Feeding Lower Protein Rations – How Low Can We Go?

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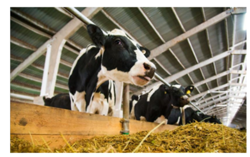

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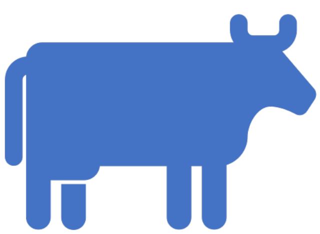
WHY?



- **1. Improve profitability!!**
  - Lower feed cost (in most cases)
  - Improve income over feed costs
- **2. Improve the efficiency of N use in the dairy cow.**
- **3. Decrease N excretion to the environment.**
  - Decreases crop acres needed for N application.
- **4. Decrease ammonia release potential from manure.**

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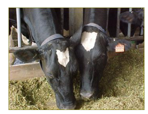
Balancing dairy cow diets for "protein"

GOAL - To meet RDP and RUP requirements for desired milk yield and milk composition with a minimum amounts of each

1) RDP – purpose is to meet the ammonia and AA requirements of ***rumen microbes*** for maximum carbohydrate digestion & synthesis of microbial protein



2) RUP – purpose is to provide the additional AA that the ***cow*** requires that are not provided by microbial protein

Source: Dr. C. Schwab

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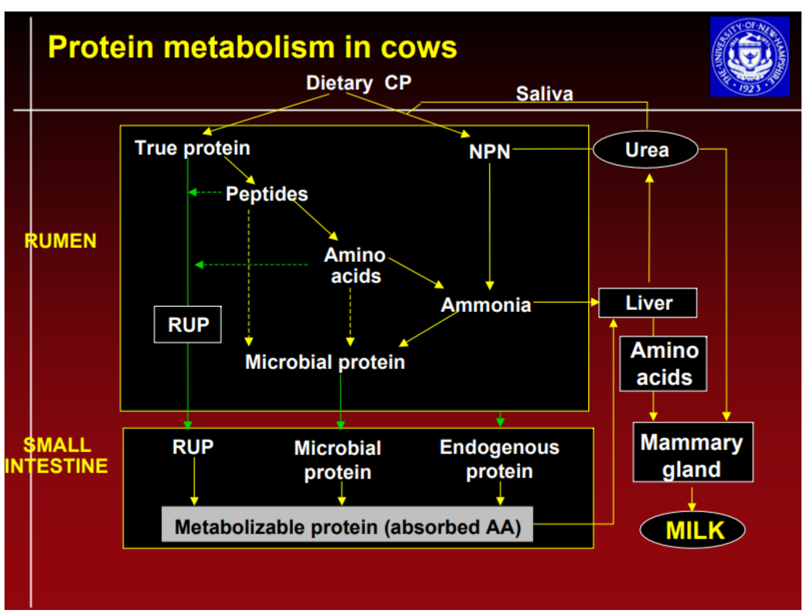

Dr. C. Schwab

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What Do Dairy Cows Do with Feed CP (N)?

- **Excrete in milk**
- **Excrete in manure**
- Store as body reserves

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Where to Start

- Need to separate crude protein from true or metabolizable protein and amino acids.
- Cows don't understand crude protein.
- The rumen has requirements for rumen N, mostly in the form of ammonia and some amino acids and peptides.
- Post-ruminal requirements are for digestible amino acids – from undegraded feed (RUP) and microbial protein.

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2001 Dairy NRC

Replaced crude protein (CP) with metabolizable protein (MP)

MP is defined as:

The true protein that is digested post-ruminally and the component amino acids absorbed by the small intestine

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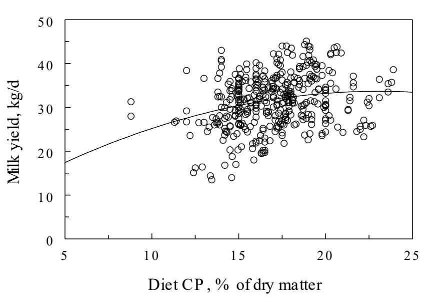
393 means, 81 studies



- **Milk yield (kg/d) =**
- **0.8 X DMI (kg/d) + 2.3 X CP (%) – 0.05 X CP^2 (%) – 9.8 (r^2 = 0.29)**

