Efficiency of Alternate Furrow Irrigation Is It an Alternative?

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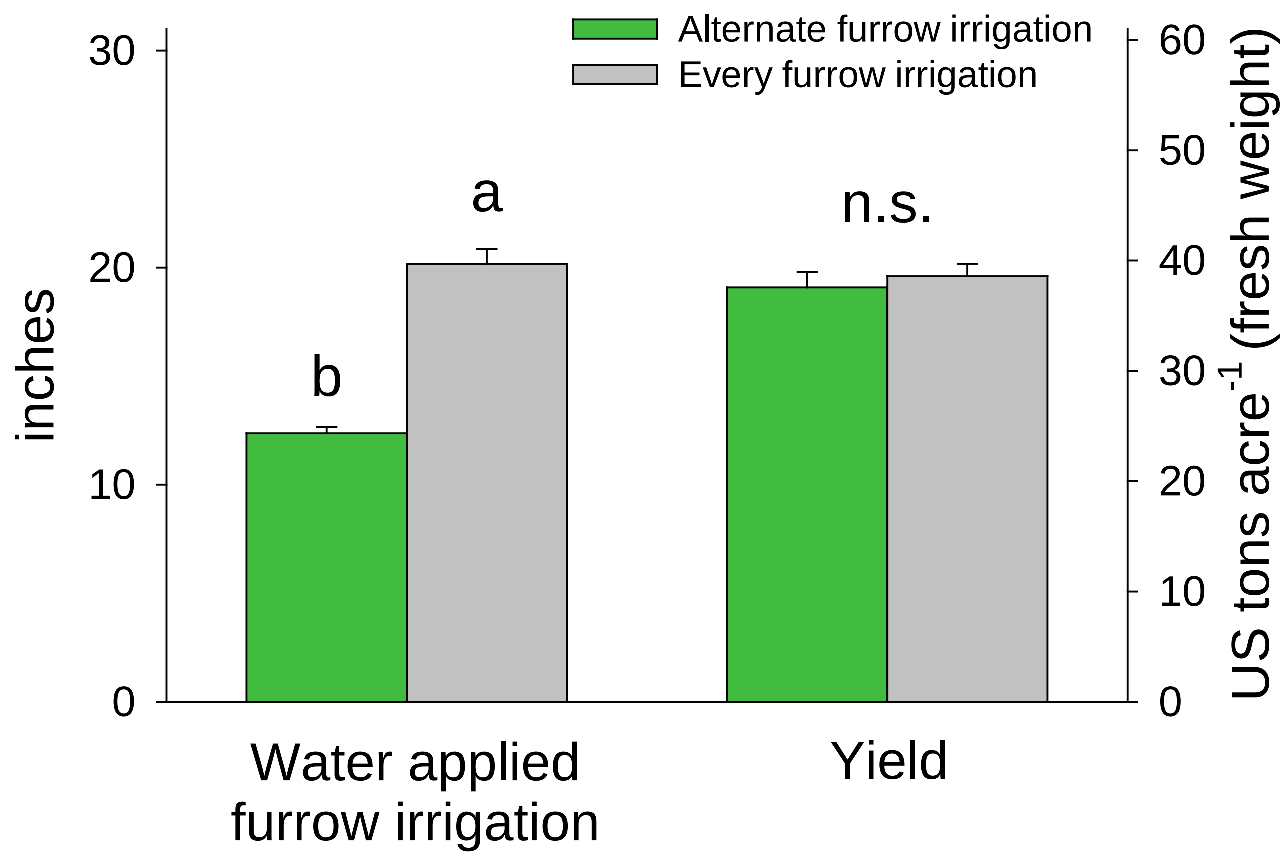
Summary of Results for 4 Field Trials in 2011



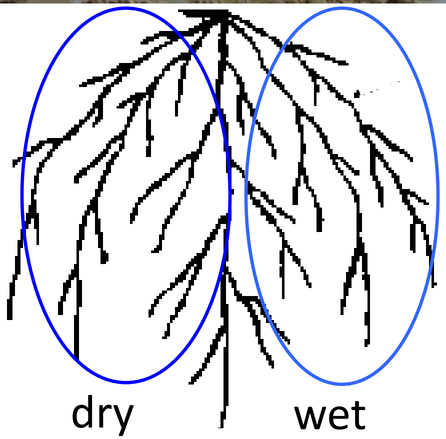
On average for the 4 field trials for processing tomatoes:

