# Protein: Can We Feed Less?

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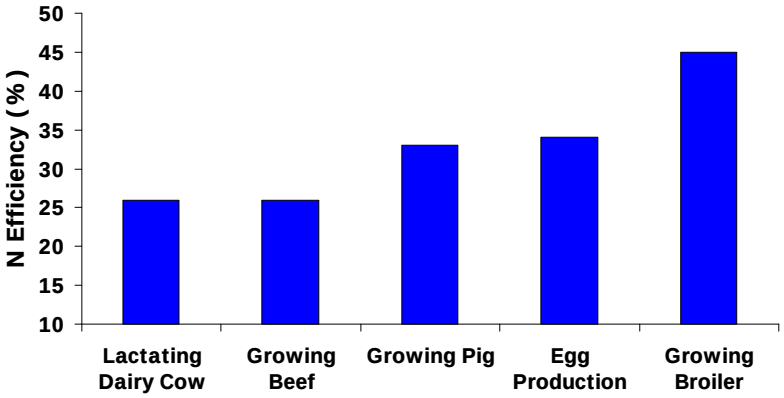
## N Conversion Efficiencies for Different Production Systems




Bequette et al., 2003

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# Environmental Impact of Waste N

Eutrophication

Air Quality and High N Rain

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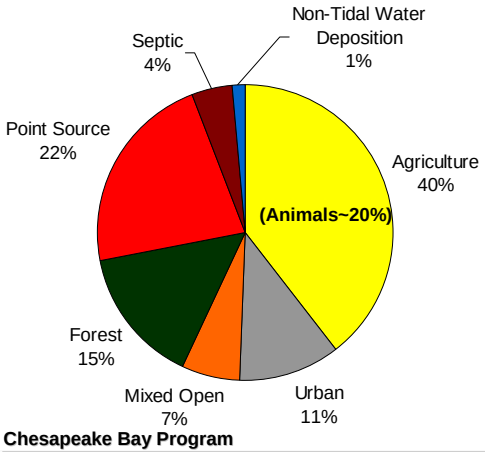
# Animal Agriculture is a Significant Source of Bay Nitrogen

**Chesapeake Bay Watershed - Nitrogen Loads (2003)**




**Chesapeake Bay Program**

**Chesapeake Bay Program Dairy:**
**Through feed management, achieve 20% reduction in manure nutrients in one-half the cows by 2015.**

**2.1 million lb N/yr**

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# But I'm concerned about Making Money!

Income over feed costs

- ↓ CP ⇒ ↑ $ ??
- Diet cost
- Milk production



# Dairy Ration Nutrient Costs
## Central Ohio

| Nutrient Name | Apr-2007 | Apr-2008 | Aug-2008 |
|---|---|---|---|
| | -------- Nutrient Costs -------- | | |
| Net energy for lactation - (NRC, 2001; $/Mcal) | 0.088 | 0.154 | 0.171 |
| Metabolizable Protein ($/lb) | 0.165 | 0.294 | **0.242** |
| Non-effective NDF ($/lb) | -0.07 | -0.126 | -0.219 |
| Effective-NDF ($/lb) | 0.002 | 0.014 | 0.072 |

St-Pierre, 2008
http://dairy.osu.edu/bdnews/v009iss04.htm#CostofNutrients

# Dairy Ration Nutrient Costs
## Central Ohio

| Nutrient | Apr-2007 | Apr-2008 | Aug-2008 |
|---|---|---|---|
| | -- Nutrient costs, $/cow/day -- | | |
| $NE_L$ | 2.93 | 5.13 | 5.69 |
| **MP** | **0.77** | **1.36** | **1.12** |
| ne-NDF | -0.24 | -0.43 | -0.74 |
| e-NDF | 0.02 | 0.14 | 0.73 |
| Minerals and vitamins | 0.2 | 0.2 | 0.2 |
| TOTAL | 3.68 | 6.40 | 7.00 |

