BASIC ISSUES OF MANURE MANAGEMENT:
ASSIGNING MANURE SPREADING PRIORITIES

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THE GOAL OF MANURE MANAGEMENT

- UTILIZE PLANT NUTRIENTS FOR CROPS
  - PROPER RATE
  - INCLUDE ALL NUTRIENT INPUTS

- DISTRIBUTE MANURE EVENLY ON FARM
  - AVOID HIGH SOIL TEST P

- AVOID APPLICATION WHERE LOSSES OCCUR
  - STEEPLY SLOPING GROUND
  - NEAR SURFACE WATER
  - SHALLOW OR SANDY SOILS
PRACTICAL MANURE MANAGEMENT

BALANCE DISPOSAL NEED WITH NUTRIENT UTILIZATION AND ENVIRONMENTAL CONCERNS

NUTRIENT RECYCLING
CROP REQUIREMENT

DISPOSAL NEED
TIME/LABOR
COMPARING MANURE APPLICATION STRATEGIES

N BASED
- HIGHEST RATES
- P & K BUILDUP
- LABOR EFFICIENT
- LAND EFFICIENT

P BASED
- MAX. NUTRIENT EFFIC.
- AVOIDS P & K BUILDUP
- LABOR INEFFICIENT
- REQUIRES MORE LAND
UNCERTAINTIES WITH MANURE USE

- APPLICATION RATE
- UNIFORMITY OF APPLICATION
- NUTRIENT CONTENT
- RESIDUAL AVAILABILITY
- WEATHER EFFECTS
- MINIMIZING LOSSES
- CROPPING SYSTEM COMPATIBILITY
- REGULATORY CONSTRAINTS
HELPING FARMERS OVERCOME OBSTACLES TO MANURE MANAGEMENT

EDUCATION

SPREADER CALIBRATION
MANURE IS A VALUABLE RESOURCE

FIRST YEAR AVAILABILITY - SOLID (lb/ton)

<table>
<thead>
<tr>
<th>NUTRIENT</th>
<th>DAIRY</th>
<th>BEEF</th>
<th>POULTRY</th>
<th>SWINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>3 (4)</td>
<td>4 (4)</td>
<td>13 (15)</td>
<td>4 (5)</td>
</tr>
<tr>
<td>P₂O₅</td>
<td>3</td>
<td>5</td>
<td>14</td>
<td>3</td>
</tr>
<tr>
<td>K₂O</td>
<td>8</td>
<td>8</td>
<td>9</td>
<td>7</td>
</tr>
</tbody>
</table>

(N AVAILABILITY IF INCORPORATED)
MANURE IS A VALUABLE RESOURCE

FIRST YEAR AVAILABILITY - SOLID ($/ton)

<table>
<thead>
<tr>
<th>NUTRIENT</th>
<th>DAIRY</th>
<th>BEEF</th>
<th>POULTRY</th>
<th>SWINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>0.66</td>
<td>0.88</td>
<td>2.86</td>
<td>0.88</td>
</tr>
<tr>
<td>$P_{2}O_{5}$</td>
<td>0.75</td>
<td>1.25</td>
<td>3.50</td>
<td>0.75</td>
</tr>
<tr>
<td>$K_{2}O$</td>
<td>0.96</td>
<td>0.96</td>
<td>1.08</td>
<td>0.84</td>
</tr>
<tr>
<td>TOTAL</td>
<td>2.37</td>
<td>3.09</td>
<td>7.44</td>
<td>2.47</td>
</tr>
</tbody>
</table>
STORAGE MAKES MANURE MANAGEMENT EASIER

DESIGNED STORAGE

MESSY IN-FIELD STACKING
EFFECT OF HANDLING ON NUTRIENT AVAILABILITY

- **PRESERVE LIQUID PORTION**
  - 50% N, 5% P, 70% K

- **INCORPORATE**
  - REDUCE N VOLATILIZATION
  - REDUCE RUNOFF LOSS

- **STACKING/COMPOSTING**
  - REDUCES NUTRIENT CONTENT
  - REDUCES AVAILABILITY
MANURE SPREADING CONCERNS

IN FLOODPLAINS

THROUGH WATERWAYS

ON GROWING CROPS

ON PUBLIC ROADS
WATER QUALITY IS A POLITICAL ISSUE

RECREATION - TROUT FISHING

PUBLIC HEALTH - CRYPTOSPORIDIIUM

THE JOURNAL

IS IT THE WATER?

'Esta water plant to close boiling advisory remains
Area in for weekend of mystery mystery

MILWAUKEE SENTINEL
PROXIMITY TO WATER (SURFACE APPLICATION)

- > 200’ FROM STREAMS AND LAKES
- > 200’ FROM WELLS, SINKHOLES, GRAVEL PITS, ETC.

NO SPREADING IN WATERWAYS, WETLANDS, TERRACES, ETC.