- No yield difference
- Applied water was reduced by 30%

Alternate Furrow Irrigation: the Basics

Partial root drying = Alternate furrow irrigation
Technique = Practice

- Watering only half of the root system at each irrigation event
- Managing to maintain yields with a reduction in applied water
- Root to shoot signaling and tighter control of transpiration
- Increase crop water use efficiency (yield / applied water), especially in dry years



Can furrow-irrigated processing tomatoes be managed with less water?

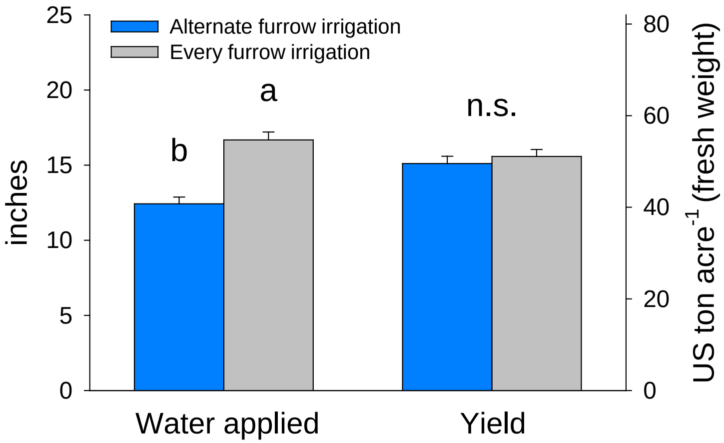
Research Station and On-Farm Experiments

– Two irrigation treatments:
  Alternate furrow (**AFI**) vs. Every furrow (**EFI**)
  - Managed by the 'irrigators'
  - No input from the research team on irrigation

– 2010 Research trial: cv. AB2 and CXD255
– 4 on-farm trials in 2011: cv. Shasta

Experimental design
- Irrigation strips of 6 beds each
  - 2010: 2 AFI strips and 2 EFI strips (4 total)
  - 2011: 3 AFI strips and 3 EFI strips (6 total) per field

Year 2010



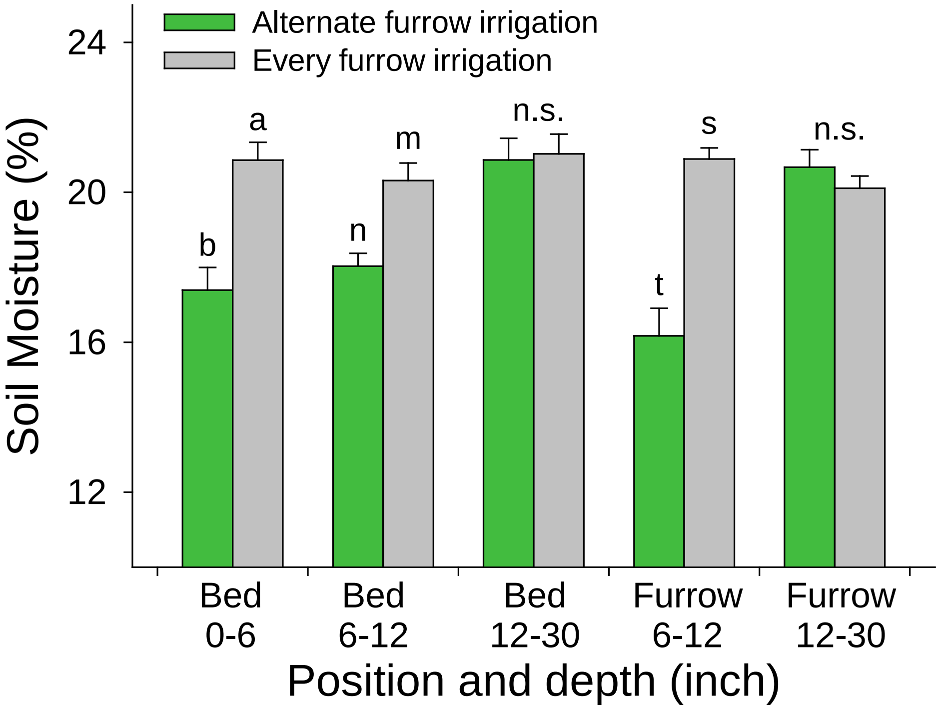
Soil types:
- Reiff very fine sandy loam (13% clay, 63% sand)
- Yolo silt loam (21% clay, 11% sand)
- Sycamore silty clay loam (30% clay, 7% sand)

