Organic Nitrogen Management for High Tunnel Tomatoes

Cordelia Hall
Cornell Vegetable Program
NOFA-NY Winter Conference 2017
Intensive multi-farm high tunnel study
High tunnel soils develop issues

Phosphorus, calcium and pH build up over time & limit plants ability to take up other nutrients
Achieving optimal nitrogen levels in high tunnel tomatoes:

**Stage of growth:**
- **Vegetative:** 4% to 5%
- **Fruiting:** 3.5% to 4%

The goal is to provide sufficient nitrogen without increasing P, Ca, salts or pH OR excess nitrogen!

For high tunnel tomatoes, provide 125-150 pounds of nitrogen **per acre** per season.

For a typical 3,000 ft² (0.07 acre) high tunnel, this is roughly 9-11 pounds of nitrogen – less if you don’t count the aisles!
A worst case scenario

Nutrient level
Recommended level (veg.)
Recommended level (fruiting)
June 13th  
Fertility source: compost only  
June 30th
Nitrogen Management Strategy:

- 100% of N applied pre-plant with a slow release material (feather meal)
- No in-season response to falling N levels on foliar test results (intentional in this case).

Result: Nitrogen falls below optimal levels and never recovers. Yield suffers.
Nitrogen Management Strategy:

- Blood meal (12-0-0) applied pre-plant
- Multiple soluble organic N source injected through drip throughout the season

Result: Nitrogen levels stay above recommended levels all season long. Not ideal for fruit set or $$. 
Farm D

Nitrogen Management Strategy:

- Plant based compost applied pre-plant
- Additional N source applied mid-season when foliar tests showed N levels dropping.

Result: Growers response to foliar test results prevent sub-optimal nitrogen levels.
### Pre-Plant Nitrogen Sources (low phosphorus, calcium, salts & pH)

<table>
<thead>
<tr>
<th>Name</th>
<th>Analysis</th>
<th>$ per pound of nitrogen (average)</th>
<th>Release Rate</th>
<th>Things to note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa Meal</td>
<td>3-1-2 (varies)</td>
<td>$20+</td>
<td>Medium-slow</td>
<td>Incorporate well into the root zone.</td>
</tr>
<tr>
<td>Blood Meal</td>
<td>12-0-0</td>
<td>~$15</td>
<td>Very fast</td>
<td>Hot. Can burn roots. Mix with a slow release fertilizer for season on N availability</td>
</tr>
<tr>
<td>Composted plant material</td>
<td>Variable, usually around 2-1-1</td>
<td>Variable</td>
<td>Slow</td>
<td>Need to test for nutrient content. Will help increase organic matter and improve tilth. Don’t rely on it alone for nitrogen.</td>
</tr>
<tr>
<td>Feather meal</td>
<td>13-0-0 (varies)</td>
<td>$8</td>
<td>Medium</td>
<td>Can be hot – incorporate well to avoid hotspots.</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>7-1-2</td>
<td>$13</td>
<td>Medium</td>
<td>Apply 2 weeks prior to transplant to avoid burning plants.</td>
</tr>
</tbody>
</table>
# In-Season Nitrogen Sources

*(low phosphorus, calcium, salts & pH)*

<table>
<thead>
<tr>
<th>Name</th>
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<th>Drawbacks</th>
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</thead>
<tbody>
<tr>
<td>Blood meal</td>
<td>12-0-0</td>
<td>~$15</td>
<td>Very Fast</td>
<td>Hot, can burn roots. Not soluble (can side dress)</td>
</tr>
<tr>
<td>Chilean nitrate (Sodium nitrate)</td>
<td>16-0-0</td>
<td>$3</td>
<td>Very fast</td>
<td>High salts. Currently OMRI approved but likely to become prohibited pending rule changes. Use for no more than 20% of N requirement and check with certifier.</td>
</tr>
<tr>
<td>Nature’s Source</td>
<td>3-1-1</td>
<td>~$50</td>
<td>Fast</td>
<td>Soluble. Made from oilseed extracts.</td>
</tr>
<tr>
<td>Pure Protein Dry</td>
<td>15-1-1</td>
<td>$200</td>
<td>Fast</td>
<td>Codfish hydrosolate. Soluble (can be injected)</td>
</tr>
<tr>
<td>Verdanta PL-2</td>
<td>2-0-6</td>
<td>?</td>
<td>Fast</td>
<td>New soluble product made of fermented sugar cane. Low salt index. High K.</td>
</tr>
<tr>
<td>Ferti-Nitro Plus</td>
<td>13-0-0</td>
<td>$53</td>
<td>Fast</td>
<td>Soy protein derivative.</td>
</tr>
<tr>
<td>Wisgeranic</td>
<td>3-1-1</td>
<td>In development</td>
<td>Fast</td>
<td>Derived from food waste</td>
</tr>
</tbody>
</table>
Nitrogen sources to consider avoiding
(high phosphorus, calcium, salts & pH)