No correlation between DMI and %CP; dietary CP or milk protein %

Source: 2001 Dairy NRC

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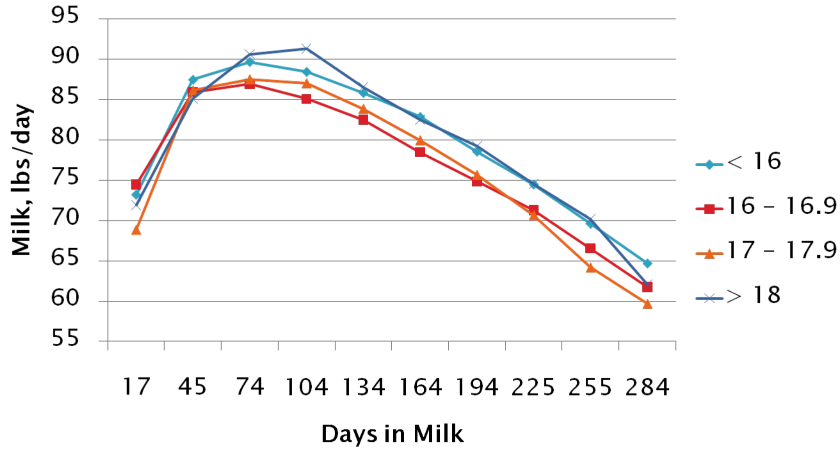
Pennsylvania Herds



Chesapeake Bay Project – 60 herds – Dr. Jim Ferguson

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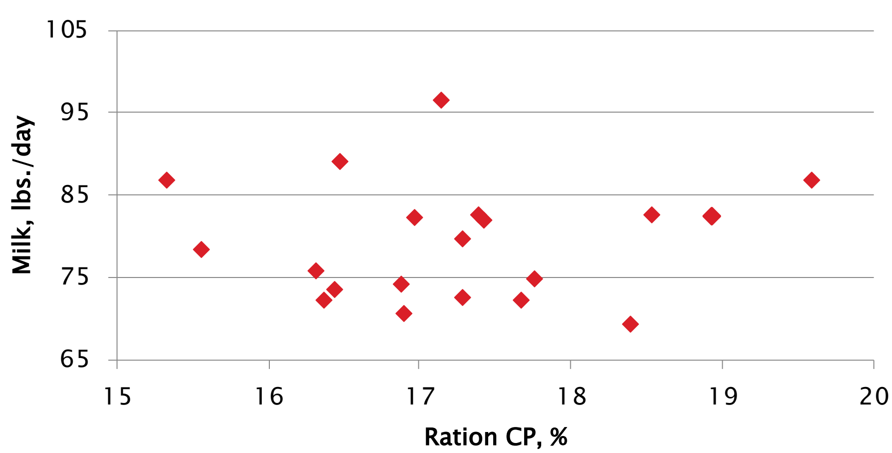
California High Milk Herds



Castillo et. al., 2010 – 21 herds

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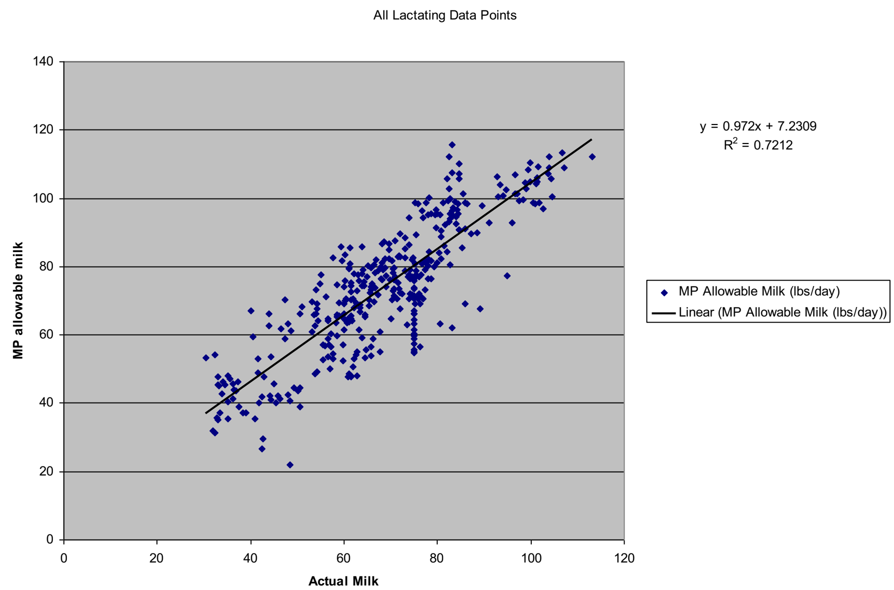