Field Conditions and Measurements

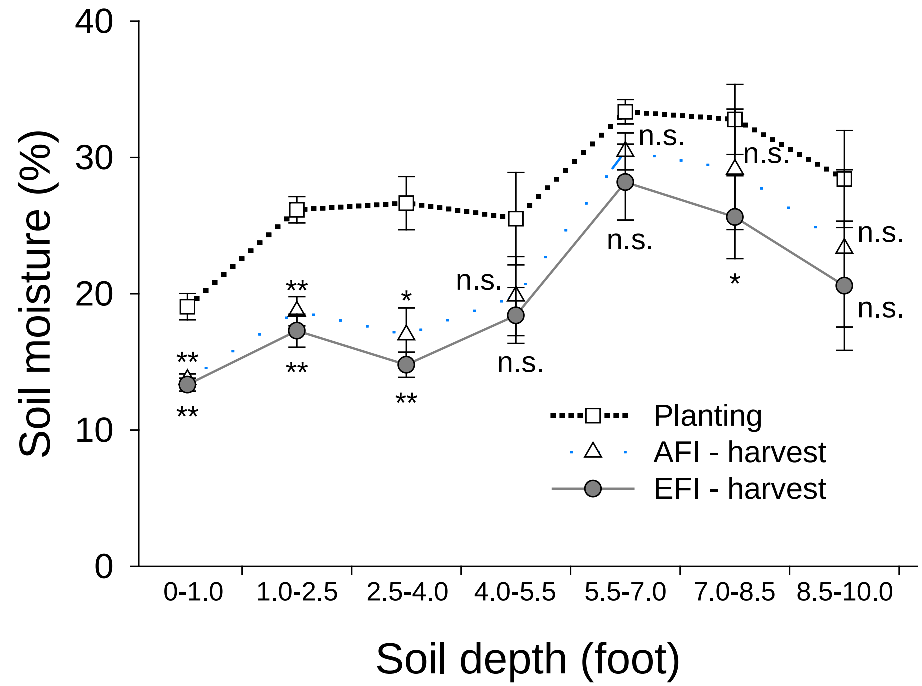
	Year	
	2010	2011
Number of trials	1	4
Field area (acres)	~1	~60
Furrow irrigations	10	6
Planting date	18-May	4-Apr
Harvest	21-Sep	1-Aug
Mean max temp. (°F)	85	78
Mean min temp. (°F)	53	50
Precipitation (inches)	0.4	2.5
Cumulative Et_o	31	27

- Plant measurements:
  - Canopy growth
  - Biomass and fruit quality
  - Leaf gas exchange measurements (net photosynthesis, transpiration)
  - ^{13}C stable isotope as a indirect measure of WUE from shoots and leaves
- Field-soil measurements
  - Irrigation estimates
  - Soil moisture – including 8 or 10 ft deep sampling at planting and harvest

Soil Moisture, Research Station (2010)



