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Protein & Carbohydrate In Rumen Fermentation

Mary Beth Hall

U.S. Dairy Forage Research Center
USDA Agricultural Research Service

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Rations that don't behave.....

When cows don't perform like we think they should, the cows are not the ones who are wrong.

What were we missing?

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Feed Digestion In The Rumen

Carbohydrate

Gas

Microbes

Organic acids

Ammonia & BCVFA

Protein

Energy & pH

High quality protein

Carbohydrate fermentation drives microbial protein production.
More carbohydrate fermentation = more organic acids and lower pH.

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NFC & RDP and NDF Digestibility

NDF digested %

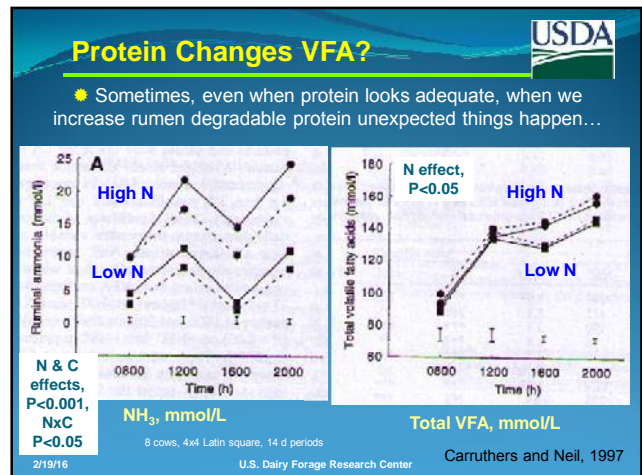
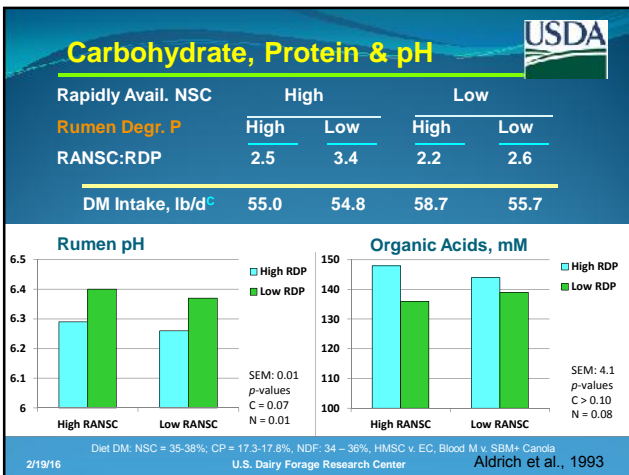
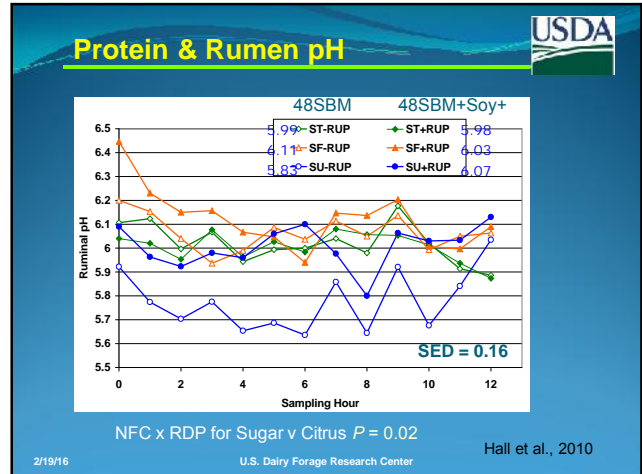
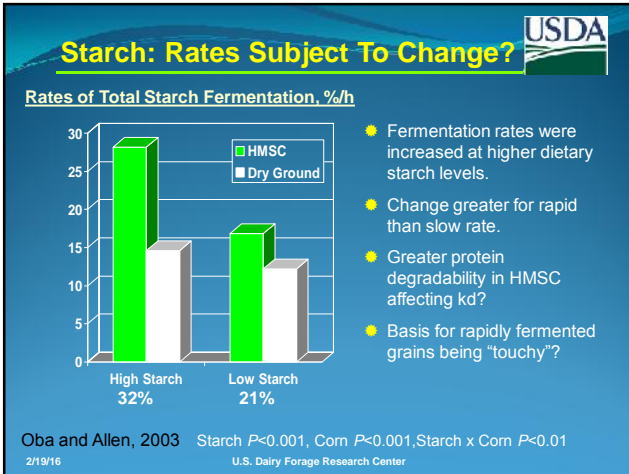
NFC Level	Ctrl	Starch	Glucose	Fructose	Sucrose
0.031% of BW as RDP	60	52.5	45.1	52	41.9
0.122% of BW as RDP	59.3	61.2	68.1	71.3	62.3

