

# Targeted Feeding Strategies to Reduce Nitrogen Losses and Ammonia Emissions from Dairy Cows

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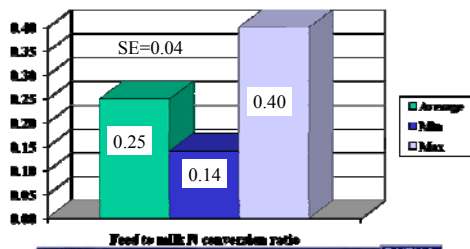
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Hristov et al., 2005

## Efficiency of utilization of feed N in Holstein dairy cows (846 diets)



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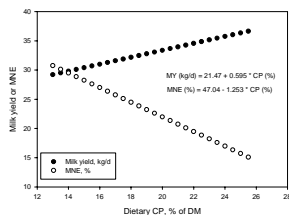
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Hristov & Huhtanen, 2008

## Effect of dietary crude protein on milk yield and milk N efficiency (simulation based on 1,700 diets)



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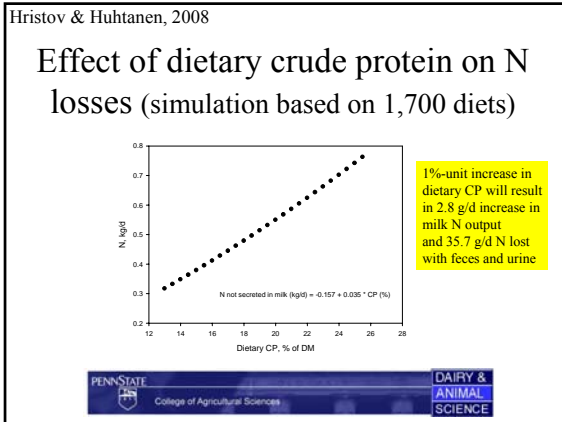
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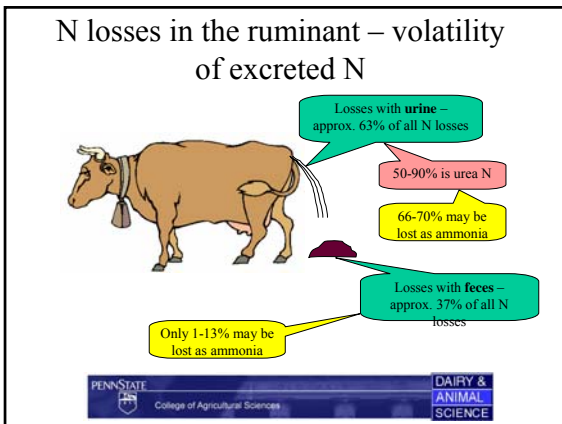
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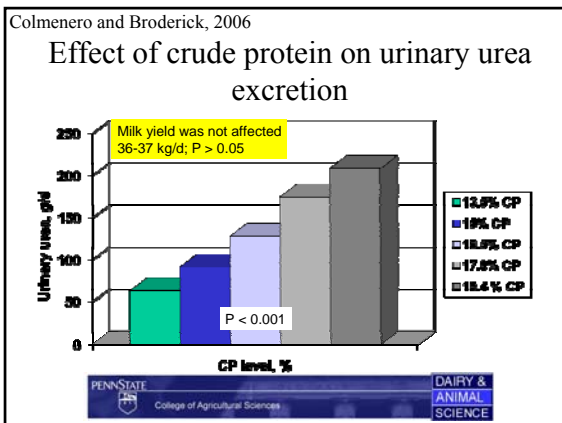
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Roy Huntley, EPA, personal communication

51%  
28%  
Half from ruminant

- Industrial processes
- Transportation
- Livestock
- Fertilizer application
- Other

**Ammonia emissions:**  
Crude protein level in the diet

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Published ammonia emission rates

EPA (2004) = 8 kg/cow/yr  
Rumburg et al. (2004) = 140 kg/cow/yr

41 to 82 kg  
16-26 kg from the barn floor, or 25-30% of total loss

1.2 kg Barn floor  
2 to 7 kg Barn floor

Hristov et al. (2004)  
Hristov et al. (2007)  
Danish Olesen (2006)  
Wheeler et al. (2008)  
Powell et al. (2008)

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Hristov et al., 2007  
N mass-balance study

About 50% of the estimated N output with feces and urine was unaccounted for in manure in 24 h

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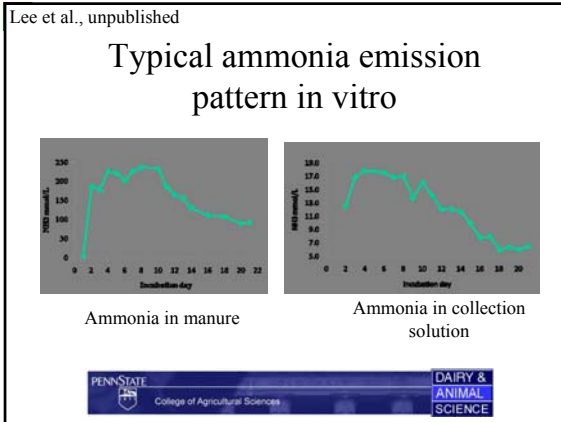
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Agle et al., 2008

