Strawberry nutrient management

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- Tom Bottoms
- Barry Farrara
- strawberry growers
2010 strawberry nutrient management projects:
- Survey of 26 ‘Albion’ fields in the Watsonville-Salinas and Santa Maria areas to revise tissue sampling nutrient standards
- Monitoring of irrigation and fertility practices in 14 additional fields in the Watsonville-Salinas area
Determination of nutrient uptake by strawberry:

- monthly whole plant samples from 2 local ‘Albion’ fields

- plant and fruit measured separately
Nutrient uptake by strawberry:

Plant N uptake (lb/acre)

Date

Mar 22
Apr 28
May 26
June 24
July 28
Aug 27
Mar 22
Apr 28
May 26
June 24
July 28
Aug 27

fruit

plant
Nutrient uptake by strawberry:

- N uptake averaged about 1 lb / acre / day from April through August
- Uptake would be slightly higher in field with better yield or higher plant population
Nutrients in strawberry fruit:
Each ton of fruit contains approximately:
- 2.5 lb N
- 4.0 lb K
- 0.6 lb P

In a 30 ton/acre average yield, with a 15% cull rate, that equals:
- 90 lb N
- 140 lb K
- 20 lb P
By early October, seasonal crop nutrient uptake would be:

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>P</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant</td>
<td>100</td>
<td>20</td>
<td>90</td>
</tr>
<tr>
<td>Fruit</td>
<td>90</td>
<td>20</td>
<td>140</td>
</tr>
<tr>
<td>Total</td>
<td>190</td>
<td>40</td>
<td>230</td>
</tr>
</tbody>
</table>

Daily uptake (lb/acre) during active growth is approximately:
- 1 to 1.2 lb N
- 1.1 to 1.3 lb K
- 0.2 lb P
Preplant fertilization:

- be sure why you are applying preplant fertilizer
- choose a fertilizer that fits your need
Strawberry fields tend to have high soil P and K availability:

- **Olsen P (PPM)**
  - Fields 1 to 29 show varying levels of Olsen P, with peaks indicating high availability.

- **Exchangeable K (PPM)**
  - Fields 1 to 29 show varying levels of Exchangeable K, with peaks indicating high availability.

Crop response threshold is indicated by the horizontal lines in the graphs.
Winter nutrient uptake is slow!
Fields coming out of vegetables tend to have high residual soil nitrate:

- 2010 pre-fertilization sampling of new strawberry fields

<table>
<thead>
<tr>
<th>Field</th>
<th>Previous crop</th>
<th>Soil NO$_3$-N (lb/acre in top foot)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>vegetables</td>
<td>80</td>
</tr>
<tr>
<td>2</td>
<td>vegetables</td>
<td>75</td>
</tr>
<tr>
<td>3</td>
<td>vegetables</td>
<td>80</td>
</tr>
<tr>
<td>4</td>
<td>vegetables</td>
<td>95</td>
</tr>
<tr>
<td>5</td>
<td>vegetables</td>
<td>95</td>
</tr>
<tr>
<td>6</td>
<td>vegetables</td>
<td>160</td>
</tr>
<tr>
<td>7</td>
<td>vegetables</td>
<td>140</td>
</tr>
<tr>
<td>8</td>
<td>vegetables</td>
<td>195</td>
</tr>
<tr>
<td>9</td>
<td>strawberry</td>
<td>10</td>
</tr>
</tbody>
</table>
How fast does Controlled Release Fertilizer (CRF) release N?
- product ratings are typically 6-9 month release
- release somewhat slower in cool winter months, but substantial release still occurs

By early January about 25% of CRF already released
So, is fall-applied Controlled Release Fertilizer a good idea?

- P and K may or may not be necessary
- Immediately available N is unlikely to be needed
- A moderate amount of CRF nitrogen provides insurance in case of nitrate loss during crown establishment, or winter rain
- A high rate of CRF will be inefficient, especially in a wet winter
What is a reasonable N fertigation approach?

- Crop uptake is about 1 lb N/acre/day
- N can come from:
  - controlled release fertilizer
  - irrigation water NO₃-N
  - mineralization of soil organic N
  - fertigated N
Controlled Release Fertilizer:
- diminishing contribution after April or May

Irrigation water NO$_3$-N:
- water @ 10 PPM delivers about 30 lb N/acre over the season
- water @ 20 PPM delivers about 60 lb N/acre over the season
How do growers manage N fertilization?

2009-10 Watsonville-Salinas fields
How does N fertilization rate affect yield?

![Graph showing the effect of N fertilization rate on yield.](image)

- **Relative yield (%)**
- **N fertilization rate (lb/acre)**

- **Data points**
  - Green diamonds: Preplant N
  - Red squares: Total N

The graph illustrates the relationship between N fertilization rate and relative yield, with data points indicating varying responses at different rates.
Tissue analysis:
### 2010 ‘Albion’ leaf nutrient concentration at midseason:

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Critical value (UC Pub. 4098)</th>
<th>2010 field average</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Nitrogen</td>
<td>2.80</td>
<td>2.66</td>
</tr>
<tr>
<td>% Phosphorus</td>
<td>0.10</td>
<td>0.36</td>
</tr>
<tr>
<td>% Potassium</td>
<td>1.00</td>
<td>1.57</td>
</tr>
<tr>
<td>% Calcium</td>
<td>0.30</td>
<td>1.40</td>
</tr>
<tr>
<td>% Magnesium</td>
<td>0.20</td>
<td>0.34</td>
</tr>
<tr>
<td>PPM Zinc</td>
<td>20</td>
<td>18</td>
</tr>
<tr>
<td>PPM Manganese</td>
<td>30</td>
<td>245</td>
</tr>
<tr>
<td>PPM Iron</td>
<td>50</td>
<td>120</td>
</tr>
<tr>
<td>PPM Boron</td>
<td>25</td>
<td>58</td>
</tr>
<tr>
<td>PPM Copper</td>
<td>3.0</td>
<td>4.5</td>
</tr>
</tbody>
</table>
In summary ... 

- strawberry nutrient uptake pattern is clear, with seasonal N uptake around 200 lb/acre in high yield fields
- current preplant fertilization practices can be made more efficient
- moderate seasonal N rates appear to be sufficient for high yield production
- current leaf nutrient sufficiency guidelines need revision