VT Dairy Farm Sustainability Project, 2002

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MP Considerations

- MP is not a tabular system.
- MP is calculated based on feed composition, dry matter intake, rate of degradation and rate of passage.
- Feed labs cannot analyze a feed for MP.
- The MP of a TMR varies depending on dry matter intake and rate of passage.

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Why is Crude Protein Still Used?

- Familiar term
- Feed tag requirements
- Forage labs can analyze CP but not MP
- Feed and forage CP is needed as inputs to ration programs
- Most feed companies are now using programs that do formulate on MP. CP is provided for information.

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MP, CP and Milk

MP, grams	CP, %	Predicted Milk, lbs.
3270	15.3	107
3278	13.9	109
3279	16.9	105
3269	18.3	107
3282	17.3	102

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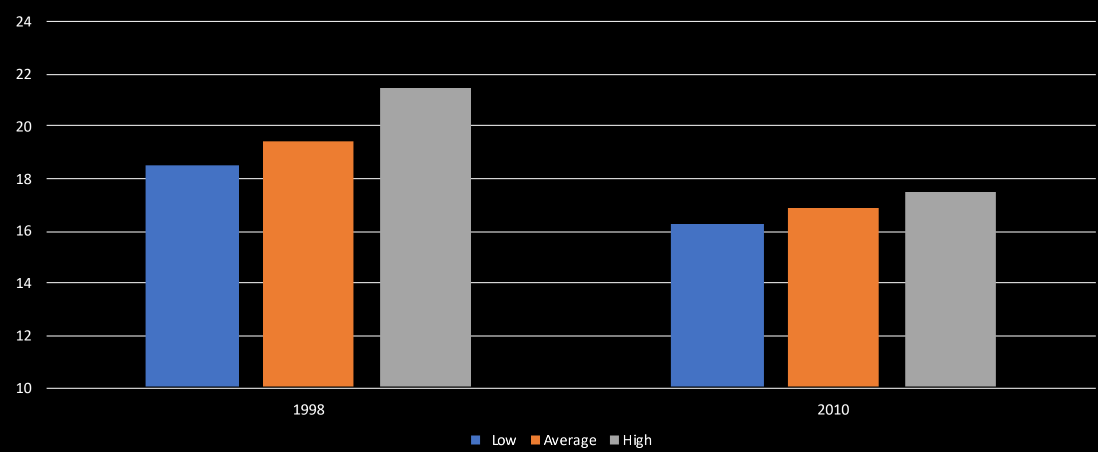
How Have CP Levels Changed in Wisconsin Dairy Herds?



6 Herds, 31,300 lbs. milk

5 Herds, 34,250 lbs. milk

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Dr. A. Hristov – Penn State - 2014

"Based on long-term trials conducted at Penn State, we conclude that dairy cows producing up to 88 lb./day can be safely fed balanced diets with 16% (and even 15%) crude protein (CP) without affecting milk production or composition"

It was also indicated that dry matter intake and milk production decreased when low CP diets were fed that were deficient in MP. Total tract NDF digestibility may also be lower in these diets.

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How Low Can we go in Ration CP?

Study from Japan

- -Dry forage diets, 27% forage
- - Milk = 90 – 95 lbs./day
- - Rations <15% CP

Cornell research

- - Corn silage rations
- - Total CP = 14.2%
- - Milk = 90 – 95 lbs./day

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New York Field Trial

Used 2 cooperating herds in western NY.

2 different nutritionists.
- independent consultant
- rep for a major feed company

Farms selected by the nutritionists as having an opportunity to lower ration CP levels and being willing to cooperate in the trial.

Rations were for the high group in each herd over an 8-month period.