SURFACE APPLICATION MAX = 75 lb/a $P_2O_5$

USDA-NRCS TECH. GUIDE 590
MANURE AND THE ENVIRONMENT

- **SURFACE WATER**
  - PHOSPHORUS
- **GROUND WATER**
  - NITROGEN
- **WINTER SPREADING**
  - SLOPES >9 %
  - 12 % WITH STRIPS AND CORN RESIDUE
A SIMPLE SYSTEM TO HELP FARMERS MAKE SMART DECISIONS ABOUT MANURE APPLICATIONS

DIRECT MANURE

- Nutrient demanding crops
- Low testing soils
- Upland areas
- Level land
- Medium-fine texture soils
- Deep, well-drained

AVOID MANURE

- Legume forage
- Plowdown
- High testing soils
- Floodplains, waterways
- Steep land
- Sandy soils
- Shallow soils
DEVELOPING A MANURE SPREADING PLAN

THREE STEPS:

1. ESTIMATE MANURE AVAILABLE YEARLY
   NUMBER, TYPE, SIZE, HANDLING

2. PRIORITIZE FIELDS BASED ON NUTRIENT NEED
   AND ENVIRONMENTAL CONSIDERATIONS
   CROP N OR P NEED
   SOIL TEST P AND K
   WATER PROXIMITY
   SLOPE
   SOIL TYPE

3. DISTRIBUTE MANURE BASED ON RANK
   “CHECKBOOK SYSTEM” BASED ON LOADS
   CONSIDER SEASONAL ACCESSIBILITY
WHAT’S NEEDED TO DEVELOP PLANS

- **MANURE AMOUNT**
  - TOTAL
  - COLLECTIBLE

- **NUTRIENT AVAILABILITY**
  - BOOK ESTIMATES
  - ANALYSIS

- **CROPPING PLAN**
  - PREVIOUS AND PLANNED CROPS
  - FIELD ID AND SIZE
WHAT'S NEEDED TO DEVELOP PLANS

- **FARM SOILS MAP**
  - TEXTURE, SLOPE, WATER, BEDROCK
  - CONSERVATION PRACTICES
  - RESTRICTED AREA/TIMES

- **INDIVIDUAL FIELD SOIL TEST**
  - NPK RECS. AND PK TEST RESULTS
  - LEGUME CREDITS
  - N AVAILABILITY TESTS

- **CALIBRATED SPREADER**
  - MULTIPLE RATES DESIRABLE
STEP ONE: ESTIMATE MANURE AVAILABLE YEARLY

EXAMPLE: 100 COW DAIRY W/REPLACEMENTS, SEMI-SOLID

100 cows \( \times \) 21 t/yr = 2100 t
60 heifers \( \times \) 10 t/yr = 600 t
40 calves \( \times \) 2 t/yr = 80 t

\[
\begin{align*}
\text{Total} & = 2780 \text{ t} \\
\text{Adjusted} & = 2363 \text{ t}
\end{align*}
\]
DO NOT RANK THE FOLLOWING FIELDS

- RECOMMENDED NUTRIENTS PREVIOUSLY APPLIED AS FERTILIZER
- APPLICATION IN 10 YR. FLOODPLAIN OR WITHIN 200 FT. OF SURFACE WATER OR OPEN ACCESS TO GROUNDWATER THAT WILL NOT BE INCORPORATED
- SLOPES >9% OR >12% WITH RUNOFF REDUCTION PRACTICES
## INDIVIDUAL FIELD ASSESSMENT - CROP N NEED

<table>
<thead>
<tr>
<th>PLANNED CROP</th>
<th>POINTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONTINUOUS CORN</td>
<td>10</td>
</tr>
<tr>
<td>SECOND YEAR CORN</td>
<td>8</td>
</tr>
<tr>
<td>CORN FOLLOWING LEGUME FORAGE</td>
<td>1</td>
</tr>
<tr>
<td>SMALL GRAIN</td>
<td>6</td>
</tr>
<tr>
<td>SMALL GRAIN (WITH SEEDING)</td>
<td>2-4</td>
</tr>
<tr>
<td>TOPDRESS FAIR LEGUME STAND</td>
<td>2</td>
</tr>
<tr>
<td>PRIOR TO DIRECT SEEDING ALFALFA</td>
<td>8</td>
</tr>
<tr>
<td>PHOSPHORUS</td>
<td>PTS.</td>
</tr>
<tr>
<td>--------------</td>
<td>------</td>
</tr>
<tr>
<td>&gt; 150 ppm</td>
<td>1</td>
</tr>
<tr>
<td>75–150 ppm</td>
<td>3</td>
</tr>
<tr>
<td>30–75 ppm</td>
<td>5</td>
</tr>
<tr>
<td>&lt;30 ppm</td>
<td>10</td>
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</table>
## INDIVIDUAL FIELD ASSESSMENT - FIELD LIMITATIONS

