Insights into Amino Acid Requirements for Dairy Cattle. Where to Next?

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"Agriculture in the 21st century faces multiple challenges: it has to produce more food...to feed a growing population...adopt more efficient and sustainable production methods and adapt to climate change."

Adapted from FAO "High-Level Expert Forum", 2009

Challenges of Production

- Environmental issues
  - Leaching, volatilizations, and gas emissions
- Health concerns
  - Spread of disease



FAO "Milk and Dairy Products in Human Nutrition", 2013

*"Agriculture in the 21st century faces multiple challenges: it has to produce more food...to feed a growing population...adopt more **efficient and sustainable production methods** and adapt to climate change."*

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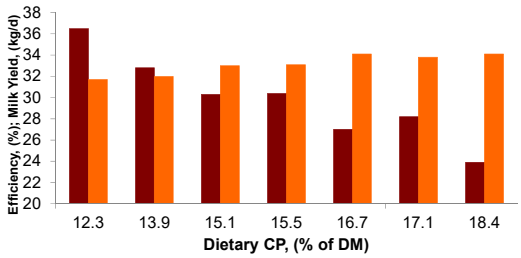
Improving Efficiency



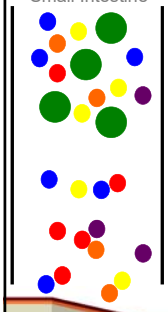
Broderick, 2003; Kalscheur et al., 2006

Improving Efficiency

- Swine and Poultry Production
  - – ↓ dietary protein and EAA supplementation
  - – Gross N efficiencies of 40% or greater
- Dairy Production
  - – Achieve N efficiency of ~25%
  - – N requirements expressed in terms of MP
  - – Overfeed EAA results in poor N efficiency

Nahm, K. H., 2002; Tamminga, 1992

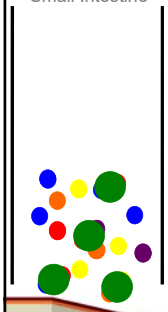
Current AA Requirements



- Flow of MP and EAA
  - – Dietary RUP and microbial protein
  - – Requirements for Lys & Met as a proportion of total MP required
- Splanchnic and mammary removal of EAA differs among AA
  - – Defining AA in aggregate or as fixed proportion of MP likely over/under-predicts requirement for other EAA

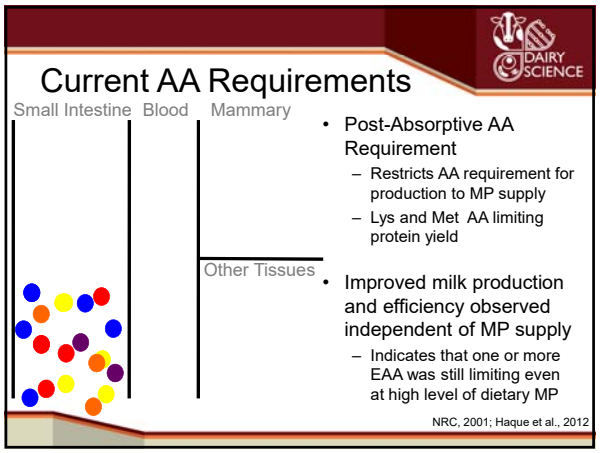
NRC, 2001; Hanigan et al., 2001; El-Kadi et al., 2006; Bequette et al., 2000

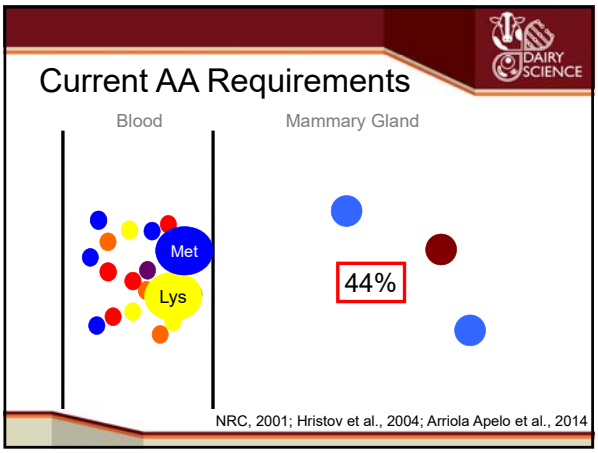
Current AA Requirements

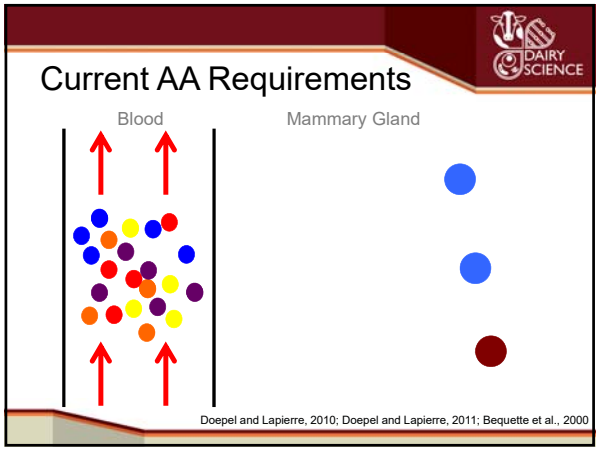


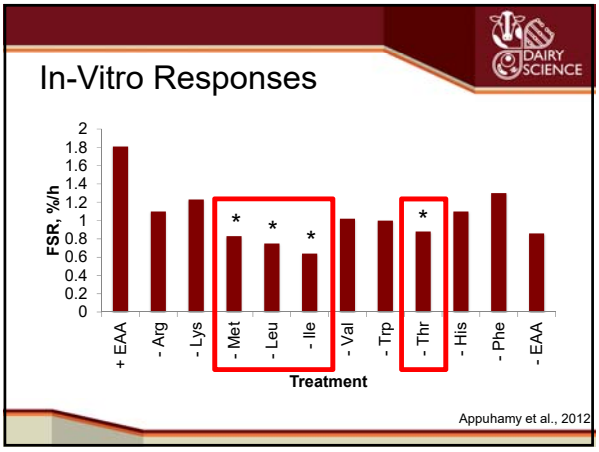
- Intestinal digestibility
  - – RUP based on digestion coefficients for protein in each feed ingredient
  - – Microbial protein assumed to be 80%
- Comparison of coefficient predictions and net portal appearance of absorbed EAA
  - – Predictions with small errors suggesting this method works within range of observed data

NRC, 2001; Pacheco et al., 2006

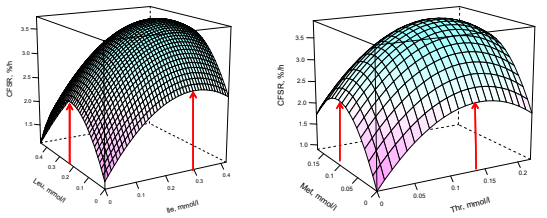

Current AA Requirements
Small Intestine
Blood
Mammary
Other Tissues
• Post-Absorptive AA Requirement
– Restricts AA requirement for production to MP supply
– Lys and Met AA limiting protein yield
• Improved milk production and efficiency observed independent of MP supply
– Indicates that one or more EAA was still limiting even at high level of dietary MP
NRC, 2001; Haque et al., 2012


Current AA Requirements
Blood
Mammary Gland
Met
Lys
44%
NRC, 2001; Hristov et al., 2004; Arriola Apelo et al., 2014


Current AA Requirements
Blood
Mammary Gland
Doepel and Lapierre, 2010; Doepel and Lapierre, 2011; Bequette et al., 2000


In-Vitro Responses
FSR, %/h
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
+ EAA
- Arg
- Lys
- Met
- Leu
- Ile
- Val
- Trp
- Thr
- His
- Phe
- EAA
Treatment
Appuhamy et al., 2012

In-Vitro Responses



Arriola Apelo et al., 2014

Objective: Shift the single limiting AA paradigm and amend the current model for AA requirements in order to improve AA utilization by dairy cattle

In-Vivo Responses

- Challenge the single-limiting AA theory
  - Ile, Leu, Met, Thr
  - Saturable responses
  - Max response
  - DMI depression
- Determine independent milk protein yield and DMI responses

Aguilar et al., unpublished

In-Vivo Responses

- Experimental Design
  - 48 lactating cows
    - Blocked into 4 groups (1 group for each AA)
  - 4x4 LSD replicated within Block (AA)
    - 4, 12-d periods
    - Fed 1 of 4 doses of encapsulated AA based on block
  - 75% of NRC MP requirement (13.5% CP, %DM)
- Sample collection
  - Last 5d of each period
  - Daily feed intake, milk yield, milk composition, BW

Aguilar et al., unpublished

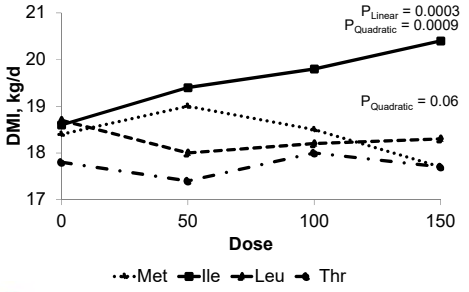
In-Vivo Responses

	Ile	Leu	Met	Thr
Dose		g/d/cow		
0%	0	0	0	0
50%	68	30	16	40
100%	136	59	31	80
150%	204	89	47	120

Doses of AA calculated as the difference between NC and the supply of each AA provided by a properly balanced diet at NRC requirements for MP

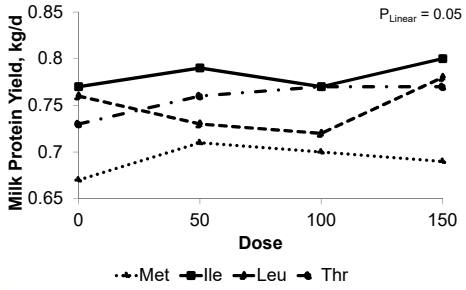
Aguilar et al., unpublished

In-Vivo Responses



Aguilar et al., unpublished

In-Vivo Responses



Aguilar et al., unpublished

In-Vivo Responses

Determine independent and interactive effects of AA on milk protein synthesis and post-absorptive efficiency of use for milk protein synthesis

Aguilar et al., unpublished

In-Vivo Responses

- Experimental Design
  - Incomplete LSD replicated within block
    - 3, 21-d periods
    - Blocked by milk protein yield
  - 48 lactating cows blocked into 4 groups of 12
    - 75% of NRC MP requirement (14% CP, %DM)
    - Fed 1 of 12 treatments in individual calan gates
    - NC, I, L, M, T, IT, LT, MT, IL, ILM, ILT, ILMT
  - 48 lactating cows blocked into 4 groups of 12
    - 100% of NRC MP requirement (16.2% CP, %DM)
    - Fed treatment in 1 of 4 pens

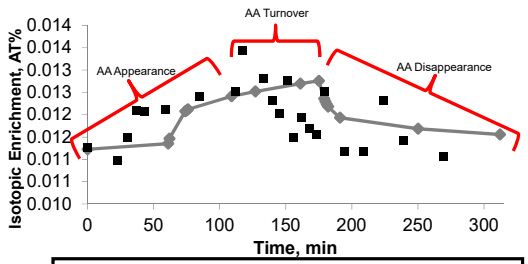
Aguilar et al., unpublished

In-Vivo Responses

- Experimental Design cont'd
  - Doses of AA (g/d/cow)
    - Met, 31 (100% Dose)
    - Ile, 204 (150% Dose)
    - Leu, 89 (150% Dose)
    - Thr, 120 (150% Dose)
  - Isotopic Infusion
    - 40 animals given continuous infusion of a stable, isotopically labeled AA mixture
    - Blood collected during 2 hour infusion and 1 hour post infusion
    - Milk samples collected pre and post infusion

Aguilar et al., unpublished

In-Vivo Responses



Label in milk will provide relative assessment of the efficiency of use of each AA in response to manipulation of dietary AA

Estes et al., unpublished

The ultimate goal is to use this information to derive new AA requirement equations that will more appropriately represent true biological behavior and that will provide more accurate AA requirement predictions.


DAIRY SCIENCE
Questions?

ARE ALTERNATIVE FEED INGREDIENTS REALLY SAVING YOU MONEY?

70th Annual Convention Virginia State Feed Association and "Cow" College
February 17-19,2016
Mike Blair, Ph. D.
Director, Global Antimicrobials
Phibro Animal Health Corporation

TOPICS

- What is an Alternative Feed Ingredient?
- Alternative Feed Ingredients
- Determining true savings/costs
- Cost *versus* value
- Practical Evaluation of Alternative Feed Ingredients

What is an Alternative Feed Ingredient?

1. Criteria determined by the operation
2. Agri Stats definition

Any ingredient which will replace corn, soybean meal or fat in the diet

Alternative Feed Ingredients

Primary Energy– Corn & Fats
- Wheat
- Milo – low tannin

Primary Protein/amino acids - Soybean Meal
- Canola/Sunflower Meals
- DDG's
- Expelled soybean meal
- Bakery Meals
- Meat and bone meal & animal protein blends
- Vegetable Protein Blends

Determining true savings/costs

- Savings per ton of feed x tons of feed = $$$$ savings
- Decision made
- True Savings?

