

Perspectives in ruminant protein efficiency, recycling, and amino acids

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Topics for today

Urea recycling

Should I add urea to the diet?

Amino acid requirements

Should we believe the NRC?

Decreasing dietary CP

Reproduction, diet cost, environment

Still meet MP requirement?

- Increase RUP
- Supplement AA

But, are the bacteria happy?

Predicting RDP requirements

Estimate MCP (microbial protein)

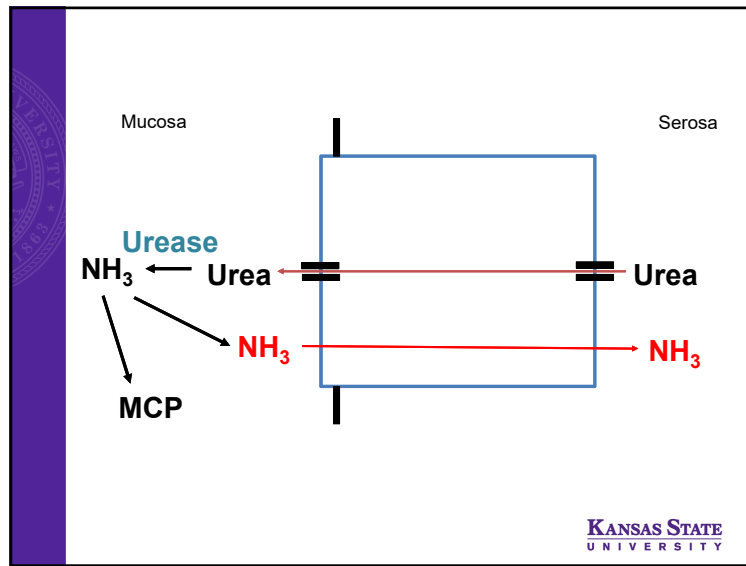
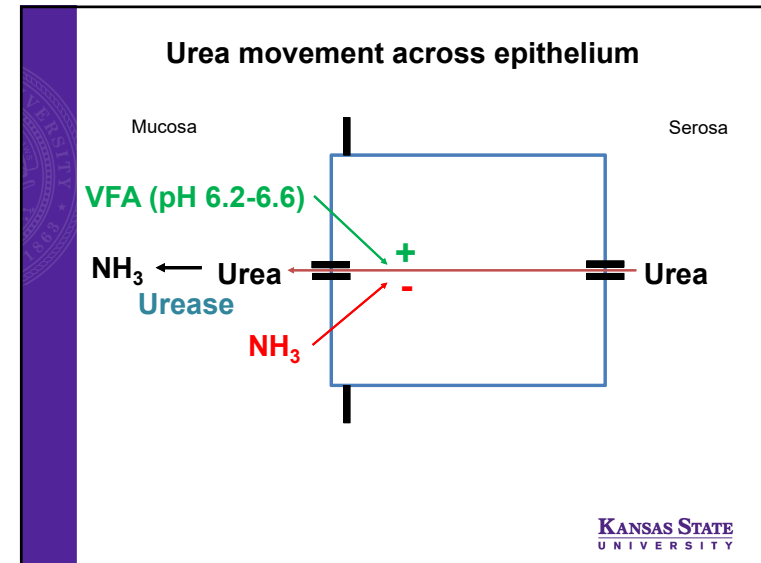
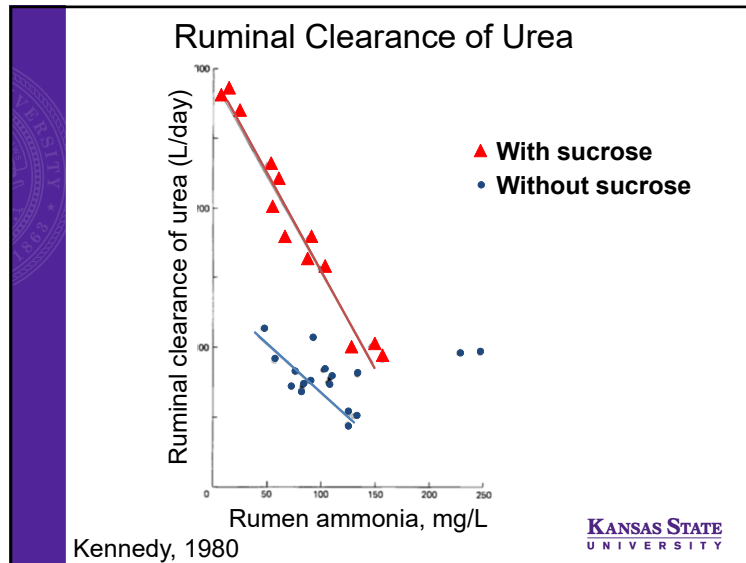
Estimate efficiency of N capture

