Potential of Soil Health Building Management Strategies to Improve Resilience and Sustainability of Organic Processing Tomato in California

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Soil Health as a Mechanism for Resilience

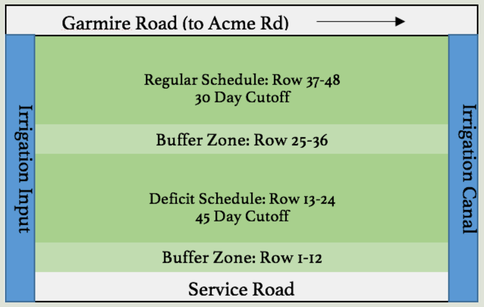
- The current **drought** has dramatically decreased irrigation water allocated to organic tomato growers. There is an urgent need to test new irrigation strategies that reduce water inputs while maintaining product quality, nutrient supply and high productivity levels.

- AIM: develop integrated irrigation practices **that capitalize on soil health to improve efficiency of irrigation water** and resiliency of California organic processing tomato

- **We conducted on-farm research to**

(1) Measure the potential of soil health building management strategies to decrease irrigation water inputs.
(2) Develop BMP that maximize water use efficiency, disease and weed suppression, N retention and tomato quality.

Materials and Methods



Plant and soil samples were taken at regular intervals during the growing season:

1. Soil samples at 0-10cm and 10-30cm
   - KCl extractable NH4 and NO3
   - Soil Microbial Activity (FDA)
2. Plant development and yield
   - Harvest Index and Yield
   - NDVI
   - Processing quality
   - Nutritional content

- Data analysis done in R with Wilcoxon signed rank test.

- Processing tomato field planted in Spring 2016
- Silty Clay Loam: Total C (1.45%), OM (3.2%), Total N (101 ppm), P (74.1 ppm), CEC (21.2 meq/100g), pH (6.4)
- 2 irrigation treatments were applied
  - **Regular irrigation** cutoff 30 days before harvest
  - **Deficit irrigation** cutoff 45 days before harvest
- Soil health building practices: 4.4T of 3% compost, 0.6 tons of gypsum, 1 gal EM1, 1 lB seaweed pre-plant

Year	Management History
2016	Tomato
2015	Cover Crop to Beans
2014	Cover Crop to Melon/Squash
2013	Tomato
2012	Fall Legume to Peas
2011	Cover Crop to Rice

Results

Table 1: YIELD AND WATER USE EFFICIENCY

Treatment	Yield Tons per Acre	Harvest Index	WUE (T/acre feet)
Deficit	62.00	0.844	27.17
Regular	62.69	0.849	22.01
p-Value	1	0.7	–

Table 2: NUTRITIONAL QUALITY

Treatment	Glucose %	Fructose %	Dry Matter %	Vitamin C ppm	Beta-Carotene ppm	Total Phenols mg GAE/g
Deficit	24.7	27.2	5.8	5591	48.5	6.08
Regular	24.1	25.7	5.8	5552	48.9	5.83
p-Value	0.4	0.2	1	1	0.8857	0.8857

Figure 1: CANOPY SENESCENCE - NDVI

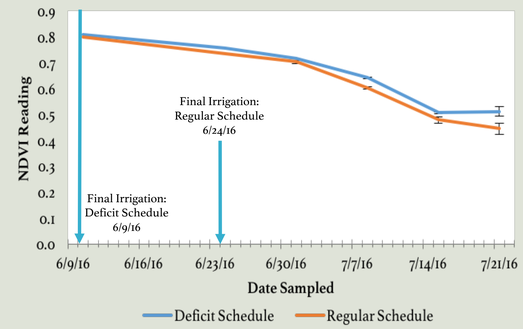
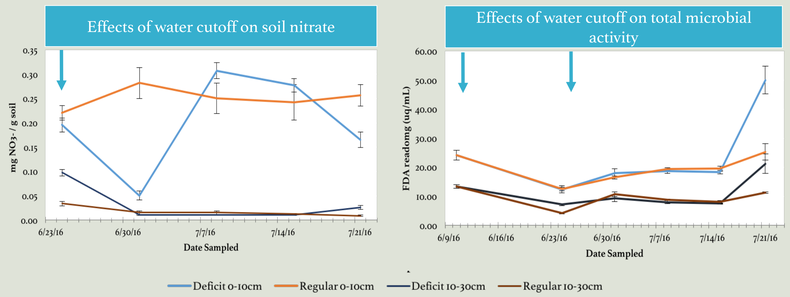


Figure 2: N MINERALIZATION & MICROBIAL ACTIVITY



Results

PLANT GROWTH, YIELD, AND WUE

- ✓ The deficit irrigation implemented saved 0.5 ac/feet of irrigation water and increased WUE by 19% with no significant effect on yield and plant development
- ✓ Despite its potential to decrease pest pressure, deficit irrigation had no effects on canopy health and weed counts (data not shown).

TOMATO QUALITY

- ✓ We observed no reduction in nutritional value and a trend toward higher phenols.

SOIL N AND MICROBIAL ACTIVITY

- ✓ Mineralization dynamics of organic inputs was different between the two irrigation schedule in shallow soil with a sharp decrease after irrigation stops in deficit conditions.
- ✓ This was not explained by decrease in microbial activity which remained constant.
- ✓ Microbial activity increased sharply at the end of the growing season in deficit irrigated rows which could explain the observed reductions in nitrate.

Conclusions

- **Smart irrigation strategies** can be optimized for shifts in soil properties and water uptake dynamic with adoption of soil-health building management strategies on organic farms in Northern California.
- Comparison with marginal/degraded soils and potential to **reduce leaching** and **weed pressure** remain to be measured
- Practices developed will assist organic tomato growers dynamically **cope with irrigation water shortages and increasingly stringent N regulations without hampering the quality of their harvested product.**

Acknowledgments and References

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