St-Pierre, 2008
http://dairy.osu.edu/bdnews/v009iss04.htm#CostofNutrients

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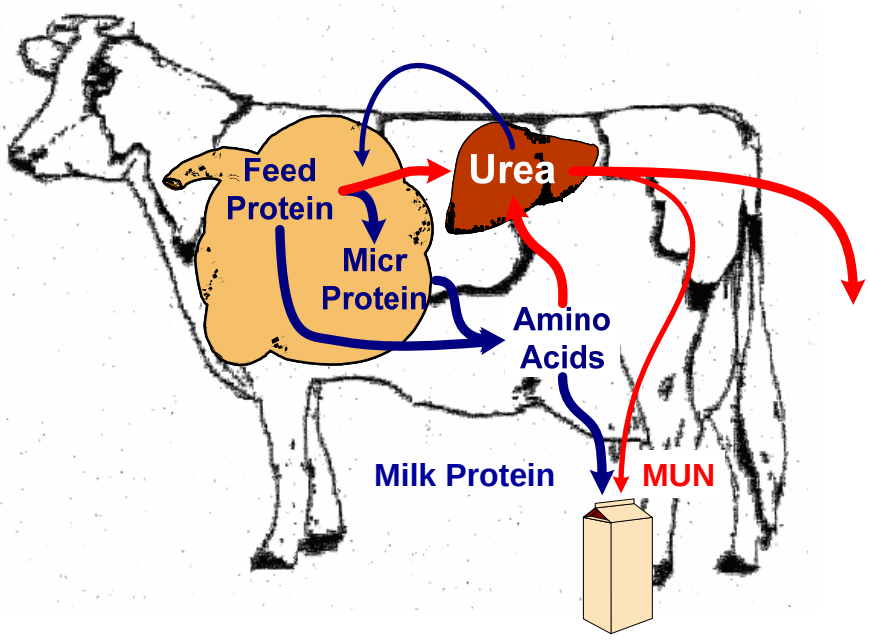


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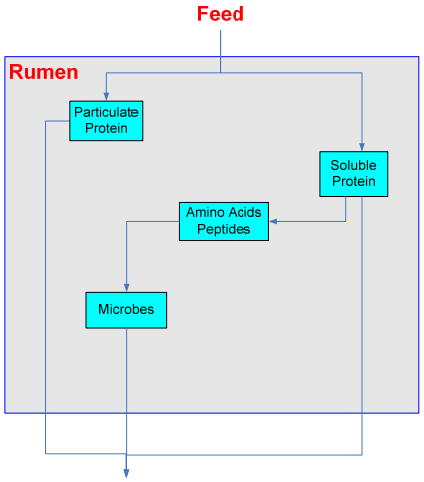
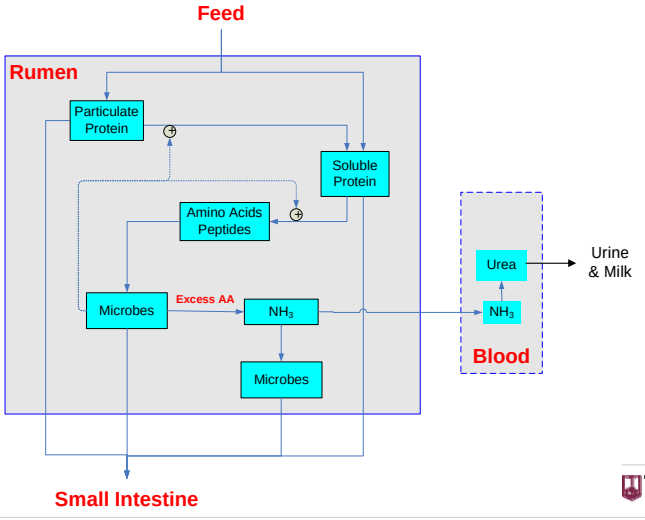
# Protein Degradation in the Rumen