RAN requirement = $MCP \div \text{efficiency}$

RAN supply = RDP + recycled urea

(MCP = Microbial Crude Protein)

(RAN = Ruminally Available N)



Lactating dairy cattle

	Urea supplementation (% of DM)		
	0	0.4	0.8
Diet CP, %	12.6	13.7	14.9
DMI, kg/d	18.1	18.9	19.0
Milk, kg/d	32.7	33.8	34.0
Milk protein, kg/d	0.90	0.94	0.96
Rumen NH ₃ , mM	3.8	6.2	8.2
PUN, mM	3.3	5.5	7.8

Rojen et al., 2011

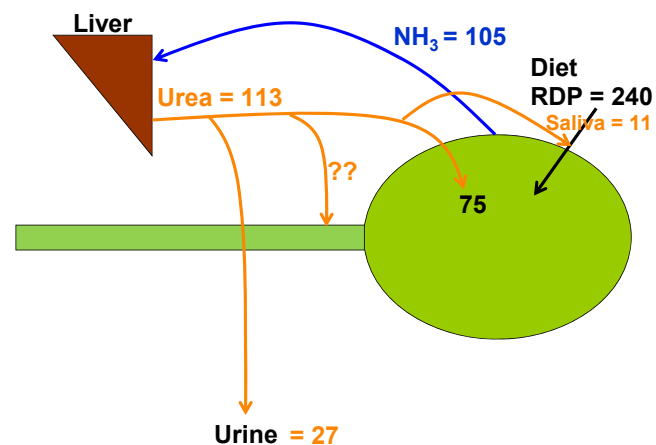
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Lactating dairy cattle

Nitrogen	Urea supplementation (% of DM)		
	0	0.4	0.8
N Intake, g/d	366	416	457
Urea			
Production, g/d	113	174	186
Recycled, g/d	75	104	96
Salivary, g/d	11	16	0
Recycled, %	66	60	52

Rojen et al., 2011

Dairy cows fed 12.6% CP diet



Rojen et al., 2011

How do we use this information?

Target optimal supply of RAN:

