Diet Factors Affecting Ammonia Production From Dairy Cow Manure

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Wooster
1. Amount of N excreted/cow
2. Number of cows
3. Route (or form) of N excretion
4. Manure storing/handling system
To provide 5.6 billion lbs of milk protein (US consumption in 2010)

<table>
<thead>
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<th>Lbs. Milk/Cow</th>
<th>Cows</th>
<th>Heifers/Dry Cows</th>
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<td>20,000</td>
<td>9.8 mil</td>
<td>+7.5 mil</td>
</tr>
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Managing cows for high production = greatest effect on environmental impact of dairy farming
N intake and Excretion

Cows that eat more N (protein) excrete more N

\[ y = 0.7x + 0.02 \]
Sources of Manure Ammonia

Urea + water \[ \xrightarrow{\text{Urease}} 2\text{NH}_3 + \text{CO}_2 \]  
Feces

Urine

Amino acids \[ \xrightarrow{\text{Deaminases}} \text{NH}_3 \]  
Feces

Hours-days

Days-weeks
RDP

NH₃

Bacterial Protein

Rumen Degradable Protein

Urea, alfalfa, soybean meal
Distillers, heated soy, gluten meal

RUMEN

RUP

Small Intestine

Indigestible

Rumen Undegradable Protein
N intake and Excretion when RDP Constant

Weiss et al., 2009

U = 0.39
F = 0.37
T = 0.76
- Urine N
- Digestible RUP
- Imbalance of digest. RUP-AA
- Easily fermented Carbs

- Fecal N
- Heat-damaged forages
- Distillers grains
- Hay-crop (oilseed meals)
- Slowly fermented carbs
48 hr NH3-N = 0.77*Urine N

48 hr NH3 Not related to fecal N
NH3 Production per unit of manure

Best

Worst +216%
Maximum Milk Protein: 75% alfalfa with 11.1% MP
Maximum Milk Protein Yield

- Per unit manure
- Best
- Worst (+52%)
Manure Ammonia

NH₃/lb of Manure * lb Manure/cow * Cows

DIET
Manure output

Mean = 176 lbs
Diet affects manure and manure ammonia differently

\[ \text{Manure Output} = \text{Alfalfa} + \text{Starch} \]

\[ \text{NH}_3/\text{kg of manure} = \text{Alfalfa} + \text{MP} \]

Weiss et al., 2009
Best: 75% Alf, 11.1% MP, 30% Starch
Worst: 25% Alf, 12% MP, 22% Starch
To Reduce Manure NH$_3$ by Dairy Industry

1. Feed adequate (slight excess) protein

2. Feed high energy diets (starch)

3. Feed substantial amount of alfalfa *

* Land use and feed costs may limit this option