Fertility management in organic strawberries
Organic P management:

- P in composted manure is at least 70% as available as synthetic P fertilizer.

- Using composted manure for N availability often results in excess P:
  - 5 dry tons/acre of poultry manure compost with 2% P = 200 lb P/acre
  - ≈ the equivalent of 325 lb of chemical P$_2$O$_5$/acre
  - ≈ 8 times the seasonal crop uptake.
Organically managed soils can be an environmental threat:

**Graph:**
- **Y-axis:** Soluble P in runoff (PPM)
- **X-axis:** Olsen P (PPM)
- **Legend:**
  - Conventional
  - Organic

**Data Points:**
- Conventional samples are represented by blue triangles.
- Organic samples are represented by green circles.

**Note:**
- Likely water quality target.

**Text:**
- 2002-04 laboratory study of coastal soils
How much N does a strawberry crop need, and when does it need it?

Salinas area organic strawberries, 4 year ave., 38,000 lb marketable fruit/acre

Data from J. Muramoto
In organic production plant-available N comes from:

- Soil organic matter
- Cover crops or other crop residue
- Compost
- Organic fertilizers
Soil organic matter:

Each 1% O.M. = 20,000 lb/acre in 6” of soil

≈ about 12,000 lb C
≈ about 1,300 lb organic N

During the growth season (March - August) at least 2 - 4 % of organic N should mineralize (become plant-available)

Example: soil with 1.5% organic matter

≈ 2,000 lb organic N in top 6 inches

if 2% mineralized = 40 lb N/acre from soil organic matter
Cover crops:

- If residue > 3% N:
  30 - 70% of N mineralized
- If residue < 2.5% N:
  ???

![Graph showing cumulative % N mineralized over months after incorporation]
Composts and manures:

- Nitrogen mineralization rates vary based on N content. Higher % N or lower C:N ratio increases N mineralization rate.

Mean of 4 materials of each type, all poultry-based:

% N = 2.5 - 3.5%, C/N ratio = 7 - 10
Organic fertilizers:
- High N waste products have rapid mineralization

Materials 11 - 16% N, C:N ratio < 4

Incubation at 68 °F in coastal organic field soil
How do preplant inputs match up with crop need?

Hypothetical field:
soil with 1.5% organic matter
Preplant input (per acre):
- 6 tons of poultry manure compost
- 500 lb feather meal
Fundamental problem:
How to keep available N in the root zone until crop uptake?

N can be lost through:
- Denitrification – loss is small unless soil is poorly drained clay
- Leaching from rain - can be significant even with plastic mulch
- Leaching from irrigation - often a major issue
2005-06 Watsonville organic strawberry trial:

<table>
<thead>
<tr>
<th></th>
<th>Soil inorganic N (lb/acre)</th>
<th>Crop N uptake (lb/acre)</th>
<th>Apparent N loss (lb/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov. 4 (planting)</td>
<td>160</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dec. 9</td>
<td>125</td>
<td></td>
<td>35</td>
</tr>
<tr>
<td>Jan. 30</td>
<td>35</td>
<td>5</td>
<td>85</td>
</tr>
<tr>
<td>March 10</td>
<td>15</td>
<td>15</td>
<td>10</td>
</tr>
</tbody>
</table>

**Bottom line:**

✓ Loss of > 100 lb available N / acre between planting and the beginning of rapid plant growth

Data from Muramoto et al.
Keys to efficient irrigation:

- Tie irrigation volume to environmental demand - use $\text{ET}_o$ and crop coefficients
- Adjust irrigation frequency to limit leaching
Limit individual irrigations:
< 0.5 inches for sandy soil
< 0.75 inches for clay soil

Root zone
In-season N fertilization may be necessary:

Issues:

- N availability
- Cost
- Compatibility with drip system
Liquid organic fertilizers:

Product A:

**Guaranteed Analysis**

6-2-0.5

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Nitrogen (N)</td>
<td>6.0%</td>
</tr>
<tr>
<td>4.0% Water Soluble Organic Nitrogen</td>
<td></td>
</tr>
<tr>
<td>2.0% Water Insoluble Organic Nitrogen</td>
<td></td>
</tr>
<tr>
<td>Available Phosphoric Acid ($P_2O_5$)</td>
<td>2.0%</td>
</tr>
<tr>
<td>Soluble Potash ($K_2O$)</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

Derived from feather meal and seabird guano.

Produce B:

**Guaranteed Analysis**

<table>
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<tr>
<th>Component</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Total Nitrogen (N)</td>
<td>6.0%</td>
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<tr>
<td>4.0% Ammoniacal Nitrogen</td>
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<tr>
<td>1.6% Water Soluble Organic Nitrogen</td>
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<tr>
<td>0.4% Water Insoluble Organic Nitrogen</td>
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<tr>
<td>Available Phosphoric Acid ($P_2O_5$)</td>
<td>2.0%</td>
</tr>
<tr>
<td>Soluble Potash ($K_2O$)</td>
<td>0.0%</td>
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</table>

**PRIMARY PLANT FOOD INGREDIENTS:**

Enzymatically digested meal from ocean going fish. Stabilized with sulfuric acid.
N availability from high-N liquid fertilizers:

- mineral N fraction immediately available
- about 50% of organic N available within 2 weeks
Planning N injections:

- match crop N uptake

From March through summer, crop N uptake ≈ 3 - 4 lb N / acre / week
Planning N injections:

- Soil NO$_3$-N ‘quick test’

Planning N injections:

- plant tissue analysis?
In summary:

- Limit high-P composted manure use to prevent soil P buildup
- Protect available soil N from loss with irrigation
- In-season application of injectable N fertilizers may be necessary, but requirements should be modest and predictable