Welcome
A Lunchtime Webinar Series
Serving Pennsylvania’s Best Practices on Animal Ag, Water-, and Air Quality

TODAY’S FOCUS: Animal Nutrition & Water Quality

- Jana Malot, State Grassland Conservationist, Natural Resource Conservation Service (NRCS) Pennsylvania Office
- Sarah Dinh, Dairy and Environment Extension Educator, Penn State Cooperative Extension, Lancaster County
- Paul Patterson, Professor of Poultry Science, Penn State Department of Poultry Sciences

Hosting
Michele Moyer
Penn State Dairy Alliance
Manure Du Jour

January 21, 2009

Jana Malot

Natural Resources Conservation Service
Pennsylvania
Grazing Livestock Nutrition

A-1 Lean Beef
Purpose:

Is to make you aware of the resource concerns that pertain to pastures that affect water quality. Then we will discuss factors that affect or treat those resource concerns.
SWAPA + H
Pasture RMS Template

SWAPA + H + E

- Soil
- Water
- Air
- Plants
- Animals
- Human
- Energy
Soil

- Erosion
  - Plant Canopy
  - Root Mass
- Condition/Health/Tilth
  - Roots
  - Plant residue
- Deposition
  - Reduced due to less erosion
Water

• Quantity
  – Plant Cover
  – Root Mass
  – Cooler surface

• Quality
  – Less runoff
  – Less fertilizer/nutrients applied
Pasture Resource Concerns

- Air
  - Carbon Sequestration
  - Apply less nitrogen due to legume content
  - Nutrients applied by livestock and used quickly
  - No manure storages/or smaller ones
Plants

• Healthier plants
  – Vigor
  – Diversity/Desirable Plants
  – Plant Cover
  – Plant Residue
  – Percent Legume
Animals
Wildlife and Domestic

- Food
- Cover
Grazing Livestock

• Overfeeding nutrients
  – Too much Protein
    • Increased cost
    • Production increase not proportional
    • Increased nitrogen in manure
  – Too much Phosphorus
    Increased cost
    • Production not increased substantially
    • Increased Phosphorus in manure
    • More acres to spread manure
    • Increased fuel costs, or more exporting
Grazing Livestock

• Under Feeding
  – Production is decreased
  – Income is down
  – Livestock are not healthy
  – Need more manure for crops or
  – Buy fertilizer
  – Etc.
Humans

- Social
- Economics
Energy

- Harvest own food
- Spread manure
- Natural Ventilation
- Etc
Well managed pastures are high in QUALITY!!!
Grazing Tips to Protect or Enhance
Water Quality

- Take care not to overfeed phosphorus in the total feed ration.

- Supplement dairy pastures with partial TMR* – DO NOT DO THE REVERSE, supplement TMR feeding with pasture.

- Analysis Pasture and Supplemental Feedstuffs for feed values and adjust rations according to feed analysis results.

- Properly Locate and Rotate winter hay and feeding areas.
Manure Du Jour

January 21, 2009

Sarah Dinh

Penn State Cooperative Extension,
Lancaster County and Capital Region
Nutritional Strategies on Dairy Farms Impact Water Quality

Sarah Dinh, Ph.D.
Dairy/Environment Extension Educator – Lancaster County
skd16@psu.edu
January 21, 2009
Introduction

• Lactating dairy cows excrete approximately 285 lbs of nitrogen per cow per year (St-Pierre and Thraen, 1999)

• Improving the conversion of feed N to animal product (milk) is the most efficient way to reduce N loss from the farm (Kohn et al., 1997)
Computer Programs

- Evaluate or create a ration that meets the nutrient requirements for a specific group of cows
- National Research Council: Nutrient Requirements for Dairy Cows, 2001 (NRC)
- Cornell, Penn, Miner (CPM)
Terms

• **Crude protein – CP**
  • Most common measurement of protein
  • RDP + RUP = CP

• **Rumen degradable protein – RDP**
  • Degraded in the rumen by rumen microbes

• **Rumen undegradable protein – RUP**
  • Bypasses rumen undegraded and digested in small intestine

• **Metabolizable protein – MP**
  • Protein digested and absorbed into the blood stream
Nitrogen

- Feeding more RDP or RUP than what is needed (feeding above the requirement)
  - More excretion of N in urine as urea
  - Urea is easily converted to ammonia upon manure contact
  - No difference in the amount of protein in milk
  - Potentially higher feed costs
Milk Urea-N (MUN)

- Highly correlated with urea-N in urine
- Easily monitored by Coops and DHIA
- Goal is 8 – 12 mg/dL
- Higher indicates overfeeding protein
- Lower indicates underfeeding protein
Factors That Can Increase MUN

- Dietary factors
  - Overfeeding RDP (requirement ~10% of ration DM)
  - Overfeeding RUP (requirement ~6% of ration DM)
  - Not enough ruminal available energy
    - Ex. Feeding a new corn silage with less available starch, not processing of corn silage, larger particle size of corn grain
Factors That Can Increase MUN

