Water use efficiency for fruit quality, ecosystem benefits and resilience in fresh market tomato production

Deficit Irrigation in Fresh Market Tomatoes

Scott Stoddard, UCCE Merced
Louise Jackson, UC Davis
Eli Carlisle, UC Davis
Janina Milkereit, UC Davis
Deficit irrigation guidelines have been developed for processing tomatoes (Hartz and Hanson, 2009).

No information for impacts on fresh market tomato production.

2013 - 15 serious drought.
Processing Tomatoes

40-06% deficit irrigation at 5-6 weeks before harvest.
The focus of these experiments will be to 1) examine effects of plant density and deficit irrigation management on the yield and fruit quality of mature green tomatoes; 2) monitor how the treatments affect insect, weed, and pathogen pressure in each system.
Scoto Bros.
Merced area
Early furrow irrigation

**Treatments:**
1. skip-row
2. skip-row 80
3. full irrigation

Transplant March 3, 2015
Treatments start April 25
Harvest June 12
Live Oak Farms
Le Grand area
mid-season drip irrigation

Treatments:
1. irrigate 7 days
2. irrigate 6-5 days/week
3. irrigate 5-4 days/week

Transplant May 20, 2015
Treatments start July 7
Harvest August 10
Merced College Farm
north Merced area
late drip irrigation

**Treatments:**
1. 100% of ETc
2. 80% of ETc
3. 60% of ETc
4. 40% of ETc

Transplant June 4, 2015
Treatments start July 20
Harvest Sept 10
2016 Trials:
Scoto Bros (furrow)
1. full irrigation
2. 3 rows on, 1 off (25% reduction)
3. 2 rows on, 1 off (33% reduction)

Live Oak Farms (drip)
1. full irrigation
2. 15% reduction (6 days/week)
3. 30% reduction (5 days/week)

Merced College (drip)
1. 100% ETc
2. 90% ETc
3. 80% ETc
4. 70% ETc

all locations begin ~ 42 DAT

2017 Trials:
Scoto Bros (furrow)
1. ——
2. ———
3. ———

Live Oak Farms (drip)
1. full irrigation
2. 15% reduction (6 days/week)
3. 30% reduction (5 days/week)

Merced College (drip)
1. 100% ETc
2. 90% ETc
3. 80% ETc
4. 70% ETc

all locations begin ~ 42 DAT
Results

Merced College Weekly Irrigation 2015

- Applied water, A-Inches
- Weeks

Weeks:
- 6/3/15
- 6/10/15
- 6/17/15
- 6/24/15
- 7/1/15
- 7/8/15
- 7/15/15
- 7/22/15
- 7/29/15
- 8/5/15
- 8/12/15
- 8/19/15
- 8/26/15
- 9/2/15
- 9/9/15

Applied water (%)
- 100% ETc
- 80% of ETc
- 60% of ETc
- 40% of ETc
- ETc

Graph showing breaks in water application percentages.
All deficit irrigation treatments significantly reduced yield
Red% and sunburn fruit increased in all deficit irrigation treatments.
Results 2016

Table 4. Yield and sunburn results at the Scoto Bros location (furrow irrigation) as affected by irrigation treatments, 2016.

<table>
<thead>
<tr>
<th>treatment</th>
<th>total yield lbs/plot</th>
<th>TMY lbs/plot</th>
<th>estimated boxes/A</th>
<th>% XL</th>
<th>% red</th>
<th>Culls (%)</th>
<th>Sunburn</th>
<th>Worms</th>
<th>other</th>
<th>BER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 full</td>
<td>67.1</td>
<td>46.7</td>
<td>1626.3</td>
<td>14.5%</td>
<td>6.9%</td>
<td>0.4%</td>
<td>0.5%</td>
<td>30.0%</td>
<td>1.1%</td>
<td></td>
</tr>
<tr>
<td>2 25% deficit</td>
<td>62.4</td>
<td>39.3</td>
<td>1370.8</td>
<td>20.3%</td>
<td>10.4%</td>
<td>2.0%</td>
<td>2.1%</td>
<td>26.7%</td>
<td>4.6%</td>
<td></td>
</tr>
<tr>
<td>3 33% deficit</td>
<td>56.3</td>
<td>35.6</td>
<td>1239.2</td>
<td>24.0%</td>
<td>9.3%</td>
<td>10.2%</td>
<td>1.3%</td>
<td>28.1%</td>
<td>6.1%</td>
<td></td>
</tr>
</tbody>
</table>
Live Oak 2016

Lbs/plot

- grower std (no reduction)
- 15% water deficit
- 30% water deficit

Categories: M, L, XL
Live Oak 2017

- 29% TMY yield loss

- 86%

- 80%
Deficit irrigation treatments in last 6 weeks of the season (42-84 DAT) significantly reduced yield in all years and locations.

S fruit, red%, and cull% all increased with deficit irrigation.
Processing tomatoes: 40-06% deficit irrigation at 5-6 weeks before harvest.

Irrigation treatments imposed at 45-80 DAT occur during rapid plant growth.
Thank you.

Joe Scoto
Bob Giampaoli
Beaver (Merced College)