



From Jones Factors to Amino Acid Balancing

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Ohio Dairy Nutrient Prices (NRC 2001)



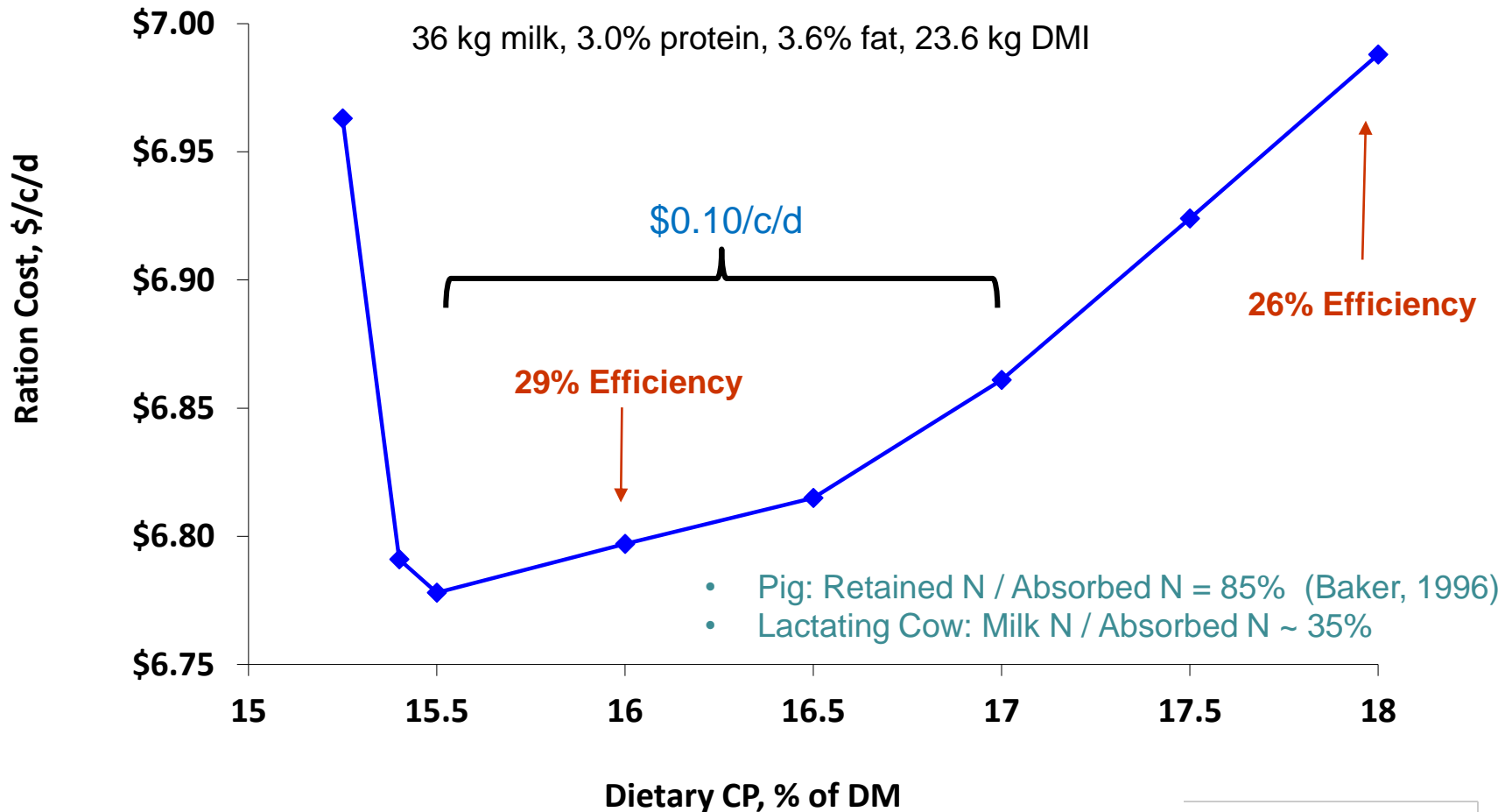
November 28, 2017 Evaluation
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Nutrient	Cost/Unit	Daily Supply*	Cost/cow/d
NEL (3X, NRC 2001) MCal	\$0.0664	35.4 Mcal	\$2.35
Metabolizable Protein (NRC) Lbs	\$0.4375	5.44 lbs	\$2.38
Effective NDF (forage NDF) Lbs	\$0.0321	10.4 lbs	\$0.33
Non-effective NDF (Total NDF – Forage NDF) Lbs	-\$0.0591	7.3 lbs	-\$0.43
Total Cost for Energy, Protein and Fiber			\$4.63

