Balancing Nutrient Flows on the Farm

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Gather information

- Management tools:
  - Manure test
  - Soil test
  - Crop requirements
  - Calibrate
- Nutrient sources
  - Residuals from previous crop
    - Legumes add nitrogen
  - Organic inputs
    - Manure
    - Cover crops
    - Commercial fertilizer
- Estimate plant available nitrogen
  - Organic fraction
  - Ammonium fraction based on rate, timing, application method.

Sample and map soil nutrients

- Establish a sampling grid
- Collect soil cores to eight inch depth
- MSU or private testing lab for analysis

Soil test

[Image of soil test result]
Display soil properties

- Colors display soil property gradients
  - pH
  - Elevation
  - N, P and K
  - Other

Calculate crop nutrient needs

<table>
<thead>
<tr>
<th>Crop</th>
<th>Yield goal</th>
<th>N, lb/ac</th>
<th>P, lb/ac</th>
<th>K, lb/ac</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa hay</td>
<td>6 ton</td>
<td>252</td>
<td>60</td>
<td>270</td>
</tr>
<tr>
<td>Corn grain</td>
<td>120 bu</td>
<td>108</td>
<td>42</td>
<td>32</td>
</tr>
<tr>
<td>Soybean</td>
<td>40 bu</td>
<td>152</td>
<td>35</td>
<td>56</td>
</tr>
<tr>
<td>Wheat, grain + straw</td>
<td>72 bu</td>
<td>92</td>
<td>42</td>
<td>57</td>
</tr>
</tbody>
</table>

See Extension Bull E500, Fert. Recommendations for Field Crops

Manure sampling
Calculating Plant Available Nitrogen (PAN)

- Be sure to get a manure test that reports both Total N and Ammonium N.
- NH₄-N retained in the soil
- Mineralized from organic fraction
- Add together to estimate the PAN

### Mineralized Organic Nitrogen

<table>
<thead>
<tr>
<th>Manure Type</th>
<th>Manure Handling</th>
<th>First year availability, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swine</td>
<td>Fresh</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>Anaerobic Liquid</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td>Aerobic Liquid</td>
<td>0.30</td>
</tr>
<tr>
<td>Beef</td>
<td>Solid w/o bedding</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td>Solid w/ bedding</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>Anaerobic liquid</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td>Aerobic liquid</td>
<td>0.25</td>
</tr>
<tr>
<td>Dairy</td>
<td>Solid w/o bedding</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td>Solid w/ bedding</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>Anaerobic liquid</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td>Aerobic liquid</td>
<td>0.25</td>
</tr>
<tr>
<td>Poultry</td>
<td>Deep pit</td>
<td>0.60</td>
</tr>
<tr>
<td></td>
<td>Solid with litter</td>
<td>0.80</td>
</tr>
<tr>
<td></td>
<td>Solid without litter</td>
<td>0.80</td>
</tr>
</tbody>
</table>

Source: MWPS
Estimating NH₄⁻N loss

Michigan example:

<table>
<thead>
<tr>
<th>Days to Incorporation</th>
<th>NH₄⁻N Retained (%)</th>
<th>NH₄⁻N Lost (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injection</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>0-1</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>2-3</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>4-7</td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>&gt; 7</td>
<td>10</td>
<td>90</td>
</tr>
</tbody>
</table>

Source: MSU Extension Bulletin MM-2

Application method & timing determine mineral N losses and availability.
Swine finisher: Total N 39 lb/1000 gal

Ammonium 19 lb
Organic 20 lb

Species, type and application
Broadcast
Injected

Mineralization Factor
First year 0.30x20 = 6 lb

0 to 19 lb N + 6 lb N

PAN may range from
Surface applied, no incorp. = 6 lbs N per 1000 gal
Injected in spring = 25 lbs N per 1000 gal
How much...and where?

Flow meter

Calibrate!

PSNT (Pre-Sidedress Nitrate Test)

- Measure available nitrate
- Set sidedress rate based on yield goal and available nitrate
- Testing and timing are critical

Spreader w/ 2 nurse trucks

Tank spreader, two nurse trucks, three operators

16,000 gal/h w/ 4,500 gal spreader, 2-4,500 trucks
Summary

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