Managing Manure Nutrients for Crop Production
2020 Soil Fertility Short Course

Part 2

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with thanks to:
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IOWA STATE UNIVERSITY
Extension and Outreach
How much per acre is being applied?
Calibrating Liquid Manure Tank Applicators

AE 3601A  December 2016

Distribution of Liquid Manure Application

AE 3600  December 2016

IOWA STATE UNIVERSITY
Extension and Outreach
Calibration and uniformity of solid manure spreaders

Quiz Questions

1. When spreading solid manure with a rear-delivery spreader, is there more variation in manure applied across the swath or in the travel direction?

2. About how wide is the effective swath width for a rear-beater spreader to maintain relatively uniform application?

The best manure application matches crop needs while considering application uniformity and soil test values. Application uniformity is not as great a concern for soils with adequate levels of P and K and that don’t exhibit a significant response to N. From PM-1941
Figure 2. Typical single-swath pattern for a rear-beater spreader.
Size sheets 5’ X 4’3”
Pounds collected on a sheet = tons/acre applied
How much are we applying?

• Application Rate (T/acre) = 
  \( \frac{(3136 \times \# \text{ of Manure})}{(\text{L” } \times \text{ W” of sheets})} \)

Example: 1# collected on a 24” x 36” sheet of plastic:

\( \frac{(3136 \times 1)}{(12 \times 24)} = \frac{3136}{288} = 10.9 \text{ Tons/Acre} \)
Is it applied uniformly?
Determining Application Rates under a Manure Management Plan

• Method 1 for N
  – Estimate N needs by multiplying the proven yield for a given field (or area of a field) by a factor which represents the crop’s N requirement and then taking credit for N from other sources.

  \[ N \text{ fertilizer} = (\text{Proven yield} \times N \text{ factor}) - N \text{ credits} \]
Here is one example for determining N requirements for Iowa manure plans. N supplied by liquid swine manure

In Story County, the 5 year corn average, plus 10%, is 212 bu/acre**. Last year’s soybean crop yielded 60 bushels/acre. 

\[ N \text{ fertilizer} = (212 \times 1.2) - 50 \text{ lb N/acre} \]
\[ = 254 - 50 = 204 \text{ lb N/acre} \]

Do we need this much?

Manure rate = 204 lb N/acre ÷ 37 lb N per 1,000 gal
\[ = 5,513 \text{ gal/acre} \]

\[ [5,513 \text{ gal} \times 15 \text{ lb P}_2\text{O}_5/1,000 \text{ gal} = 83 \text{ lb P}_2\text{O}_5/\text{acre}] \]
\[ [5,513 \text{ gal} \times 23 \text{ lb K}_2\text{O}/1,000 \text{ gal} = 127 \text{ lb K}_2\text{O}/\text{acre}] \]

** From Appendix A, Iowa DNTR Manure Management Plans forms
One method for checking if adequate N is available:

- This method involves use of the Late Spring Soil Nitrate test.
  - Take a 0- to 12-inch soil sample taken when corn is 6 to 12 inches tall.
  - Have the soil samples analyzed for nitrate-N.
  - Use the recommended side dress N rate, based on a table from ISU.
  - Sample in “Sets of 8”?
Nitrogen fertilizer recommendations for manured soils\textsuperscript{a} and corn after alfalfa
(from Blackmer, Voss, and Mallarino, 1997)

<table>
<thead>
<tr>
<th>Grain and fertilizer prices</th>
<th>Soil test nitrate ppm N</th>
<th>Recommended N rate lb N/acre</th>
<th>Excess\textsuperscript{b} rainfall</th>
<th>Normal rainfall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unfavorable</td>
<td>0-10</td>
<td>90</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>(1 bu. buys 11-15 lb. of N)</td>
<td>11-15</td>
<td>0</td>
<td>60</td>
<td>0\textsuperscript{c}</td>
</tr>
<tr>
<td></td>
<td>&gt;20</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Favorable</td>
<td>0-10</td>
<td>90</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>(1 bu. buys 16-25 lb. of N)</td>
<td>11-15</td>
<td>60</td>
<td>60</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>&gt;25</td>
<td>0</td>
<td>30</td>
<td>0</td>
</tr>
</tbody>
</table>

\textsuperscript{a} Uniform manure, or 2 of 4 years.  
\textsuperscript{b} May rainfall > 5 in.  
\textsuperscript{c} Optional 30 lb N/acre.
Manure Plan Exception to the N Rate Method:

A high P index for a field can lower the amount you can apply, or keep you from applying manure to the field.
“Soybean Rule”

• Anyone with MMP or NMP
• Applies to
  – Liquid manure
  – Process wastewater
  – Settled open feedlot effluent

• Planted in or will be beans
• Manure nitrogen limited to 100 lbs/acre of available N
Frozen Ground Application Rules

- Applies *only* to confinements (>500 animal units) with liquid manure
- Limited from 12-21 to 4-01 on snow covered ground (1” snow or more, or >.5” ice)
- Limited on frozen ground from February 1 to April 1 unless it can be injected or incorporated (or under emergency situations, with permission)
Manure application timing and nutrient availability

• Fall applications allow time for organic portions of the manure to mineralize.
• Fall applications also allow for more potential N loss to the environment.
• Do not apply liquid manure in the fall until the soil temperature (4” deep in the soil) is 50°F and cooling.
• Applying manure to frozen soils increases the potential for environmental contamination.
  – N and P movement into surface water can be significant.
  – Apply only on relatively flat land (slopes of 4 % or less).
Assessing Site Vulnerability

The FD-36 watershed

Watershed boundary

Stream channel

Sharpley, Gburek, USDA-ARS, Beegle, Penn State, University Park, PA
In Summary - To get value from manure:

• Know the nutrient content
• Calculate losses and availability
• Know the rate being applied
• Insure that application is uniform
THANK YOU!

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