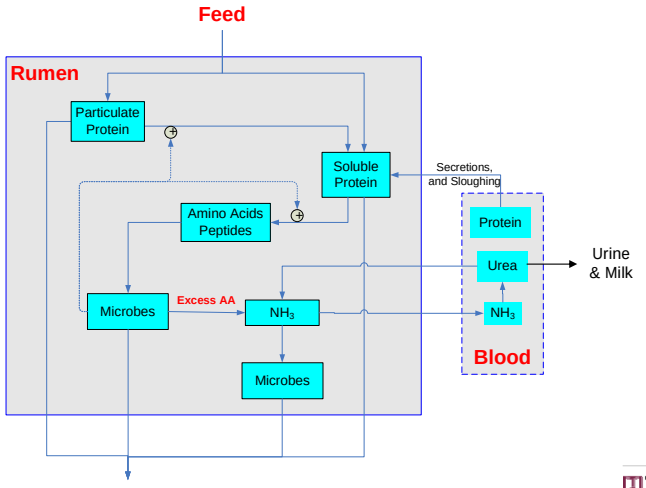

- Ruminally Degradable Protein (RDP)
  - Soluble + Degraded Particulate
- Ruminally Undegraded Protein (RUP)
  - Undegraded Particulate
- Microbial Protein (MicrP)
  - From RDP
- Metabolizable Protein (MP)
  - MP = RUP + MicrP



# Protein Degradation in the Rumen



# Protein Degradation in the Rumen and N Recycling

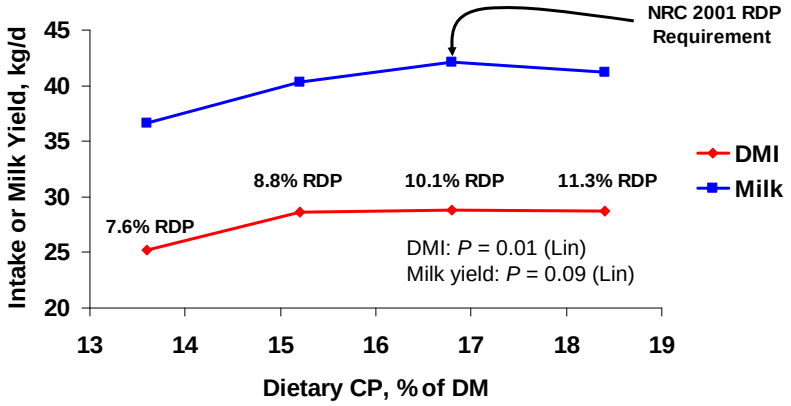





# Ruminally Degradable Protein (RDP)

- Supports microbial growth
- Too little RDP
  - ↓ microbial flow from the rumen
  - ↓ fiber digestion
  - Fiber digesting bacteria require ammonia
- Too much RDP
  - Microbes degrade and use for energy
  - Wastes N
  - Costs money

# Effects of Dietary Protein (RDP) on Intake and Milk Yield




Cyriac et al., 2006

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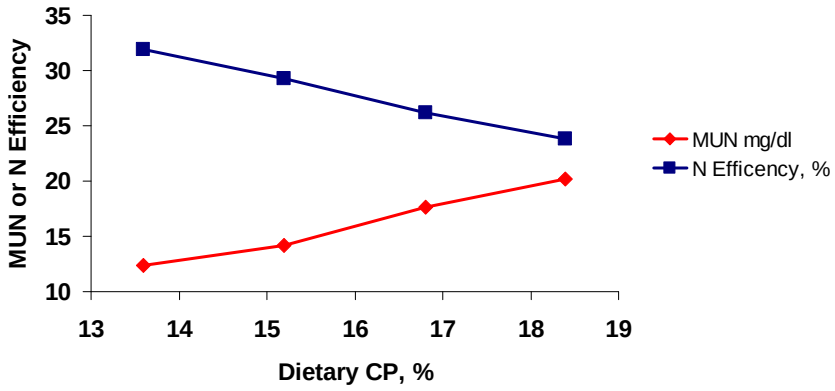
# Effects of Dietary Protein (RDP) on MUN and N Efficiency




