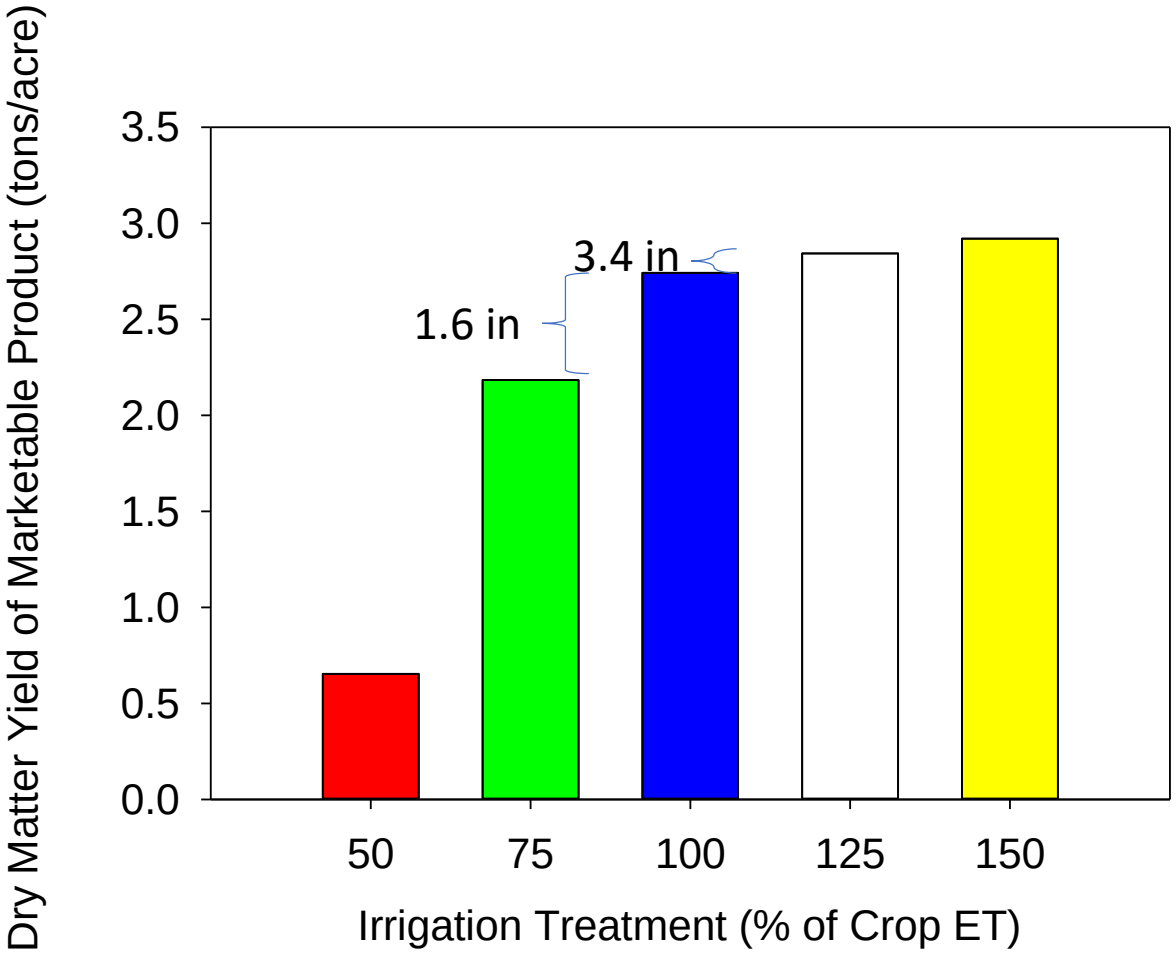


Commercial Harvest Evaluated on October 17 and 25