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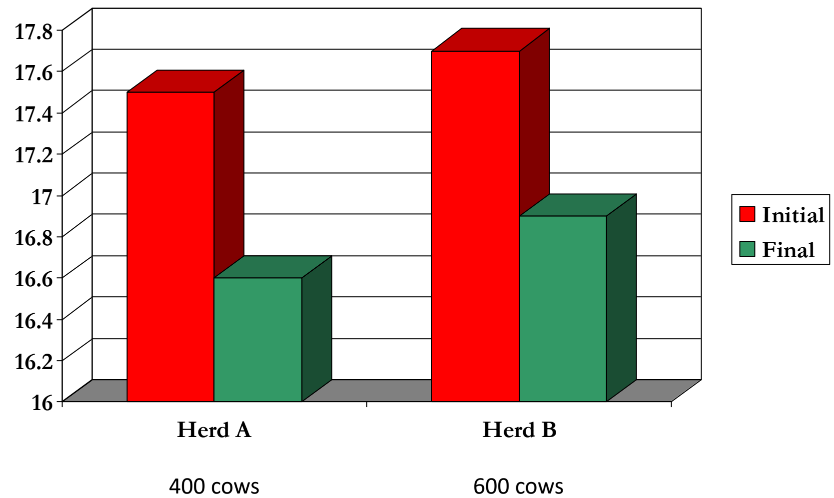
Ration CP, %



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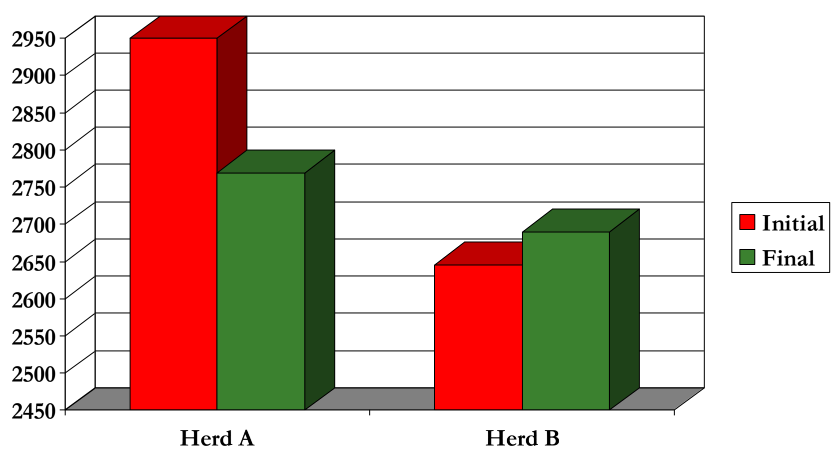
Ration MP, g/day



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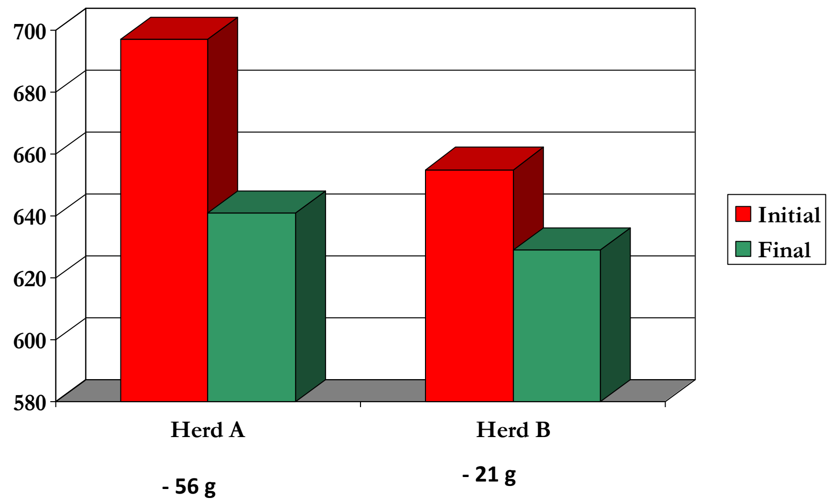
N Intake, g/day