* 1600 lb cow, 80 lbs milk/d, 3.0% protein, 3.5% fat

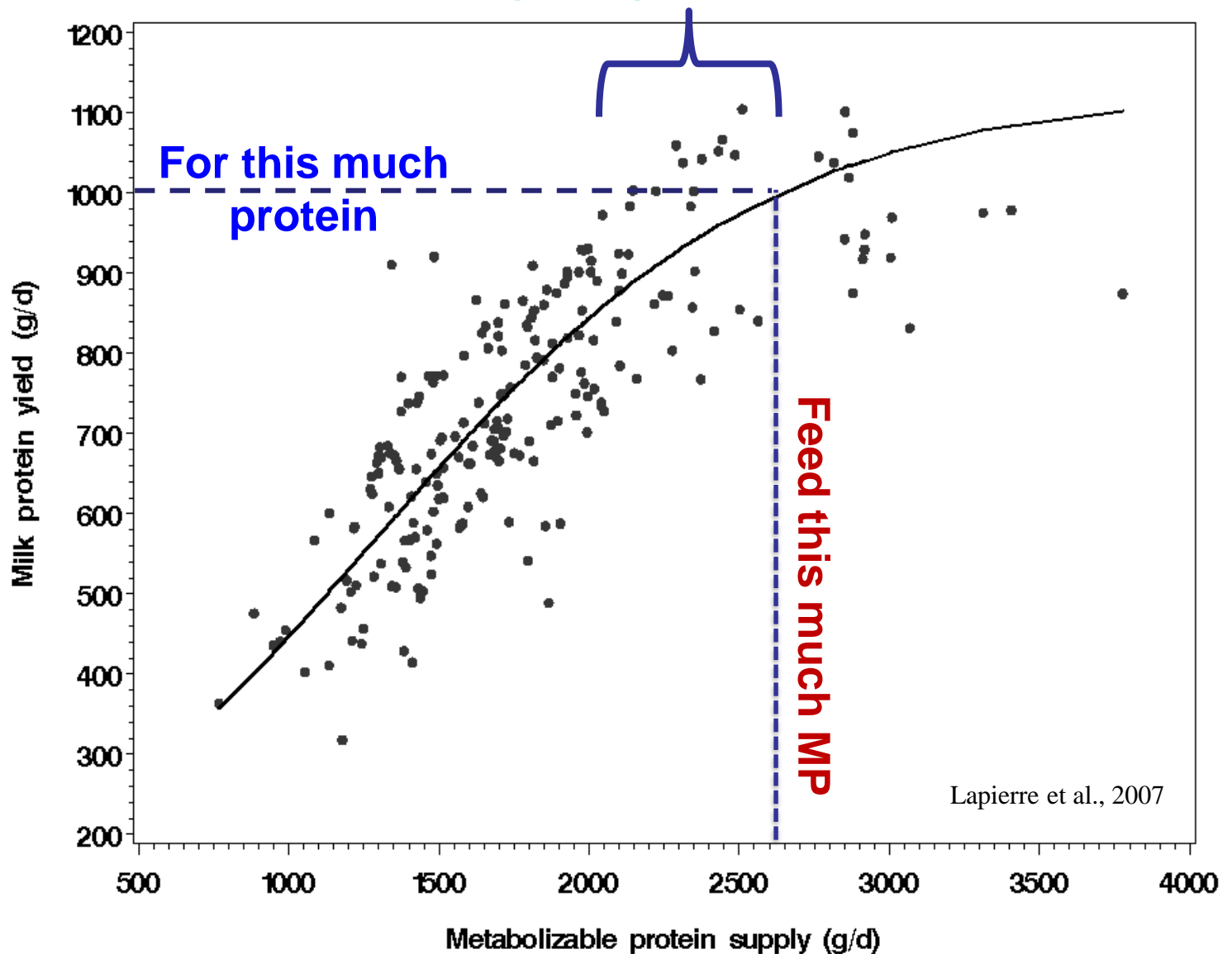
NRC 2001 Least Cost Rations

Balanced to NRC 2001 Requirements (MP & RDP)



