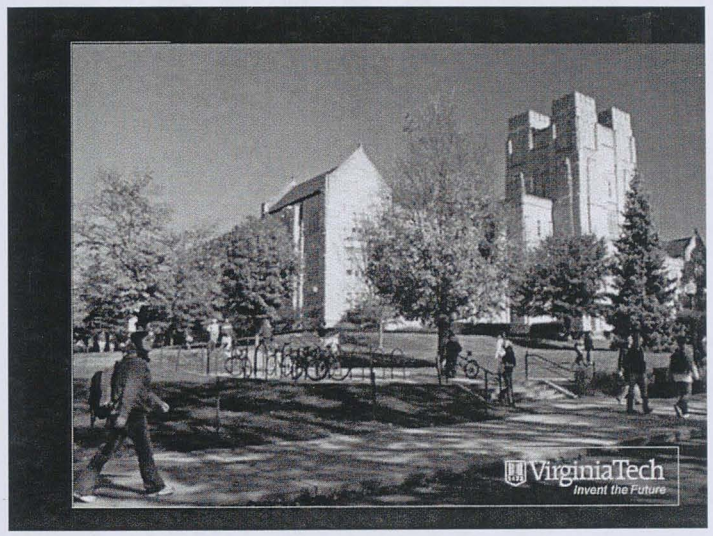
Balancing for Protein and Amino Acids: It Isn't Quite as Simple as it Might Seem

M.D. Hanigan
Department of Dairy Science, Virginia Polytechnic Institute and State University, Blacksburg, VA



NOTES

Outline

1. Food production is a growth industry, but we have a lot of challenges
2. RDP requirements may be too high
3. Variable efficiency of MP use for lactation
4. No such thing as a single limiting nutrient.
5. Summary and Take Home

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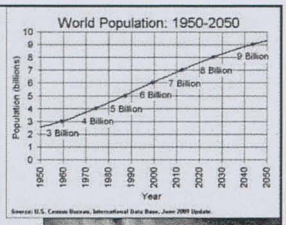
Animal Nutrition is Important!

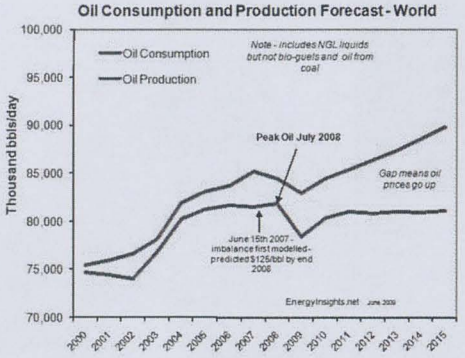
Food production must double by 2050!



http://www.restlessbeings.org/images/child_malnutrition_on_the_map.jpg
http://bryanking.net/wp-content/uploads/2009/02/malnutrition.jpg

http://www.census.gov/ipc/www/idb/worldpopgraph.php

Finite Oil Reserves



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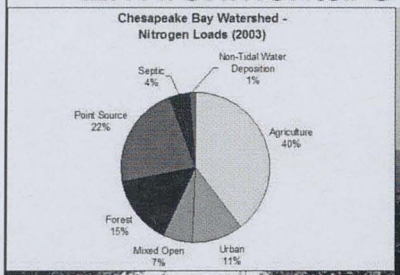
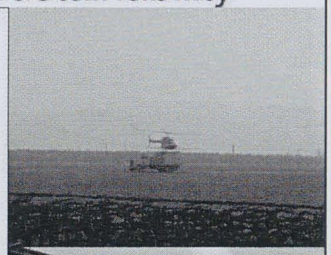
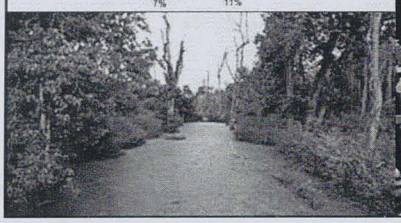
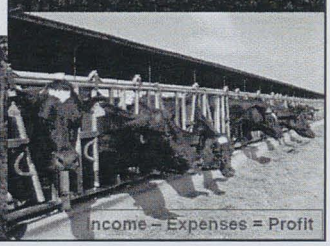
http://www.energyinsights.net/cgi-script/csArticles/articles/000046/004690.htm

