Using the CNCPS Model to Evaluate the Importance of Nitrogen Fractions in Dairy Rations

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Why Use Models??

- Opportunity to evaluate management or nutritional strategies for potential impact on the dairy farm
- Explore options prior to implementation
- Evaluate current situation and define opportunities for change
- Design research trials
Developed over 25+ years
Nutrition model based on protein and carbohydrate nutrition
Most recent (version 5) was released in 2003
CPM-Dairy is a similar program
Still needs refinement
Summary of Feed Fractions: Protein and Carbohydrate in CNCPS and CPM Dairy

**DEFINITIONS:**
- **DIP**: Degradable Intake Protein
- **UIP**: Undegradable Intake Protein
- **DE**: Digestible Energy
- **DP**: Digestible Protein
- **ME**: Metabolizable Energy
- **MP**: Metabolizable (Absorbed) Protein
- **NSC**: Non-Structural Carbohydrates
  - (Organic Acids, Sugars, Starch, Soluble Fiber [pectic substances, beta-glucans, etc.])
- **SC**: Structural Carbohydrates

Revised 3/98, M.B. Hall  (Revised 7/00, L. E. Chase
Dr. M. B. Hall - Univ. of Florida (USDFRC)
Nitrogen Fractions in Silage

- True protein
- NPN compounds
- Ammonia, amino, amide, amine, nitrate, amino acids
- Amines = putrescine, cadaverine
Protein Fractions – CNCPS

Crude Protein

Soluble Protein
- NPN
- True Protein
  - B_1
  - tungstic acid

Insoluble Protein
- B_2
- detergents
- B_3
- NDIP
- ADIP

Borate phosphate buffer
Nitrogen Compounds in Fresh Forage and Silage

Oshima et al., 1979
NPN as a % of Total-N in 1st Cutting Alfalfa

Muck, 1987
Proteolysis

- The breakdown of true protein to amino acids and other simpler N compounds
- Extent determined by plant type, pH, wilting, temperature, protease activity, fermentation, DM
- More proteolysis = More breakdown (more NPN)
Forage Soluble Protein Levels

- Dairy One Forage Lab
- Samples analyzed between 5/03 and 4/04
- Soluble protein is expressed as % of CP
- Normal range = Mean = or – 1 SD
- Normal range represents about 67% of the total samples
### Forage Soluble Protein, % of CP

<table>
<thead>
<tr>
<th>Item</th>
<th>Legume Silage</th>
<th>Grass Silage</th>
<th>Corn Silage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>59.5</td>
<td>50.65</td>
<td>51.7</td>
</tr>
<tr>
<td>NR- Low</td>
<td>50.8</td>
<td>40.8</td>
<td>41.8</td>
</tr>
<tr>
<td>NR – High</td>
<td>68.1</td>
<td>60.5</td>
<td>61.6</td>
</tr>
</tbody>
</table>
Figure 2. The Effect of DM on Corn Silage Fermentations

Source: CVAS Analytical Services
Figure 1. The effect of DM on legume silage fermentations

Source: CVAS Analytical Services
Silage DM versus Ammonia N (% of CP) in Alfalfa Silage – Cumberland Valley

Excessive plant and Clostridial proteolysis
What’s the Impact on MP Predicted Milk?

- Used the CNCPS program
- 2\textsuperscript{nd} lactation cow, 100 DIM, 90 lbs. milk/day
- 56% forage in the total ration
- 1:1 ratio of AS and CS (DM basis)
- CS = 8.5% CP, 45% NDF
- AS = 20% CP, 40% NDF
MP Predicted Milk, lbs/day

Forage Soluble CP, % of CP

- 40 lbs
- 50 lbs
- 60 lbs
- 70 lbs

Base run
Predicted MUN, mg%
Is High Soluble CP a Problem?

- What evidence do you have of a “problem” from using these forages?
- Ammonia smell in the barn?
- High MUN?
- BCS loss (using energy to excrete CP)
- More fluid manure (more urine)
Improving the Efficiency of N Use at the Farm Level

- Using management practices that reduce proteolysis (lower % of total-N in the soluble and NPN fractions) may be one of the best strategies to improve the efficiency of N use.

- Most of these are management factors that the producer has control over (except the weather).
How Can Proteolysis be Reduced?

- Forage type – Red clover and timothy seem to have lower NPN levels than alfalfa
- Processing – Decreasing the hours of field wilting time can decrease proteolysis
- Protease inhibitors – Have potential
- Silo management – Rapid filling, packing, etc. can lower proteolysis
- Silage treatments – Acids may lower
What Are The Options?

1. Can you feed less of the high soluble CP forage?
   - More of the other forages
   - Add some dry hay

2. Select supplemental CP sources that are lower in soluble CP (HT SBM versus SBM, roasted soybeans, etc.)
What Are The Options – 2?

- Select carbohydrate sources that break down rapidly in the rumen (increase use of the ammonia)
  - Barley versus corn
  - Molasses or sugar
  - Corn grain particle size (fine)
What Are the Options – 3?

- Feeding management
  - TMR if possible
  - If conventional system, increase the number of times the forages are fed
    - Match grain feeding times with forage feeding times
    - Feed the grain energy source as close to the forage feeding times as possible
What Are the Options – 4?

- Work with the producer relative to forage management practices to lower soluble CP in next years crop
- Decrease field wilting time – wide swaths, dry faster
- Harvest at right DM and maturity
- Fill the silo fast, pack and seal
- Consider LAB inoculants
Controlling the protein fractions in forages is one way to improve the efficiency of nitrogen use and decrease nitrogen excretion to the environment on dairy farms.

Forage management is the first and most important step in this process.
Ration adjustments can help but can only help to minimize the problem of high levels of soluble CP and NPN in forages
HAVE YOU HUGGED A COW TODAY?

MILK. FRESH SQUEEZED DAILY.
THANKS!