Study Goals

- Do large farms have a greater potential to pollute (P) than small farms?

- Where is our P coming from -- -- and will Nutrient Management solve the problem?
  - Mass balance of different farm sizes best way to answer the question.
What is a Mass Balance?

- Identifying all sources of nutrients entering and leaving the farm

  - Inputs: Feed, Fertilizer, purchased animals
  - Outputs: Milk, Meat, Crops sold.
  - Environmental sources: Legumes, Rain
  - Environmental Losses: Erosion, Leaching

- Goal is to be near zero.
Many tools and methods available

- Dutch “Yardstick” most used in upper Midwest
  - Blue Earth Basin (MN)
  - Apple-Ashwaubenon (WI)
  - Central Nebraska
Dutch Yardstick

- Developed in the Netherlands in ‘80’s.

- Used as an Environmental Taxation Tool
  - Import too much: Tax penalty
  - Below balance: Tax credit
Yardstick Scores from Dutch Dairy Farm

Year


Lbs nutrients/acre


N

P

K
Apple-Ashwaubenon 1997-1998

- 17 farms
- 13 dairies from 50 to 500 hd
- 4 cash grain operations
Nutrient Surplus
Apple-Ashwaubenon Study

Lb/Acre

Nitrogen
Phosphorus
Potassium

Excess ave
<table>
<thead>
<tr>
<th></th>
<th>Farm Years</th>
<th>N Mean (lbs/acre)</th>
<th>P Mean (lbs/acre)</th>
<th>K Mean (lbs/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>cash grain farms</td>
<td>8</td>
<td>-9</td>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td>all dairy farms</td>
<td>26</td>
<td>87</td>
<td>15</td>
<td>80</td>
</tr>
<tr>
<td>dairies &lt;100 cows</td>
<td>12</td>
<td>80</td>
<td>16</td>
<td>97</td>
</tr>
<tr>
<td>dairies &gt;100 &lt;300 cows</td>
<td>8</td>
<td>63</td>
<td>10</td>
<td>46</td>
</tr>
<tr>
<td>Dairies &gt;300 cows</td>
<td>6</td>
<td>133</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lb/cow/yr: all dairy farms</td>
<td>26</td>
<td>124# /cow</td>
<td>21# /cow</td>
<td>106# /cow</td>
</tr>
</tbody>
</table>
Feed Fertilizer Animal Natural

Nutrient Source

Nitrogen Phosphorus Potassium

% of Farm Imports

100%

80%

60%

40%

20%

0%

Feed: 53% 55%
Fertilizer: 43%
Animal: 1% 2% 0%
Natural: 0% 0%
Animal N Feed N Fertilizer N Fixed N Atmospheric N

Nitrogen Source

% of Total Imports

Dairy Farms
Cash Grain Farms

1% 0%
53% 0%
32% 76%
11% 20%
3% 5%
Sources of Feed Phosphorus

- CP Sources: 51%
- Other: 32%
- Mineral Sources: 17%
Animal K Feed K Fertilizer K

Potassium Source

% of Total Imports

Dairy Farms
Cash Grain Farms
Conclusions

- Acres and cow numbers
  - DO NOT affect per acre phosphorus loading.
  - Increase per acre N and K loading.

- Phosphorus problem CAN NOT be solved by just looking at the fertilizer sources.
Conclusions

- Implementing the following eliminated surplus
  - Reduce feed P from 0.52 to 0.38%
  - Reduce % P in starter fertilizer (9-23-30 → 9-15-30)
  - Minor change in manure rates on some fields.