Determining true savings/costs

- Availability
  - How long will supply last?
    - Worth the effort? Do savings hold true?
    - Delivery – dependable or variable?
      - Railroad – demurrage costs
      - Trucks – 3rd Generation Trucking Rules
      - Time of year – summer *versus* winter
      - Overtime costs to handle
      - Bird performance
      - FSMA!
      - Veterinary Feed Directive (VFD)

Determining true savings/costs

- Bin Space
  - Enough ingredient bin space to handle?
  - Will ingredient flow through system?
  - Does ingredient need to be ground? *e.g.* wheat replacing corn

Determining true savings/costs

- Impact on production of final feeds
  - Effect on through-put?
  - Effect on pellet quality and thus bird performance?

Cost *versus* Value - CONSIDER THE VALUE CHAIN

- The Bird
- Feed Mill
- Feed Formulation
- People

Economic Validation by the Bird

- Ingredient must be priced to lower the feed cost per pound of meat /dozen eggs or increase yield which the birds will tell us. Strain and bird size needs to be considered
- Consistency and reliability of product performance will be key.
- Eliminate the "trader" mentality. Not all DDG's, animal proteins, grains the same!

Feed Mill

Can the ingredient be used in the feed mill? Every feed mill is different!

- Bin Space
- Receiving Issues/costs
- Hassle factor for the feed mill – must be quantified *via* overtime, demurrage costs etc.

People

- People business
- Purchasing, nutrition, feed mill and live production all need to work together to determine the value of alternative ingredients.
- Eliminate "silos" and "conflicting goals " and respect each other's positions.

THANK YOU!

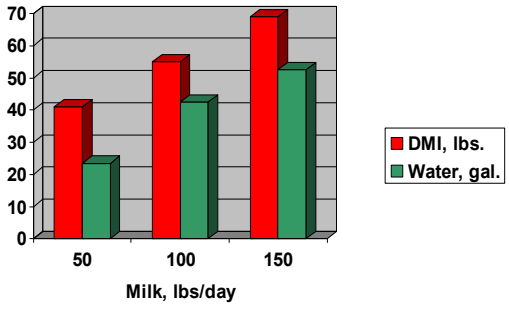
FEEDING THE HIGH PRODUCING DAIRY HERD

Dr. L. E. Chase
Professor Emeritus – Animal Science
Cornell University

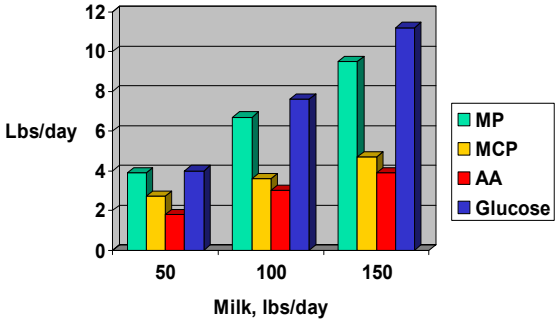
What is A High Producing Dairy Herd?

- How many are there?
- What is the highest herd average?

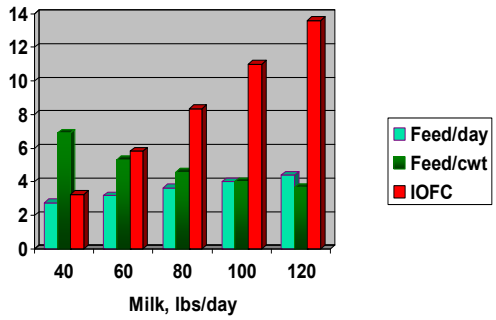
Daily Inputs Required



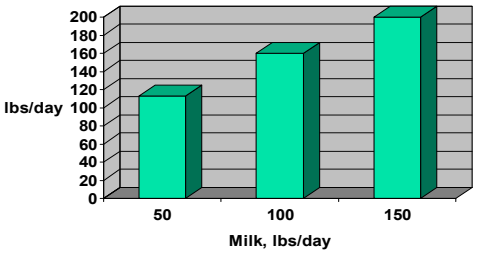
The Cow Needs



Feed Cost and IOFC, $



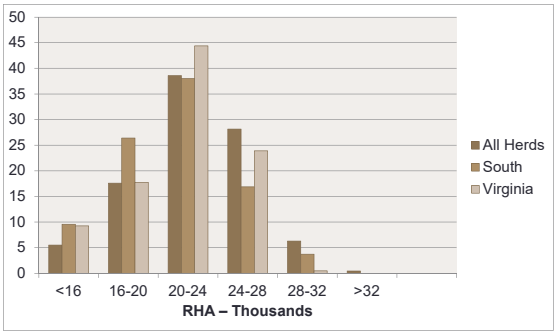
Daily Co-Product Production



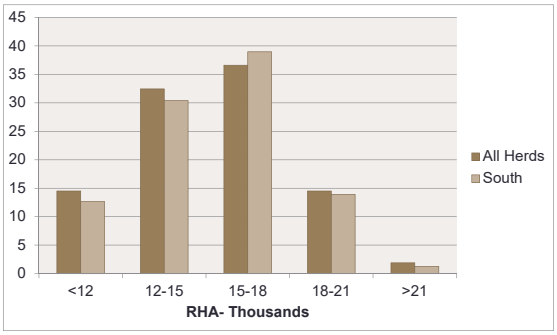
Raleigh DHI Data – 1/16

- Used the Dairy Metrics program to query the database.
- Search criteria:
  - Holstein and Jersey herds.
  - Total herds and herds in the South.
  - Sorted by milk production groups.
- Goal – Define some herd parameters associated with milk production levels.
- Holstein Herds:
  - All herds = 10,121
  - South = 806 (Virginia = 259 herds)
- Jersey Herds:
  - All herds – 568 (Virginia = 9 herds)

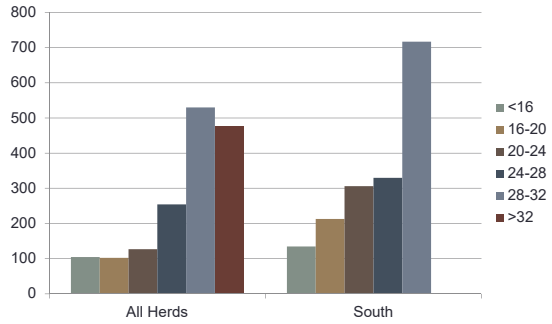
Holstein Herds, % of Herds



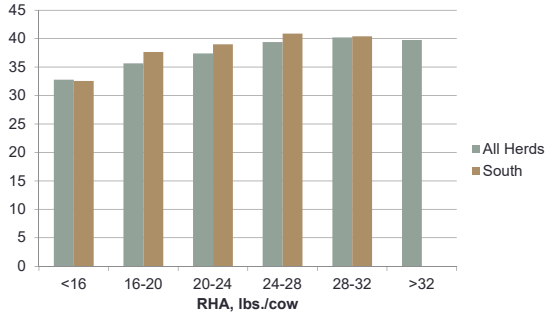
Jersey Herds, % of Herds



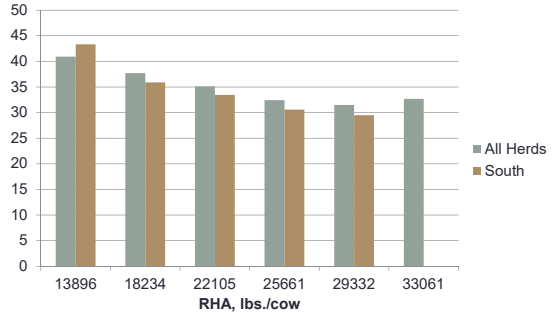
Cows/Herd – Holstein Herds by Milk Production Level



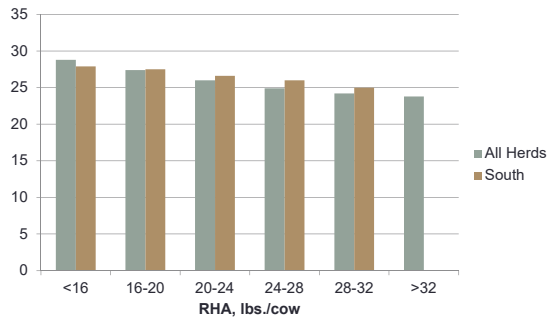
% 1st Calf Heifers – Holstein Herds



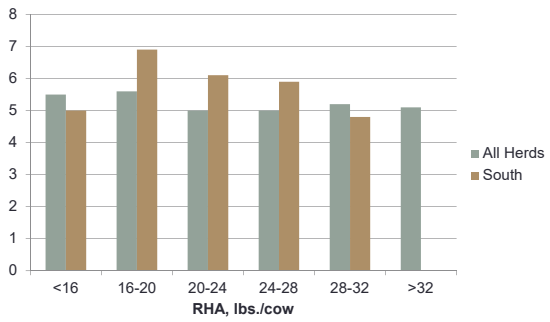
% 3+ Lactation Cows – Holstein Herds



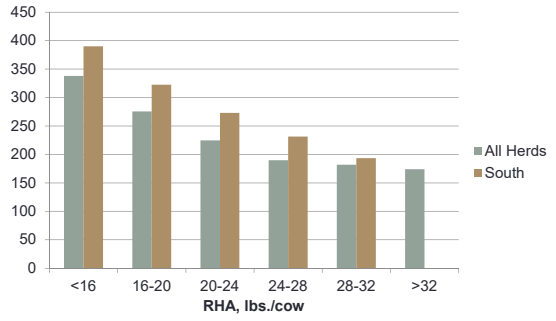
Age at 1st Calving, Months



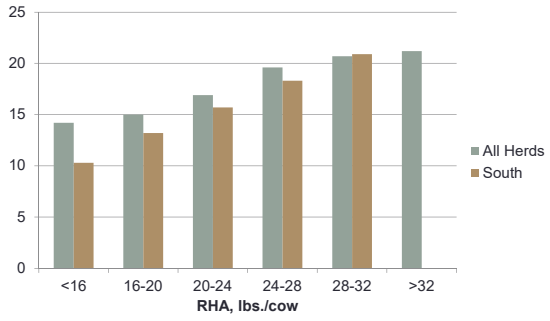
% Cows Died – Holstein Herds



SCC – '000's



21 Day Pregnancy Rate, %



Interim Summary

- Higher producing herds have:
  - More 1st lactation heifers and less older cows.
  - Lower age at calving for 1st calf heifers.
  - Similar number of cows that die.
  - Lower somatic cell counts.
  - Higher 21 day pregnancy rates.

Highest Herds

- Holstein -
  - Highest is 35045 lbs./cow.
  - 44 herds > 32,000 lbs./cow.
  - South = 31,875 lbs./cow. (highest herd)
  - South = 30 herds >28,000 lbs./cow.
- Jersey herds -
  - Highest herd is 22,638 lbs./cow.
  - 10 herds are > 21,000 lbs./cow.
  - Highest South herd is 21,067 lbs./cow.

Rations in High Producing Herds

- How do high producing herds get enough units of nutrients per day into the cows?
- A. Increase ration nutrient density?
- B. Increase DMI?

Ration Questions

- A large dairy sells a TMR to a neighboring small farm. Milk production on the large dairy is 78 lbs./cow/day while it is 86 lbs./cow/day on the small farm. How do you explain this?
- A high group of cows is averaging 120 lbs. of milk per day on a TMR “formulated” for 85 lbs. of milk. How do you explain this?
- A high group of cows is averaging 120 lbs. of milk per day but the top cow in the group is producing 180 lbs. of milk. How do you explain this?

What Do High Producing Herds Feed?

- 25 herds.
- Holstein herds fed TMR's.
- Northeast and Midwest herds.
- Milk = 30,842 lbs./cow (28,031 to 36,729 lbs./cow).
- Milk fat, % = 3.75 (range = 3.21 to 4.26%).
- Milk true protein, % = 3.05 (range = 2.9 to 3.22).
- All rations run through the CNCPS 6.1 model.