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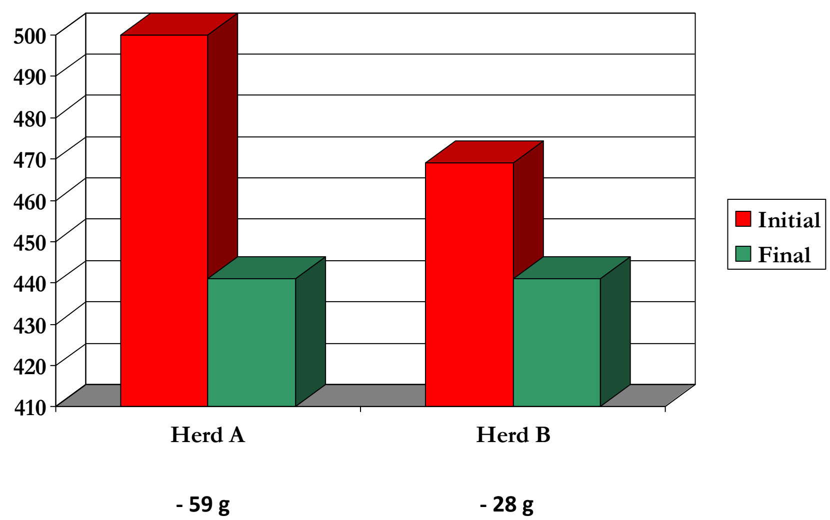
Total Manure N Excretion, g/day



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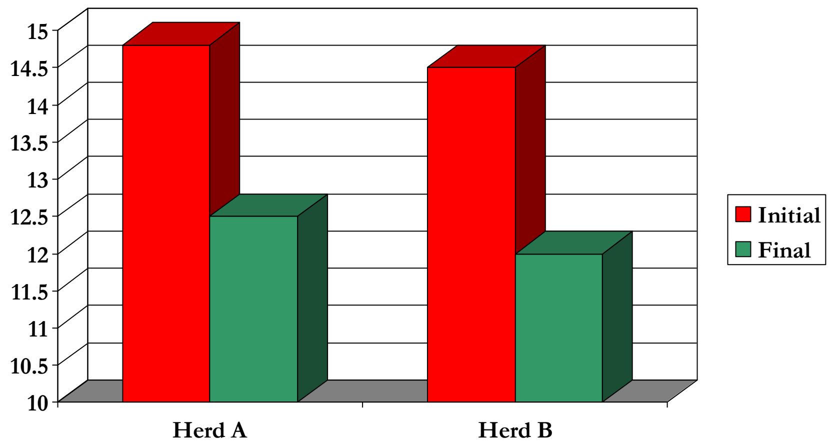
Milk Urea Nitrogen, mg/dl



Based on daily bulk tank data

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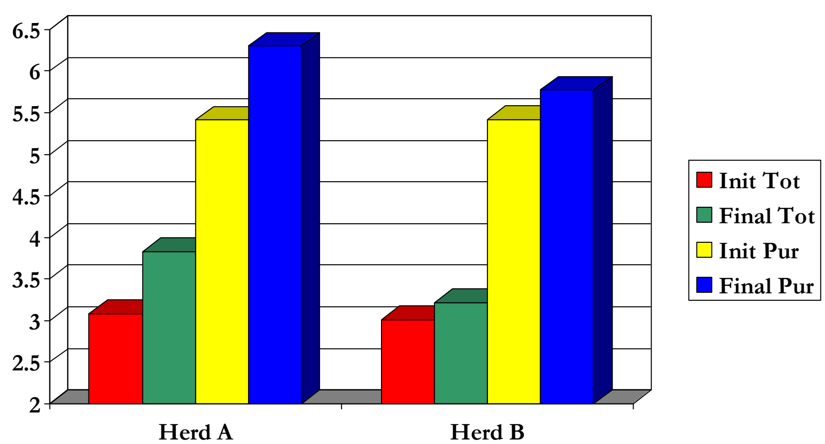
Income over Total and Purchased Feed Cost, $/cow/day



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Delaware County Field Trial

- 8 dairy herds in the Upper Susquehanna watershed (feeds into the Chesapeake Bay)
- 3-year trial
- Rations were formulated by the feed industry professional working with the farm.
- We interacted with the farm and feed industry professional to assist in implementing Precision Feed Management Plans.