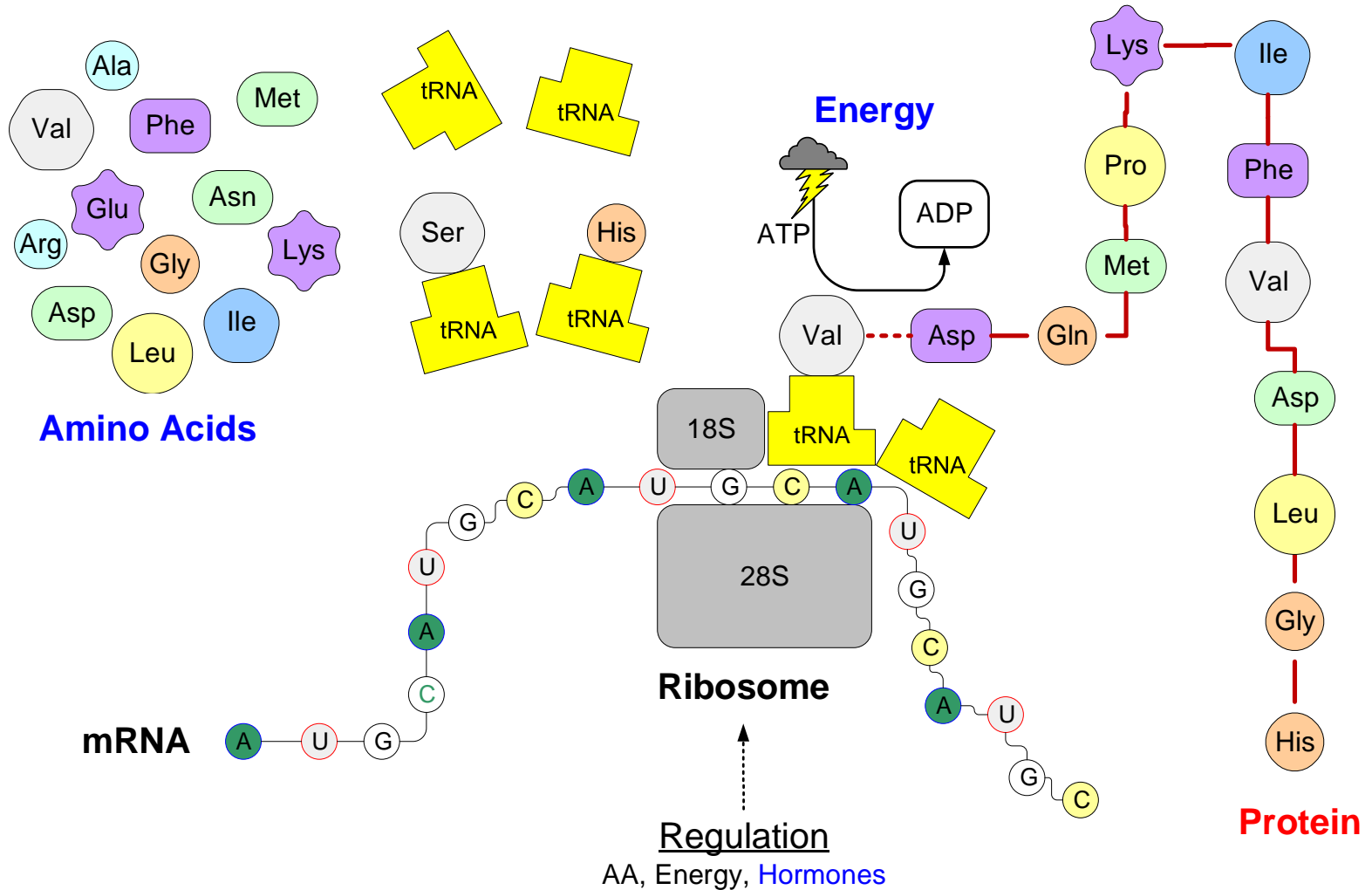
Milk Protein vs Metabolizable Protein

$$600 \text{ g} / 454 \text{ g/lb} \times \$0.44 = \$0.58/\text{c/d}$$



Protein is a String of Amino Acids

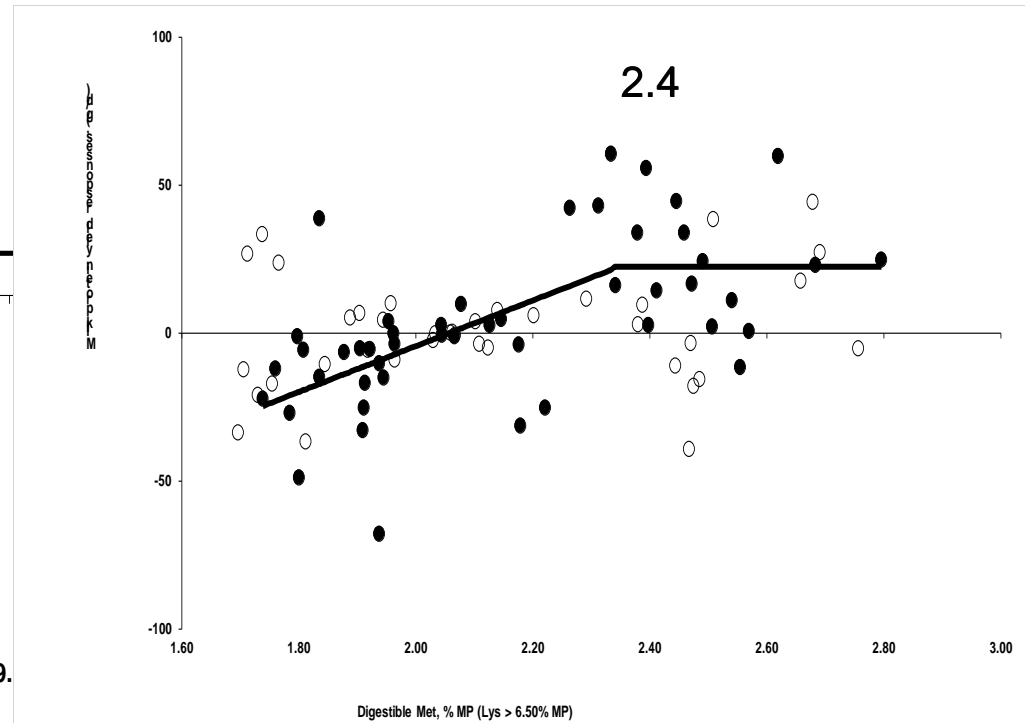
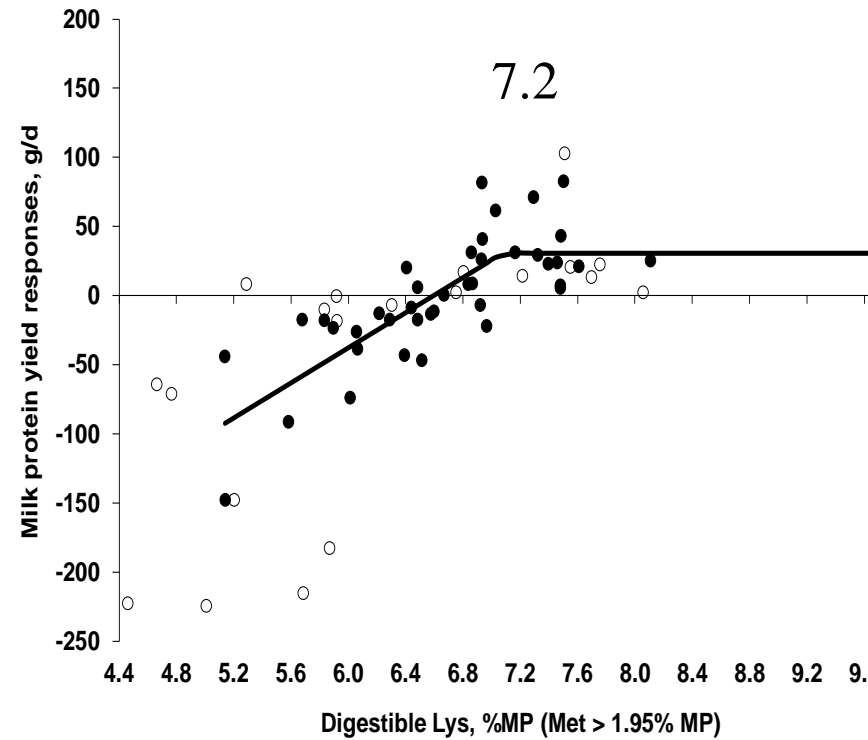
∴ All Amino Acids are Required