Forages Fed and NDF

Item	Mean	Range
% Forage in Ration	52.9	45 – 62.8
Corn Silage, % of Ration DM	32.2	18.8 – 49
Corn Silage, % of Forage DM	62.1	35.2 – 80.9
Ration NDF, %	30.1	24.5 – 32.8
Forage NDF, % of Ration DM	22.9	19.75 – 28.2

Other Forages Fed

Forage	Number of Herds	% of Total DM	% of Forages Fed
Straw	4	1.2	2.3
Dry Hay	12	3.47	6.5
Hay crop Silage	25	18.9	37

Ration Protein and Amino Acids

Item	Mean	Range
CP, %	16.7	14.3 – 18.1
MP, g/day	3007	2501 – 3718
MP bacteria, % of total MP	46.3	38.9 – 52.6
Lysine, % of MP	6.5	5.87 – 6.94
Methionine, % of MP	2.16	1.76 – 2.55
Lysine:Methionine ratio	3.06:1	2.54:1 – 3.76:1

Starch, Sugar and Fat

Item	Mean	Range
Ration Starch, %	26.7	21.3 – 30.1
Ration Sugar, %	4.4	2.7 – 8.3
Ration Fat, %	5.3	4.2 – 6.6

Energy Sources Fed

- HMSC = 10
- Corn grain = 21
- Whey = 6
- Molasses = 10
- Sugar = 4
- Whole cottonseed = 13
- Tallow = 9
- Bypass fat = 20

Protein Sources Fed

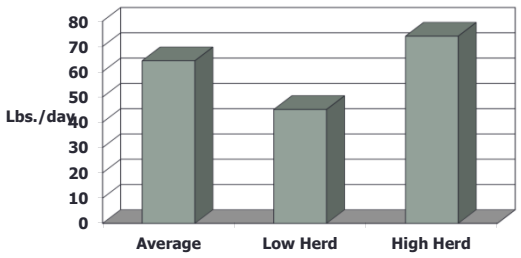
- Corn gluten feed = 9
- Corn germ meal = 4
- Corn gluten meal = 2
- Distillers = 13
- Soybean meal = 14
- Roasted soybeans = 8
- Expeller SBM = 20
- Canola meal = 18
- Urea = 12
- Animal protein blends = 7
- Blood meal = 13
- RP methionine = 18

Non-dietary Factors and Milk Production

- 47 herds in NE Spain
- 3,129 cows
- All herds were fed the *same TMR*
- Mixed at the cooperative and delivered to each herd daily
- Feed **delivered** per cow ranged from 35.4 to 54.3 lbs. of DM

Bach et.al., J. Dairy Sci. 91:3259-3267, 2008

Herd Milk Production



What Were the Key Differences in These Herds?

- Age at 1st calving was negatively correlated with milk production
- Stalls/cow were positively related to milk
- Herds that pushed up feed produced 8.3 lbs. more milk
- Herds that had refusals produced 3.5 lbs. more milk.

These factors accounted for >50% of variation in milk production

Corwin Holtz - 2010

- 7 Big Management Areas That Make a Difference
  - 25% = Cow Comfort
  - 25% = Forage Quality
  - 15% = Transition/Dry Cow Mgmt.
  - 15 % = Reproduction
  - 10% = Routine
  - 5% = Social interaction
  - 5 % = Nutrition
- Holtz-Nelson Consulting Group

Feeding Management and Milk Production

- Sova et. al., JDS – 2013 -
  - 22 free-stall herds in Ontario.
  - Herd size = 162 cows.
  - Average group size – 83 cows.
  - Average days in milk = 187.
  - Average DMI = 54.5 lbs.
  - Average milk production = 75.5 lbs.
  - TMR's were studied for 7 consecutive days.
  - If multiple feeding groups, used the highest producing group.
  - Feeds fed and refused were recorded and sampled daily.

Key Findings

- Feeding 2x versus 1 x =
  - Increase of 3.1 lbs. of DMI.
  - Increase of 4.4 lbs. of milk.
  - Decreased ration sorting.
- Every 2% group-level sorting of long particles was associated with a 2.2 lbs. per day decrease in milk.

- Sova et.al., 2013

Cow Comfort

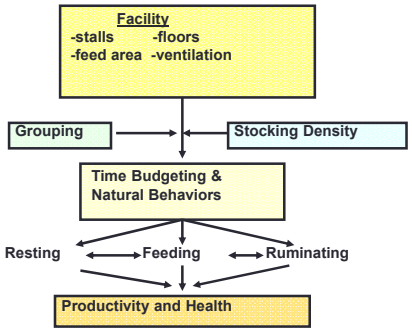
- A 700 cow herd built a new free-stall barn to reduce cows/stall from 1.2 to 1.
  - Predicted milk response was 5-6 lbs./day.
  - Actual was 8-10 lbs. of milk.
- At Cornell, we moved from a 40 year old free-stall barn to a new, sand-bedded free-stall barn in 2013:
  - Resting time increased.
  - Time standing decreased.
  - Milk increased 7-9 lbs. with no ration change.
- Many other herds report increases of 5 – 12 lbs. of milk per cow when cow comfort is improved.

Feed bunk space affects where cows choose to eat (Rioja-Lang et al., 2012)

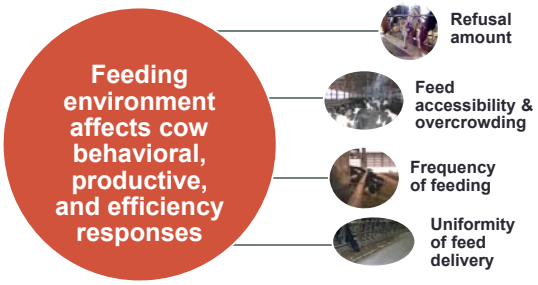
- Compared 76, 60, 46, and 30 cm of bunk space and preference for:
  - low-palatability feed alone
  - high-palatability feed next to a dominant cow
- Y-maze testing to offer choices

Space (cm)	HPF Dominant	Equal choice	LPF Alone	*P*
30	0	1	11	<0.001
46	1	3	8	<0.05
60	3	4	5	>0.05
76	5	2	5	>0.05

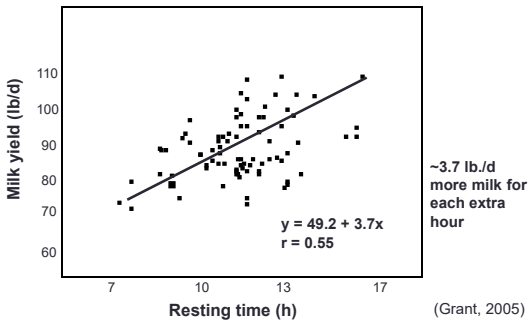
Optimizing Cow Behavior: On-Farm Concept



Feeding environment and efficiency



Relationship between resting and milk yield
(Miner Institute data base)



(Grant, 2005)

Kentucky High Producing Herds

- Smith et. al., The Professional Animal Scientist – 2013.
- Surveyed 23 Kentucky dairy herds with > 22,000 lbs. of milk. Average milk = 23,736 lbs. (range = 22,028 to 27,687 lbs. milk).
- 65% of the herds were partial confinement and 35% were total confinement.
- Average number of cows = 191 (range 25 to 1,590).
- 74% of the herds milked 2x.

Kentucky Herds – Management Practices Adopted

- Regular forage testing = 100%.
- Fans, sprinkler or both = 91%.
- Rations balanced at least yearly = 87%.
- Separate far-off and close-up groups = 70%.
- Kernel processor = 70%.
- Electronic feed management program = 57%.
- Push up feed regularly = 52%.

Kentucky Herds – Feed Additives

- Use rumen buffers = 91%.
- Use yeast cultures = 78%.
- Use organic or chelated minerals = 65%.
- Use mycotoxin binders = 65%.
- Use bypass = 57%.
- Use ionophores = 57%.
- Use direct-fed microbials = 43%.
- Use anionic salts = 35%.

"What 1 Management Practice Has Contributed the Most to Your Current Level of Milk Production?

- Attention to detail = 8 responses.
- Nutrition = 5 responses.
- Cow comfort = 4 responses.
- Quality forages = 4 responses.
- Record keeping = 3 responses.
- Genetics = 3 responses.
- Consistency = 2 responses.
- Many others had 1 response each.

Survey of Kentucky dairy herds.

Milking Frequency, % of Herds

Survey	2x	3x	4x
Michigan, 2006	39	61	
Wisconsin, 2010		100	
New York, 2000	20	72	8
Kentucky, 2013	74	26	
Wisconsin, 2004		83	17
Wisconsin, 1997	33	67	

Number of Feedings/Day, % of Herds

Survey	1	2	3+
Minnesota, 2010	70	22	8
Wisconsin, 2010	20	60	20
New York, 2000	44	41	15
Wisconsin, 1997	20	40	40
Wisconsin, 2004	100		
Wisconsin consultant	67	22	11

Number of Feed Pushups/Day, % of Herds

Survey	0	1-3	3-6	>6
New York, 2000	13	26	35	26
Wisconsin, 1997		17	67	16
Wisconsin, 2004	33	17	17	33
Wisconsin, 2010	20		20	60
Wisconsin consultant	11	11	56	22

Phil Helfter – Norco Farm - 1999

- **"Nutrition is not the key to my success"**
- Northern NY herd.
- 800 cows.
- Consistently > 100 lbs. of milk per cow shipped.
- "If a cow gets sick, it's my fault"

J. Kollwelter WI- 2013

- I really believe by the year 2020 we should be able to push 50,000 pounds of milk.
- 210 cows, currently 40,280 lbs. milk.
- CI = 13.2, CR = 60%, AFC =22-23 months.
- "Nothing replaces walking the pens, looking at cows and being observant"
- "There are no secrets. Cow comfort, feeding a balanced ration, good genetics….all the information is out there"
- "I don't push the cows – I just set them up to succeed"

Gordie Jones - 2014

- Rules that still apply:
  - Cow comfort is first
  - Forage is king
  - And better forage is better
  - Preg rate means you keep cows
  - Dry cow program stops early fresh cow losses
  - Milk quality is EVERYTHING

Dr. Herb Bucholtz – Michigan State - 2006

- "To achieve high per cow milk production, there are no magic ingredients or herd management techniques. It is a combination of overall excellent management of all aspects involved in feeding and managing the entire dairy herd"

Jim Barmore - 2006

- "Dairy producers need to spend more time on feeding management (feed delivery, feeding frequency, ration variation) vs. ration formulation. I see very few problems today in ration formulation and several opportunities for improvement in feeding management."

Dairy Consultant - Wisconsin

What Have We Learned?

- Ration nutrient specifications in high producing herds are "similar" to the nutrient profiles of many other herds.
- These herds use a wide variety of forages, feed ingredients and feed additives to obtain the final ration nutrient parameters.
- These herds generally tend to have more 1st lactation animals, a lower AFC, lower SCC, higher 21 day pregnancy rates and fewer fresh cow problems.

Summary

- My key points from working with and observing these herds:
  - They have comfortable cows.
  - High quality forages.
  - High and consistent DMI.
  - A "cow person" that observes and manages the cows on a daily basis.


HAVE YOU HUGGED A COW TODAY?
MILK. FRESH SQUEEZED DAILY.

National Grain and Feed Association

Food Safety Modernization Act

2016 Virginia State Feed Association Convention &
Virginia Tech Dairy Nutritional Management "Cow" College

February 17, 2016

David Fairfield
National Grain and Feed Association

Food Safety Modernization Act of 2011

- Signed into law on Jan. 4, 2011
- Greatly expands FDA's authority to regulate the U.S. food supply
  - Mandates that FDA create a **new prevention-based regulatory system** to ensure the safety of food/feed products
  - Requires FDA to develop and issue more than 50 regulations and/or guidance documents

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Subject of FSMA Rule	Date Regs Issued
Current Good Manufacturing Practice (CGMPs) and Preventive Controls – Human Food	Aug. 30, 2015 *(Sept. 17, 2015)*
Current Good Manufacturing Practice (CGMPs) and Preventive Controls – Animal Food	
Produce Safety Standards	Oct. 31, 2015 *(Nov. 27, 2015)*
Foreign Supplier Verification Programs	Oct. 31, 2015 *(Nov. 27, 2015)*
Accreditation of Third-Party Auditors	
Sanitary Transportation of Food **	March 31, 2016
Food Defense/Intentional Adulteration **	May 31, 2016

Applicability of FSMA Rules

- **Who's In, Who's Out …**
  - FSMA rules generally apply to facilities required to register as a "food facility" with FDA under Bioterrorism Act requirements
  - Farms (operations meeting FDA's definition of a "***farm***") are exempt
  - Individual rules also specify certain exemptions and modified requirements

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Updated Farm Definition

Farm means:

1) ***Primary production farm.*** A primary production farm is an operation **under one management** in one general **(but not necessarily contiguous)** physical location devoted to the growing of crops, **the harvesting of crops**, the raising of animals (including seafood), or any combination of these activities. The term "farm" includes operations that, in addition to these activities:
   - i) **Pack or hold raw agricultural commodities**;
   - ii) Pack or hold **processed** food, provided that all processed food used in such activities is either consumed on that farm or another farm under the same management, or is processed food identified in paragraph (1)(iii)(B)(1) of this definition; and
   - iii) Manufacture/process food, provided that:
     - A) All food used in such activities is consumed on that farm or another farm under the same **management**; or
     - **B) Any manufacturing/processing of food that is not consumed on that farm or another farm under the same management consists only of:**
       - **(1) Drying/dehydrating raw agricultural commodities to create a distinct commodity (such as drying/dehydrating grapes to produce raisins), and packaging and labeling such commodities, without additional manufacturing/processing (an example of additional manufacturing/processing is slicing);**
       - **(2) Treatment to manipulate the ripening of raw agricultural commodities (such as by treating produce with ethylene gas), and packaging and labeling treated raw agricultural commodities, without additional manufacturing/processing; and**
       - **(3) Packaging and labeling raw agricultural commodities, when these activities do not involve additional manufacturing/processing (an example of additional manufacturing/processing is irradiation); OR**

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Updated Farm Definition

***Farm* means:**

2) ***Secondary activities farm.*** **A secondary activities farm is an operation, not located on a primary production farm, devoted to harvesting (such as hulling or shelling), packing, and/or holding of raw agricultural commodities, provided that the primary production farm(s) that grows, harvests, and/or raises the majority of the raw agricultural commodities harvested, packed, and/or held by the secondary activities farm owns, or jointly owns, a majority interest in the secondary activities farm. A secondary activities farm may also conduct those additional activities allowed on a primary production farm as described in paragraphs (1)(ii) and (iii) of this definition.**