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Initial and Final Diet Crude Protein and CNCPS Predicted Manure Nitrogen Excretion by Herd

Herd	Initial CP, %	Final CP, %	Initial Manure N Excretion, g/cow/d	Final Manure N Excretion, g/cow/d	Manure N Excretion Change, %	Manure N Excretion Change, kg/herd/yr
A	16.0	14.9	358	323	-9.7	-383
B	16.3	14.9	319	282	-11.5	-730
C	20.5	16.0	510	362	-29	-4755
D	17.1	16.0	385	344	-10.6	-1138
E	19.0	16.2	465	370	-20.4	-6520
F	17.4	16.5	456	423	-7.2	-5241
G	16.7	15.7	424	345	-18.6	-16,296
H	16.9	16.2	422	400	-5.2	-2128

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Milk income, total feed cost and income over feed cost, $/cow/day

Item	Herd A	Herd B	Herd C	Herd D	Herd E	Herd F	Herd G	Herd H
Milk Income, $	9.67	12.65	13.30	16.73	14.63	16.97	16.75	13.80
ITFC, $	4.86	4.80	5.30	5.41	6.45	6.49	6.64	5.62
FTFC, $	4.69	4.80	4.84	5.21	5.63	6.44	6.18	5.53
IOTFC, $	4.81	7.85	8.00	11.32	8.18	10.48	10.11	8.18
FIOTFC, $	4.98	7.85	8.46	11.52	9.00	10.53	10.57	8.27
IOTFC Change, $/cow/year	62	0	168	73	299	18	168	33
IOPFC Change, $/cow/year	77	76	277	37	219	18	361	33

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Delaware County Trial Results

Item	Initial	Final
Milk, lbs./cow/day	69	72
Ration CP, %	17.5	15.8
Manure N, g/cow/day	417	356

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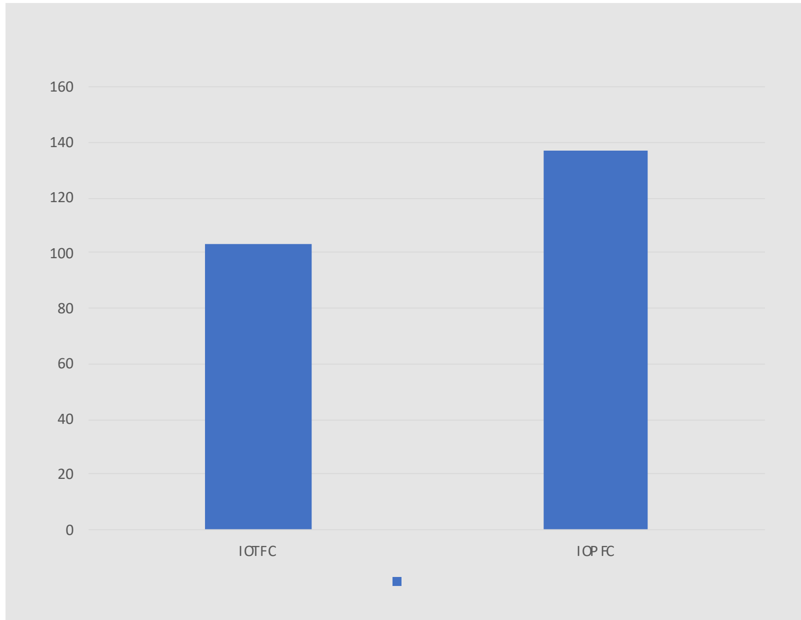
Delaware County Change in Income Over Feed Cost, $/cow/year



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Pennsylvania Herd

Dr. Bob Stoltzfus.

200 cow Holstein herd, 80-85 lbs. milk

Adjustments over as 3-year period.

Lowered ration CP from 18.3% to 16.2%.

MP from 2978 to 3017 g.

Lowered feed cost 30 cents/cow/day

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High Producing Herds

- A request was made to feed industry professionals for rations fed in herds producing >95 lbs. of milk/cow/day.
- 79 rations were submitted.
- A subset of 35 rations lower than 16.4% CP was used for this presentation.
- Average ECM was 105 lbs./cow/day.

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Ration Characteristics, % of Ration DM

Item	Average	Range
Forage	57.1	50 - 66
NDF	30.4	25.7 – 35.7
Sugar	4.4	2.2 – 6.5
Starch	27.5	22.4 – 33.8
Fat	5.0	3.7 – 6.2

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Protein and Amino Acids

Item	Average	Range
CP, % of ration DM	15.7	13.4 – 16.4
MP, g/day	3106	2587 – 3592
RDP, % of DM	8.9	6.6 – 10.4
MP from bacteria, %	51.2	45.9 -57.8
MP, % of required	107	98 - 122
Lysine, % of MP	6.68	6.22 – 7.1
Methionine, % of MP	2.37	2.09 – 2.76

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Amino Acids

Lysine -

- 16 herds had >6.8 lysine as % of MP.