- Feed sorting
- No animal grouping
- Component feeding instead of total mixed ration feeding
Phosphorus In the Cow

- 80-85% of P is stored in bones and teeth
- Involved in numerous metabolic reactions
- 0.35% to 0.39% as a percent of ration dry matter is enough to meet the requirements
# P Concentrations in Common Feedstuffs

<table>
<thead>
<tr>
<th>Feed</th>
<th>P content (% of dry matter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn Silage</td>
<td>0.26</td>
</tr>
<tr>
<td>Corn Grain</td>
<td>0.30</td>
</tr>
<tr>
<td>Corn Gluten Feed</td>
<td>1.00</td>
</tr>
<tr>
<td>Corn Gluten Meal</td>
<td>0.60</td>
</tr>
<tr>
<td>Whole Cottonseed</td>
<td>0.60</td>
</tr>
<tr>
<td>Distillers grains</td>
<td>0.83</td>
</tr>
<tr>
<td>Soybean Meal, 48%</td>
<td>0.70</td>
</tr>
</tbody>
</table>

Adapted from “Reducing Dietary Phosphorus in the Dairy Herd” by Zhiguo Wu and Virginia Ishler, Penn State University
Feed Management Program

- **Goals** - Reduce feed costs and nutrient importation
- **Conditions where the program applies**
  - Whole farm nutrient imbalance
  - Farm with significant nutrient buildup
  - Farm that does not have enough land to apply manure
  - Improve feed efficiency
Feed Management Program

- Plans written and monitored by certified feed management plan writers
- EQIP funding available to support the implementation of the program on farm
Main Points

- Feed to NRC 2001 recommendations
- MUN is an excellent tool to monitor N utilization and N excretion
- Feed Management program will help farmers to decrease N and P excretion from their cows
Manure Du Jour

Poultry Nutrition Aimed at Improving Water Quality

Paul Patterson, Department of Poultry Science, Penn State University
Hen Mass Balance
Nitrogen Partitioning

Feed Nitrogen = 100%

Patterson & Lorenz, 1996
# Partitioning of Feed Nitrogen in Commercial Poultry

<table>
<thead>
<tr>
<th>Poultry</th>
<th>Feed %</th>
<th>Manure or litter</th>
<th>Carcass</th>
<th>Eggs</th>
<th>Atmosphere</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laying hens</td>
<td>100</td>
<td>25.01</td>
<td>0.84</td>
<td>34.07</td>
<td>40.01</td>
</tr>
<tr>
<td>Pullets</td>
<td>100</td>
<td>43.20</td>
<td>25.30</td>
<td>----</td>
<td>31.50</td>
</tr>
<tr>
<td>Turkeys</td>
<td>100</td>
<td>28.00</td>
<td>46.00</td>
<td>----</td>
<td>26.00</td>
</tr>
<tr>
<td>Broilers</td>
<td>100</td>
<td>30.56</td>
<td>51.08</td>
<td>----</td>
<td>18.36</td>
</tr>
</tbody>
</table>

Layer Example

- 100,000 hens @ 3.28 lb ave. = 328,000 lb
  2.8 lb pullet, 3.7 lb layer,
  79 lb feed & 28 lb manure/hen/yr
- 1,000 lb/animal units = 328 AEU
- @ 2 AEU/acre, need a minimum 164 acres (66 ha)
<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>GRAIN Lbs./Acre</th>
<th>SILAGE Lbs./Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>130</td>
<td>200</td>
</tr>
<tr>
<td>P&lt;sub&gt;2&lt;/sub&gt;O&lt;sub&gt;5&lt;/sub&gt;</td>
<td>57</td>
<td>80</td>
</tr>
<tr>
<td>K&lt;sub&gt;2&lt;/sub&gt;O</td>
<td>42</td>
<td>234</td>
</tr>
<tr>
<td>Ca</td>
<td>15</td>
<td>42</td>
</tr>
<tr>
<td>Mg</td>
<td>21</td>
<td>39</td>
</tr>
<tr>
<td>Zn</td>
<td>0.15</td>
<td>0.54</td>
</tr>
</tbody>
</table>

Corn plant nutrient removal at yield of 150 bu. acre.
Hen House Example

<table>
<thead>
<tr>
<th></th>
<th>lb/ac</th>
<th>Beyond corn req</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manure:</td>
<td>2.78 mil lbs</td>
<td></td>
</tr>
<tr>
<td>Tot-N</td>
<td>53,650 lb</td>
<td>328</td>
</tr>
<tr>
<td>P$_2$O$_5$</td>
<td>79,120</td>
<td>483</td>
</tr>
<tr>
<td>K$_2$O</td>
<td>44,630</td>
<td>272</td>
</tr>
</tbody>
</table>
Dietary Strategies for N

1. Formulate on amino acids (AA) not CP
# Impact of Supplemental Amino Acids on Dietary Protein and Amino Acid Level – Layer Peaking Diet