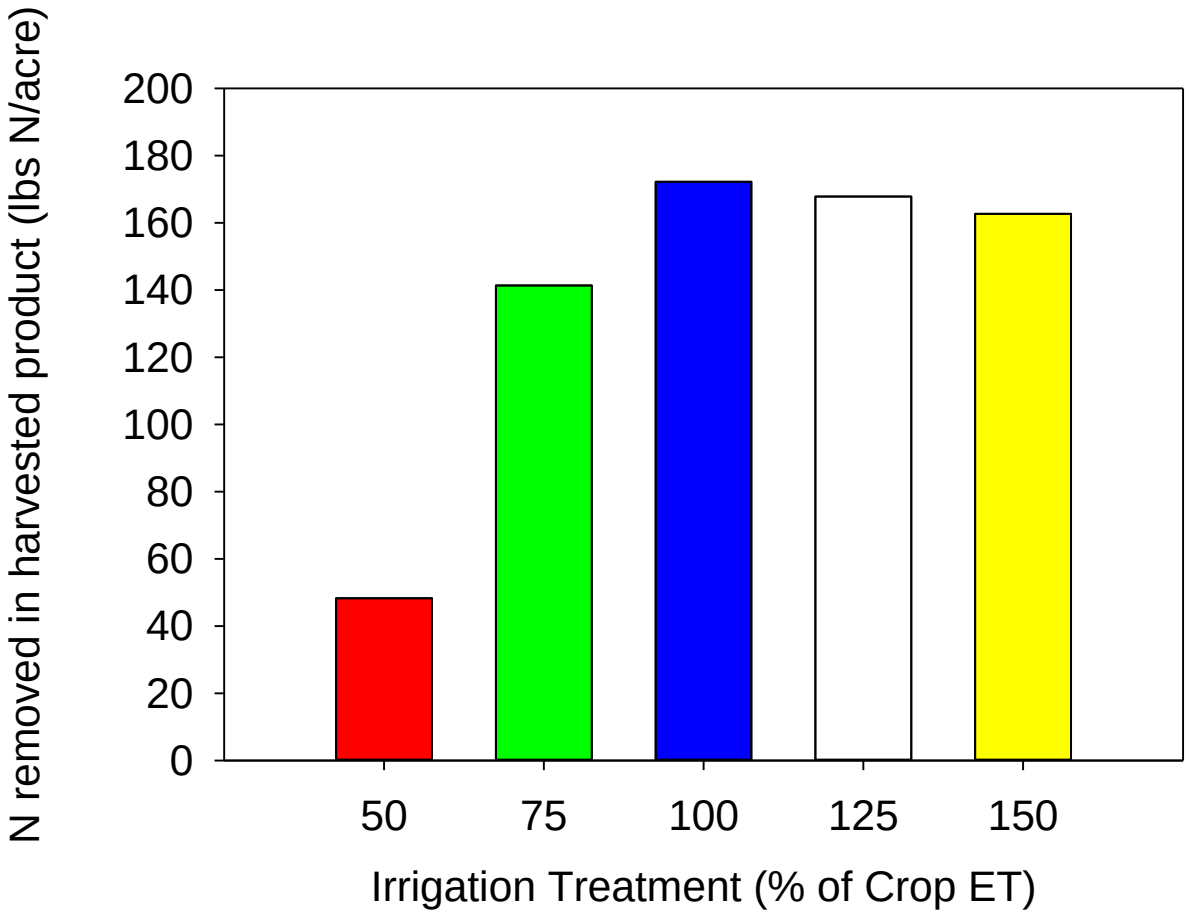
Marketable Yield for 2nd Harvest Evaluation (October 25)