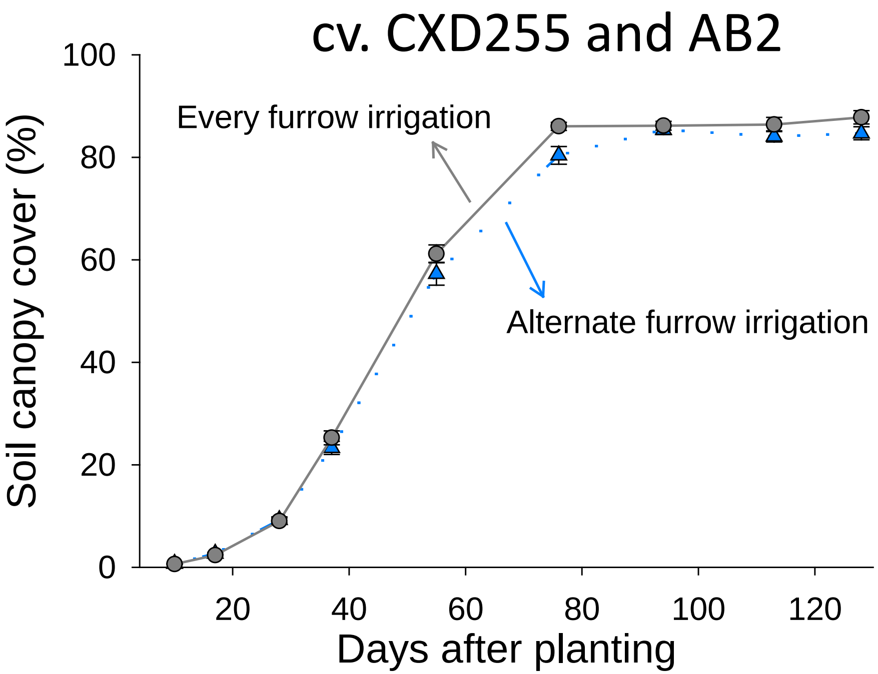
65 days after transplanting



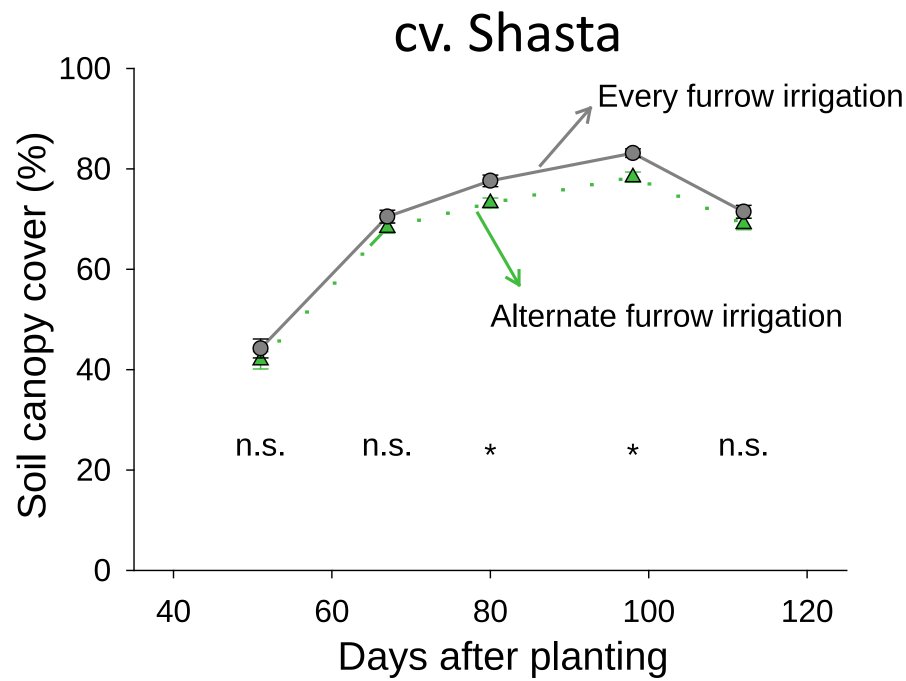
Soil type: Reiff very fine sandy loam

- Soil moisture content was lower with alternate furrow irrigation in the top 30 cm at mid-season (65 days after planting)
- Soil moisture to a depth of 10 feet was similar at harvest