Cyriac et al., 2006

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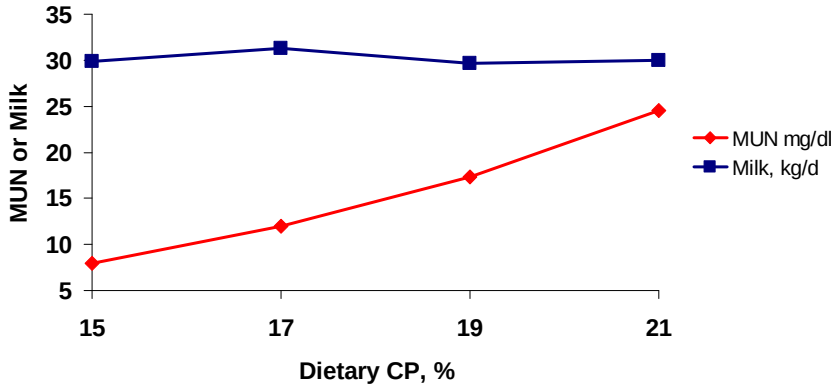
# Effects of Dietary Protein on MUN and Milk Yield




Burgos et al., 2007

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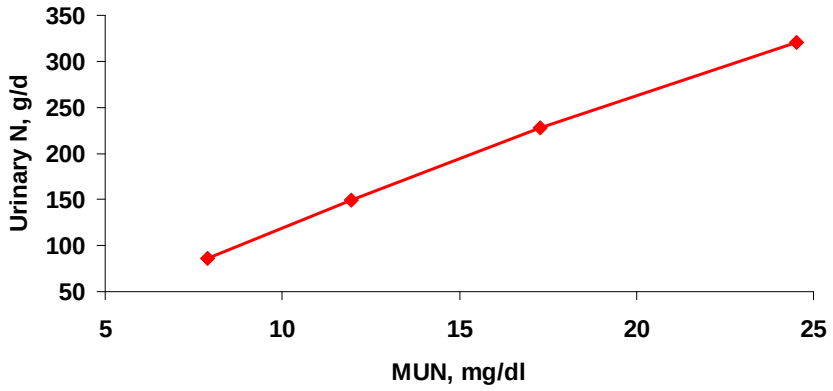
# Effects of Dietary Protein on MUN and Urinary N Output




Burgos et al., 2007

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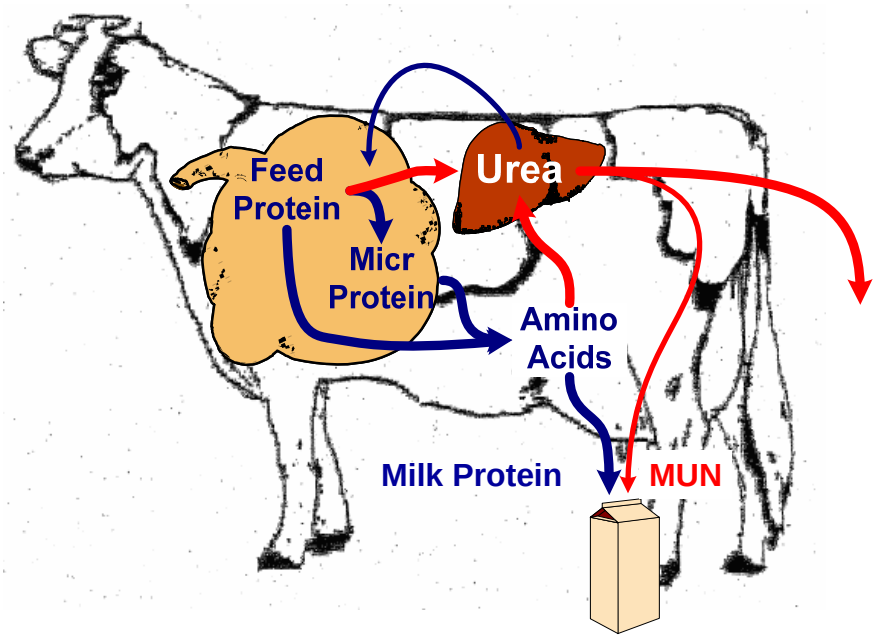