<table>
<thead>
<tr>
<th>Diet Target</th>
<th>Available Supplemental Amino Acids</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Met, Lys, Thr.</td>
</tr>
<tr>
<td></td>
<td>%</td>
</tr>
<tr>
<td>Crude Protein</td>
<td>18.22</td>
</tr>
<tr>
<td>Lysine</td>
<td>0.82</td>
</tr>
<tr>
<td>Methionine</td>
<td>0.40</td>
</tr>
<tr>
<td>Met+Cys</td>
<td>0.69</td>
</tr>
<tr>
<td>Threonine</td>
<td>0.61</td>
</tr>
</tbody>
</table>

Source: Michael Elliot, Wenger Feeds, Rheems, PA
Dietary Strategies for N

1. Formulate on amino acids (AA) not CP
2. Optimize dietary AA with requirement
Dietary Strategies for N

1. Formulate on amino acids (AA) not CP
2. Optimize dietary AA with requirement
3. Phase-feed for current weight/production
Available Dietary Strategies to Reduce Dietary N and NH₃ Emissions

1. Formulate on amino acids (AA) not CP
2. Optimize dietary AA with requirement “Ideal Protein” concept
3. Phase-feed for current weight/production
4. Use ingredients “True AA Digestibility”
5. Select ingredients with low nutr variability
6. Utilize feed additives/enzymes
7. Avoid/control anti-nutritional factors
Dietary Enzymes for Broilers
(Zanella et al., 1999)

- Ileal AA digestibility
  37d commercial broilers
- Corn/Soy diet ± protease, xylanase, amylase
- CP digest increased 2.9%
- 45d performance trial:
  improved wt gain and F/G
Turkey Tom Mass Balance
Phosphorus Partitioning

Feed Phosphorus = 100%

- Manure-P: 65.8%
- Carcass-P: 34.1%
Turkey Example

- 6,000 toms x 4 flocks per year
  - 28.6 lb final wt.
  - 69.3 lb feed/bird & 23.3 lb litter/bird/yr

- @ 1,000 lb/animal unit = 94 AEU

- @ 2 AEU/acre, need a minimum 47 acres
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<th>SILAGE (Lbs./Acre)</th>
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<tr>
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<td>57</td>
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<td>234</td>
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Turkey Example

<table>
<thead>
<tr>
<th></th>
<th>lb/acre</th>
<th>Beyond corn req</th>
</tr>
</thead>
<tbody>
<tr>
<td>Litter: 408,280 lb (204t)</td>
<td>(4.3t/acre)</td>
<td></td>
</tr>
<tr>
<td>Tot-N</td>
<td>10,238 lb</td>
<td>218</td>
</tr>
<tr>
<td>P$_2$O$_5$</td>
<td>29,890 lb</td>
<td>636</td>
</tr>
<tr>
<td>K$_2$O</td>
<td>8,166 lb</td>
<td>174</td>
</tr>
</tbody>
</table>
Dietary Strategies for P

1. Meet but do not exceed the P requirement
2. Select ingredients with readily available P
3. Utilize effective Vitamin D levels and compounds
4. Utilize additives/enzymes to enhance utilization
P Recommendations for Poultry

![Graph showing P recommendations for different phases of poultry growth. The graph compares Broiler, Pullet, Turkey-NRC, and Turkey-Com in phases 1 to 6.](chart.png)
<table>
<thead>
<tr>
<th>Compound</th>
<th>Biological Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta-trical phosphate Std</td>
<td>100</td>
</tr>
<tr>
<td>Fishmeal</td>
<td>100</td>
</tr>
<tr>
<td>Poultry byproduct meal</td>
<td>100</td>
</tr>
<tr>
<td>Dehy alfalfa meal</td>
<td>80</td>
</tr>
<tr>
<td>Corn</td>
<td>30</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>25</td>
</tr>
</tbody>
</table>
Highly available P (HAP) cereals

- HAP corn vs conventional corn
- Cereals with natural phytase
- SBM with transgenic phytase
Summary

- Numerous dietary strategies for nitrogen
- Numerous dietary strategies for phosphorus
- Many are cost effective, and may improve bird performance
- There are also management strategies farmers can implement to reduce N & P water contamination
Question and Answers

• Questions received in writing will be directed to the speakers by the host.
• If your question is not answered during the time remaining, responses to the questions will be posted at www.aec.cas.psu.edu
• Recordings of this session can also be viewed at the URL listed above.
Next Week on Manure Du Jour

Focus on
Water Quality – Barnyard & Exercise Lots

Featuring

• **Ann Swinker**, Department of Dairy & Animal Science, Penn State

• **Beth Futrick**, Blair Co. Conservation District and the Pennsylvania Agricultural Ombudsman Program

• **Jerry Martin**, Department of Crops & Soils Sciences, Penn State

For more information  [www.aec.cas.psu.edu](http://www.aec.cas.psu.edu)