Environmental Sustainability





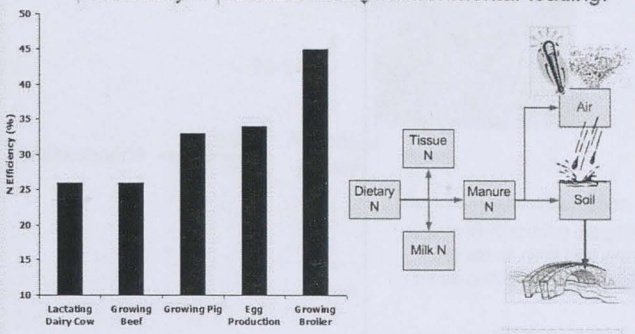




Income – Expenses = Profit

N Conversion Efficiencies are Relatively Poor for the Ruminant

↑ efficiency = ↑ food/ac and ↓ environmental loading!



Bequette et al., 2003

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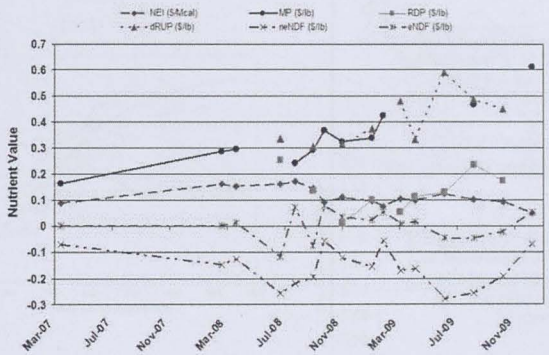
Nutrient Values for Ohio



Aggregated from the Buckeye Dairy News: http://dairy.osu.edu/bdnews/bdnews.html
St-Pierre and Knapp

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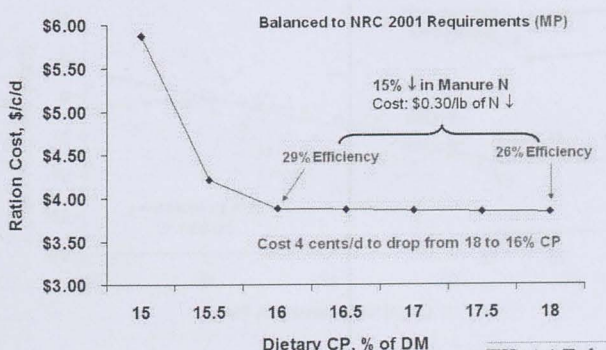
NRC 2001 Least Cost Rations at Varying Dietary Crude Protein Content



Stewart et al., 2012

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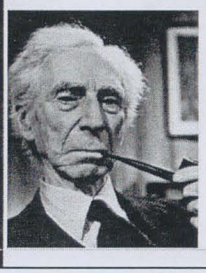
It isn't what we don't know that gives us trouble, it's what we know that ain't so.
Will Rogers



In all affairs, love, religion, politics or business, it's a healthy idea, now and then, to hang a question mark on things you have long taken for granted.
Bertrand Russell

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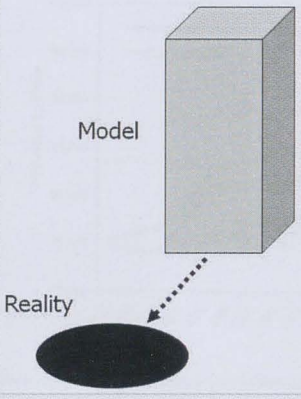
Is Our Bias Preventing Progress?