<table>
<thead>
<tr>
<th>PROXIMITY TO WATER</th>
<th>PTS.</th>
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</thead>
<tbody>
<tr>
<td>INCORPORATED W/IN 10 YR. FLOODPLAIN OR WITHIN 200 FT. OF SURFACE WATER</td>
<td>1</td>
</tr>
<tr>
<td>OUTSIDE THESE RESTRICTIONS</td>
<td>5</td>
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</table>

<table>
<thead>
<tr>
<th>SLOPE</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;9%</td>
<td>1</td>
</tr>
<tr>
<td>6-9% OR 9-12% w/ RUNOFF REDUCTION PRACT.</td>
<td>3</td>
</tr>
<tr>
<td>2-6% OR 6-9% w/ RUNOFF REDUCTION PRACT.</td>
<td>5</td>
</tr>
<tr>
<td>&lt;2% OR 2-6% w/ RUNOFF REDUCTION PRACT.</td>
<td>10</td>
</tr>
</tbody>
</table>
## INDIVIDUAL FIELD ASSESSMENT - FIELD LIMITATIONS

<table>
<thead>
<tr>
<th>SOIL TEXTURE</th>
<th>PTS.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SANDS, LOAMY SANDS</td>
<td>1</td>
</tr>
<tr>
<td>sandy loams, loams or sands, loamy sands spring applied</td>
<td>3</td>
</tr>
<tr>
<td>others or sandy loams, loams spring applied</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DEPTH TO BEDROCK</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 10 in.</td>
<td>0</td>
</tr>
<tr>
<td>10 - 20 in.</td>
<td>1</td>
</tr>
<tr>
<td>&gt; 20 in.</td>
<td>5</td>
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</table>
**STEP TWO: RANK ALL FIELDS**

<table>
<thead>
<tr>
<th>FIELD</th>
<th>ROTATION</th>
<th>P</th>
<th>K</th>
<th>WATER</th>
<th>SLOPE</th>
<th>TEXT</th>
<th>DEPTH</th>
<th>RANK</th>
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<tbody>
<tr>
<td>1</td>
<td>CCC</td>
<td>10</td>
<td>5</td>
<td>8</td>
<td>5</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>CCSb</td>
<td>2</td>
<td>5</td>
<td>8</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>ACC</td>
<td>8</td>
<td>3</td>
<td>8</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>AAC</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>CCO/A</td>
<td>2</td>
<td>5</td>
<td>8</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>CSbC</td>
<td>8</td>
<td>3</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>AAA</td>
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<td>10</td>
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<td>5</td>
<td>3</td>
<td>5</td>
<td>5</td>
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<tr>
<td>8</td>
<td>CSbW</td>
<td>6</td>
<td>1</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>CCA</td>
<td>8</td>
<td>3</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
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</table>
## Step Three: Allocate Based on Rank

<table>
<thead>
<tr>
<th>Field</th>
<th>Rank</th>
<th>Acres</th>
<th>N Rate</th>
<th>Manure Used</th>
<th>Left</th>
<th>Loads</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>lb/a</td>
<td>ton/a</td>
<td>ton</td>
<td>ton</td>
</tr>
<tr>
<td>1</td>
<td>48</td>
<td>15</td>
<td>160</td>
<td>40</td>
<td>600</td>
<td>1763</td>
</tr>
<tr>
<td>3</td>
<td>39</td>
<td>22</td>
<td>110</td>
<td>27</td>
<td>594</td>
<td>1169</td>
</tr>
<tr>
<td>7</td>
<td>38</td>
<td>7</td>
<td>75</td>
<td>25</td>
<td>175</td>
<td>994</td>
</tr>
<tr>
<td>6</td>
<td>37</td>
<td>12</td>
<td>120</td>
<td>30</td>
<td>360</td>
<td>634</td>
</tr>
<tr>
<td>9</td>
<td>37</td>
<td>2</td>
<td>75</td>
<td>25</td>
<td>300</td>
<td>334</td>
</tr>
<tr>
<td>2</td>
<td>35</td>
<td>13</td>
<td>75</td>
<td>25</td>
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</tr>
<tr>
<td>5</td>
<td>35</td>
<td>5</td>
<td>20</td>
<td>7</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>8</td>
<td>33</td>
<td>10</td>
<td>20</td>
<td>7</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>4</td>
<td>29</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

Assume 10 ton/Load
CUSTOMIZE FOR LOCAL CONDITIONS

- **REGULATIONS**
  - MAX. 75 lb P$_2$O$_5$/A IF NOT INCORPORATED
  - TILLAGE SYSTEM/TIMING
  - RESTRICTED AREAS/TIMES

- **WINTER SPREADING**
  - SAVE CLOSE FIELDS
  - SELECT FLAT FIELDS

- **CROPPING SYSTEM**
  - POOR FORAGE STANDS FOR SUMMER SPREADING
SUMMARY

- Goal is to apply where needed and losses are minimized
- No system is perfect
- Account for nutrients from all sources
- Know how much is applied
- Customize for local recs. & regs.
- Storage provides convenience