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The Farm Definition and Feed

- The farm definition includes operations under one management devoted to the raising of animals that manufacture feed so long as the feed is consumed on that farm or another farm under the same management; e.g., feedlots, laying operations where hens are fed on farms under the same management
  - Current definition is size-neutral; FDA says this is a "gap" they intend to address

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The Farm Definition and Feed

- The farm definition does <u>not</u> include operations under one management where feed is manufactured and animals are fed on a farm or farms <u>not</u> under the same management; e.g., contract grower arrangements where animals are fed on farms <u>not</u> under the same management that produces the feed

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Applicability of FSMA Rules

1-2. Human Food and Animal Food CGMP and Preventive Controls

- Facilities ***"solely engaged"*** in storing grain and oilseeds exempt from requirements to implement CGMPs and preventive controls
  - **Different treatment for elevators handling "fruits"** [i.e., lentils, kidney beans, pinto beans, lima beans, coffee beans, cocoa beans, peanuts, tree nuts and seeds for direct consumption (e.g., sunflower seeds)]
  - Elevators solely engaged in storing, handling such "fruits" exempt from CGMP requirements, but not exempt from the preventive controls and supply chain program requirements
- Grain millers, processors potentially covered by rules for human food and animal food
- Feed and pet food facilities covered by animal food rule

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Applicability of FSMA Rules

3. Foreign Supplier Verification Programs

- Applies to ***importers*** of grains and oilseeds, feed ingredients - ***could include a grain elevator***

4. Accreditation of Third-Party Auditors

- Applies to foreign food in certain circumstances; i.e., high-risk designation by FDA or participation in Voluntary Qualified Importer Program (VQIP)

5. Sanitary Transportation of Food

- Will apply to grain elevators and feed facilities; will cover truck and rail transportation

6. Food Defense/Intentional Adulteration

- FDA proposed that animal food be exempt, human food covered

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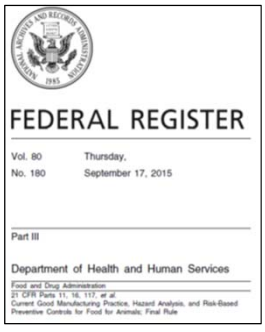
CGMPs and Preventive Controls for Animal Food

- **PART 507—Current Good Manufacturing Practice, Hazard Analysis, and Risk–Based Preventive Controls for Food for Animals:**
  - **Subpart A: General Provisions**
  - **Subpart B: Current Good Manufacturing Practices (CGMPs)**
  - **Subpart C: Hazard Analysis and Risk-Based Preventive Controls**
  - **Subpart D: Withdrawal of a Qualified Facility Exemption**
  - **Subpart E: Supply-Chain Program**
  - **Subpart F: Requirements Applying to Records That Must Be Established and Maintained**


FEDERAL REGISTER

Vol. 80 Thursday,
No. 180 September 17, 2015

Part III

Department of Health and Human Services

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Qualified Individual Requirements

- Individuals who manufacture, process, pack, or hold animal food subject to the rule are to be qualified to perform their assigned duties
  - Each individual (including temporary, seasonal and contract personnel) must:
    1. Have the education, training, or experience (or a combination thereof) necessary to manufacture, process, pack, or hold safe animal food as appropriate to the individual's assigned duties; and
    2. Receive training in the principle of animal food hygiene and animal food safety, including the importance of employee health and personal hygiene, as appropriate to the animal food, and the facility

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Qualified Individual Requirements

- Rule does not specify the frequency of training, but FDA expects training to occur before working in production operations and periodic refresher training thereafter
- Rule requires that training records are to be maintained for at least two years
- Rule does not prescribe the content of training records

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CGMPs Requirements

- **CGMPs** – Required conditions and practices to ensure that animal feed/pet food will not become adulterated
- **CGMPs** establish ***new*** requirements for animal feed/pet food facilities
  - All other applicable regulations still apply
    - BSE-Prevention requirements
    - 21 CFR Part 225 CGMPs
    - Others …

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CGMPs Requirements – Overview

- **Establish requirements for following conditions/practices:**
  - Personnel – cleanliness and training
  - Plant and grounds – maintenance, design, construction
  - Sanitation – housekeeping, cleaning, pest control
  - Water supply and plumbing – water quality, plumbing design, rubbish control
  - Equipment and utensils – maintenance, design, construction
  - Plant operations – labeling, inspection of raw materials, ingredients, protection against metal/foreign objects
  - Holding and distribution – storage and transportation
  - Holding and distribution of human food by-products for use as animal food

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Exempt from CGMPs

1. Farms
2. Establishments **solely engaged in the holding** and/or transportation of one or more raw agricultural commodities other than fruits or vegetables (e.g., grain elevators)
3. Establishments **solely** engaged in hulling, shelling, drying, packing, and/or holding nuts and hulls (without manufacturing/processing, such as grinding shells or roasting nuts)
4. Establishments **solely** engaged in ginning of cotton (without manufacturing/processing, such as extracting oil from cottonseed)

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Preventive Controls for Animal Food – Overview

- Requires covered facilities to develop and implement a written animal food safety plan
  - Plan to be developed/overseen by a "***preventive controls qualified individual***"
    - ***Preventive controls qualified individual*** means a qualified individual who has successfully completed training in the development and application of risk-based preventive controls at least equivalent to that received under a standardized curriculum recognized as adequate by FDA (Food Safety Preventive Controls Alliance), **or** is otherwise qualified through job experience to develop and apply an animal food safety system.

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Preventive Controls for Animal Food – Overview

- **Animal Food Safety Plan** to include a written hazard identification and analysis
  - Identify and evaluate ***"known or reasonably foreseeable hazards"*** – physical, chemical (radiological), biological, including those associated with intentional economic adulteration
  - Implement one or more "***preventive controls"*** effective in preventing any hazard identified during the hazard evaluation as being a "***hazard requiring a preventive control"*** from adulterating product

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Preventive Controls for Animal Food – Overview

- IF a "***hazard requiring a preventive control"*** is identified, then one or more "***preventive controls"*** and ***"components to manage such controls"*** are to be implemented to ensure the hazard is controlled effectively. ***"Components to manage such controls"*** include, as appropriate to the preventive control:
  - Monitoring
  - Validation
  - Verification
  - Corrective actions and corrections
  - Records
  - Recall plan

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Preventive Controls for Animal Food – Overview

- All required activities within the animal food safety plan are to be documented and retained for at least two years; electronic records allowed
- Reassessment of animal food safety plan is required
  - At least every three years – entire plan
  - More frequently if situations prescribed in the rule occur

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Exempt from Preventive Controls

- Farms
- Facilities *solely* engaged in the storage of raw agricultural commodities (other than fruits and vegetables) intended for further distribution or processing, e.g., grain elevators
- Facilities *solely* engaged in the storage of unexposed packaged animal food that does not require time/temperature control to significantly minimize or prevent the growth of, or toxin production by, pathogens

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Supply-Chain Program Requirements for Animal Food – Overview

- Applies to a covered facility that has identified a ***hazard requiring a preventive control*** **and** who relies on its ***"supplier"*** to control the hazard
- ***Supply-chain-applied control*** means a preventive control for a hazard in a raw material or other ingredient when the hazard in the raw material or other ingredient is controlled before its receipt

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Supply-Chain Program Requirements for Animal Food – Overview

- ***Supplier*** means the establishment that manufactures/processes the animal food, raises the animal, or grows the food that is provided to a receiving facility without further manufacturing/processing by another establishment, except for further manufacturing/processing that consists solely of the addition of labeling or similar activity of a de minimis nature

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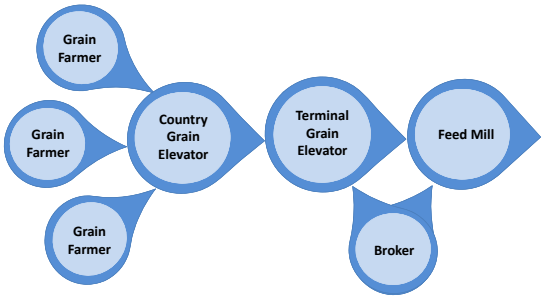
Who's The Supplier?



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Supply-Chain Program Requirements for Animal Food – Overview

- IF a receiving facility has identified a hazard requiring a ***supply-chain-applied control***, then the receiving facility is required to have a written supply-chain program to:
  - Receive that raw material or ingredient only from approved suppliers
  - Perform activities to verify that the supplier is adequately controlling the hazard

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Compliance Dates for CGMPs and PCs

Business Size	CGMPs Compliance Date	Preventive Controls Compliance Date
Business Other than Small and Very Small	1 year – Sept. 19, 2016	2 years – Sept. 18, 2017
Small Business	2 years – Sept. 18, 2017	3 years – Sept. 17, 2018
Very Small Business	3 years – Sept. 17, 2018	4 years – Sept. 17, 2019

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Business Sizes

- **Small Business**: A business employing fewer than 500 full-time equivalent employees. The rule specifies that when determining the number of full-time equivalent employees, the calculation is to include all employees of the business rather than be limited to the employees at a particular facility.
- **Very Small Business:** A business (including any subsidiaries and affiliates) averaging less than $2,500,000, adjusted for inflation, per year, during the 3-year period preceding the applicable calendar year in sales of animal food plus the market value of animal food manufactured, processed, packed, or held without sale (e.g., held for a fee or supplied to a farm without sale).

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Compliance Dates for Supply-Chain Program

Situation	Compliance date:
A receiving facility is a small business and its supplier will be subject to the CGMPs, but not the preventive control requirements, of the animal food preventive controls rule	Six months after the receiving facility's supplier of that raw material or other ingredient is required to comply with the CGMP requirements of this rule
A receiving facility is a small business and its supplier is subject to the animal food preventive controls rule	The later of: September 17, 2018 or 6 months after the receiving facility's supplier of that raw material or other ingredient is required to comply with this rule
A receiving facility is not a small business or a very small business and its supplier will be subject to CGMPs, but not the preventive control requirements, of the animal food preventive controls rule	Six months after the receiving facility's supplier of that raw material or other ingredient is required to comply with the CGMP requirements of this rule
A receiving facility is not a small business or a very small business and its supplier will be subject to the animal food preventive controls rule	The later of: September 18, 2017 or 6 months after the receiving facility's supplier of that raw material or other ingredient is required to comply with the applicable rule

FDA Guidance Documents – In Process

- Current Good Manufacturing Practices
- Human Food By-Products for Use as Animal Food
- Hazard Analysis and Preventive Controls
- A Small Entity Compliance Guide that explains the actions a small or very small business must take to comply with the rule

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Food Safety Preventive Controls Alliance

- FDA-recognized hazard analysis and preventive controls training for food/feed industry and regulatory personnel -
  - Developed by subject-matter experts from government, industry, academia
  - Individuals successfully completing training will be ***"preventive controls qualified individuals"***
  - Curriculum likely to be available in June
  - Likely will be a 20-hour course

FSPCA
FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

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Food Safety Modernization Act

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National Grain and Feed Association
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Information Used to Monitor Our Robotic Milking Herd

Scott and Laura Flory
Hillside Farm
Dublin, VA

Hillside Farm

- Herd size – 230
- Facility- Freestall Barn with 4 Lely A-4's and Juno Feed Pusher
- Closed Loop Flush System with Sand Lane
- Automatic Calf Feeder and Growing Calf Barn
- RHA – 27,300 lbs/cow

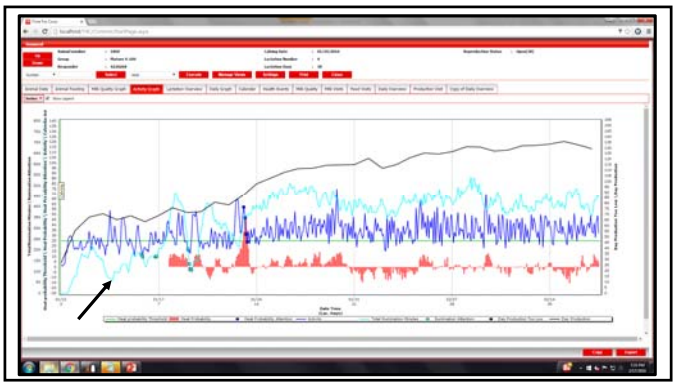
Scope of Data

- 100 data points/cow/day
- Over 20,000 numbers collected in 24 hours herd wide
- One lactation = 500x amount of data as monthly test data

"It's not information overload, it's filter failure."
-Clay Shirky

Rumination

- Herd Wide
- Within Management Groups
- Individual Animals
- Precedes all unfavorable circumstances



