SNAP-Plus

- Nutrient management planning software program

Phosphorus Index

- Nutrient management planning tool that assesses the risk of phosphorus delivery to surface water from agricultural fields
SNAP-Plus software uses “routine” information:

- Soil test
- Crop and tillage
- Slope and slope length
SNAP-Plus

Provides field-by-field:
• Multi-year nutrient management plan
• Rotational soil loss assessment
• P Index calculation
• P balance calculation
• Record-keeping
Nutrient Management Standard 590:

All fields that receive crop nutrients must be farmed to T (according to farm conservation plan).

SNAP-Plus currently provides a RUSLE2 rotational soil loss assessment (may be 10-20% higher than if done with full RUSLE2).
Nutrient Management Standard 590:

Available nitrogen applications can not exceed crop N requirements or N removal for legumes

SNAP-Plus calculates N recommendations and N credits
## Nitrogen Uptake for First Year Legumes and Companion Crops

<table>
<thead>
<tr>
<th>Crop</th>
<th>Yields</th>
<th>N Uptake</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>per acre</em></td>
<td><em>lb/acre</em></td>
</tr>
<tr>
<td>Legume hay</td>
<td>2-3 T</td>
<td>220</td>
</tr>
<tr>
<td>Legume hay with oatlage</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; cut: 1-2 T</td>
<td>240</td>
</tr>
<tr>
<td></td>
<td>2&lt;sup&gt;nd&lt;/sup&gt; cut: 1-2 T</td>
<td></td>
</tr>
<tr>
<td>Soybean</td>
<td>50 bu</td>
<td>180</td>
</tr>
</tbody>
</table>
Nutrient Management Standard 590:

Phosphorus applications must be planned using soil test P thresholds or the P Index.

**Soil test P thresholds** –
- > 50 ppm – limit P applications to crop removal
- > 100 ppm – eliminate P applications if possible; cumulative P applications must be 25% less than crop removal (over 4 years)

**P Index** –
Must be less than 6 averaged across the rotation.

SNAP-Plus calculates both the P balance and P Index for each field.
SNAP-Plus Test Version

Test version for 590 Standard is available on web:

www.soils.wisc.edu/Snap-Plus/590Test.html
<table>
<thead>
<tr>
<th>Year</th>
<th>Crop</th>
<th>Yield Goal</th>
<th>Tillage</th>
<th>Soil Test Date</th>
<th>Recommendation</th>
<th>Prior years legume credit</th>
<th>Prior years manure credit</th>
<th>Plan manure applications</th>
<th>Plan fertilizer applications</th>
<th>Total credits</th>
<th>Adjusted recommendation</th>
<th>Annual Total P Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>Corn grain</td>
<td>130-150</td>
<td>Fall Chisel</td>
<td>10/7/2004</td>
<td>N 120 P 0 K 40</td>
<td>0</td>
<td>0</td>
<td>120 150 120</td>
<td>0 0 0 0</td>
<td>120 150 120</td>
<td>0 -150 -80</td>
<td>2.0</td>
</tr>
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<td>2006</td>
<td>Corn grain</td>
<td>130-150</td>
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<td>N 120 P 0 K 40</td>
<td>0</td>
<td>0</td>
<td>120 150 120</td>
<td>0 0 0 0</td>
<td>115 0 60</td>
<td>5 0 -20</td>
<td>2.0</td>
</tr>
<tr>
<td>2007</td>
<td>Soybeans wide row</td>
<td>45-55</td>
<td>Fall Chisel</td>
<td>10/7/2004</td>
<td>N 0 P 0 K 50</td>
<td>0</td>
<td>0</td>
<td>0 0 50</td>
<td>0 0 0 0</td>
<td>0 0 0</td>
<td>0 0 50</td>
<td>5.3</td>
</tr>
<tr>
<td>2008</td>
<td>Corn grain</td>
<td>130-150</td>
<td>Fall Chisel</td>
<td>10/7/2004</td>
<td>N 120 P 0 K 40</td>
<td>40</td>
<td>0</td>
<td>0 0 0</td>
<td>0 0 0 0</td>
<td>0 0 0</td>
<td>-12 0 40</td>
<td>2.0</td>
</tr>
</tbody>
</table>

**Summary results for 4-year crop rotation starting in 2005**
- Rotation: 2005 - 2008
- Ave soil loss: 1.6 t/acre
- Field "T": 4 t/acre
- Ave P Index: 2.8

**Summary results for 4-year nutrient balance starting in 2005**
- Balance: 2005 - 2008
  - P205: 60 lb/acre
Counties and Soils Selected for Snap-plus Planning Exercise

- Chippewa (Arland)
- Adams (Plainfield)
- Lafayette (Edmund)
- Outagamie (Boyer)
- Jefferson (Casco)
Assumptions of planning exercise using proposed standard:

- Soil test P = 105 ppm
- Slope is 8%, slope length is 150 feet
- Medium yield potential soils (except for Plainfield)
For planning exercise:

All operations must:

• Meet T
• Avoid over-applying N
• Maintain P Index less than 6 across rotation
• Apply 25% less $P_2O_5$ than crop removal
Cash Grain Operations

No Change!