- Pigs can convert 85%of absorbed N to meat when fed a perfect AA mix (Baker, 1996)
- Cows convert 33%
- Further losses in the rumen

Cause

1. Inadequate knowledge of ruminal N requirements?
2. Inadequate knowledge of animal protein and AA requirements?

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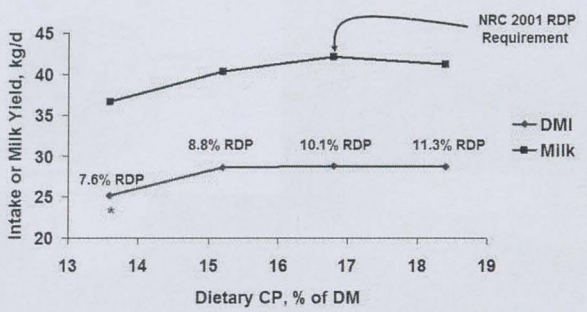
Effects of Dietary Protein (RDP) on Intake and Milk Yield



Cyriac et al., 2008

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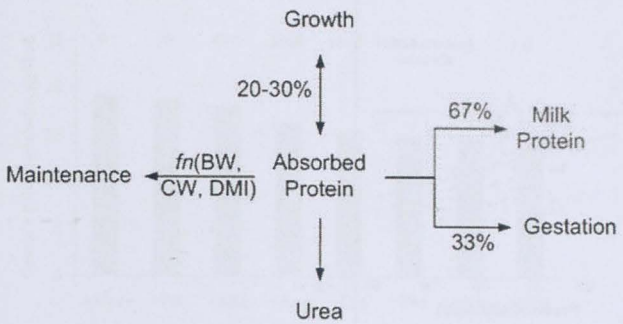
NRC 2001 MP Efficiencies
Lactating Cow



CW = Conceptus Weight

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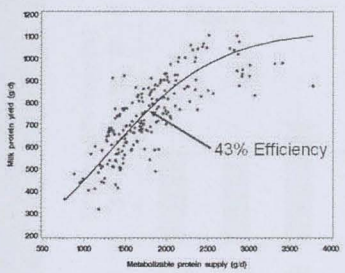
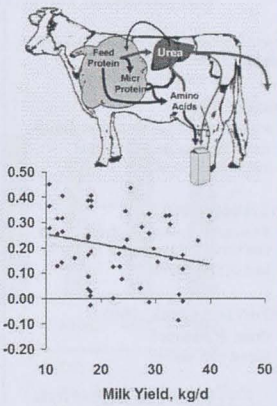
Requirement Accuracy: Marginal Efficiency of MP use for Milk N Synthesis is not 65%





Lapierre et al., 2007

Hanigan et al., 1998

NRC 2001 Metabolizable Protein Based Predictions

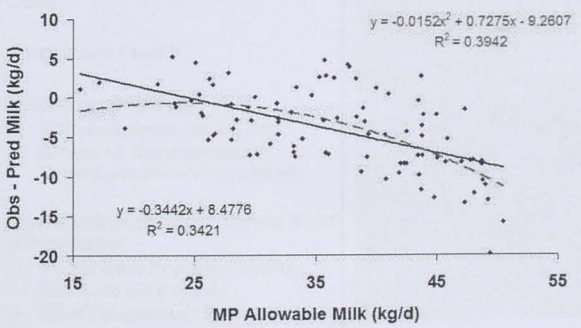


Fig. 16.3, NRC 2001 replotted against predicted milk

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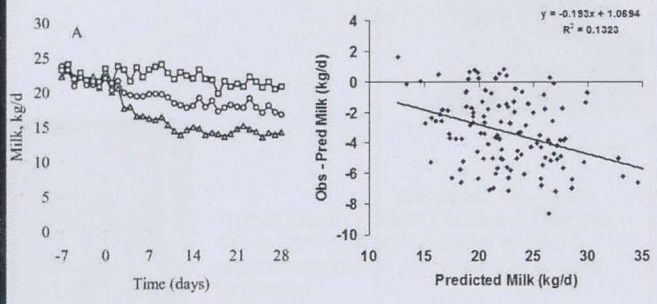
CNCPS Prediction Errors