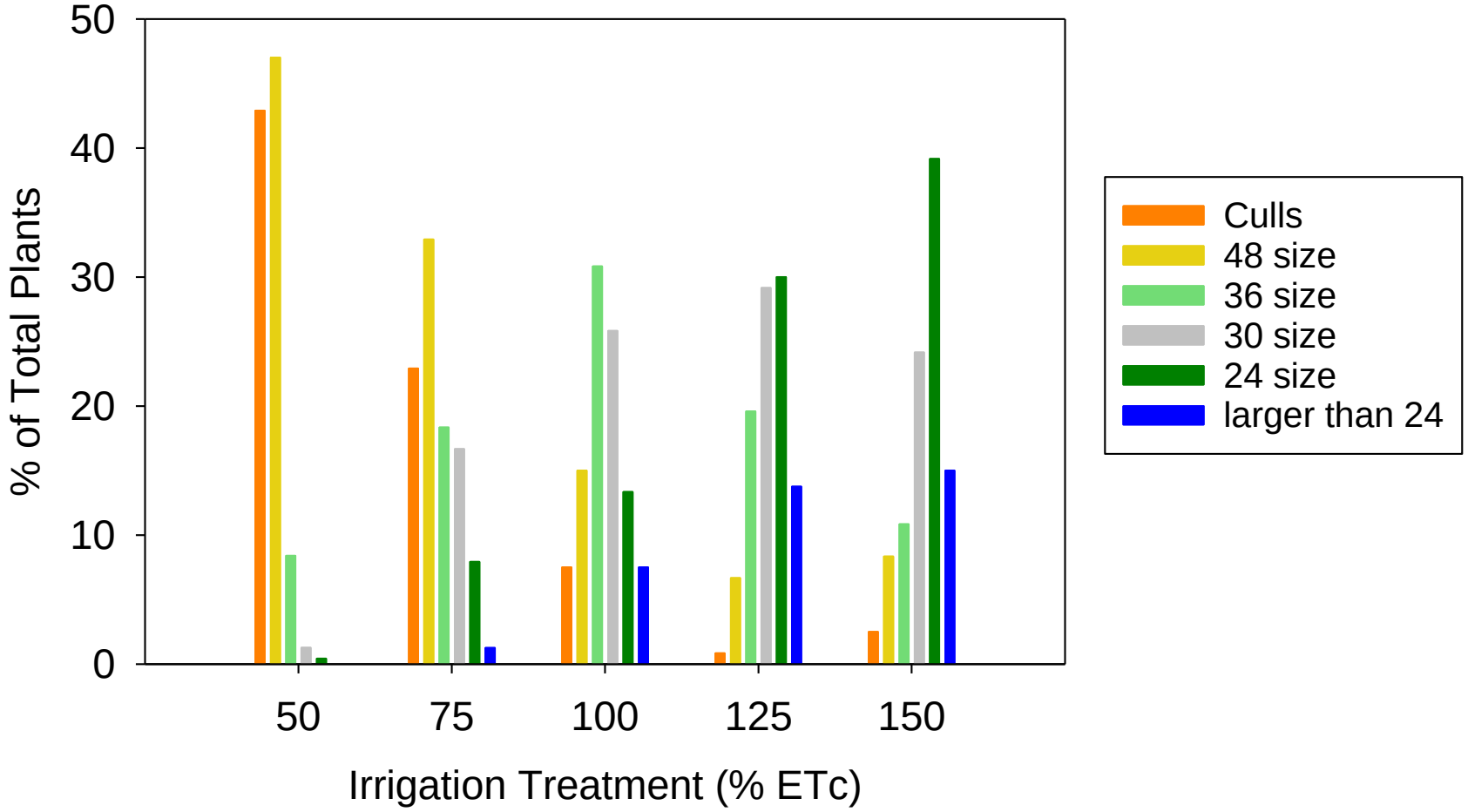
Dry Matter Yield for 2nd Harvest Evaluation (October 25)