**Animal Requires MP!**

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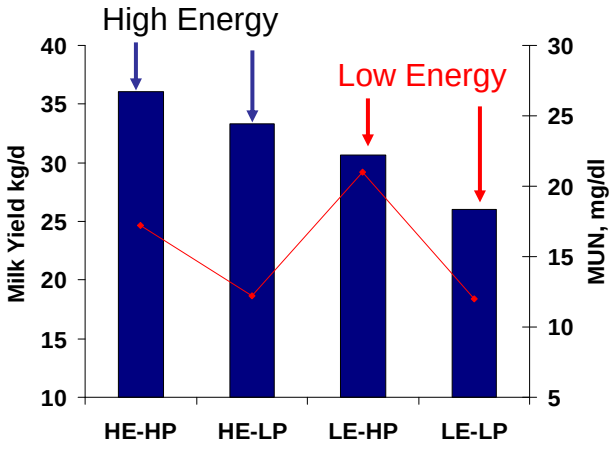
## Dietary Energy and Metabolizable Protein




HE – 1.55 Mcal/kg
LE – 1.44 Mcal/kg

HP – 17.0% CP
LP – 14.4% CP

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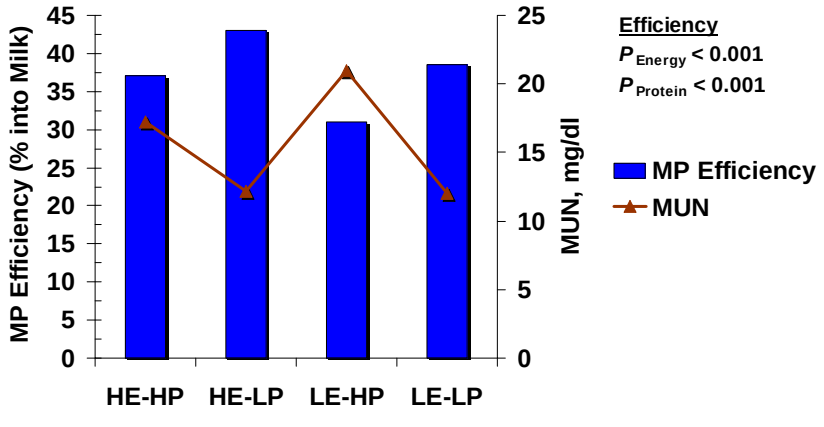
Ruis et al., 2007