Plant Growth, Years 1 & 2

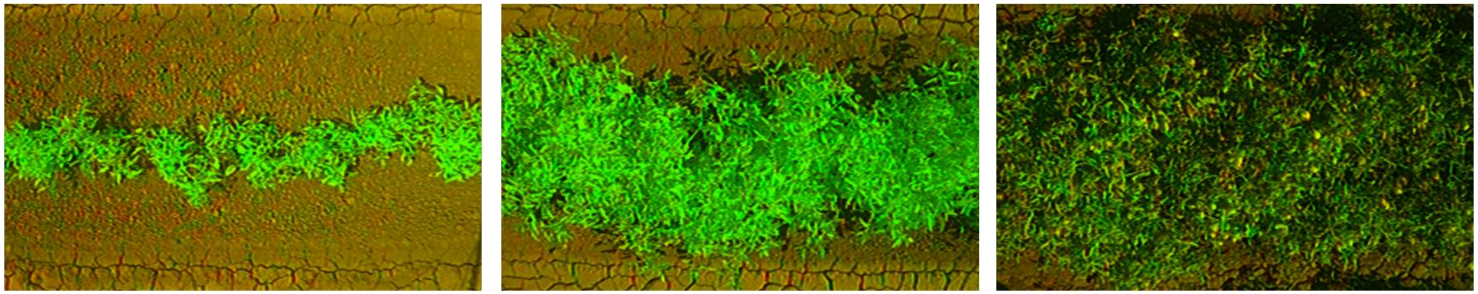


2010 (research station)



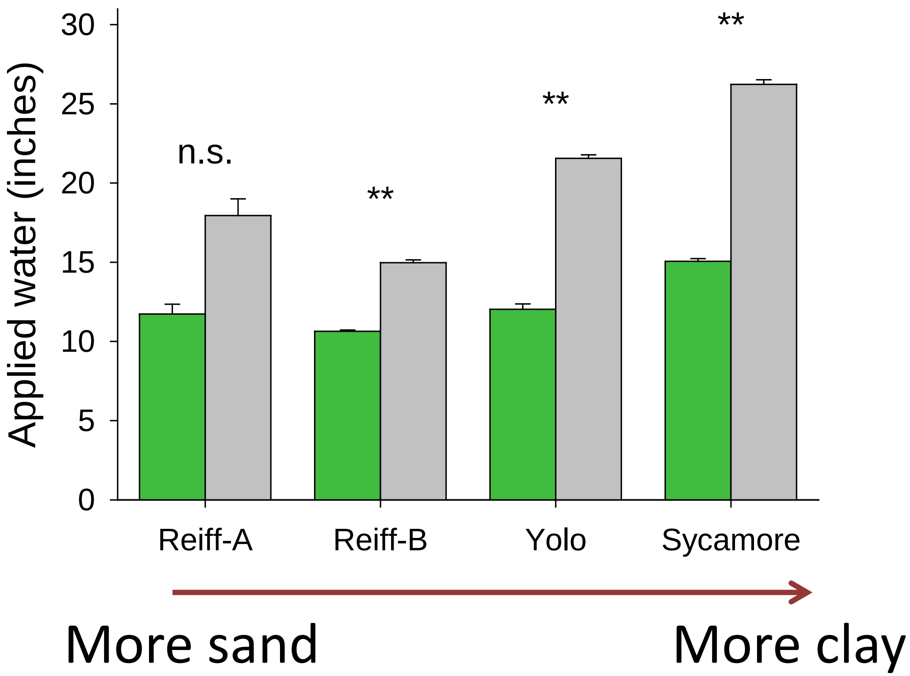
2011 (4 on-farm trials)

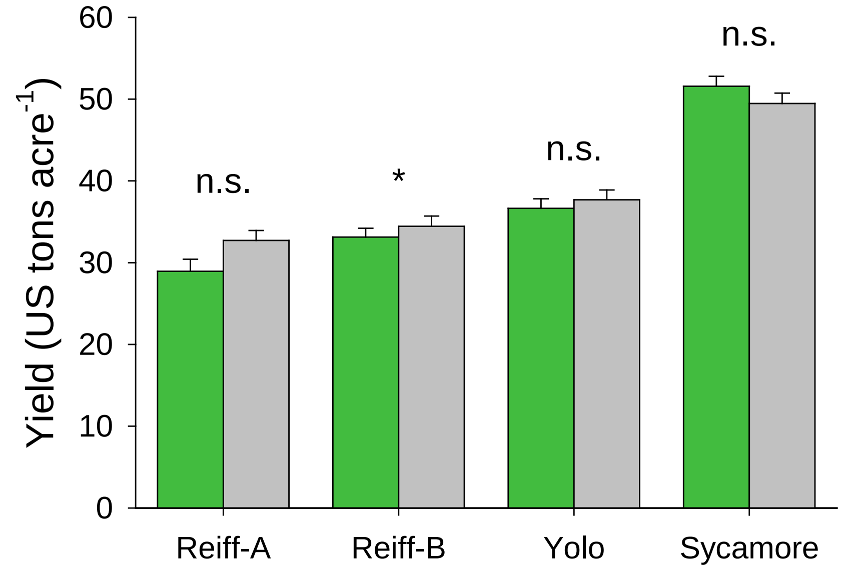
- Similar canopy growth with both types of irrigation. Slight decrease with alternate furrow irrigation on two dates in 2011