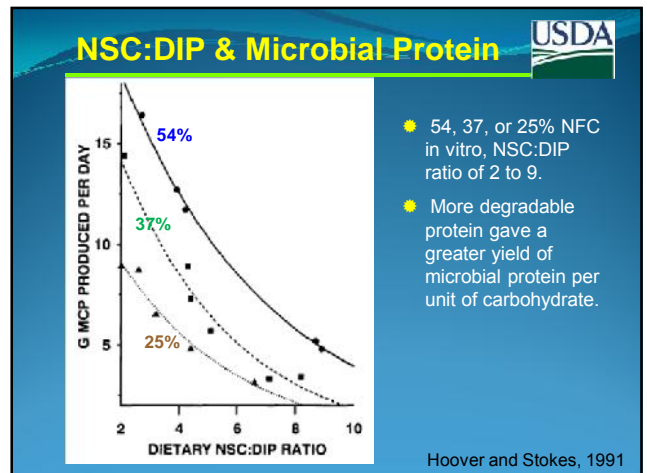
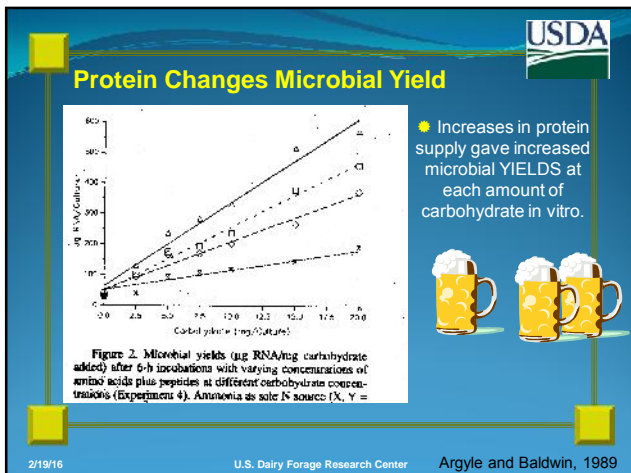
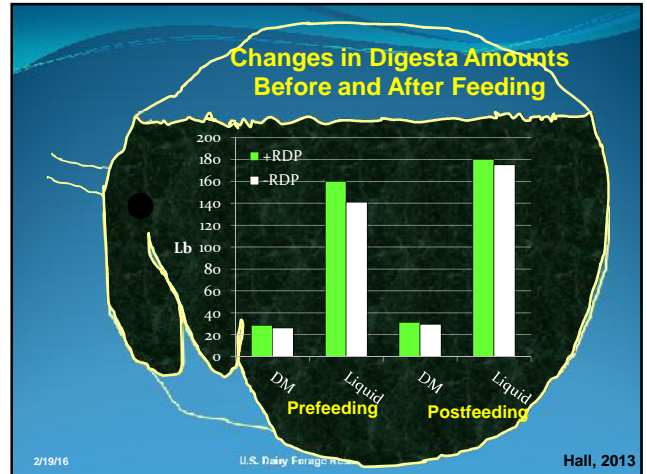
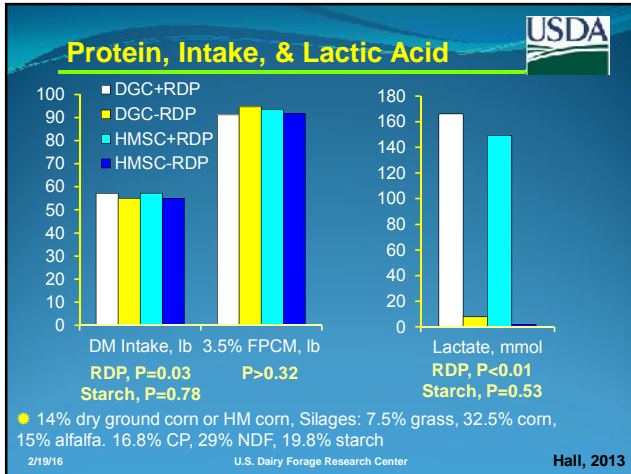
Legend: Ctrl (Green), Starch (White), Glucose (Orange), Fructose (Light Blue), Sucrose (Purple)

NFC at 0.3% of BW

Heldt et al., 1999

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Protein supplementation changed yield of microbial protein from carbohydrate.

How???