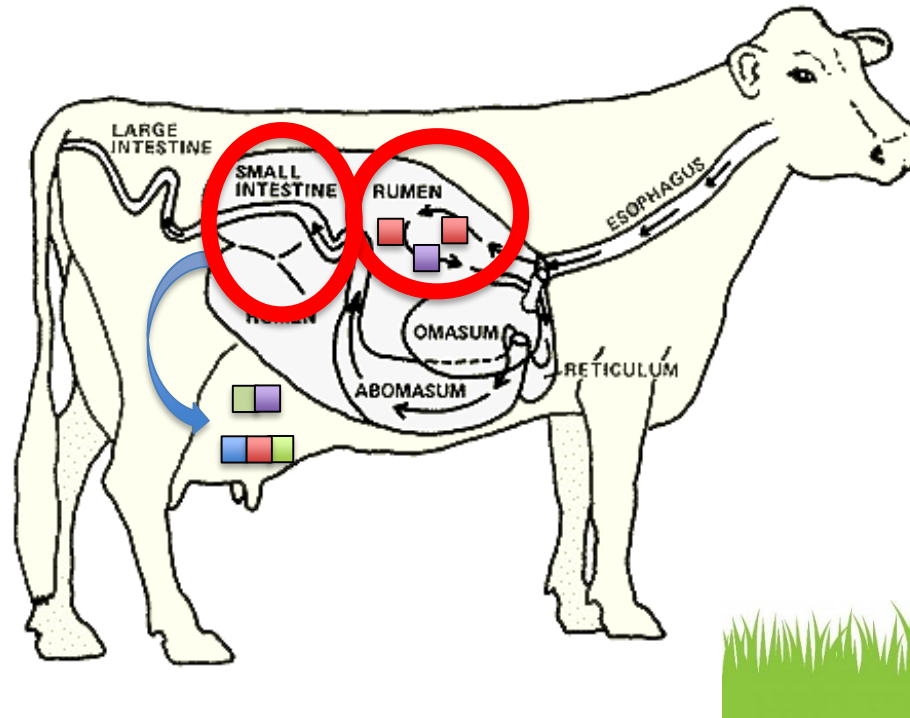
State of the Art



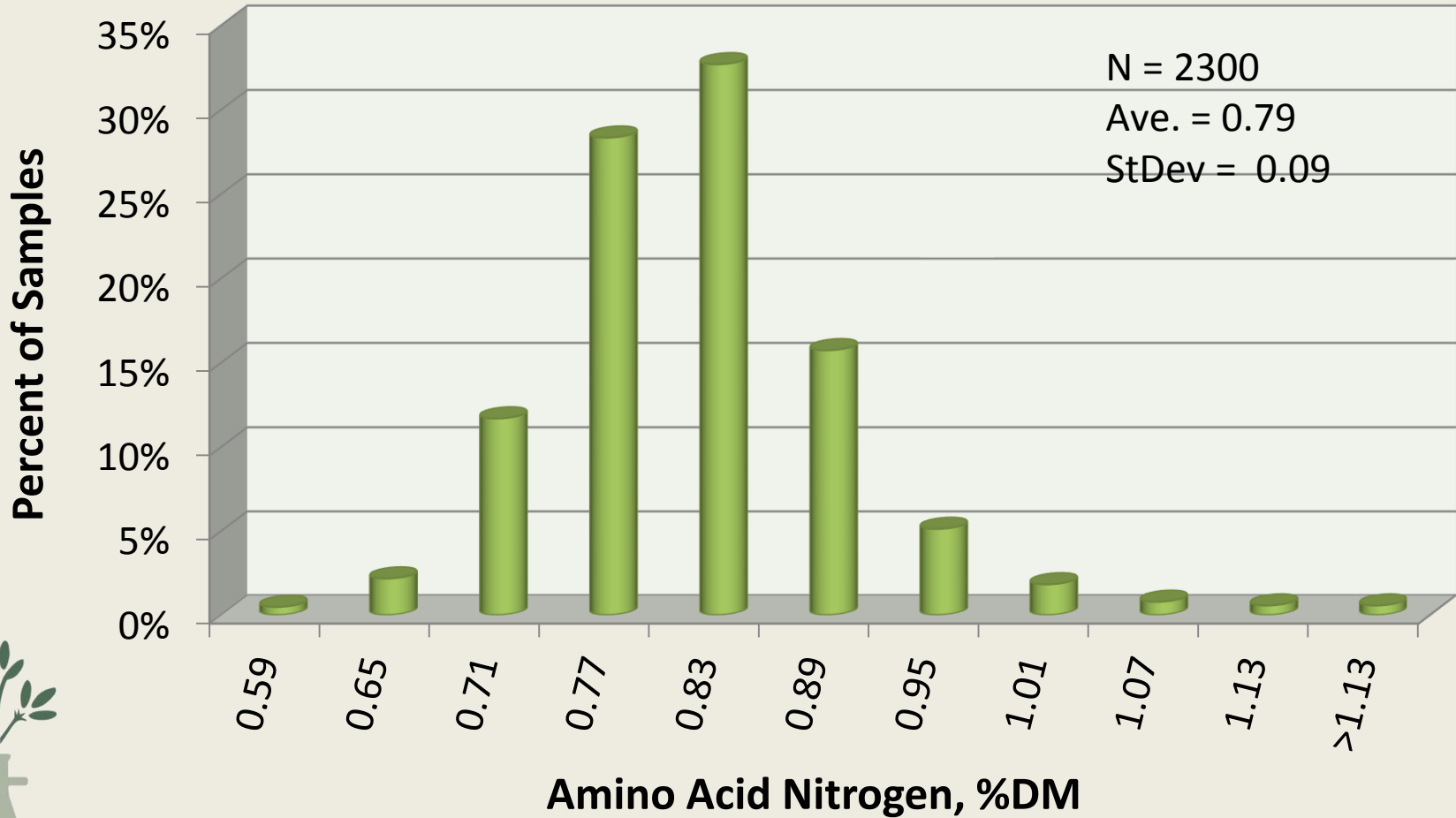
Milk Protein Responses to Digestible Lysine and Methionine