Methionine -

- 19 herds had methionine >2.3 as % of MP.
- 3 herds had methionine >2.6 as % of MP.

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Rumen Protected Amino Acid Sources

- Methionine = 26 herds
- Lysine = 8 herds
- Both = 7 herds

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RUP Sources Used

- High bypass SBM or roasted SB = 29 herds.
- Blood meal = 12 herds.
- Animal protein blend = 17 herds.

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Opportunities

- These herds still have opportunities to potentially lower protein in their rations.
- Key area is to increase attention to amino acid balance.
- This may allow lower protein levels to be fed.

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What About Fresh Cows?

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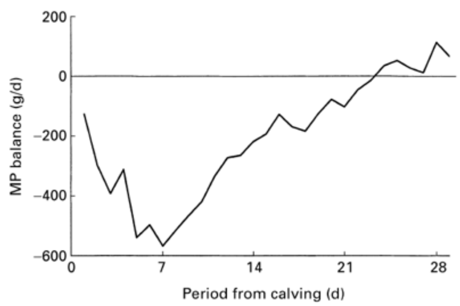
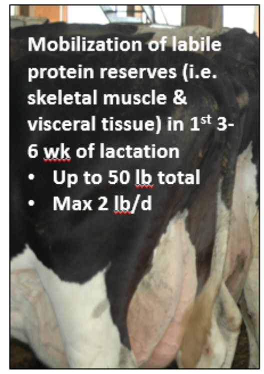
Fresh Cows Experience Negative Protein Balance





Bell et al., 2000

Source: Dr. H. Dann

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Robinson et. al. 2004

- Fed 2 diets for 42 days.
- Reduced diet CP by 1% by lowering soluble CP.
- Control ration = No added amino acids.
- Treatment ration = Encapsulated lysine and methionine.
- Treatment ration cows also received the lysine and methionine product pre-calving.

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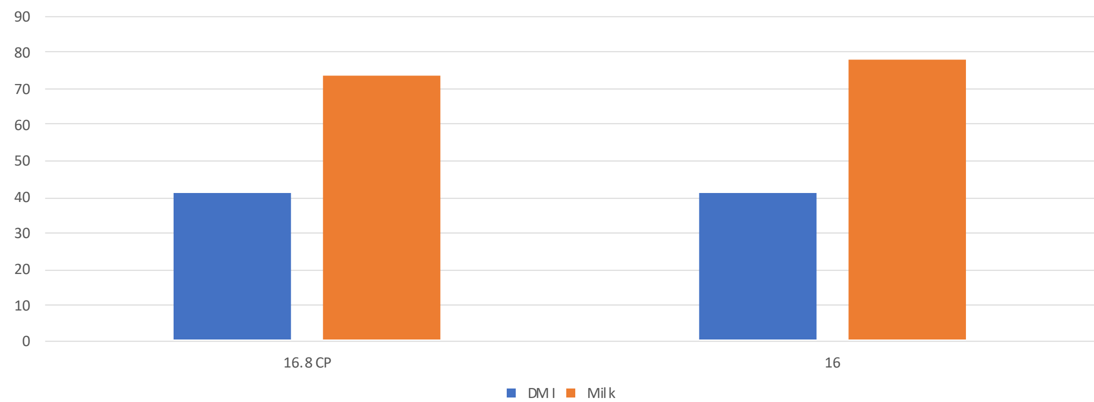
Dry Matter Intake and Milk, lbs./day



DMI and milk were not statistically different

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Xu et al., 1998

- Negative Control (methionine and lysine deficient; ~90% CNCPS)
- Blood/fish/meat and bone (met and lys adeq.; +6 and 12 g MP met and lys/d postpartum)
- Neg Control + RPAA
  - Pre: 13.5 g/d MP-Lys and 4 g/d MP Met
  - Post: 27 g/d MP-Lys and 8 g/d MP Met
- Neg Control + High RPAA
  - Pre: 13.5 g/d MP-Lys and 4 g/d MP Met
  - Post: 40 g/d MP-Lys and 13 g/d MP Met

Xu et al., 1998 JDS 81:1062-1077.