### Crude protein levels study - diets

Composition (DM)	Control	LowCP	ExLowCP
Crude protein, %	17.6	15.2	14.4
NEL, Mcal/kg	1.55	1.51	1.51
NDF, %	30	30	32
Forage NDF	25	24	26
NFC, %	44	46	46
MP balance, g/d	+15	+16	+18
RDP balance, g/d	+570	+1	-369

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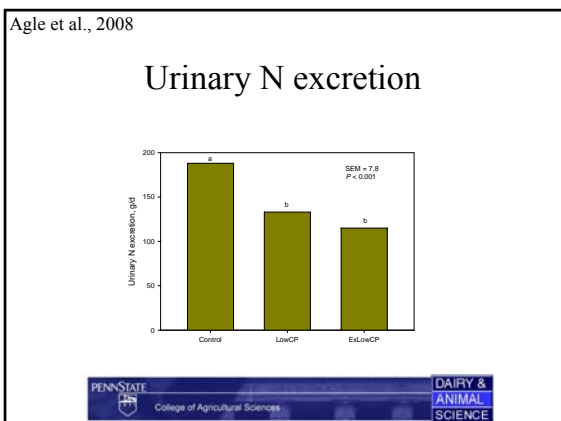
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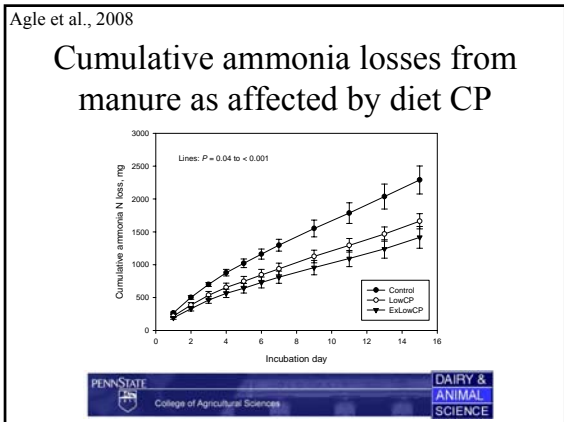
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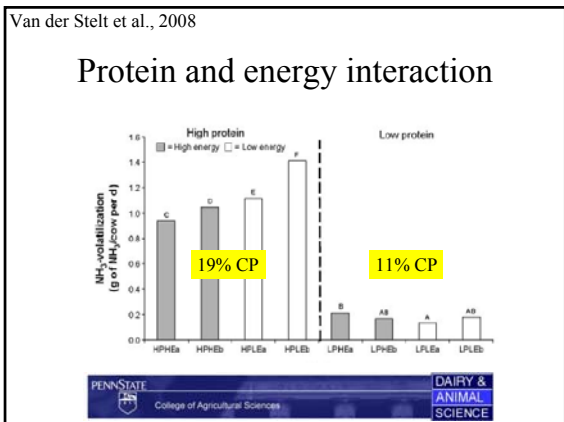
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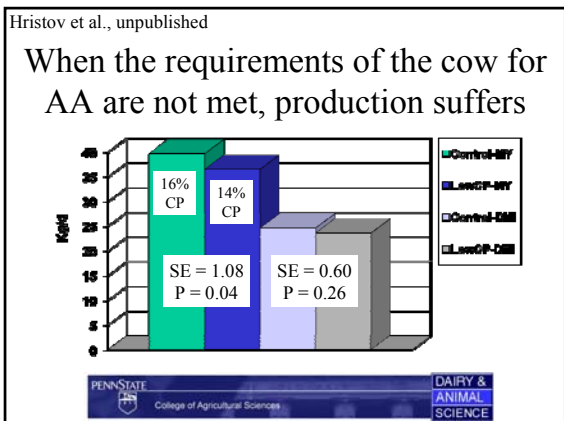
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## Ammonia emissions: Energy density of the diet




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Agle et al., 2008

### Energy density study - diets

Composition (DM)	Control	High-energy diet
<b>Forage, %</b>	<b>50</b>	<b>17</b>
Crude protein, %	17.9	17.8
RDP, %	12	12
NEL, Mcal/kg	1.65	1.83
<b>NDF, %</b>	<b>32</b>	<b>25</b>
Forage NDF	22	13
<b>NFC, %</b>	<b>39</b>	<b>47</b>




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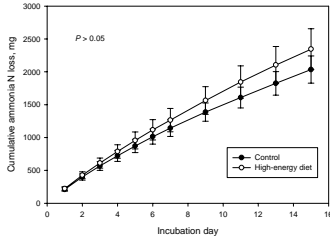
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Agle et al., 2008

### Cumulative ammonia losses from manure



Incubation day	Control (mg)	High-energy diet (mg)
0	0	0
2	~400	~450
4	~800	~900
6	~1200	~1350
8	~1600	~1800
10	~2000	~2250
12	~2400	~2700
14	~2800	~3150
16	~3200	~3600




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## Take-home message

- ❑ **Dietary CP concentration is the most important single factor determining milk N efficiency**
  - Rumen N balance should be reduced to improve N efficiency
- ❑ Feeding diets with lowered CP & ruminally-degradable protein concentrations will decrease urinary N excretion
  - **In one study, cumulative ammonia losses from manure were reduced by 38%**
- ❑ In one study, increasing energy density of the diet reduced ruminal ammonia concentration and relative urinary N losses, **but had no effect on cumulative ammonia losses from manure**



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## References

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