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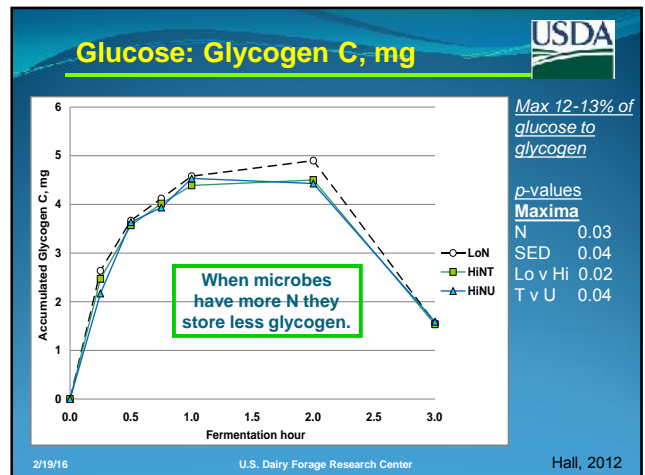
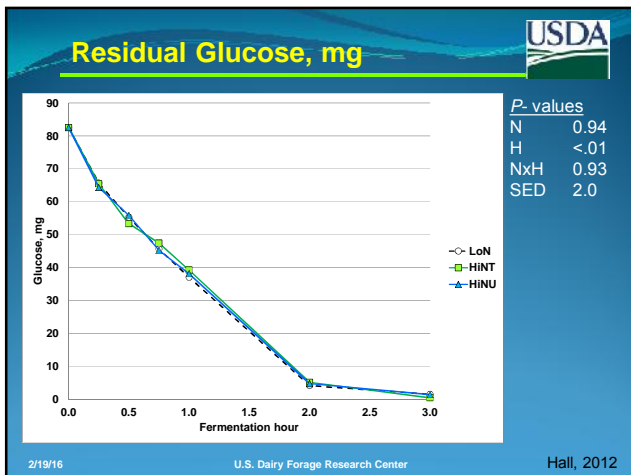
How Microbes Process NFC

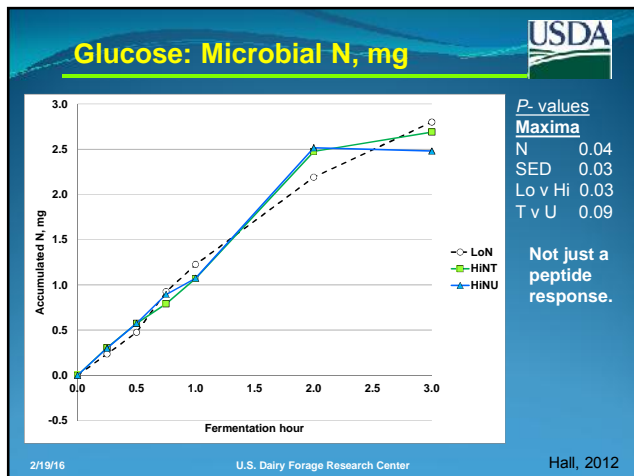
Carbohydrates that microbes utilize rapidly.

- ❖ glucose
- ❖ fructose
- ❖ sucrose
- ❖ lactose
- ❖ raffinose
- ❖ fructan
- ❖ starch

Readily Available Carbohydrates = Organic acids + Microbes + Gas + Glycogen

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What Microbes Do With Energy

IF, microbes have all the nutrients they need:
 Stay Alive
 Make More Microbes

IF, something is lacking:
 Stay Alive
 Make Some Microbes
 Make Glycogen
 Waste Energy

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Counterbalancing

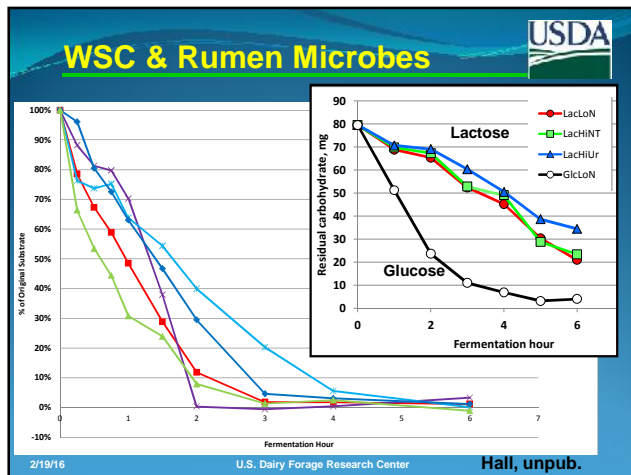
More Glycogen

- More energy to make glycogen
- Less energy for microbe growth
- Dampen pH drops
- Slows the fermentation
- Another SI "starch" source?

Less Glycogen

- Make more microbes (?)
- Make more lactate (less energy?)
- Greater ruminal digestion?
- Change passage (?)


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Rumen degradable protein affects:

- How rapidly carbohydrates are fermented in the rumen
- The efficiency of microbial growth
- Total microbe production



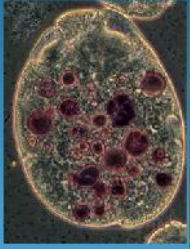
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So What?

Feed efficiency starts in the rumen.

This fits in the big picture of what we need to do to keep the cow productive, more efficient, and healthy.



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Ok, now don't go overfeeding protein to us! Maybe get the timing and proportions a bit tighter?

Hmmm. Would less degradable protein help on low rumen pH?

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Summary

- Degradable protein affects carbohydrate use by rumen microbes, their efficiency, and potential nutrient supply.
- Don't go and overfeed protein!!! Adjust timing for rapidly available protein relative to rapidly available carbohydrate?
- Rumen products need to be delivered to cow to be useful. How will kp affect net results?
- We have more to learn.



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Questions?



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