Amino Acid Supply

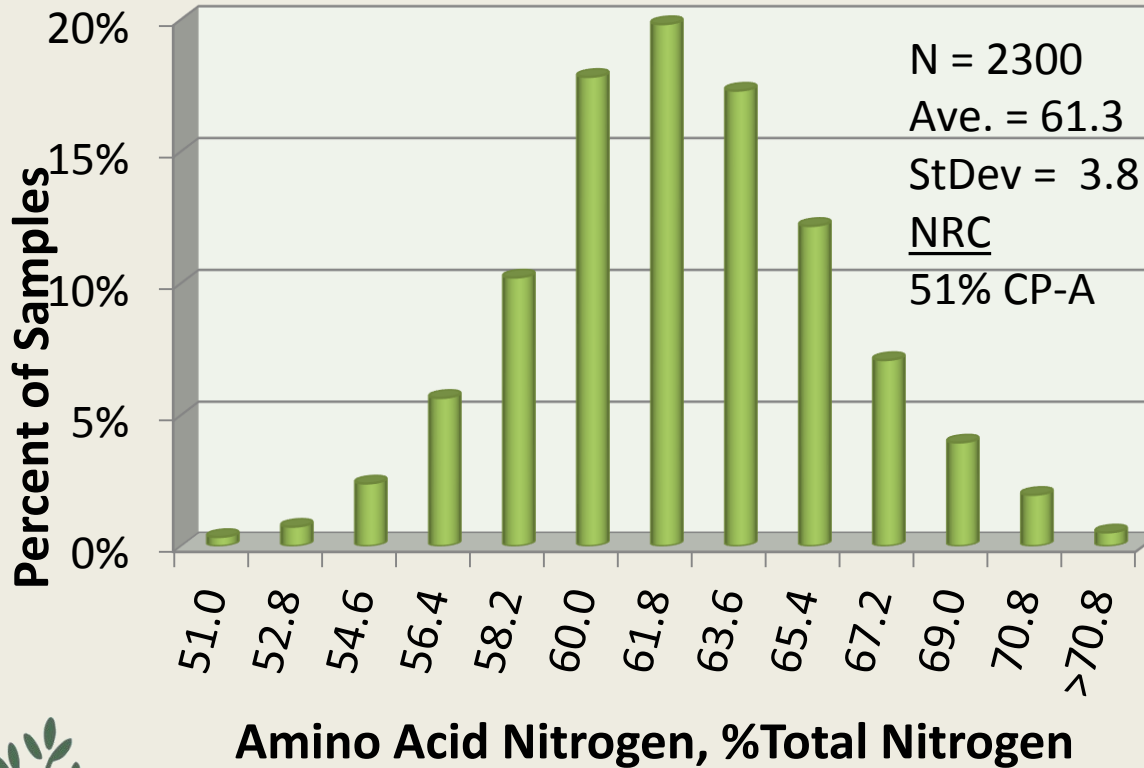


Distribution of Amino Acid Nitrogen as % DM in Corn Silage



Distribution of Amino Acid Nitrogen as % Total Nitrogen in Corn Silage

Similar for Haylage

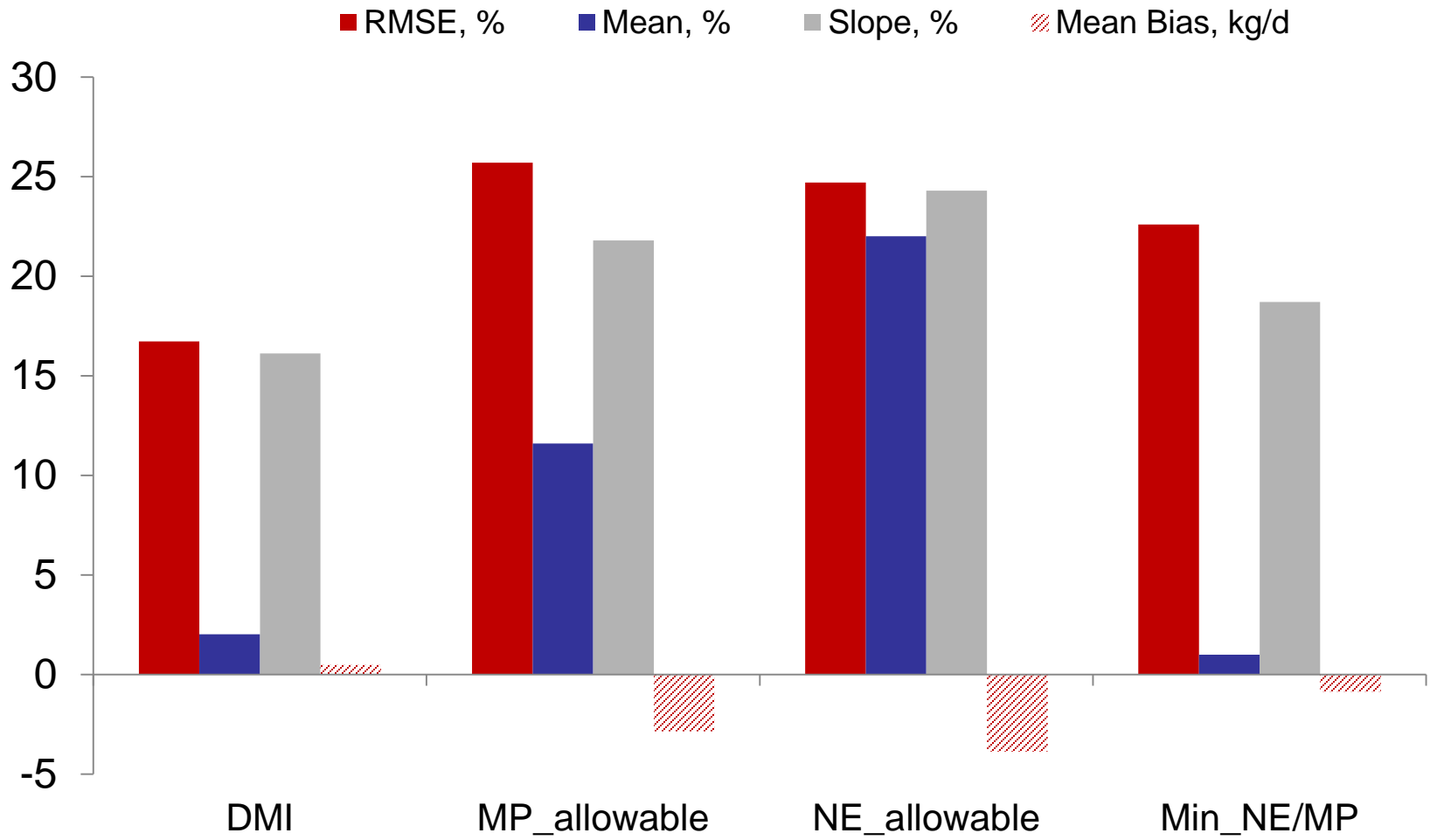


25% Haylage Diet

