Amendment N release

Incubations at optimum moisture and temperature show the amount of N which may become available during the growing season. Amendment types followed five patterns:

- Yard trimmings composts released little to no N. They contribute to long-term fertility but not the current crop demand.
- Poultry manure composts had 10-20% of their N available at application, and then slowly released over time. After 12 weeks, about 30% of their N was available.
- Granular fertilizers had 15-25% of their N available at the time of addition, and mineralized quickly for the first few weeks.
- Liquids and guano mineralized more quickly, and 65-100% N was potentially available.
- Blood and feather meal contained no available N initially, but mineralized very quickly when mixed with soil.

Amendment carbon to nitrogen ratio predicts N availability

Potential N release had a strong relationship to C:N ratio. The graph above summarizes the N release of all the amendments tested.

<table>
<thead>
<tr>
<th>Material</th>
<th>Typical C:N ratio</th>
<th>N available after 12 weeks</th>
<th>Releases in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipal yard trimmings composts</td>
<td>13-20</td>
<td>-3% - 4%</td>
<td>Years</td>
</tr>
<tr>
<td>Poultry manure composts</td>
<td>6-8</td>
<td>30 - 35%</td>
<td>Weeks-months</td>
</tr>
<tr>
<td>Granular fertilizers</td>
<td>5-7</td>
<td>38 - 60%</td>
<td>Days-weeks</td>
</tr>
<tr>
<td>Blood &amp; feather meal</td>
<td>3-4</td>
<td>65 - 70%</td>
<td>Days</td>
</tr>
<tr>
<td>Liquids</td>
<td>4-6</td>
<td>65 - 70%</td>
<td>Days</td>
</tr>
<tr>
<td>Guano</td>
<td>3-4</td>
<td>80-90%</td>
<td>Days</td>
</tr>
</tbody>
</table>

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Nitrogen uptake rate
Brandywine tomatoes took up little N before flowering. On average 73% of the crop’s total N was taken up between full bloom and the first harvest. Peak N uptake rates averaged 3-5 lbs N/acre/day.

The N uptake rate slowed during the harvest period.

Predicting crop uptake
Given a marketable yield of 15 tons per acre, a cull rate of 45%, and N uptake of 6.5 lbs/ton of fruit produced

Step 1: Use marketable yield to calculate total yield
Total yield=(marketable yield)/(1-cull rate)
Total yield=(15 tons marketable fruit)/(1-0.45)=27.3 tons fruit

Step 2: Use an estimate of plant N uptake for each ton of yield to calculate plant uptake
N uptake=Total yield * uptake per ton
N uptake=(27.3 tons fruit) *(6.5 lbs N uptake per ton fruit)=177 tons N/acre taken up by the crop

Predicting N removed from the field
Given a marketable yield of 15 tons per acre, a cull rate of 45%, and 2.4 lbs N in each ton of fruit

Step 1: Calculate the N removed with the marketable yield
N removed=(marketable yield) * (N per ton fruit)
N removed=(15 tons marketable fruit/acre) * (2.4 lbs N/ton fruit)=36 lbs N/acre

Next, account for culls which may be removed from the field

Step 2: Calculate the weight of the culls leaving the field (estimate about 1/3 of the total culls)
Culls leaving the field=((Marketable yield)/(1-cull rate)) * cull rate * proportion culls leaving the field
Culls leaving the field=((15 tons per acre)/(1-0.45)) * 0.45 * 0.33=4.1 tons culls/acre

Step 3: Calculate the total N leaving the field
N removed=N in marketable fruit+N in culls leaving the field
N removed=36 lbs N/acre+(4.1 tons culls/acre * 2.4 lbs N/ton)=45.8 lbs N/acre removed from the field

Nitrogen partitioning at harvest
In our study, relatively little of the N taken up ended up in the marketable fruit. See next page for calculating N uptake and removal.

Average and range of yield and N uptake parameters from Yolo county field sites in 2017 and 2018

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Average</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>N uptake (lbs/acre)</td>
<td>202</td>
<td>58</td>
<td>391</td>
</tr>
<tr>
<td>Yields (tons/acre)</td>
<td>31</td>
<td>13</td>
<td>48</td>
</tr>
<tr>
<td>N in fruit (lbs/ton)</td>
<td>2.4</td>
<td>1.6</td>
<td>3.9</td>
</tr>
<tr>
<td>Cull rate (%)</td>
<td>51</td>
<td>23</td>
<td>78</td>
</tr>
<tr>
<td>Plant N uptake (lbs/ton fruit)</td>
<td>6.5</td>
<td>3.4</td>
<td>10.2</td>
</tr>
</tbody>
</table>

Observations were in line with values listed for fresh market tomatoes in the Western Fertilizer Handbook

Monitoring soil and plant N
The most meaningful time to sample the soil for available N is a couple weeks before the period of rapid uptake. Samples taken at this stage will include the N from the soil organic matter, cover crops and amendments which the quickly growing crop will be able to use.

Nitrogen concentration in the most recently matured leaf wasn’t a very sensitive indicator of N status. In this study, it had the best relationship to yield at green fruit stage. Broad ranges are shown below.