Nutrient (N) Management in Organic Production Systems

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Background and overview

- Fertilization – especially N - is the most expensive cultural practice of organic vegetable growers in California.

- Compost and green manure cover crops have long been the basic program.

- Mineralization of N from compost and cover crops is variable – material? season? cultural practices?

- New dry and liquid organic materials replacing compost and green manure
Atmosphere

N₂ fixation

Plant

Soil fauna

Soil organic matter

mineralization

NH₄

nitrification

Soil microbial biomass

immobilization

NO₃

leaching
Compost and cover crops

- More economical forms of N despite limitations
- Often sighted as slow release N sources - later N release not useful for the succeeding crop
- **Synchrony** of N release is critical limitation
- Legumes release N more quickly than grasses
(Sullivan et al., 1999);
Pattern of release from pre-plant N may not match crop N need

- Release of N for 6-8 weeks - temperature? - then returns to soil background levels

- Chilean sodium nitrate used in some programs - soluble - severe restrictions

- Other potential organic fertilizer N sources evaluated - vary in N cost and N mineralization rate.

- Materials evaluated include: seabird guano, liquid fish, pelleted chicken manure, feather meal, corn meal, blood meal, liquid soybean - meal among others.
Residual Soil Nitrate-N (ppm) vs Date

Feather Meal

N Applied (kg /ha)

[Graph showing residual soil nitrate-N levels and N applied over time]
When does N come available?
Feather better than compost

180 lb N / A

Residual Nitrate-N (ppm)

Date


Compost  Feather  Zero
208 lb N / A

Residual Nitrate N (ppm)

Date
<table>
<thead>
<tr>
<th>Product</th>
<th>Temp (°F)</th>
<th>1 week</th>
<th>4 weeks</th>
<th>8 weeks</th>
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<tbody>
<tr>
<td>Pelleted poultry manure</td>
<td>59</td>
<td>4</td>
<td>16</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>77</td>
<td>10</td>
<td>23</td>
<td>36</td>
</tr>
<tr>
<td>Sea bird guano</td>
<td>59</td>
<td>49</td>
<td>57</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>77</td>
<td>45</td>
<td>48</td>
<td>54</td>
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<tr>
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<td>42</td>
<td>61</td>
<td>64</td>
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<td>67</td>
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<tr>
<td>Fish powder</td>
<td>59</td>
<td>51</td>
<td>55</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>77</td>
<td>48</td>
<td>60</td>
<td>64</td>
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<tr>
<td>Feather meal</td>
<td>59</td>
<td>42</td>
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<td>59</td>
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<tr>
<td></td>
<td>77</td>
<td>50</td>
<td>64</td>
<td>63</td>
</tr>
<tr>
<td>Blood meal</td>
<td>59</td>
<td>41</td>
<td>60</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>77</td>
<td>51</td>
<td>67</td>
<td>70</td>
</tr>
<tr>
<td>Organic fertilizer</td>
<td>% of initial N</td>
<td>lb / ton</td>
<td>$ / ton</td>
<td>$ / lb available N</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>----------------</td>
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<td>---------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Pelleted poultry manure</td>
<td>46</td>
<td>26</td>
<td>70</td>
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<tr>
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<td>79</td>
<td>175</td>
<td>400</td>
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<tr>
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<td>74</td>
<td>173</td>
<td>700</td>
<td>4.00</td>
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<tr>
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<td>178</td>
<td>4,000</td>
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<tr>
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<tr>
<td>Blood meal</td>
<td>70</td>
<td>221</td>
<td>1,000</td>
<td>4.50</td>
</tr>
</tbody>
</table>

*Cost / lb Total Avail. N*

(Hartz and Johnston, 2006)
Organic Liquid N Sources

- Variation in types, costs, suitability for micro-irrigation.
- Sieve size critical for drip and micro-irrigation
  - affects value as N source.
    - does N stay behind the filter with organic matter?
- Some growers choose to use cheap tape and replace with each vegetable crop but this avoids problem of N availability.
- Additional work needed
Other organic fertilizer problem areas

- lack uniformity
- bulky,
- unstable,
- inconsistency --> hidden management costs
- higher cost and variability for research

- **Liquid** organic N sources for use in micro irrigation systems – can be some of most cost effective but additional disadvantages associated with N that is removed by filters.
Summary

- Green manure or pre-plant compost are most economical organic N sources but many crops need supplemental N.

- Diverse organic amendments available as N nutrient sources but bulk, uniformity, stability problems slow development of reliable response data.

- Other N amendments - feather meal, guano, liquid fish, among others – vary widely in N availability but more efficient than compost for later season N.

- Liquid organic fertilizers also variable. Smaller particle size necessary for micro-irrigation should aid N availability.
Mark Gaskell and Richard Smith. 2007. *Nitrogen Sources for Organic Vegetable Crops.* *HortTechnology* 17: 431-441
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