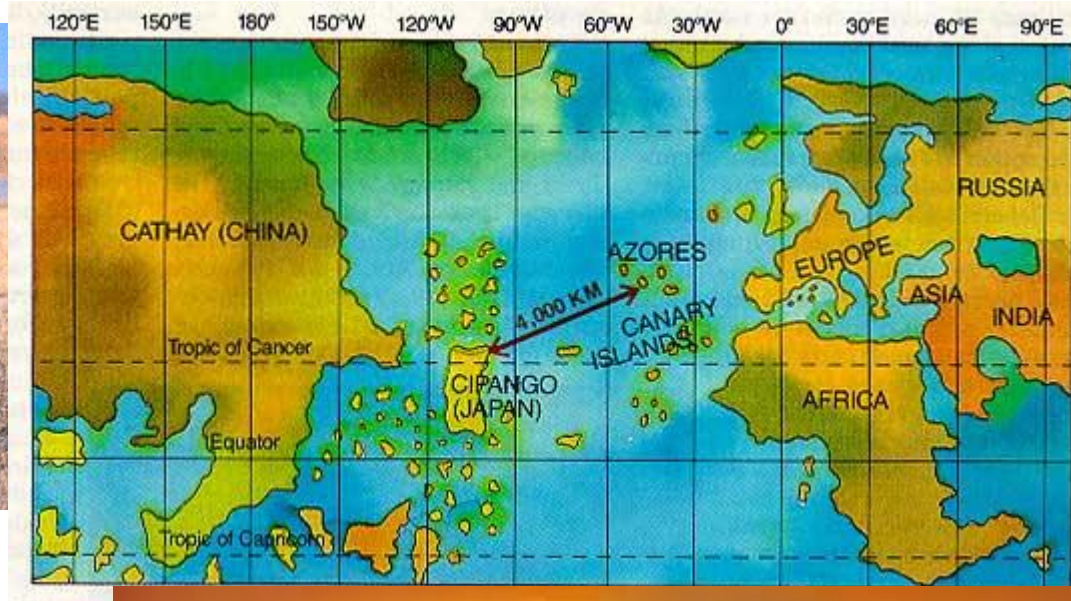
- 10 lb Haylage/d
- 10 * 20% CP = 2 lb CP
- 61.3 TP/CP - 1 SD
 $2 * 57.5\% = 1.15 \text{ TP}$
- 61.3 TP/CP + 1 SD
 $2 * 65.1\% = 1.30 \text{ TP}$
- $1.3 - 1.15 = 0.15 \text{ TP}$
- @ 50% MP/TP = 0.075 lbs MP
- $0.075 * \$0.44 = \$0.033/\text{c/d}$