Milkings/Cow/Day

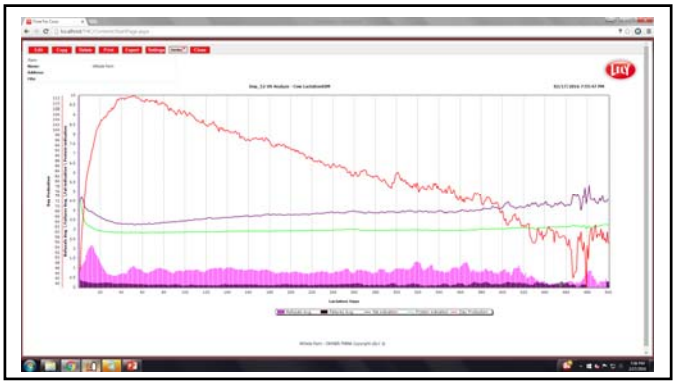
- Total Free Flow System
- Leads Milk Production
- Managed – Herd Wide, Groups, Individual Animals

Production/Components

- Focus on key management groups (i.e. Fresh Cows)
  - Production
  - Deviations over time
  - Fat/Protein Indication
  - Fat/ Protein Ratio

Refusals

- Unrewarded visits to robot (i.e. too early)
- Indicator of energy status or animals comfort level and curiosity
- Managed by group status or herd only

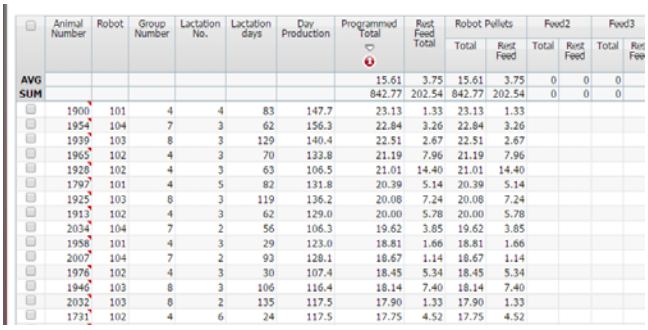


Concentrate Intake

- Can be used to monitor herd, groups or individual animals
- Designed to follow production model

Rest Feed

- Measure of how much concentrate was unclaimed based on amount allowed per production table
- Controlled amount allowed to carry to next day
- Indicator of infrequent visits by individual animal
- Monitor as a percentage for herd basis



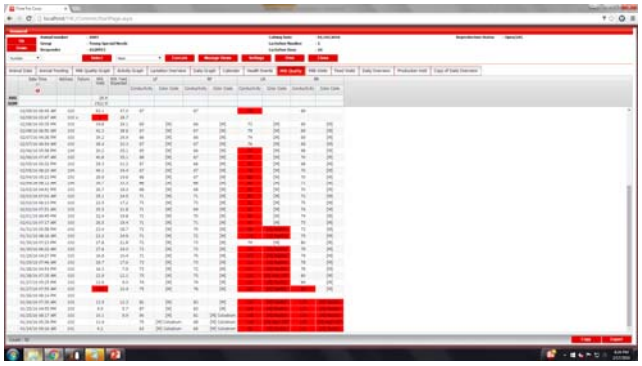
	Animal Number	Robot	Group Number	Lactation No.	Lactation days	Day Production	Programmed Total	Rest Feed Total	Robot Pellets		Feed2		Feed3	
									Total	Rest Feed	Total	Rest Feed	Total	Rest Fee
AVG							15.61	3.75	15.61	3.75	0	0	0	
SUM							842.77	202.54	842.77	202.54	0	0	0	
	1900	101	4	4	83	147.7	23.13	1.33	23.13	1.33				
	1954	104	7	3	62	156.3	22.84	3.26	22.84	3.26				
	1939	103	8	3	129	140.4	22.51	2.67	22.51	2.67				
	1965	102	4	3	70	133.8	21.19	7.96	21.19	7.96				
	1928	102	4	3	63	106.5	21.01	14.40	21.01	14.40				
	1797	101	4	5	82	131.8	20.39	5.14	20.39	5.14				
	1925	103	8	3	119	136.2	20.08	7.24	20.08	7.24				
	1913	102	4	3	62	129.0	20.00	5.78	20.00	5.78				
	2034	104	7	2	56	106.3	19.62	3.85	19.62	3.85				
	1958	101	4	3	29	123.0	18.81	1.66	18.81	1.66				
	2007	104	7	2	93	128.1	18.67	1.14	18.67	1.14				
	1976	102	4	3	30	107.4	18.45	5.34	18.45	5.34				
	1946	103	8	3	106	116.4	18.14	7.40	18.14	7.40				
	2032	103	8	2	135	117.5	17.90	1.33	17.90	1.33				
	1731	102	4	6	24	117.5	17.75	4.52	17.75	4.52				

Fetch Cows

- List generated from:
  - Animals not milked in over 12 hours
  - Animals over 8 hours that aren't meeting their minimum average milkings based on production and stage of lactation
- The fewer the better
- Indicator of overall nutritional balance and herd health

Conductivity

- Per quarter/animal every milking
- Numerical value
- Tracking deviations from other quarters or individual history
- Time lag on down trends
- Observation:
  - Milk volume has effect
  - False Positives

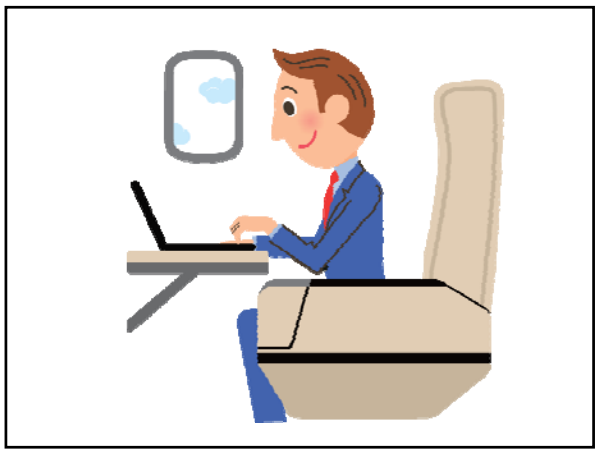


Questions?

Monitoring Dairy Management Remotely

Patrick French, PhD, Dipl ACAN

FEED COMPONENTS VirginiaTech Invent the Future PFBOVIDAE




FILE STORAGE AND
SHARING

Dropbox

Google Drive

OneDrive

SugarSync

How Can I Use This?

- File Storage
- File Sharing
  - Work
    - Rations
    - Herd Records
  - Home
    - Game Schedules
    - Photos
- Store Everything, Share Somethings

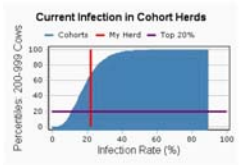
Ingredient	12/17/15 AF lb/hd/d	12/17/15 DM lb/hd/d	1/9/16 AF lb/hd/d	1/9/16 DM lb/hd/d	1/20/16 DM lb/hd/d	1/28/16 DM lb/hd/d
F5 Mix Bin 3	4.8308	4.4235	4.8480	4.4235	4.4235	5.8435
Dry corn	9.5240	8.0000	3.8170	3.0000	3.0000	3.0000
Energy Booster	0.7100	0.7030	0.7080	0.7030	0.7030	0.7030
SBM Exceller	2.8090	2.5000	4.4900	4.0000	4.0000	4.0000
Water	16.0000	0.0160	16.0000	0.0160	0.0160	0.0160
Soybean meal	1.6140	1.4200	1.5540	1.4200	1.4200	
Canola	5.4170	5.0000	4.8750	4.5000	4.5000	4.5000
Haylage	17.7300	10.0000	20.9460	10.6000	10.6000	10.6000
HMSC	5.6340	4.0000	9.7160	6.5000	7.5000	7.5000
Whey	10.0000	2.5000	10.0000	2.5000	2.5000	2.5000
Corn Silage	68.0950	28.6000	77.0240	29.5000	29.5000	29.5000
Molasses						
Total	142.3638	67.1625	153.9780	67.1625	68.1625	68.1625

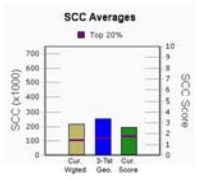
Forages in Use

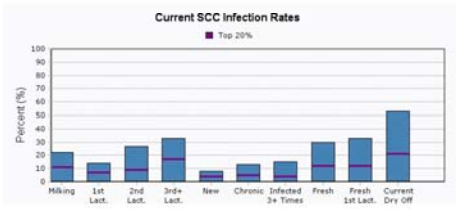
High Group

Date	Corn Silage (DM lbs/h/d)	Haylage (DM lbs/h/d)
11/17/15	28.6	10.0
12/14/15	28.6	10.0
12/18/15	28.6	10.0
12/29/15	28.6	10.0
1/9/15	29.5	10.6
1/12/16	29.5	10.6
1/23/16	29.5	10.6
2/8/16	29.5	10.6

Hig 3 4.0
HLG 7 1.0
HLG 11 5.6

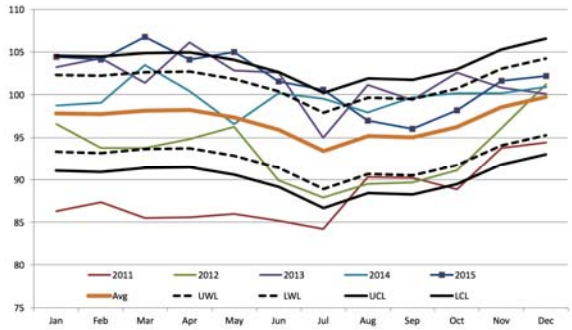






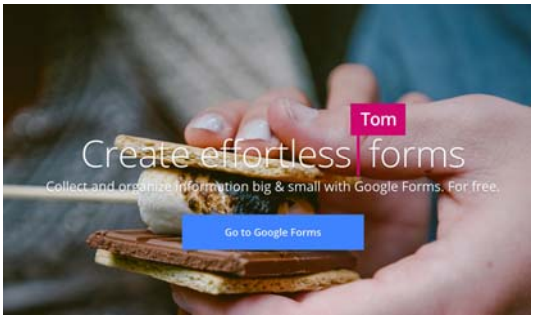
Class III Equivalent Milk (C3EM)

- C3EM = Calculated Milk Value / Class III * 100
- Class III Milk = [(Protein Price x 3.1) + (Other solids price x 5.9) x 0.965] + Fat Price x 3.5
- Calculate Milk Value =
  - Protein lbs x Protein Price + [3.1 x 3 = 9.3]
  - Fat lbs x Fat Price + [3.6 x 2 = 7.2]
  - Other Solids lbs x Other Solids Price + [5.71 x 0.4 = 2.28]
  - PPD + Bonuses – Deductions
- **KEY** - Standardized to constant prices
  - Avg Prot = $3, Fat = $2, Other = $0.40

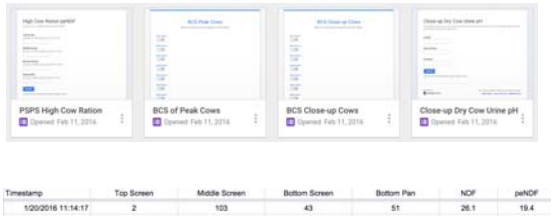


Can You Manage What You're Measuring?