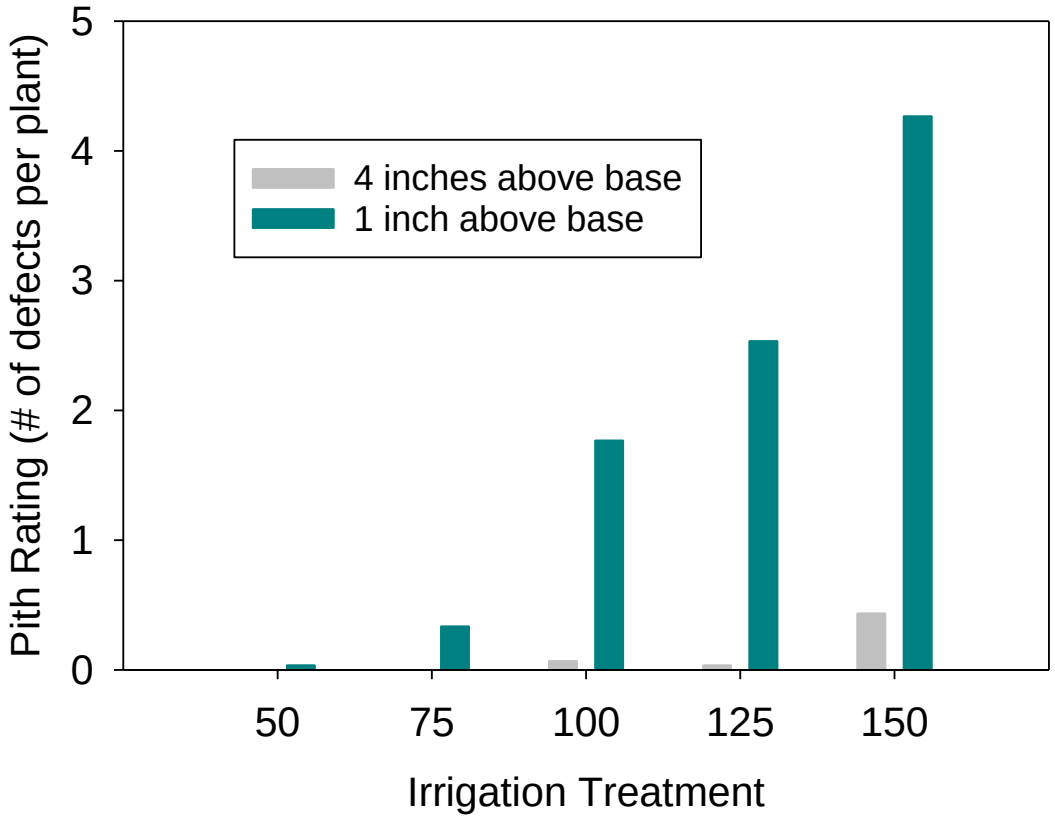
N removed at harvest was also similar for 100-150% ET treatments