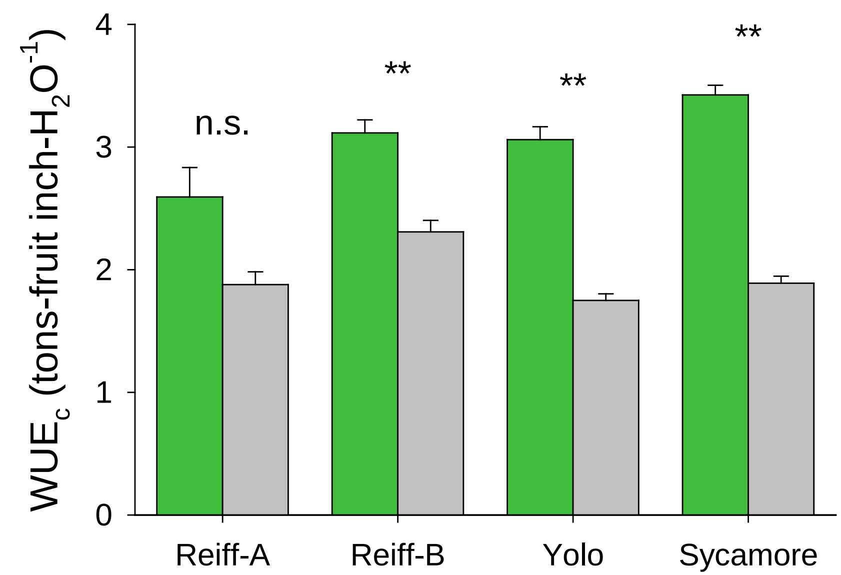


Irrigation and Crop Performance, On-Farm Trials

Alternate furrow irrigation   Every furrow irrigation

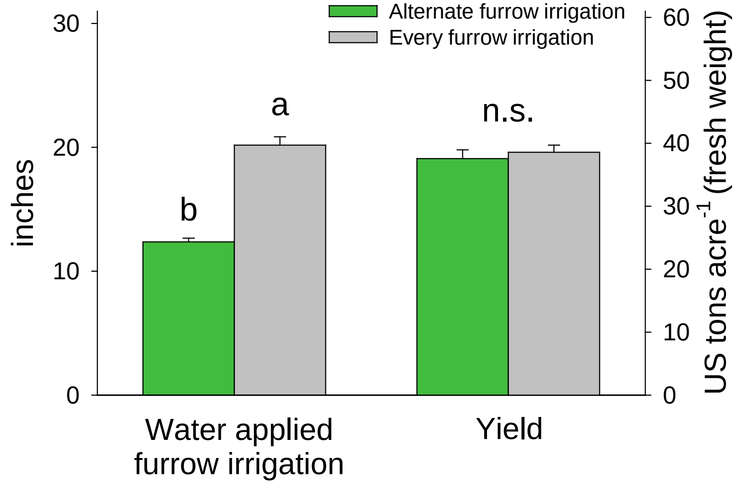






- AFI had less water applied
- Yields were similar
- Crop WUE increased in AFI
- Responsive root growth?

Is Alternate Furrow Irrigation an Alternative?