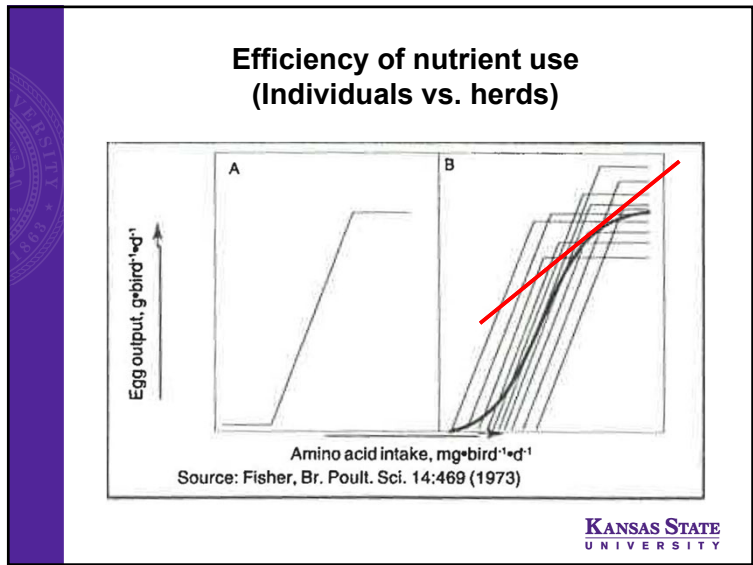
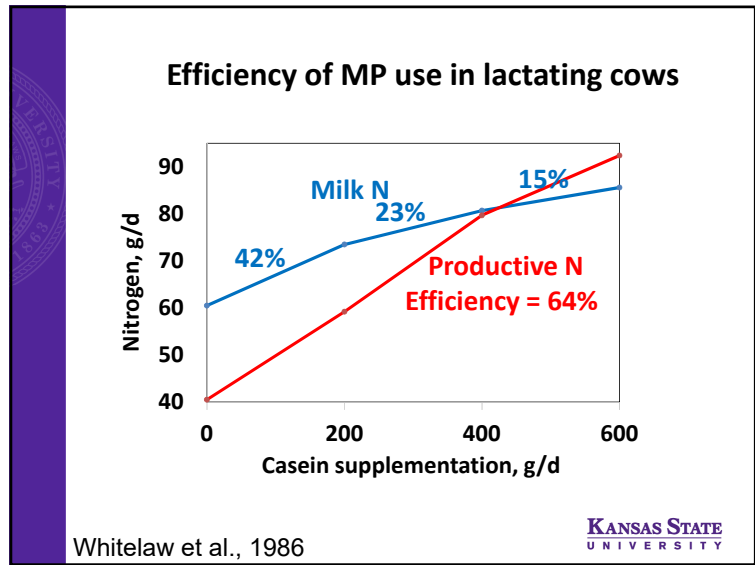
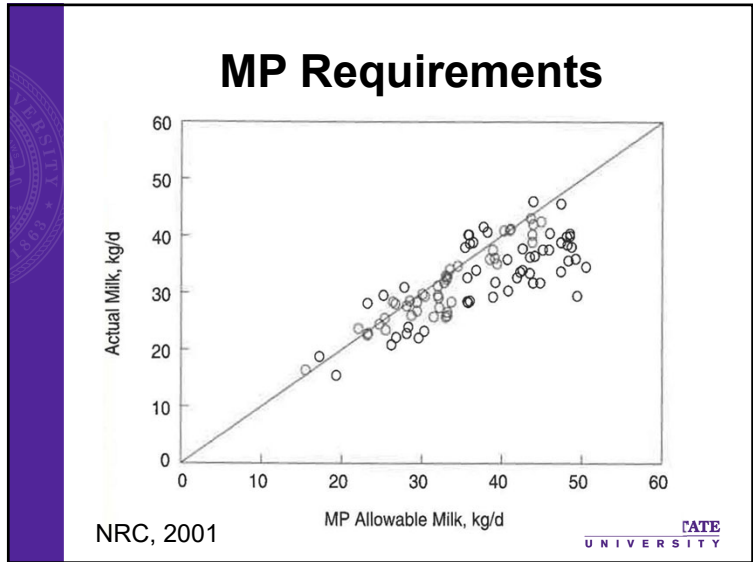
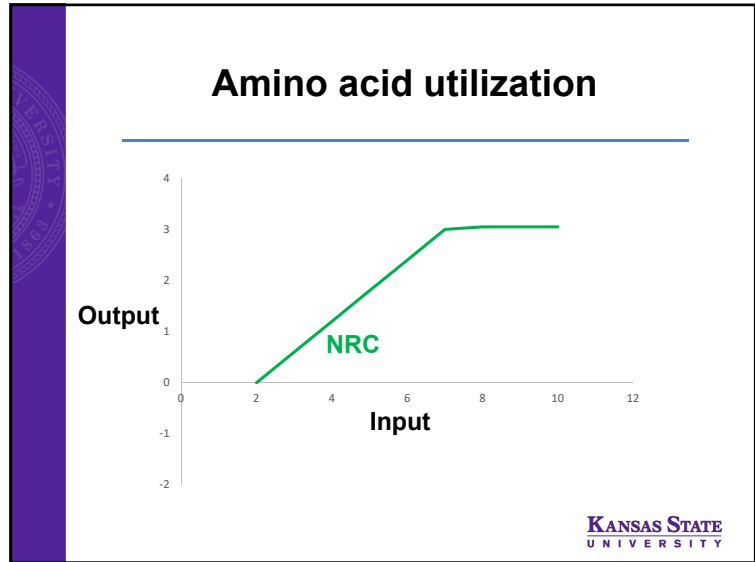
- If we know MCP and ruminally recycled urea, then we can calculate the necessary RDP

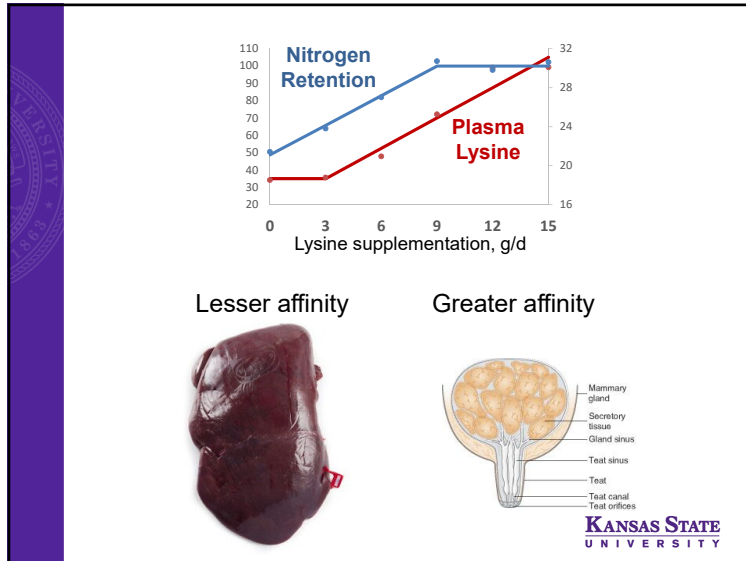
My perspective:

- For most lactation diets, deficiencies in RAN are unlikely to exist and certainly not likely to be severe

MP Requirements

- NRC (2001) MP requirement = maintenance + milk protein/0.67
- Estimate of efficiency is key!
- Efficiency < 0.67
- Efficiency not constant, at least for a herd



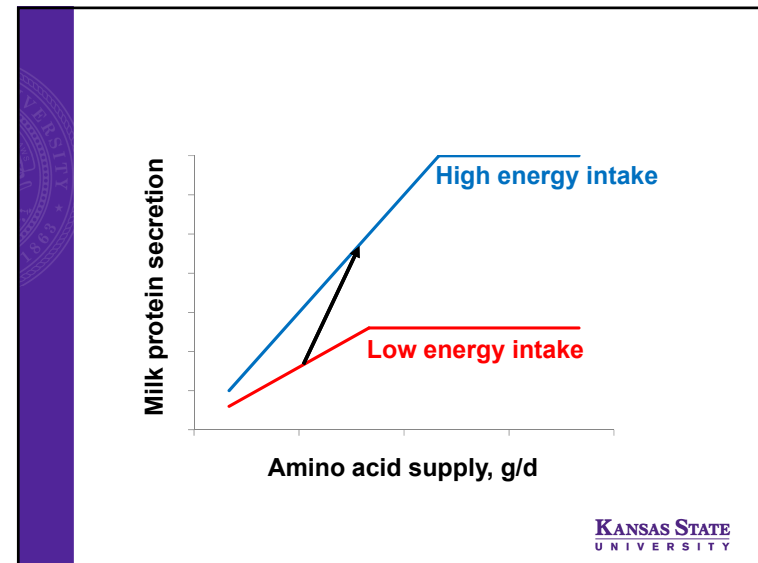
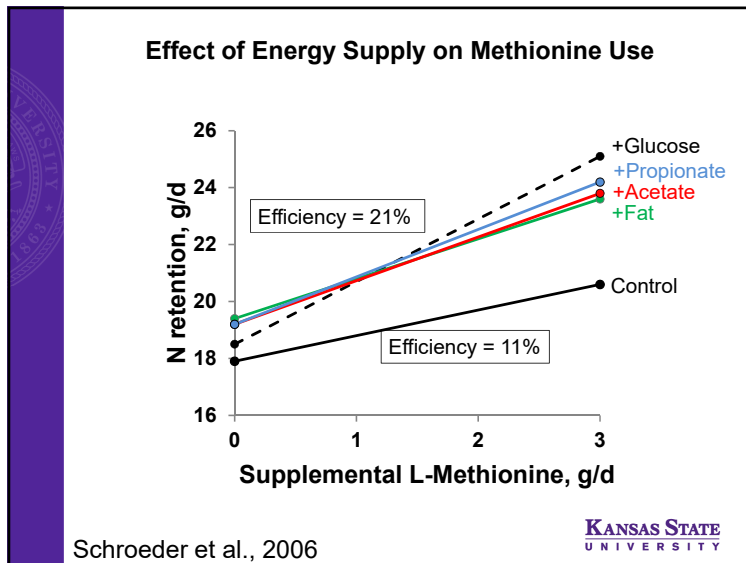


AA Requirements

Efficiency of AA use isn't static

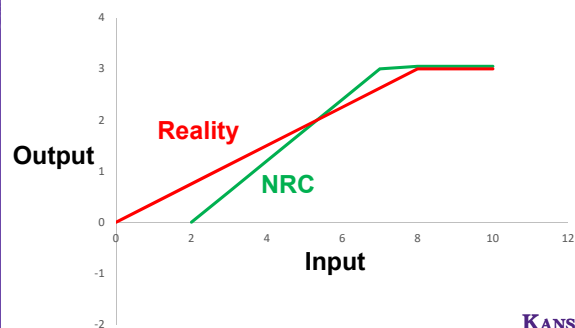
- Energy effects
- AA role as anabolic stimulus

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MP Requirements

- Estimates of maintenance and efficiency are correlated with each other



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Efficiency of use varies among AA

Average efficiency of AA utilization for growth

- Methionine = 26% (11 trials)
- Leucine = 38% (4 trials)
- Histidine = 64% (2 trials)
- Lysine = 47% (3 trials)

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AA Requirements

Why hasn't the 0.67 efficiency ruined the dairy industry?

- No one uses it as gospel
- Overestimated maintenance requirement balances the underestimated efficiency
- MP supply correlated to energy supply
- We work over a fairly narrow range

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AA Requirements

We have a lot to learn!

- Empirical observations of responses to methionine and lysine are useful in predicting times to supplement
- At some point, perhaps in 10-15 years, we'll have answers on some other amino acids

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