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

SPREADER CALIBRATION

EDUCATION
### 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 (5)</td>
<td>20 (24)</td>
<td>7 (9)</td>
</tr>
<tr>
<td>P$_2$O$_5$</td>
<td>3</td>
<td>5</td>
<td>30</td>
<td>6</td>
</tr>
<tr>
<td>K$_2$O</td>
<td>7</td>
<td>9</td>
<td>24</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

MESSY IN-FIELD STACKING

DESIGNED STORAGE
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

PUBLIC HEALTH - CRYPTOSPORIDIIUM

RECREATION - TROUT FISHING
MANURE AND ENVIRONMENTAL RULES

- **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$_2$O$_5$**

*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 × 21 t/yr = 2100 t
60 heifers × 10 t/yr = 600 t
40 calves × 2 t/yr = 80 t

2780 t

× 0.85 = 2363 t
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>
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<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>
</tbody>
</table>
## INDIVIDUAL FIELD ASSESSMENT - SOIL TEST P AND K

<table>
<thead>
<tr>
<th>PHOSPHORUS</th>
<th>PTS.</th>
<th>POTASSIUM</th>
<th>PTS.</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 150 ppm</td>
<td>1</td>
<td>&gt;200 ppm</td>
<td>6</td>
</tr>
<tr>
<td>75-150 ppm</td>
<td>3</td>
<td>100-200 ppm</td>
<td>8</td>
</tr>
<tr>
<td>30-75 ppm</td>
<td>5</td>
<td>&lt;100 ppm</td>
<td>10</td>
</tr>
<tr>
<td>&lt;30 ppm</td>
<td>10</td>
<td></td>
<td></td>
</tr>
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</table>
## INDIVIDUAL FIELD ASSESSMENT - FIELD LIMITATIONS

### PROXIMITY TO WATER

<table>
<thead>
<tr>
<th>Description</th>
<th>PTS.</th>
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<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>
</tr>
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</table>

### SLOPE

<table>
<thead>
<tr>
<th>Description</th>
<th>PTS.</th>
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</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>
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</table>

<table>
<thead>
<tr>
<th>DEPTH TO BEDROCK</th>
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<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>
</tr>
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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>
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<tr>
<td>4</td>
<td>AAC</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>10</td>
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<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>
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<td>5</td>
<td>5</td>
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<td>7</td>
<td>AAA</td>
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<td>10</td>
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<td>3</td>
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<td>8</td>
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<td>6</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
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<tr>
<td>9</td>
<td>CCA</td>
<td>8</td>
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<td>6</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</th>
<th>USED</th>
<th>LEFT</th>
<th>LOADS</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>lb/a</td>
<td>ton/a</td>
<td>ton</td>
<td>ton</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>48</td>
<td>15</td>
<td>160</td>
<td>40</td>
<td>600</td>
<td>1763</td>
<td>60</td>
</tr>
<tr>
<td>3</td>
<td>39</td>
<td>22</td>
<td>110</td>
<td>27</td>
<td>594</td>
<td>1169</td>
<td>59</td>
</tr>
<tr>
<td>7</td>
<td>38</td>
<td>7</td>
<td>75</td>
<td>25</td>
<td>175</td>
<td>994</td>
<td>18</td>
</tr>
<tr>
<td>6</td>
<td>37</td>
<td>12</td>
<td>120</td>
<td>30</td>
<td>360</td>
<td>634</td>
<td>36</td>
</tr>
<tr>
<td>9</td>
<td>37</td>
<td>2</td>
<td>75</td>
<td>25</td>
<td>300</td>
<td>334</td>
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</tr>
<tr>
<td>2</td>
<td>35</td>
<td>13</td>
<td>75</td>
<td>25</td>
<td>325</td>
<td>9</td>
<td>33</td>
</tr>
<tr>
<td>5</td>
<td>35</td>
<td>5</td>
<td>20</td>
<td>7</td>
<td>--</td>
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</tr>
<tr>
<td>8</td>
<td>33</td>
<td>10</td>
<td>20</td>
<td>7</td>
<td>--</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>
<td>--</td>
</tr>
</tbody>
</table>

ASSUME 10 TON/LOAD
CUSTOMIZE FOR LOCAL CONDITIONS

- **REGULATIONS**
  - MAX. 75 lb P₂O₅/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**