Diets Varied from 9.4 to 14.1% CP (3 Trts)



Ruiz et al., 2002. JDS

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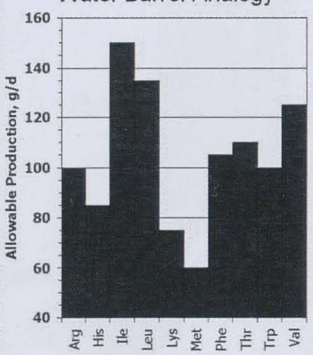
Single Limiting Nutrient Theory



- Lowest Stave determines the level of water in the barrel
- **Sprengel, 1828**
  - A soil nutrient can limit plant growth
  - When limiting, growth will be proportional to supply
- **von Liebeg, 1862**
  - If a nutrient is limiting, then growth can't respond to another nutrient
  - Law of the Minimum
- **Mitchell and Block, 1946**
  - Order of limitation
  - Barrel with staves

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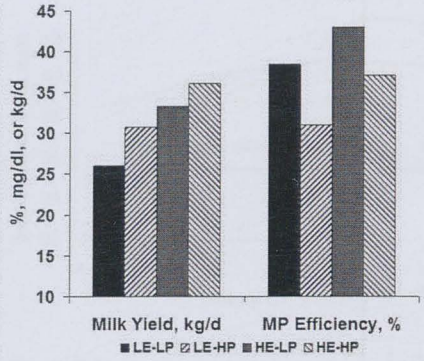
Effects of Energy and MP Supply on Production and Nitrogen Efficiency



Milk
Protein $P<.08$
Energy $P<.01$
E x P $P=.64$

Efficiency
Energy $P<.001$
Protein $P<.001$
E x P $P=.53$

HEHP = 1.54 MCal/kg, 11.8% MP
HELP = 1.54 MCal/kg, 9.5% MP
LEHP = 1.45 MCal/kg, 11.8% MP
LELP = 1.45 MCal/kg, 9.5% MP

Rius et al., 2010. JDS

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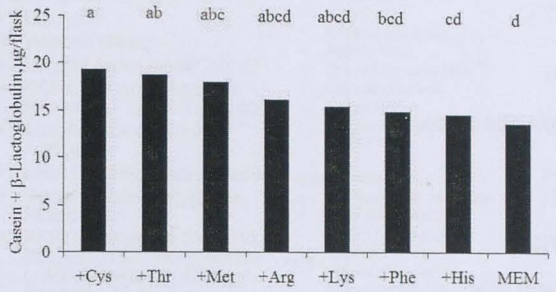
In Vitro Milk Protein Responses to Individual Amino Acids



Clark et al., 1978

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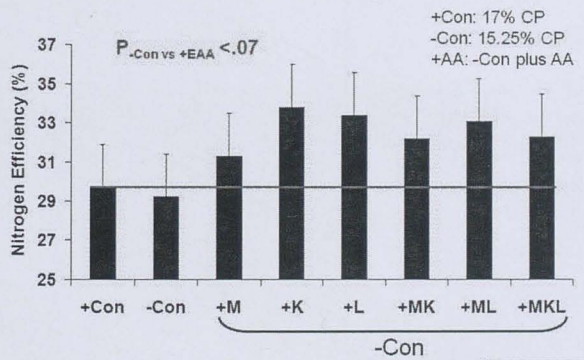
Effects of Protein and Ruminally Protected Met, Lys, and Leu on Nitrogen Efficiency