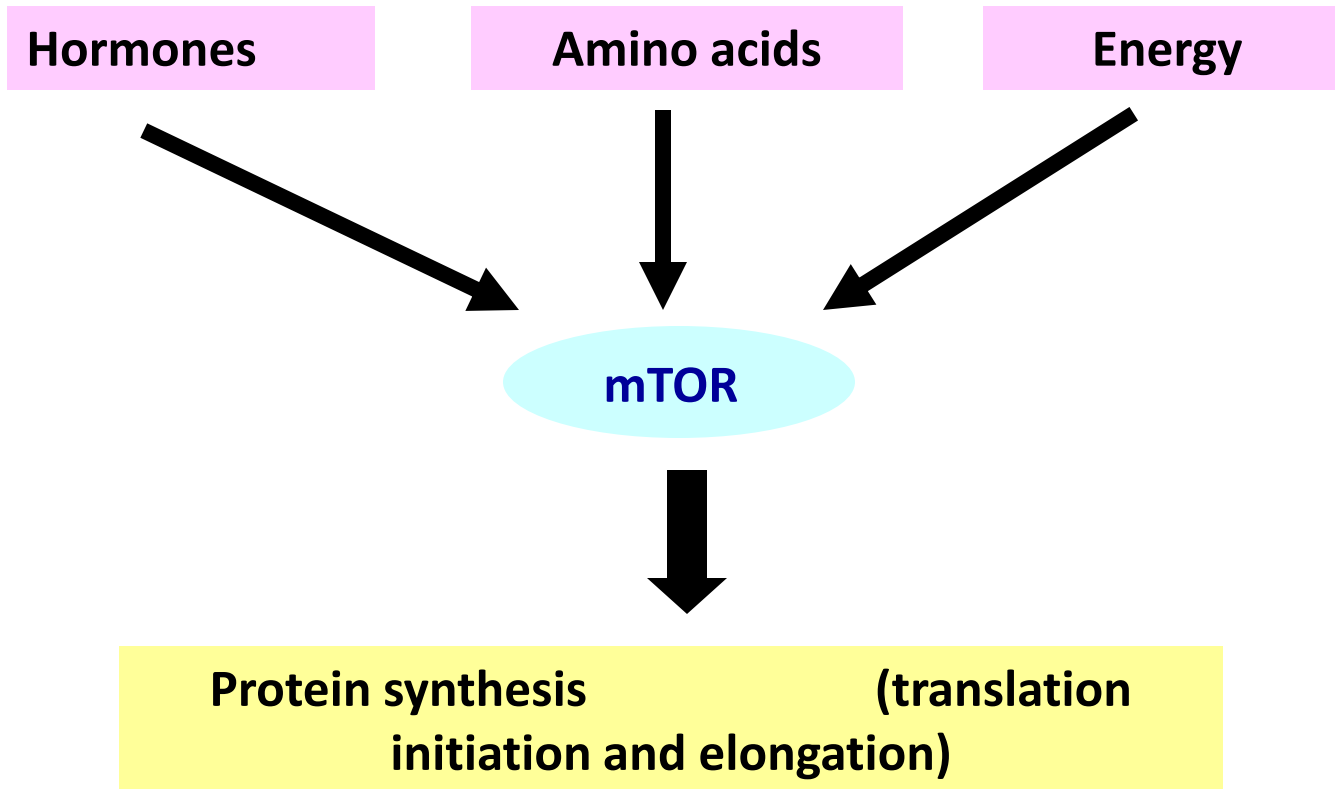


NRC 2001 Milk Predictions



Ruminant AA Models

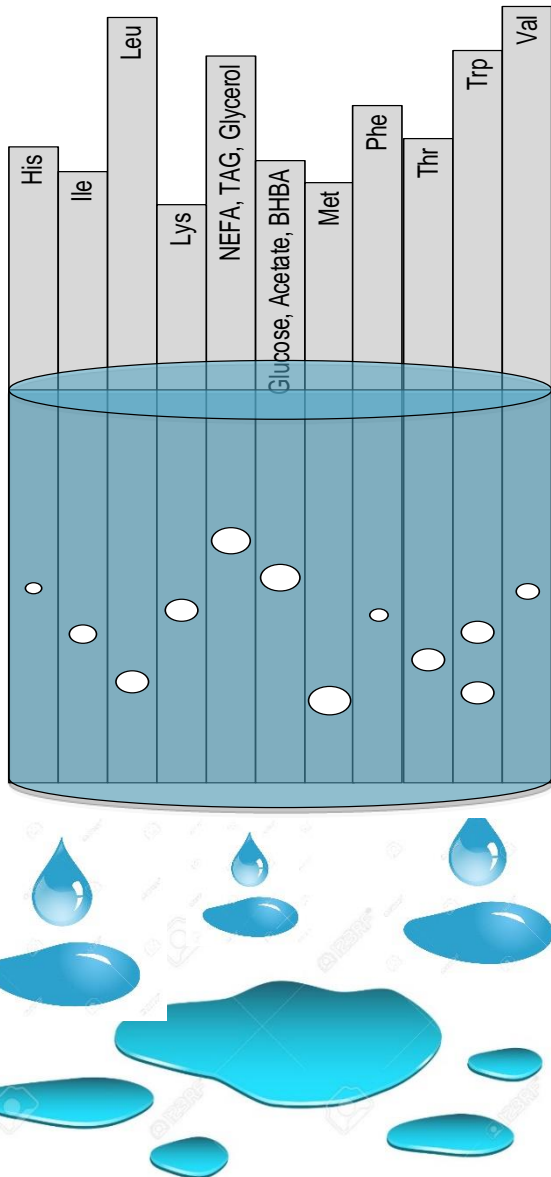




Metabolic Knowledge - Real Facts



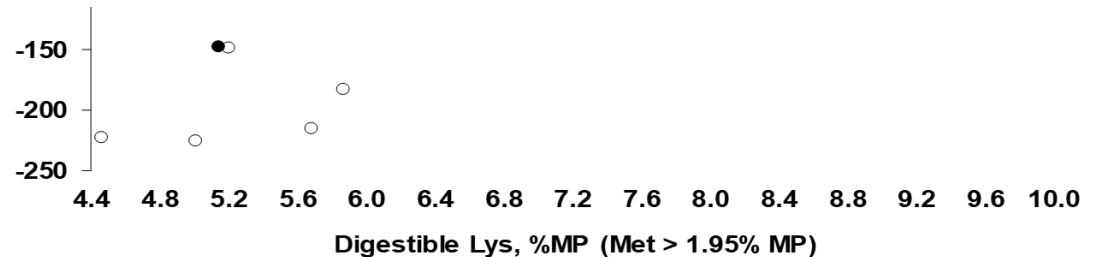
Alternative Facts



A Leaky Barrel

- Water level = Production level
- Leaks define Efficiency
- \uparrow level \Rightarrow \uparrow leaks
- Size of each leak depends on the mix of nutrients
- Plugging **ANY** leak helps
- Plugging big leaks helps more than little ones

Milk protein yield responses, g/d



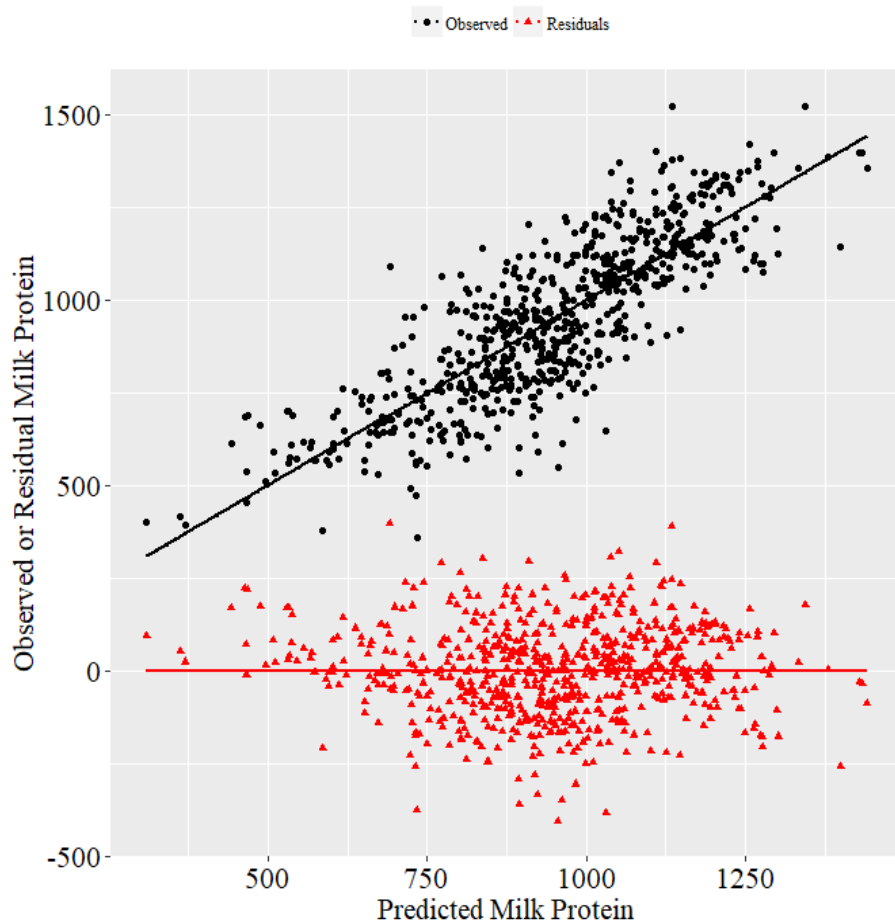
NRC, 2001

Milk Protein Predictions



$$\text{Milk Prot} = \text{DEI} + \text{EAA}_1 + \text{EAA}_1^2 + \dots + \text{EAA}_{10} + \text{EAA}_{10}^2$$

Significant AA: Arg, Arg², His, His², Ile, Ile², Met, Met², Phe, Trp, Trp², Val, FA, St, DIM, Milk Fat %



Variable	Solve	Cross Eval
N	724	
Observed Mean, g/d	948	973 ± 18
Predicted Mean, g/d	948	970 ± 14
RMSE	120	119 ± 8
RMSE, % mean	12.6	12.2 ± 0.9
Mean Bias, % MSE	0.0	0.80 ± 1.3
Slope Bias, % MSE	0.0	5.14 ± 3.7
CCC	0.82	0.79 ± 0.03

Work in Progress

The Future is Bright

- Better input measurements (more factors)
- The map will be updated soon (more complicated)
- Money on the table for the taking (up to \$0.58/c/d)

But

- Operating system upgrade required
- New functions to master
- Early adopters will differentiate themselves
- Will you be steering, just riding, or getting off?