Commercial fertilizers still applied according to UW recommended rates.
Dairy Operations

• CCAAA rotation
• With N credit for fair stand of alfalfa, no N needed for first year corn except for irrigated sands (NC farm).
• Liquid dairy manure applied to second year corn and seeding year alfalfa to maximum allowable N rate
• Manure = 9.3-5-16/1000 gal.
• Nitrogen limits manure applications
## Dairy operations

<table>
<thead>
<tr>
<th>Soil</th>
<th>T</th>
<th>Soil loss</th>
<th>Crop $P_2O_5$ uptake</th>
<th>$P_2O_5$ balance</th>
<th>PIndex</th>
</tr>
</thead>
<tbody>
<tr>
<td>NW Boyer</td>
<td>3</td>
<td>2.8</td>
<td>265</td>
<td>-115</td>
<td>4.2</td>
</tr>
<tr>
<td>NC Plainfield</td>
<td>5</td>
<td>0.2</td>
<td>305</td>
<td>-105</td>
<td>0.3</td>
</tr>
<tr>
<td>NE Arland</td>
<td>4</td>
<td>0.7</td>
<td>265</td>
<td>-115</td>
<td>1.7</td>
</tr>
<tr>
<td>SE Casco</td>
<td>3</td>
<td>2.8</td>
<td>285</td>
<td>-125</td>
<td>4.4</td>
</tr>
<tr>
<td>SW Edmund</td>
<td>2</td>
<td>1.8</td>
<td>285</td>
<td>-125</td>
<td>4.7</td>
</tr>
</tbody>
</table>
Poultry Operations

- CCCS Rotation
- Nitrogen needed for all corn years
- N requirement for one year of corn adds about 75% of the crop $P_2O_5$ removal for the 4-year rotation
- Manure = 24-30-24/ton
## Poultry operations

<table>
<thead>
<tr>
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<th>T</th>
<th>Soil loss</th>
<th>Crop $P_2O_5$ uptake</th>
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<tbody>
<tr>
<td>NW Boyer</td>
<td>3</td>
<td>1.6</td>
<td>210</td>
<td>-60</td>
<td>2.8</td>
</tr>
<tr>
<td>NC Plainfield</td>
<td>5</td>
<td>0.3</td>
<td>260</td>
<td>-65</td>
<td>0.4</td>
</tr>
<tr>
<td>NE Arland</td>
<td>4</td>
<td>2.6</td>
<td>210</td>
<td>-60</td>
<td>4.0</td>
</tr>
<tr>
<td>SE Casco</td>
<td>3</td>
<td>2.4</td>
<td>225</td>
<td>-60</td>
<td>3.9</td>
</tr>
<tr>
<td>SW Edmund</td>
<td>2</td>
<td>0.6</td>
<td>225</td>
<td>-60</td>
<td>2.7</td>
</tr>
</tbody>
</table>
Poultry operations

• Can use P Index strategy if need to apply more manure
  At 105 ppm soil test P, all PI values less than 6.
• But this is only temporary solution, because if continue to raise soil test P, P Index value will go above 6.
  At 300 ppm soil test P, only sites with very low erosion (NC, Plainfield and NE, Boyer) are less than 6.
Summary

- P index buys time to achieve P balance
- For dairy with CCAAA rotation, N determines manure rates
- High P in poultry manure requires large acreage or off-farm distribution
PI values vs. measured total P runoff losses from several sub-watersheds, Pioneer Farm, UW-Platteville

**PI vs P load**

\[ y = 0.322x + 0.479 \]

\[ R^2 = 0.7472 \]

*** Provisional data and Site 2 – 2004 removed***
More Research Base for P Index

• Year-round runoff monitoring in field-scale watersheds with different soils and management (23 sites)
• 2005: Simulated rainfall runoff experiments in North Central Wisconsin (Marshfield).
Research Base for P Index

• Analysis of soils from throughout Wisconsin for relationships between soil test P, water-soluble P, soil total P, soil properties, and soil P stratification (106 profiles).
• Simulated rainfall runoff trials with different managements and soils (335 plot events).
• Small plot replicated long-term natural runoff collectors with different managements and soils (72 plots)
Snap Plus and the P Index Update and Impact