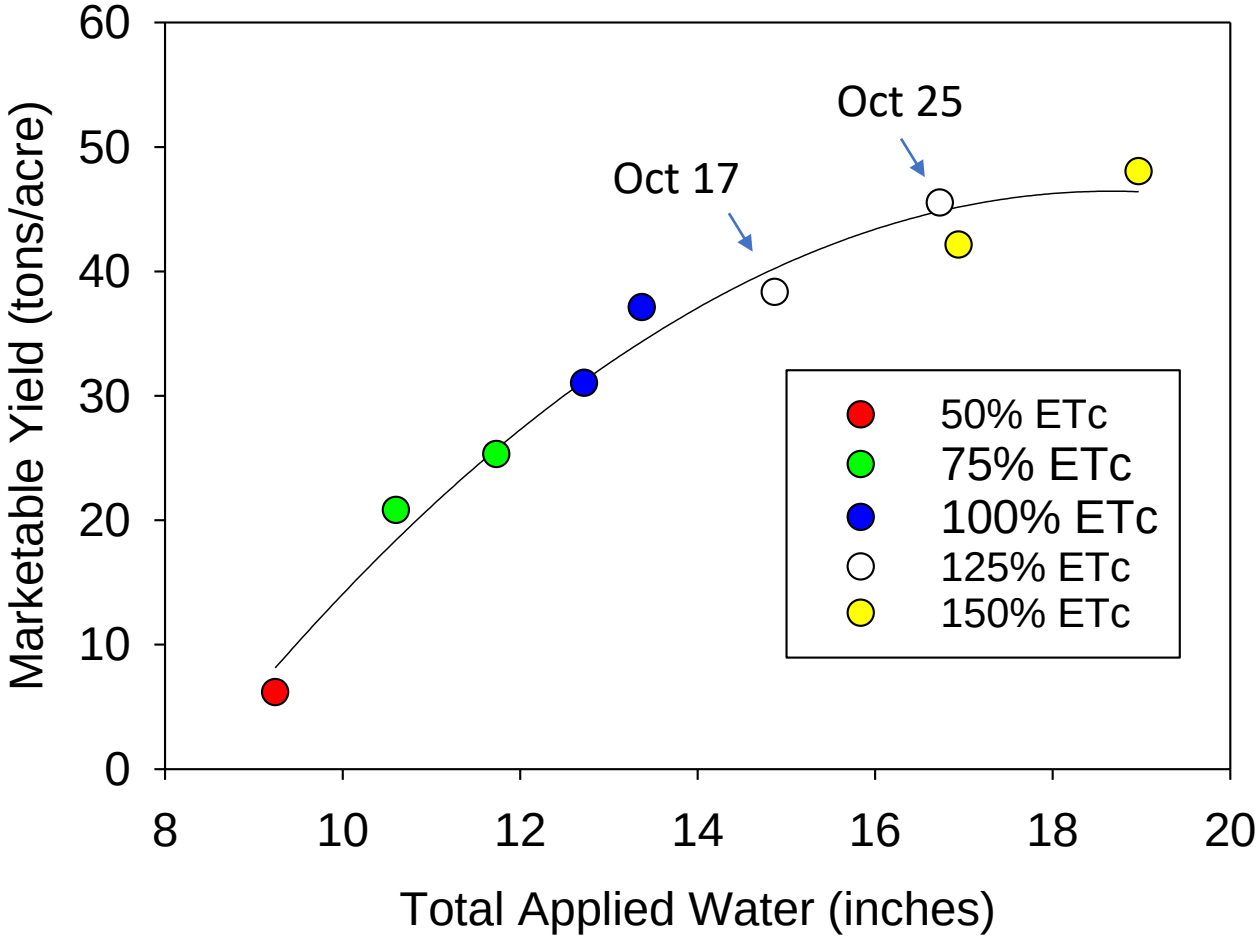
Plant size increased with higher water rates



Pith break-down increased in higher water treatments
(2nd harvest, October 25)



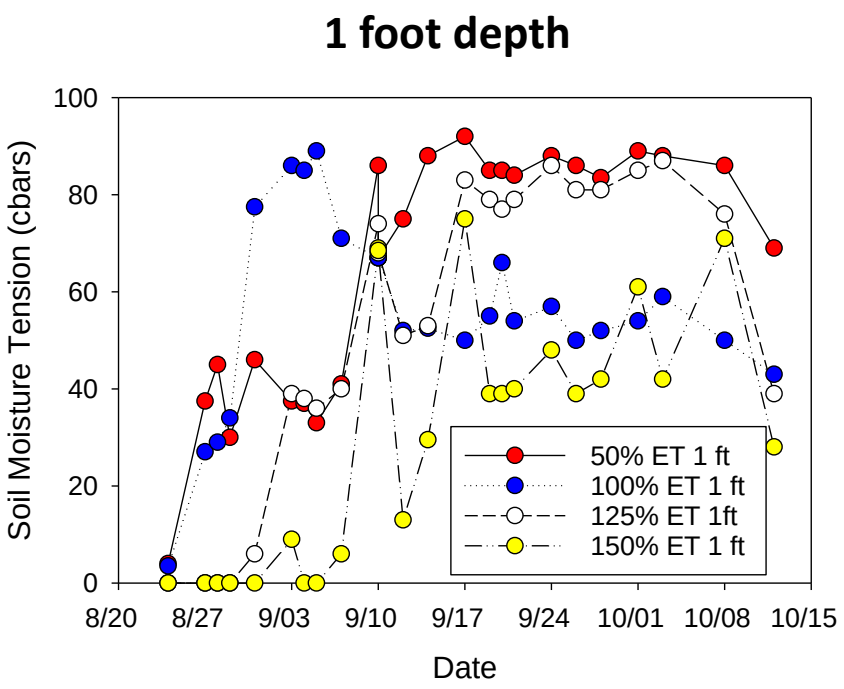
Marketable yield reached a plateau beyond 17 inches of total applied water