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<tr>
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<th>Release rate</th>
<th>Drawbacks</th>
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</thead>
<tbody>
<tr>
<td>Composted animal manure</td>
<td>Varies</td>
<td>Varies</td>
<td>Slow</td>
<td>High pH, salts and phosphorus. Can also add excess calcium.</td>
</tr>
<tr>
<td>Fish emulsion</td>
<td>2-4-2</td>
<td>Varies</td>
<td>Medium</td>
<td>High salts, phosphorus. N not readily available to plants.</td>
</tr>
<tr>
<td>Fish Meal</td>
<td>10-.5-3.5</td>
<td>~$15</td>
<td>Medium</td>
<td>Salty, lots of micronutrients that can throw things out of balance.</td>
</tr>
<tr>
<td>Foliar feeding of any kind</td>
<td>Varies</td>
<td>Varies</td>
<td>Fast</td>
<td>May cause plants to “green up” for a bit but not a good way to provide a crop with sufficient nitrogen.</td>
</tr>
</tbody>
</table>
Potassium is also key!

- Don’t neglect potassium, particularly at fruit set
- Potassium plays an especially important role in fruit QUALITY
- Yellow shoulders and blotchy ripening are related to potassium deficiency.
Take-home strategies:

✓ Soil test every year in high tunnels to monitor nutrient build up and changes in soil pH
✓ Apply 50% or more of total nitrogen prior to planting
  ➢ or plan a tunnel rotation that incorporates cover crops and/or compost with mitigating strategies like uncovering or moving the tunnel
✓ Foliar test 2 weeks after transplanting and every 2-3 weeks for as long as you feel is reasonable (~$12/test)
✓ Inject or side dress N and K to maintain levels
✓ At fruit set, decrease N and increase K
✓ If you have too many tomatoes, plant fewer the following year and use the extra tunnel space for another profitable crop!
Resources

- Cornell High Tunnel Website: [http://hightunnels.cals.cornell.edu/](http://hightunnels.cals.cornell.edu/)
- The ABCs of NPK: Refining Your Tomato Fertility Program by Steve Reiners (Cornell): [http://www.hort.cornell.edu/expo/proceedings/2015/tomatoes/The%20ABC's%20of%20NPK.pdf](http://www.hort.cornell.edu/expo/proceedings/2015/tomatoes/The%20ABC's%20of%20NPK.pdf)
- University of Missouri Extension, *Watering and Fertilizing Tomatoes in a High Tunnel* [http://extension.missouri.edu/p/G6462](http://extension.missouri.edu/p/G6462)
- PSU Extension, Using Organic Nutrient Sources: [http://extension.psu.edu/publications/uj256/view](http://extension.psu.edu/publications/uj256/view)
- PSU Extension, Deciding which Organic Nutrients to Use and How Much to Apply: [http://extension.psu.edu/plants/vegetable-fruit/fact-sheets/Deciding%20which%20organic%20nutrients%20to%20use%20and%20how%20much%20to%20apply.pdf/view](http://extension.psu.edu/plants/vegetable-fruit/fact-sheets/Deciding%20which%20organic%20nutrients%20to%20use%20and%20how%20much%20to%20apply.pdf/view)
- UVM High Tunnel Soil and Crop Management: [http://www.uvm.edu/~susagctr/Documents/HighTunnels_SoilandCropManagement.pdf](http://www.uvm.edu/~susagctr/Documents/HighTunnels_SoilandCropManagement.pdf)
- Rutgers Extension High Tunnel Cover Crops Trials and Tribulations: [https://njaes.rutgers.edu/pubs/urbanfringe/pdfs/urbanfringe-v07n02.pdf](https://njaes.rutgers.edu/pubs/urbanfringe/pdfs/urbanfringe-v07n02.pdf)
Questions? More information?
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http://hightunnels.cals.cornell.edu/
This work is made possible by funding from The New York Farm Viability Institute (in collaboration with NOFA-NY) and Toward Sustainability Foundation and Smith-Lever Funds through Cornell University.

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