Laboratory Sampling of Manure Materials:

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Introduction

- Nutrient concentrations can be estimated using “book” values for available N, P2O5, and K2O
- Manure testing takes management practices into account and delivers more accurate values
- Sampling technique greatly influences test results
- Sample handling and testing methods also affect analytical results
Sources of Manure Nutrient Content Variability

- Animal species
- Management
  - Bedding
  - Storage Type
  - Time
- Sampling technique
- Laboratory
  - Sample Preparation
  - Method
Must take a good and representative sample
Attempt to minimize the variability in technique
# Effect of In-Lab Variability on Total Nutrient Content of Manure

<table>
<thead>
<tr>
<th>Material</th>
<th>No. of Analysis</th>
<th>Nutrient*</th>
<th>DM</th>
<th>N</th>
<th>P</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid Dairy</td>
<td>4 Mean</td>
<td>DM</td>
<td>7.13</td>
<td>4.25</td>
<td>1.04</td>
<td>3.63</td>
</tr>
<tr>
<td>Manure #3</td>
<td>SD</td>
<td>N</td>
<td>0.08</td>
<td>0.09</td>
<td>0.03</td>
<td>0.04</td>
</tr>
<tr>
<td>Liquid Dairy</td>
<td>4 Mean</td>
<td>P</td>
<td>6.05</td>
<td>4.65</td>
<td>1.28</td>
<td>4.07</td>
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<tr>
<td>Manure #4</td>
<td>SD</td>
<td>K</td>
<td>0.09</td>
<td>0.05</td>
<td>0.05</td>
<td>0.04</td>
</tr>
</tbody>
</table>

* Dry Weight Basis, University of Wisconsin Soil and Forage Analysis Lab - Marshfield
# Effect of In-Lab Variability on Total Nutrient Content of Manure

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<tr>
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<th>Nutrient*</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>DM</td>
<td>N</td>
<td>P</td>
<td>K</td>
<td></td>
</tr>
<tr>
<td>Poultry (fresh)</td>
<td>8</td>
<td>Mean</td>
<td>28.14</td>
<td>6.31</td>
<td>1.76</td>
<td>3.08</td>
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<tr>
<td></td>
<td></td>
<td>SD</td>
<td>0.15</td>
<td>1.12</td>
<td>0.04</td>
<td>0.05</td>
</tr>
<tr>
<td>Dairy semi-solid (fresh)</td>
<td>8</td>
<td>Mean</td>
<td>14.14</td>
<td>3.75</td>
<td>0.83</td>
<td>3.27</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SD</td>
<td>0.14</td>
<td>0.26</td>
<td>0.02</td>
<td>0.03</td>
</tr>
</tbody>
</table>

* Dry Weight Basis, University of Wisconsin Soil and Forage Analysis Lab - Marshfield
Composite and subsample properly
Sample Identification and Delivery

- Identify container and information sheet with following information:
  - Farm name / owner’s name and address
  - Animal species and storage system
  - Date

- Also include application method on information sheet

- Keep samples frozen until shipped or delivered

- Ship early in the week (Mon – Wed) to avoid holidays and weekends
Spread the manure uniformly
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Sample Handling

- Biohazards and laboratory safety
- Sample receiving, examination and transfer
- Sample stabilization and storage
- Sample holding times
- Homogenizing and subsampling
- Archiving and disposal
Samples come in many different types of containers
Sample Containers – Plastic recommended
Sample Storage and Handling

Solid/Semi-solid samples

- Thoroughly mix composite sample
- Fill a one-gallon heavy-duty ziplock bag approximately one-half full
- Squeeze out excess air, close and seal
- Store sample in freezer if not delivered to the lab immediately
Sample Storage and Handling

- **Liquid samples**
  - Thoroughly mix composite sample
  - Fill a one-quart plastic bottle not more than three-quarters full
  - Store sample in freezer if not delivered to the lab immediately
Samples following overnight drying
High dry matter – long straw
DIFFICULT TO SUBSAMPLE
Long bedding sample
“Salad” chopper used for long straw
Dry matter determination
High vs. Low dry matter sample
2mm Wiley grind for solid samples
Oven dry samples dried in Wiley mill
Ground sample saved in plastic bottle
Dried and ground sample archived
Liquid sample – scraped following drying
Liquid samples ground by hand
Subsampling liquid samples for N
Approximately 10mls/10g used
Sulfuric Acid added to digestion flask
Acid used to wash down neck of flask
Manure added to flask and cylinder re-weighed to determine sample wt.
High DM samples added with filter paper
Macro Kjeldahl flasks with acid added
Samples archived in freezers
SOIL TEST REPORT

This Report is for:

UW SOIL & FORAGE LAB
8396 YELLOWSTONE DRIVE
MARSHFIELD WI 54449

NUTRIENT RECOMMENDATIONS

<table>
<thead>
<tr>
<th>Cropping Sequence</th>
<th>Yield Goal</th>
<th>Crop Nutrient Need</th>
<th>Legume N</th>
<th>Fertilizer Credit</th>
<th>Nutrients to Apply</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>per acre</td>
<td>N</td>
<td>P, O₃</td>
<td>K, O</td>
<td>Rate</td>
</tr>
<tr>
<td>Corn, grain</td>
<td>111-130 Bu</td>
<td>120</td>
<td>25</td>
<td>65</td>
<td>0</td>
</tr>
<tr>
<td>Oats</td>
<td>61.0-90.0 Bu</td>
<td>40</td>
<td>15</td>
<td>90</td>
<td>0</td>
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<tr>
<td>Alfalfa</td>
<td>4.6-5.5 T</td>
<td>0</td>
<td>65</td>
<td>290</td>
<td>0</td>
</tr>
</tbody>
</table>

The lime required for this rotation to reach pH 6.8 is 8.0 T/acre of 60-69 lime or 6.5 T/acre of 80-69 lime.

ADDITIONAL INFORMATION

First year replacement credit based on 2 years of non-incorporated Dairy 5.0 tons manure/acre.
If corn harvested for silage instead of grain, add extra 30 lb P2O5/A and 90 lb K2O/A to next crop.
Reduce nitrogen by 50% if barley or oats are underseeded with a legume forage.
If lime has been applied in the last 2 years, more lime may not be needed due to incomplete reaction.

A soil test report is calculated only when soil pH is more than 6.2 units below the optimum pH.

Starter fertilizer (e.g., 10 x 20 x 20 lbs N-P-O₃-K₂O) is advisable for row crops on soils slow to warm in the spring.

A soil test may estimate actual corn N needs.

If conservation tillage leaves more than 50% residue cover when corn follows after corn, add an additional 30 lb N/acre.

If alfalfa will be maintained for more than three years, increase recommended K₂O by 20% each year.
Summary

- The value of manure testing is highly dependant on sampling technique.
- Sample handling and testing methods influence analytical results.
Manure analysis conversions and constants

- 1 lb P = 2.29 P$_2$O$_5$
- 1 lb K = 1.20 lbs K$_2$O
- 1 gallon liquid manure = 8.3 lbs
- If dry matter is less than 11.5% - nutrient results are normally reported in lbs/1000 gal
- If dry matter greater than 11.5% - nutrient results are normally reported in lbs/ton
- To convert % to lbs/ton – multiply by 20
- To convert % to lbs/1000 gal – multiply by 83
Conversion factors between liquid and solid values

\[
\frac{\text{lbs}}{\text{Ton}} \times 4.15 = \frac{\text{lbs}}{1000 \text{ gal}}
\]

\[
\frac{\text{lbs}}{1000 \text{ gal}} \times 0.24 = \frac{\text{lbs}}{\text{Ton}}
\]