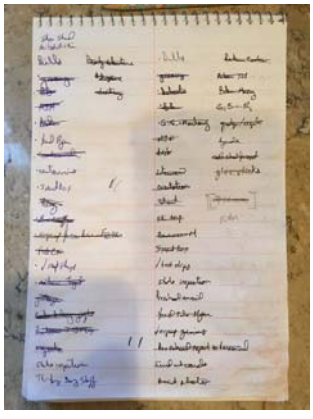
Google Forms

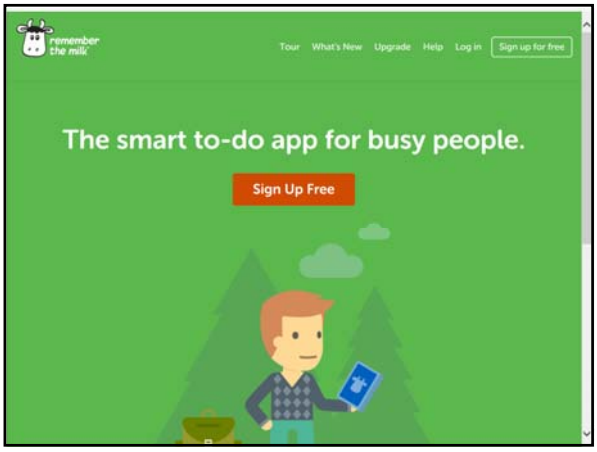


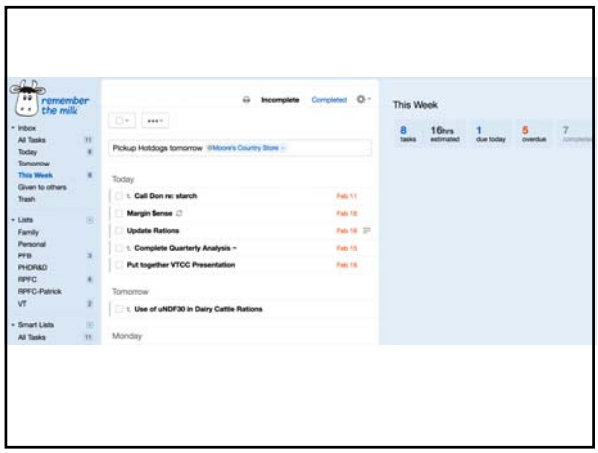
Google Forms Example

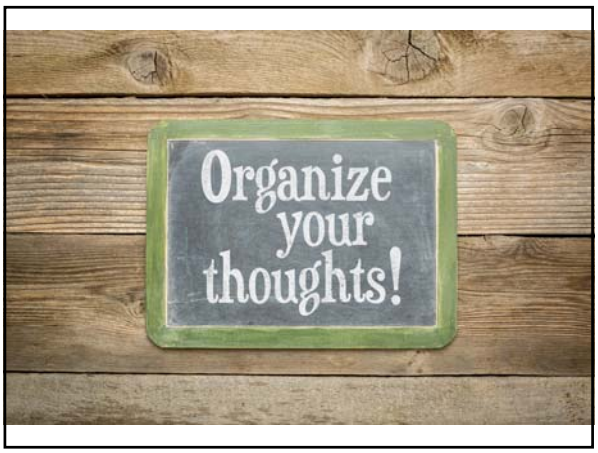


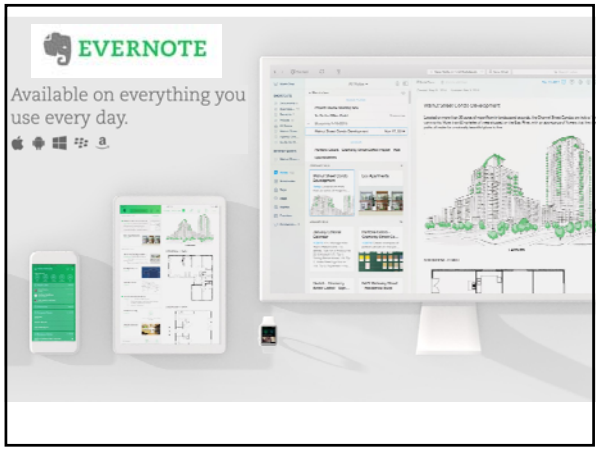
Timestamp	Top Screen	Middle Screen	Bottom Screen	Bottom Pan	NDF	peNDF
1/20/2016 11:14:17	2	103	43	51	26.1	19.4






remember the milk
Incomplete
Completed
This Week
Pickup Hotdogs tomorrow
Today
Call Don re: starch
Margin Sense
Update Rations
Complete Quarterly Analysis
Put together VTCC Presentation
Tomorrow
Use of uNDF30 in Dairy Cattle Rations
Monday


Organize your thoughts!


EVERNOTE
Available on everything you use every day.

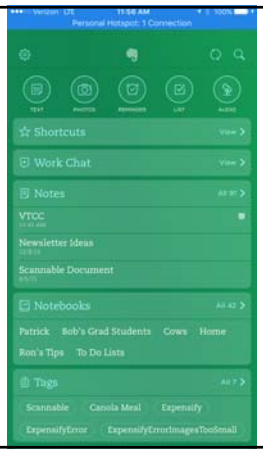

Journal of Dairy Sci Meta-Analysis
Dairy One Composition
Essi Evan's Write-ups on Canola Meal
Journal of Dairy Sci Meta-Analysis
Feeding canola meal to dairy cows: A meta-analysis on lactational responses
ABSTRACT
INTRODUCTION

Patrick click to add tags Share

Created: Feb 9, 2016 Updated: Feb 18, 2016

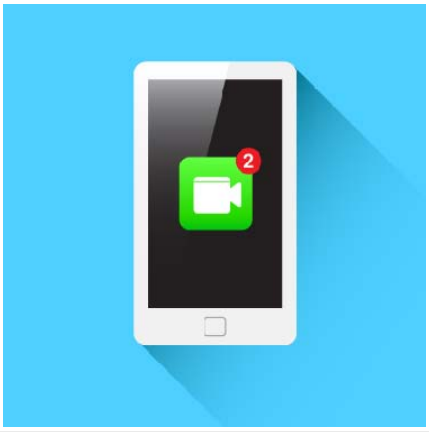
VTCC

1. Evernote - Can it work here
2. RTM - use to record to dos, but also use to get to dos from others
3. Google Forms - using to collect data
4. Dropbox - using to record more complex data, PCDart/DC305 backups, rations fed, performance, etc. Show examples. Alternatives are Google drive. NDS and Dropbox
5. Google for email and calendars
6. Can Evernote integrate with other apps
7. Take pic of Mary's system - to do list, calendars inside cabinets, family calendar
8. Dino, phdR&D, Victor Dairy, VT Dairy as examples.
9. Go back and look at Dino's apps for TSDNC and more recently Dino's project app
10. Collecting meaningful info, things that result in performance changes and are actionable - BCS, urine pH
11. Use video - FaceTime, Google Voice, Fuze
12. Incorporating many email addresses into one using Gmail



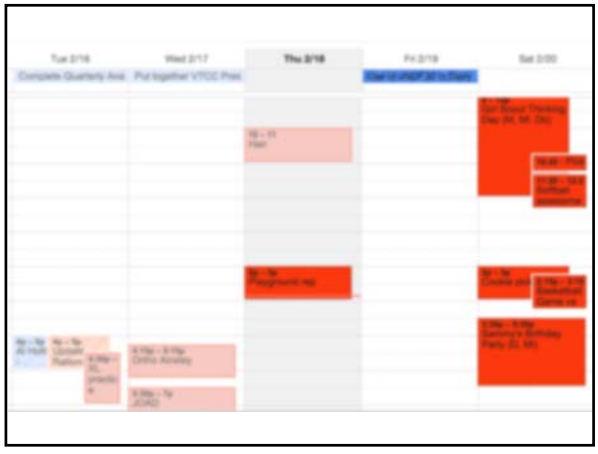
Communicate like we're in-person, although we're miles away

Google+ FaceTime skype ooVoo qik business Bee




Marketing Meeting

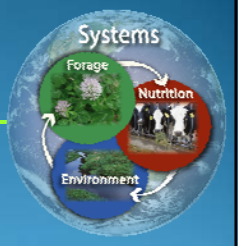

Windows Live
YAHOO!
Gmail
Aol Mail.
Outlook
Google Apps for Business




join or start a
meeting instantly.
start
join

USDA
United States Department of Agriculture

Right Quality vs High Quality Forages



Mary Beth Hall

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

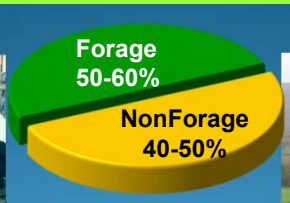
VSFA 2/18/2016

To do anything well (and repeatably), we need to understand what we are dealing with.

How do we work with forages to make rather than break rations?

Forage In Dairy Cow Rations

USDA

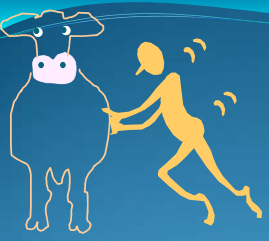


- What cows are designed to use
- Include as much forage as possible
- Meet requirements

14 herds, 28,600 – 36,960 kg RHA

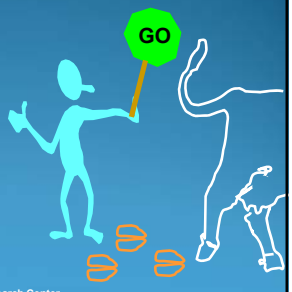
Shaver and Kaiser, 2011

2/18/16 U.S. Dairy Forage Research Center



Forage quality sets limits for amount of forage fed and production.

We must balance rations without breaking rules.



You can't push a cow to produce…..

….But you can get the obstacles out of her way so she can.

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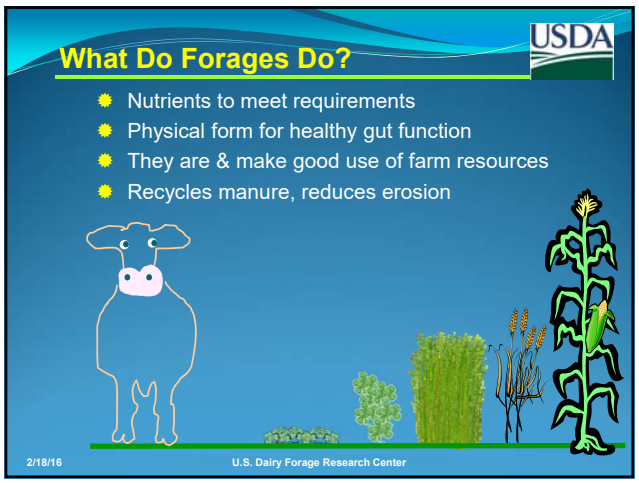
What Do Forages Do?
USDA
Nutrients to meet requirements
Physical form for healthy gut function
They are & make good use of farm resources
Recycles manure, reduces erosion
2/18/16
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Which Is High Quality Forage?
USDA
?
Alfalfa
Grass
Straw
Corn Silage
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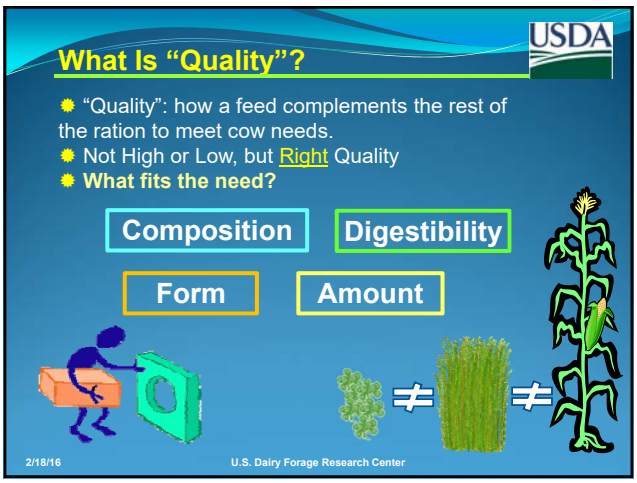
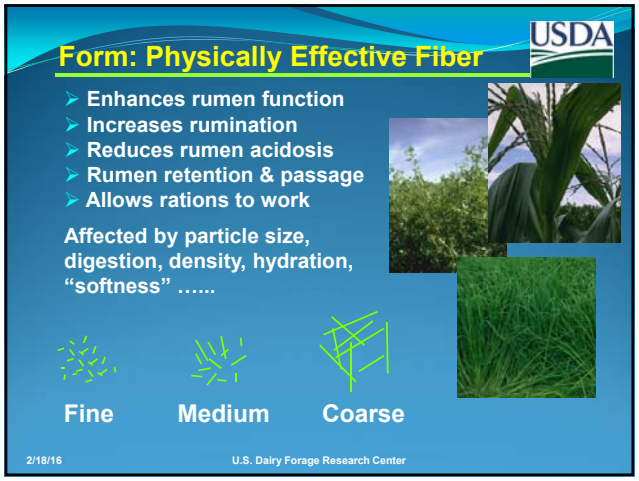
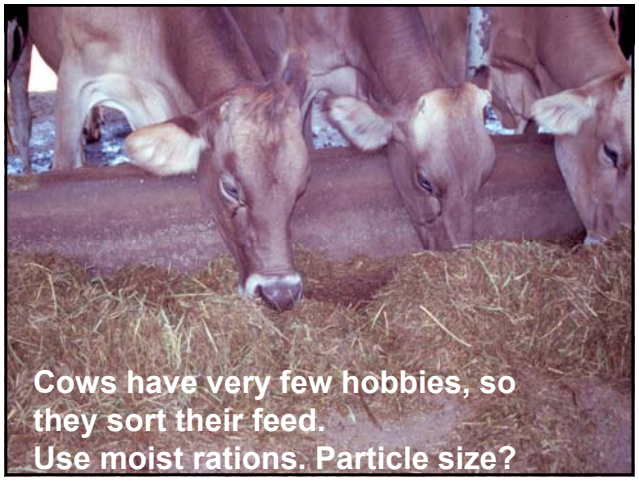
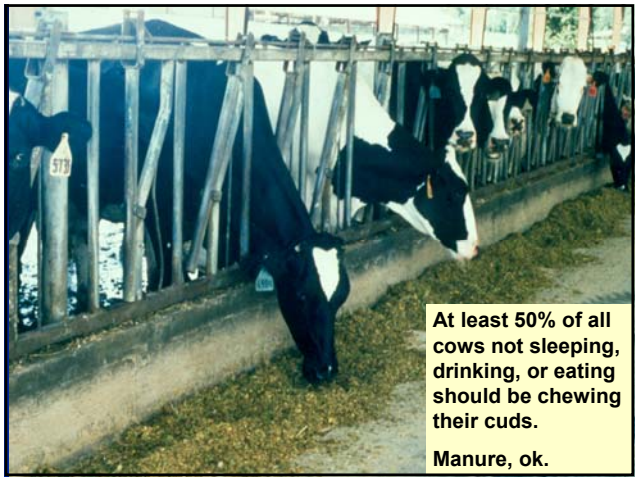
Which Is The Best Screwdriver?
USDA
2/18/16
U.S. Dairy Forage Research Center


What Is "Quality"?
USDA
"Quality": how a feed complements the rest of the ration to meet cow needs.
Not High or Low, but Right Quality
What fits the need?
Composition
Digestibility
Form
Amount
≠
≠
2/18/16
U.S. Dairy Forage Research Center


Form: Physically Effective Fiber
USDA
Enhances rumen function
Increases rumination
Reduces rumen acidosis
Rumen retention & passage
Allows rations to work
Affected by particle size, digestion, density, hydration, "softness" ……
Fine
Medium
Coarse
2/18/16
U.S. Dairy Forage Research Center

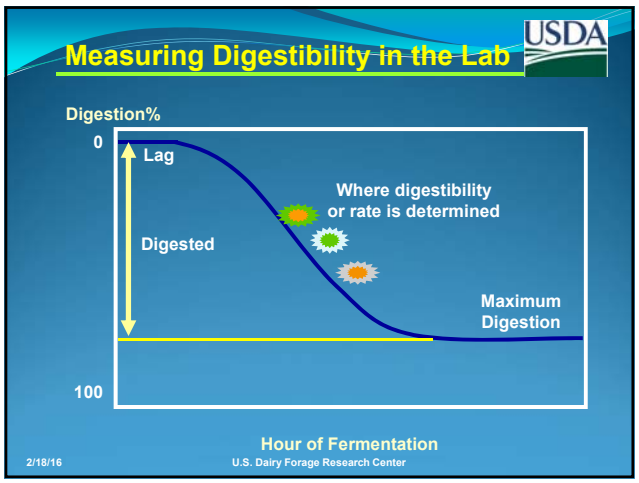

For the record, only cows can tell you whether there's enough effective fiber in the ration.
As usual, we're the only ones who know what's going on….