# Dietary Energy and Metabolizable Protein

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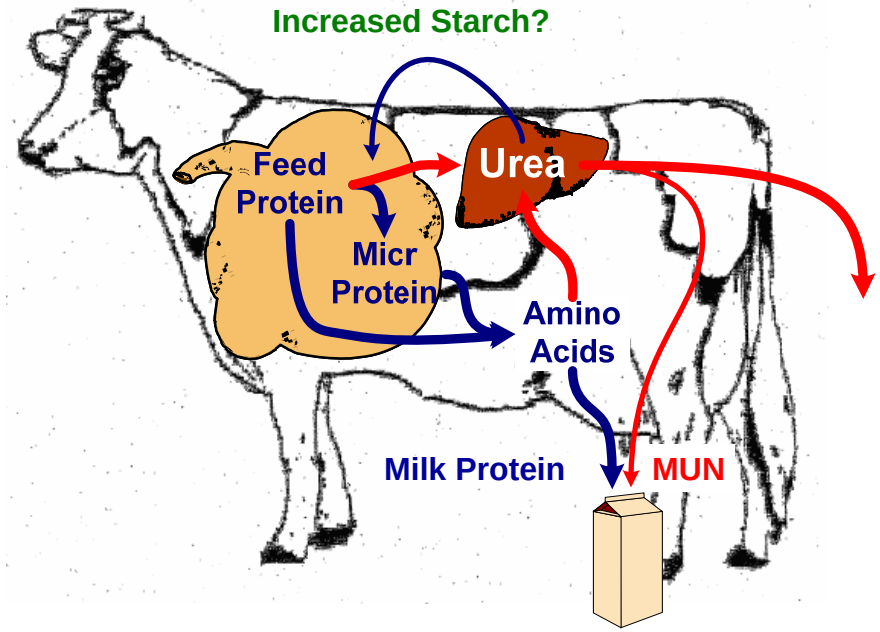
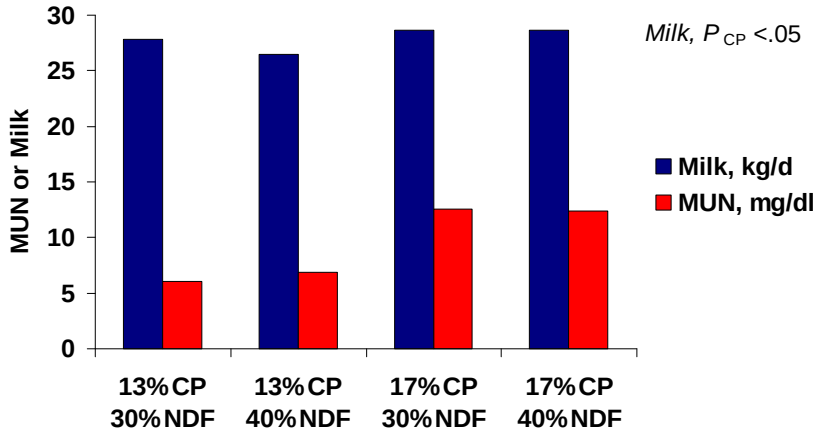
Ruis et al., 2007



# Dietary Crude Protein and Fiber

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Kaufman and St-Pierre., 2001

NEL: 30% NDF – 1.66 mcal/kg
40% NDF – 1.63 mcal/kg

# Monitor MUN to Achieve Optimum Return

1. Establish a baseline for your herd
   - Some genetic variation
   - Balance ration to NRC 2001
   - Feed ration for 2 weeks and Measure MUN

2. Reduce RDP to 9% of Diet DM while holding RUP constant
   - Dietary CP also reduced by 1% unit
   - Feed for 2 weeks and measure MUN: should ↓ by 2 mg/dl
   - Should be no change in milk yield
   - May or may not save $

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# Monitor MUN to Achieve Optimum Return

3. Systematically reduce RUP (0.25% units at a time)
   - For example, 16% to 15.75%
   - Keep RDP at 9% or above
   - Feed for 3 weeks; keep dietary energy high
   - Monitor milk yield
   - Any milk loss with underfeeding will be half of NRC predicted loss
   - Calculate Income/Feed Cost (IOFC)
   - If greater, retain reduction and lower another 0.25%
   - MUN at maximal IOFC is target for the herd



# Summary

1. We can improve N efficiency of Dairy Cows
2. Should save Feed $
3. Feed to requirements
   - RDP requirements are too high
   - RUP Requirements ??
4. Feed and Nutrient Management is part of the Answer
   - Monitor feeds for nutrient content
   - Balance to requirements
   - Monitor programs for feeding accuracy
   - Establish a target MUN
   - Monitor MUN to stay on target