Research update:
Soil fertility effects on processing tomato yield and fruit quality
Nutrient requirements for high-yield production:

Crop nutrient uptake estimates from various countries:

![Bar chart showing total nutrient accumulation (kg/ha) for California, Greece, Australia, and Brazil. The chart indicates the nutrient uptake of N, P, and K.](chart.png)
Nitrogen effects:
N rate trials in California (1998-99)

Average of 10 field trials:

- Fruit yield (MT/ha)
  - 0, 56, 112, 168, 224, 280 kg/ha

- Fruit soluble solids (° brix)
  - 0, 56, 112, 168, 224, 280 lb/acre
Why such flat response?
Residual soil NO$_3$-N variable, but substantial:

Top 60 cm of soil, 1998-99 California sidedress N trials
Excessive N fertilization is common:

2003-04 Australian data
Phosphorus effects:

✓ Yield response in soils up to approximately 20-25 PPM bicarbonate extractable P
✓ Petiole PO$_4$-P ‘sufficiency standards’ too high
✓ Fruit quality effects minimal

Mean of 4 California trials
Potassium effects:

- Soil K availability problematic in some production regions, not in others.
- K required for maximum yield may be different than K required for maximum quality.
Soil Mg suppresses K uptake:

1996-97 California field survey
K fertilizer response may vary depending on application technique and irrigation method:

<table>
<thead>
<tr>
<th>Soil K (PPM)</th>
<th>K application technique</th>
<th># of trials</th>
<th>Yield improvement</th>
<th>Yellow eye reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 150</td>
<td>Preplant or sidedress</td>
<td>7</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>&gt; 150</td>
<td>Preplant or sidedress</td>
<td>5</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>&gt; 150</td>
<td>Drip fertigated</td>
<td>4</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>
However, K fertilization does not increase soluble solids:
Soil test interpretation for potassium:
Response to K unlikely if all these conditions are met:

**Quantity:**
> 200 PPM exchangeable K

**Intensity:**
> 3% of base exchange (meq basis)

**Mg / K ratio:**
< 10:1
Micronutrient effects:

✓ No hard evidence of micronutrient effects under normal field conditions

California:
Large scale field surveys (> 100 fields) show no evidence of yield-limiting deficiencies or fruit quality effects for Ca, Mg, S, Zn, Mn, or Fe

Australia:
Small-scale field surveys in individual years show positive correlation between some micronutrient concentration in petiole sap and fruit brix; however, those associations do not hold up across years
Tissue sampling as a management tool?
In the California experience, petiole testing is:
- useful only to identify yield-limiting deficiency
- unreliable for precision fertilizer management
Factors other than soil nutrient availability can affect petiole nutrient concentration:

1998-99 California sidedress N trials
Water quality protection:
In summary:
- High-yield processing tomato production does not require exactly ‘balanced’ nutrient regimes
- The interpretation of current plant tissue tests requires additional research, and perhaps new techniques
- Large gains in yield or fruit quality are more likely to come from improvements in aspects of production other than fertilizer management
- Future fertilizer management research must include environmental protection