Bell et al, 2011

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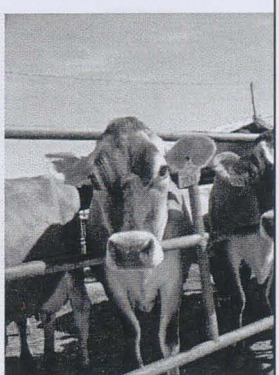
N Summary

1. We can improve N efficiency of Dairy Cows
2. Should save Feed $
3. Feed to requirements
   - RDP requirements are too high
   - MP and AA Requirements ??
     - MP may be too low for high producers
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



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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. Systematically reduce RUP (0.25% units at a time)
   - For example, 17% to 16.75% CP
   - Keep RDP constant at the established level
   - Feed for 3 weeks; keep dietary energy high
   - Monitor milk yield and protein percent
   - Any milk loss will be half of NRC predicted loss
   - Calculate Income/Feed Cost (IOFC)
   - If greater, retain reduction and lower another 0.25%
   - Pay attention to AA balance!

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Monitor MUN to Achieve Optimum Return

3. Reduce RDP by 0.5% of Diet DM while holding RUP constant
   - Dietary CP also reduced
   - Feed for 2 weeks and measure MUN: should ↓ by 1 mg/dl
   - Monitor for milk yield and milk protein loss
   - Calculate Income/Feed Cost (IOFC)
   - Drop it another 0.5% and monitor milk and MUN, etc.
   - May or may not save $
   - Resulting MUN is the target for that herd
4. Don't throw away your AA balancer!
   - Working for you – don't stray too far!
   - Not working – ... coming soon!

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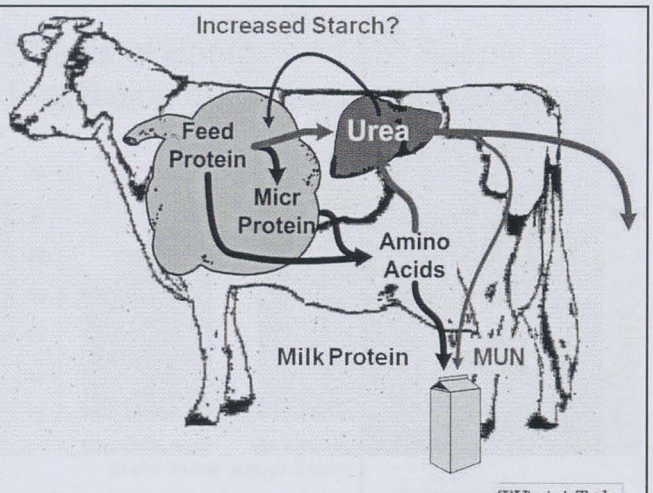

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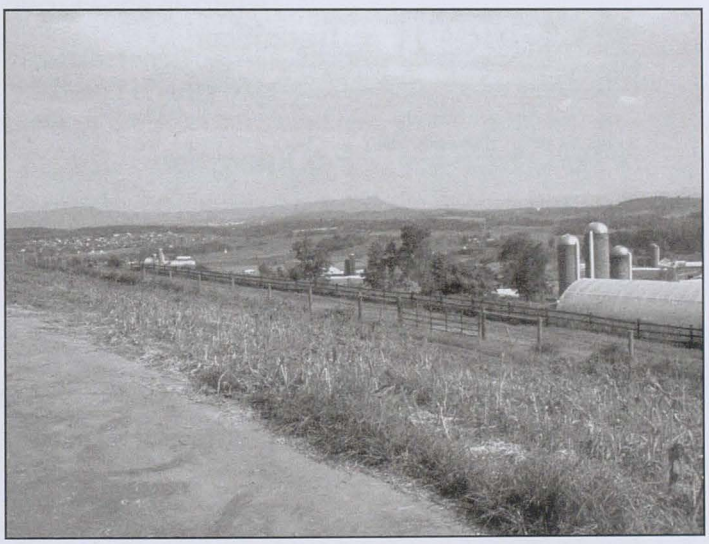

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