Summary:

- Plant canopy unaffected; physiological water use was regulated efficiently
- No yield differences even in commercial fields
- Alternate furrow irrigation reduced applied water by 30%
- Crop WUE was >35% higher in AFI
- Facilitate a quick adaptation to dry years without capital investment in technology such as drip

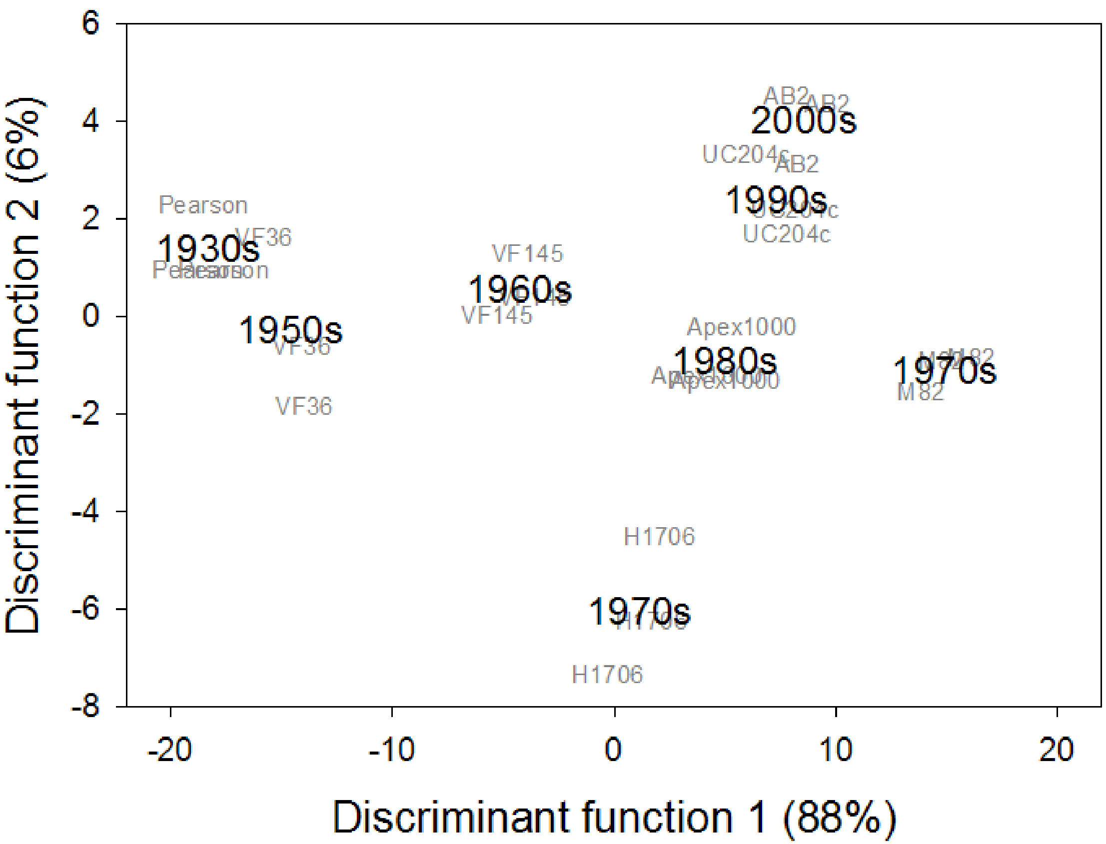
Hypothesis:

Responsive root growth + tight transpiration regulation maintains crop water balance and C assimilation with less water resources

Future direction:

Understand how crop physiological traits fit new management strategies if water availability decreases in the future (drip and furrow irrigation)

Suite of Traits and Tomato Cultivar Evolution



Most important suite of traits to describe differences:

- Early flowering
- Low vegetative biomass
- Concentrated fruit set and ripening
- High N concentration in aboveground biomass
- Lower intrinsic WUE (P_n/g_s)
- Smaller canopies

Approach:

- Original data composed of 95 variables related to morphological, physiological and phenological traits from 8 cultivars
- Multivariate analyses: PCA and stepwise discriminant analysis

Barrios-Masias and Jackson, submitted

Quick Survey: Share Your Knowledge

1) In your experience, which cultivars (old or new) have performed best during heat waves or drought?

Cultivar name	Heatwave	Drought
-		
-		
-		
-		

2) How did these cultivars stand out?

	Cultivar name
Prolific flowering	
Good heat set	
High yield	
Fruit quality	
Other	

3) After a dry winter, would you be willing to use an old cultivar if it performed well under drought or heat waves? Please list cultivars.

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4) What other stress-related traits among your currently best performing cultivars would you most like to see improved (other than disease or pest resistance)?

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Thank you for listening

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