Source: Dr. C. Zimmerman

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Xu et al., 1998
Results weeks 1 to 8 postpartum

	Negative Control	Animal Protein	NC + RPAA	NC + Hi RPAA
DMI, lb/d	36.6^{b}	37.7^{b}	38.4^{b}	46.3^{a}
Milk, lb/d	74.5^{c}	86.9^{ab}	82.7^{b}	86.0^{ab}
Protein, %	3.06^{b}	3.07^{b}	3.06^{b}	3.29^{a}
Protein, g/d	$1{,}030^{d}$	$1{,}190^{bc}$	$1{,}140^{c}$	$1{,}270^{ab}$

Xu et al., 1998 JDS 81:1062-1077.

Source: Dr. C. Zimmerman

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Fresh Cow Keys

- Dry matter intake.
- Digestible forages.
- Keep the rumen bugs happy (RDP, fermentable carbohydrates).
- RUP sources with low variability and high intestinal digestibility.
- Rumen protected amino acids.

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Feed Industry Feedback

- Consistency and quality of daily farm feed mixing and feeding management
- Daily variations in forage DM and quality
- Feeding system – component vs. TMR
- Lack of on-farm forage DM's
- Herd grouping and ration strategies

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Feed Industry Feedback - 2

- High levels of soluble CP in forages
- Accuracy of forage analysis values (sampling, analysis)
- Lack of MUN's as a monitoring tool
- Are ration formulation programs accurate enough?
- Does it work in other herds?

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Challenges to Lowering Ration CP on Dairy Farms

- **There are always considerations and risks involved when altering rations and nutrition management on dairy farms**
- **How large of a "safety" factor do we need to minimize risk?**
- **How much can we lower CP without affecting milk production?**

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Key Factor

What is the "mindset" of the dairy producer and feed professional?
(Do they believe it can work?)

Are they willing to accept some risk in using this concept? How much risk?

What plan do they have to monitor the results?

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Steps to Implementing Lower CP Rations

- 1. Do an in-depth analysis of the current rations, forages and feeding management practices currently used on the farm (Use MP to do this)
- 2. What are the opportunities?
- 3. What are the goals, objectives and risk tolerance of the dairy producer?

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Steps - 2

- 4. Initial evaluation needs to include daily feeding management practices to assess consistency.

  - Graph milk/cow and DMI
  - On-farm forage DM's
  - Graph daily herd MUN

- 5. Is this herd a candidate?

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Steps - 3

Obtain	Use	Discuss	Define
Obtain forage samples and analyze for needed model inputs.	Use a model to develop potential adjusted rations.	Discuss with the producer to get buy in.	Define how you will determine the results.

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Steps - 4

Make — Make small ration changes, monitor, evaluate and repeat the process.

Consider — Consider where amino acids fit in this process.

Maintain — Maintain a continuing dialogue with the producer regarding how things are going.

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Key Points to Make This Approach Work?

- Mindset
- Low day to day variation
  - Feeds, feeding management
- DMI – need good on-farm data
- Optimize the ration to produce microbial protein
- Select RUP sources with low variability
- Consider amino acids in formulation
- Monitor MUN's

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How Low Can You Go?

- What is your metric?
- If MP, then balance as close to 100% of requirement as you are comfortable with. Check CP to see if there are any opportunities to lower CP.

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Metric - CP

- Most herds should be able to get close to 16% CP.
- Ration CP levels of 15 – 16 can support 95+ lbs. of milk.
- Ration CP levels between 14 – 15 can also work.
- Before making any adjustments to lower ration CP, it is essential to evaluate the rations with a model that calculates MP.
- *Low CP rations only work if MP is adequate.*

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What's Next?

- 2021 Dairy NRC -
  - What changes will be made relative to N and MP?
- Balancing for additional amino acids -
  - Histidine? – Penn State, Cornell
  - Valine? – South Dakota State
  - All amino acids - Cornell

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Summary

Both research data and commercial farm data indicate that we have an opportunity to lower ration CP in many dairy herds without decreasing milk if MP requirements are met.

In many herds, we can lower ration CP by 0.5 to 1+ units of CP with minimal risk of impacting milk production.

This usually improves profits and lowers N excretion to the environment.

Consistent management with low variability is the key to making this approach work.

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Thanks!

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