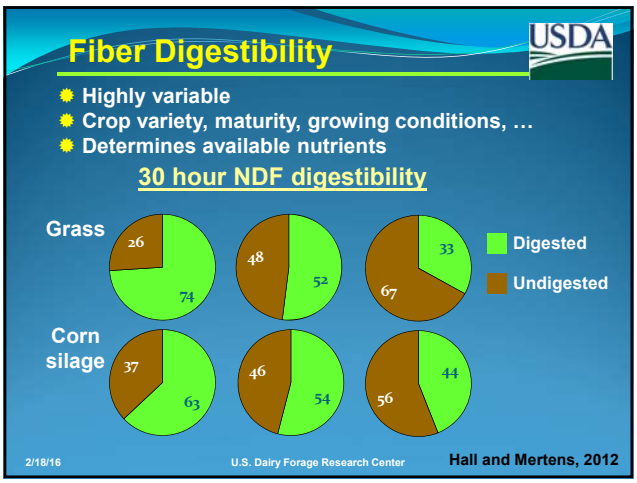

Cows have very few hobbies, so they sort their feed.
Use moist rations. Particle size?

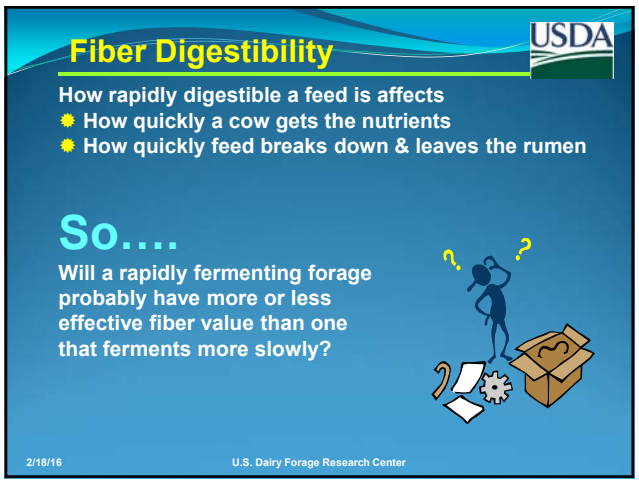

At least 50% of all cows not sleeping, drinking, or eating should be chewing their cuds.
Manure, ok.

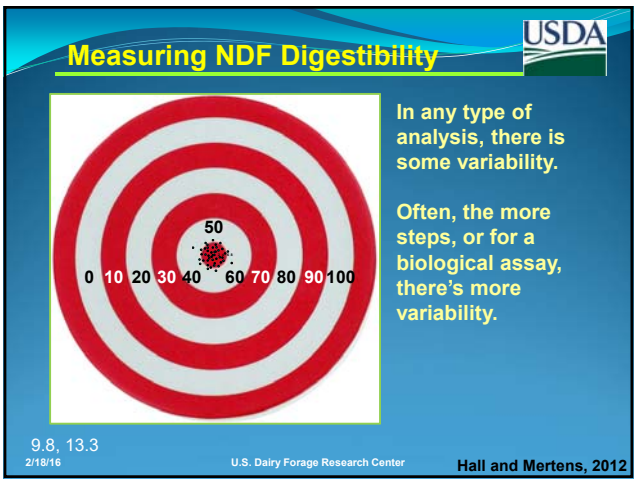

Not good. Not normal.
We broke the rules.


Fecal Particle Size
Fisher Scientific Company
Good ruminal retention = better digestion
Reduced ruminal retention = poorer digestion


Measuring Digestibility in the Lab
USDA
Digestion%
0
Lag
Where digestibility
or rate is determined
Digested
Maximum
Digestion
100
Hour of Fermentation
2/18/16
U.S. Dairy Forage Research Center


Fiber Digestibility
USDA
Highly variable
Crop variety, maturity, growing conditions, …
Determines available nutrients
30 hour NDF digestibility
Grass
Corn silage
26
74
48
52
33
67
37
63
46
54
44
56
Digested
Undigested
2/18/16
U.S. Dairy Forage Research Center
Hall and Mertens, 2012


Fiber Digestibility
USDA
How rapidly digestible a feed is affects
How quickly a cow gets the nutrients
How quickly feed breaks down & leaves the rumen
So….
Will a rapidly fermenting forage probably have more or less effective fiber value than one that ferments more slowly?
2/18/16
U.S. Dairy Forage Research Center


Measuring NDF Digestibility
USDA
50
0 10 20 30 40 60 70 80 90 100
In any type of analysis, there is some variability.
Often, the more steps, or for a biological assay, there's more variability.
9.8, 13.3
2/18/16
U.S. Dairy Forage Research Center
Hall and Mertens, 2012

NDFD Precision

Sample	Grand 30 h NDFD Range	95% Probability Limits Repeatability	Reproducibility
Alfalfa	39.1 - 58.5	9.5	10.2
Corn Silage	43.8 - 62.6	10.7	15.6
Grass	33.4 - 73.9	8.7	14.6

Mean

43.4 45.1 50 54.9 56.6

Repeatability In Lab

Reproducibility Among Labs

Very good for ranking samples within lab.

9.8, 13.3

Hall and Mertens, 2012

Composition

Water Soluble Carbohydrates
Fresh forages/hays
Temperate grasses
Almond hulls
Bakery waste
Beet & citrus pulps
Molasses
Whey products

Soluble Fiber
Legume forages
Beet & citrus pulps

Fiber
Forages
Crop residues
Nonforage fiber sources
Wheat middlings
Corn gluten feed

Starch
Grain silages
Corn, sorghum
Small grains
Bakery waste
Wheat midds
Potatoes
cull/waste

Protein
Legume forages
Soy & Canola
Corn gluten meal

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Eaten Doesn't Mean Digested

Coarse corn meal

Poorly chopped/processed corn silage

1911
2/18/16 U.S. Dairy Forage Research Center

Body Condition Changes

Too Thin.

OK?

Depending on days in milk....

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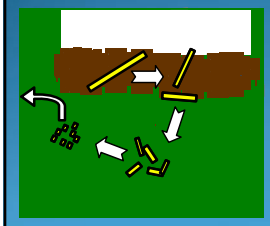
Forage: Current Recommendations

- Composition
- Physical form
- Digestibility

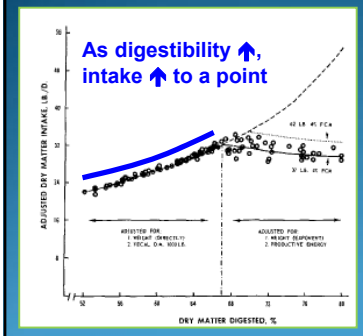


Min. Forage NDF	Min. Dietary NDF	Max. Dietary NFC
19	25	44
18	27	42
17	29	40
16	31	38
15	33	36

- NDF from Forage as 0.9 to 1% of body weight (Mertens)
- 75% NDF from forage

2/18/16 U.S. Dairy Forage Research Center Dairy NRC, 2001

(In)Digestibility and Intake



There's only so much undigestible material a cow can fit in her rumen/gut!

Undigestible feed limits intake.

NDF is the least digestible part of the diet.

Bigger pieces of feed cannot pass until they are digested & ruminated to reduce their size.

Conrad et al., 1964, J. Dairy Sci. 47:54 Conrad, 1966, J. Anim. Sci. 25:227

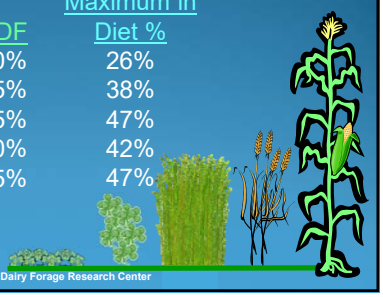
How Much Can You Feed?

Starting Point: 28% NDF in the ration

Allowable fNDF = 28% x 75% from forage = 21%

Allowable Forage = Allowable NDF% / Forage NDF%

	Forage NDF	Maximum in Diet %
Straw	80%	26%
Barley Silage	55%	38%
Alfalfa Silage	45%	47%
50:50 Barley:Alf	50%	42%
Corn Silage	45%	47%



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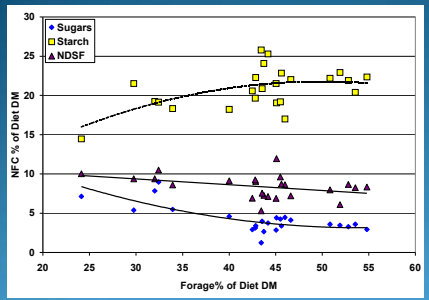
Formulating For NFC



5% WSC

25% starch

7% soluble fiber

Allowable starch relative to amount of forage/effective fiber?

2/18/16 U.S. Dairy Forage Research Center Hall and Van Horn, 2001

Moldy Feed / Mycotoxins

What is the costs of preventably sick cows?

Spoilage

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Sorting This Out On The Farm

- Balance first with forages. They dictate the ration's base.
- Aim to meet cow fiber & energy needs within bounds of present recommendations.
- …Then work with the cows to figure out the details.

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Sorting This Out On The Farm

- Things you can evaluate
  - Digestibility and composition
  - Particle size & sorting
  - Rumination and manure evaluation
  - Intake, performance, and feed efficiency
  - Body condition score change

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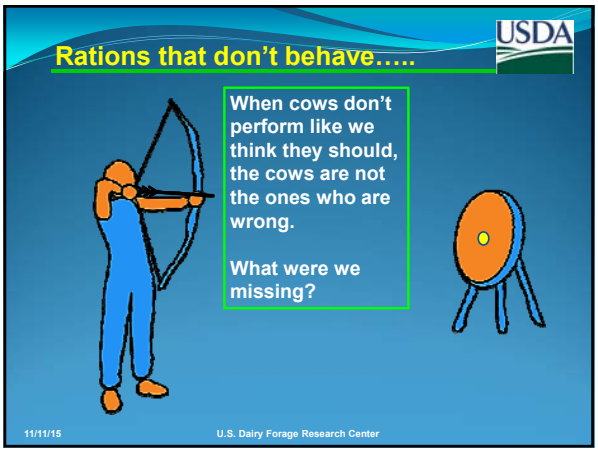
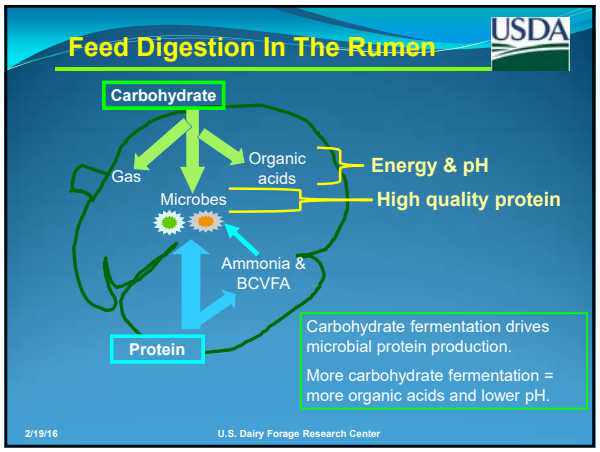
United States Department of Agriculture

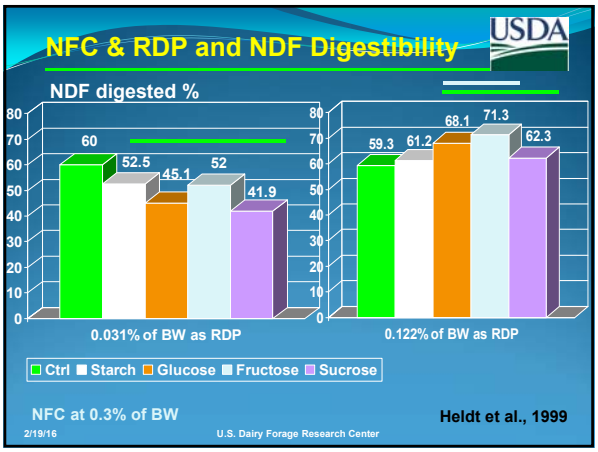
Questions?