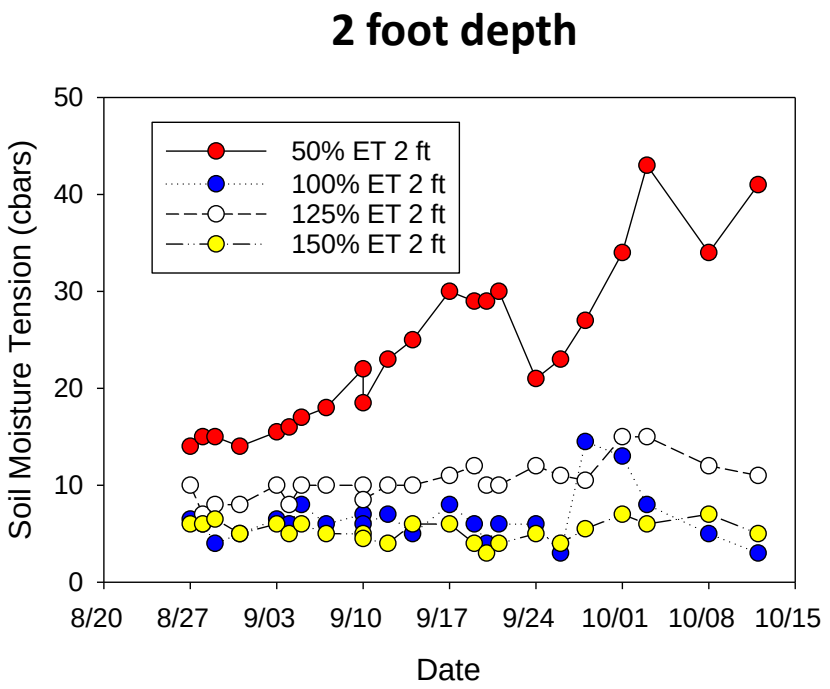


Soil moisture monitored with tensiometers

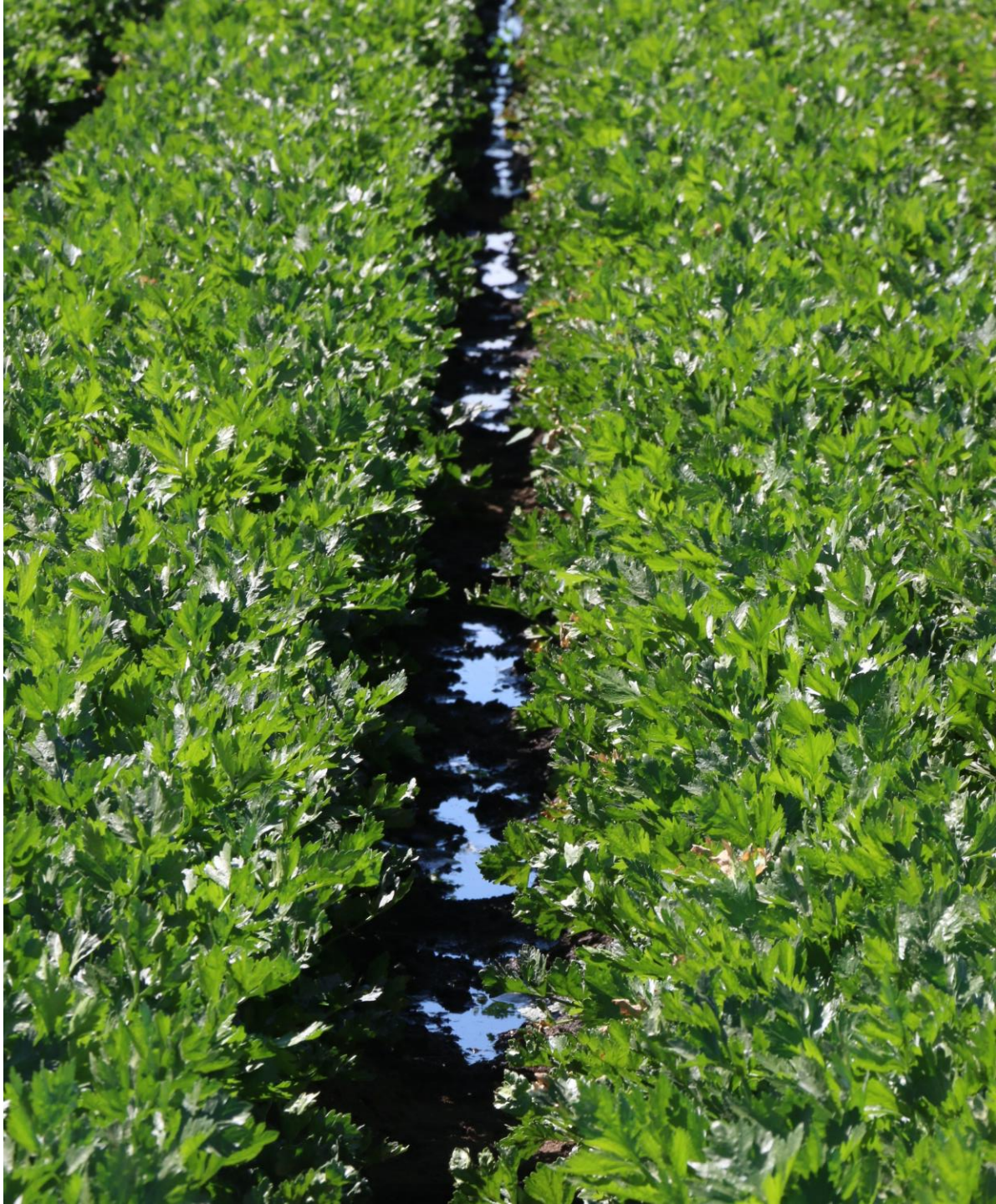
Difficult to keep 1 foot depth moist

Drier





Water did not penetrate soil in high ET treatments



Observation: Variability in plant size appeared to be related to uneven soil moisture

- Soil moisture was distributed unevenly across the bed
- Drip tape was not consistently in the center of the bed and drip applied water often ponded on soil surface and flowed into the furrows.
- Plants in rows closer to drip tape were larger than plants in rows further than the tape.
- Plants near wet furrows were larger than near dry furrows

Possible solutions:

- Use lower flow rate drip tape (< 0.5 gpm/100 ft)
- Place drip tape in a groove in the center of the bed or 1 to 2 inches below the soil surface
- Add gypsum to the water or soil surface

Preliminary Recommendations and Findings

- **Yield and quality of celery can be optimized with drip irrigation**
- **16 to 17 inches of applied water maximized yield and quality (125% ETc)**
- **Higher than county average yield was achieved with 13.5 inches (100% ETc)**
- **Need to irrigate frequently to avoid moisture stress in sandy textured soils**
- **Drip tape needs to be optimized to provide even soil moisture distribution across the beds**
- **Trial will be repeated in 2019**