U. S. Dairy Forage Research Center
www.ars.usda.gov/mwa/madison/dfrc


USDA
United States Department of Agriculture
Protein & Carbohydrate in Rumen Fermentation
Proteins do WHAT!?!?!
Mary Beth Hall
Systems
Forage
Nutrition
Environment
U.S. Dairy Forage Research Center
USDA Agricultural Research Service
VSFA 2/19/2016

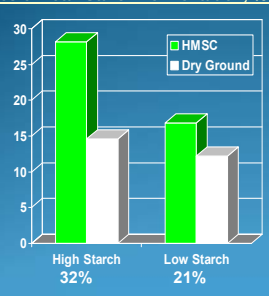

Rations that don't behave…..
When cows don't perform like we think they should, the cows are not the ones who are wrong.
What were we missing?
11/11/15
U.S. Dairy Forage Research Center


Feed Digestion In The Rumen
Carbohydrate
Gas
Organic acids
Microbes
Ammonia & BCVFA
Protein
Energy & pH
High quality protein
Carbohydrate fermentation drives microbial protein production.
More carbohydrate fermentation = more organic acids and lower pH.
2/19/16
U.S. Dairy Forage Research Center


NFC & RDP and NDF Digestibility
NDF digested %
60
52.5
45.1
52
41.9
59.3
61.2
68.1
71.3
62.3
0.031% of BW as RDP
0.122% of BW as RDP
Ctrl Starch Glucose Fructose Sucrose
NFC at 0.3% of BW
Heldt et al., 1999
2/19/16
U.S. Dairy Forage Research Center

Starch: Rates Subject To Change?

Rates of Total Starch Fermentation, %/h

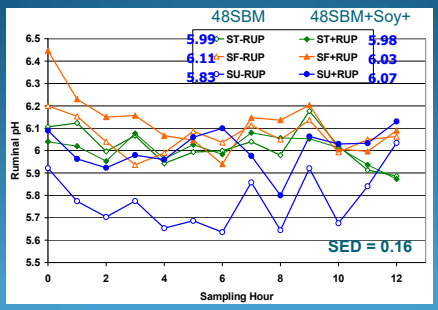


- Fermentation rates were increased at higher dietary starch levels.
- Change greater for rapid than slow rate.
- Greater protein degradability in HMSC affecting kd?
- Basis for rapidly fermented grains being "touchy"?

Oba and Allen, 2003 Starch *P*<0.001, Corn *P*<0.001,Starch x Corn *P*<0.01

2/19/16 U.S. Dairy Forage Research Center

Protein & Rumen pH



NFC x RDP for Sugar v Citrus *P* = 0.02

Hall et al., 2010

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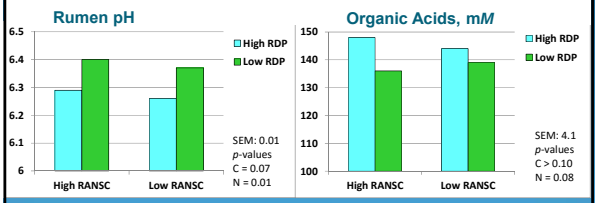
Carbohydrate, Protein & pH

Rapidly Avail. NSC	High		Low	
Rumen Degr. P	High	Low	High	Low
RANSC:RDP	2.5	3.4	2.2	2.6
DM Intake, lb/d[C]	55.0	54.8	58.7	55.7



Diet DM: NSC = 35-38%; CP = 17.3-17.8%, NDF: 34 – 36%, HMSC v. EC, Blood M v. SBM+ Canola

Aldrich et al., 1993

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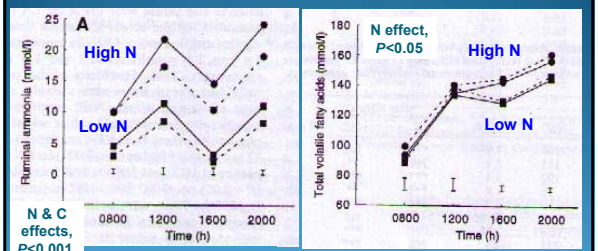
Protein Changes VFA?

- Sometimes, even when protein looks adequate, when we increase rumen degradable protein unexpected things happen…



N & C effects, *P*<0.001, NxC *P*<0.05

NH_3, mmol/L

Total VFA, mmol/L

8 cows, 4x4 Latin square, 14 d periods

Carruthers and Neil, 1997

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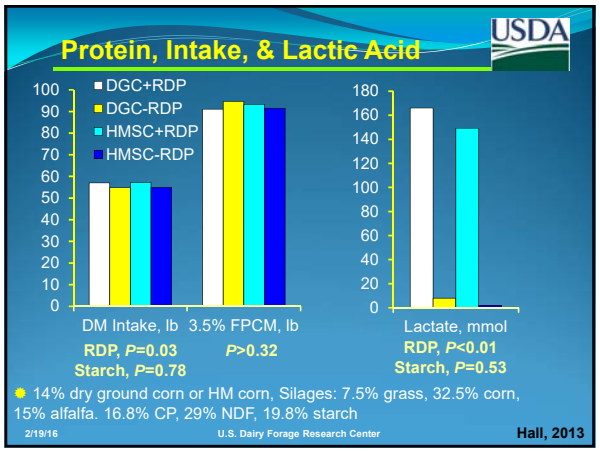
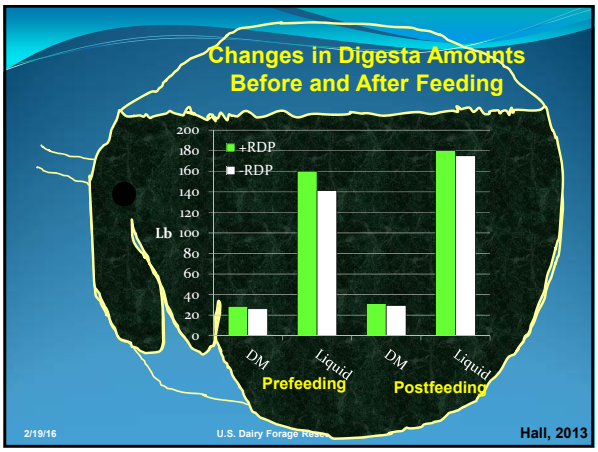
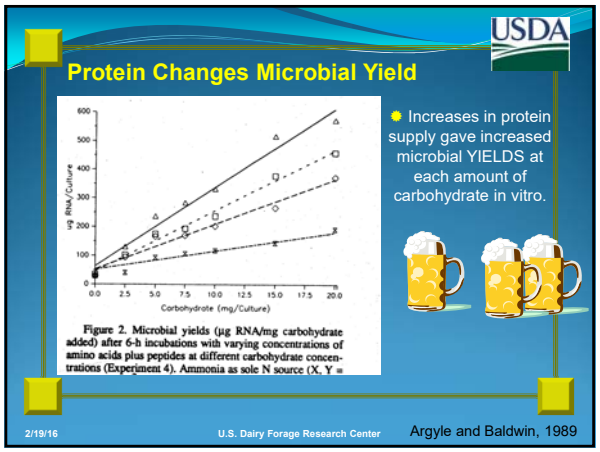
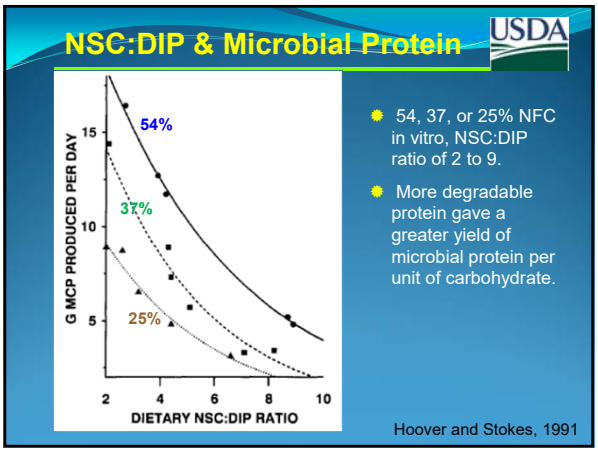
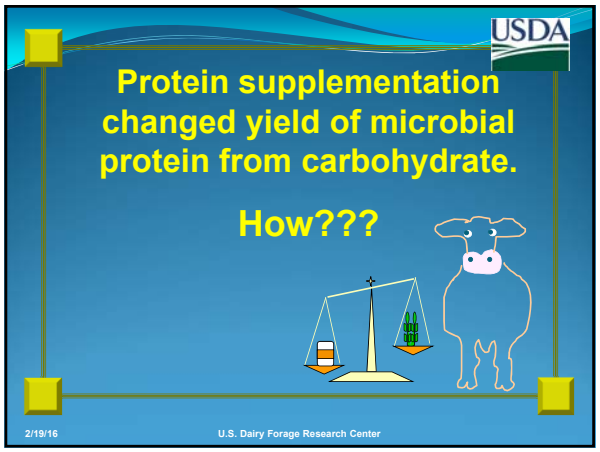
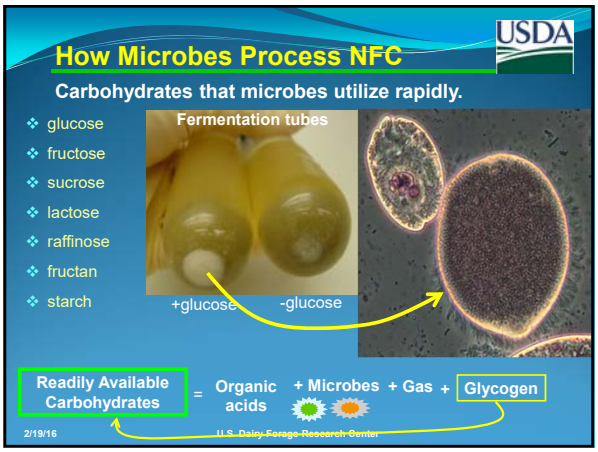

Protein, Intake, & Lactic Acid
USDA
DGC+RDP
DGC-RDP
HMSC+RDP
HMSC-RDP
DM Intake, lb
3.5% FPCM, lb
RDP, P=0.03
Starch, P=0.78
P>0.32
Lactate, mmol
RDP, P<0.01
Starch, P=0.53
14% dry ground corn or HM corn, Silages: 7.5% grass, 32.5% corn, 15% alfalfa. 16.8% CP, 29% NDF, 19.8% starch
2/19/16
U.S. Dairy Forage Research Center
Hall, 2013

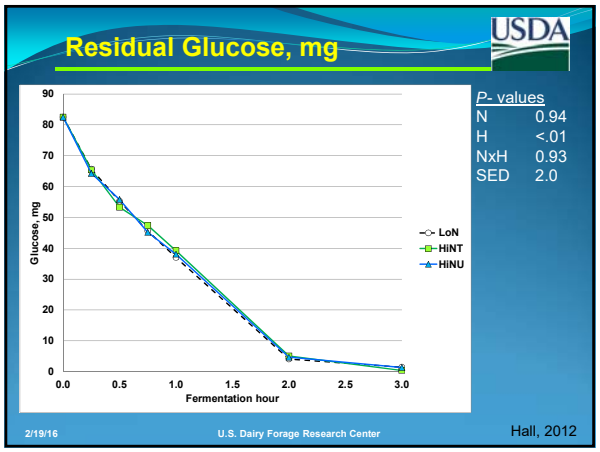

Changes in Digesta Amounts Before and After Feeding
+RDP
-RDP
Lb
DM
Liquid
DM
Liquid
Prefeeding
Postfeeding
2/19/16
Hall, 2013

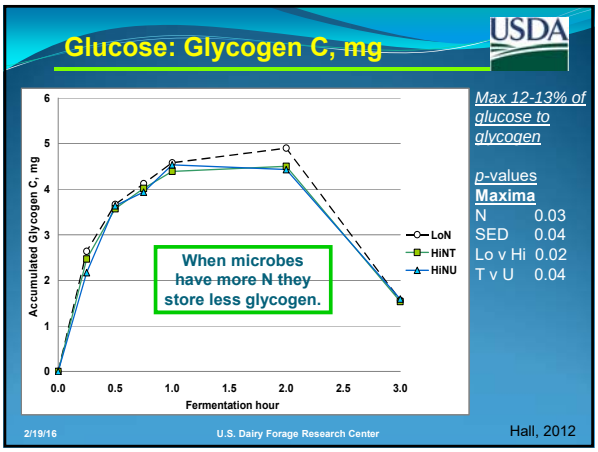

Protein Changes Microbial Yield
USDA
Figure 2. Microbial yields (μg RNA/mg carbohydrate added) after 6-h incubations with varying concentrations of amino acids plus peptides at different carbohydrate concentrations (Experiment 4). Ammonia as sole N source (X, Y =
Increases in protein supply gave increased microbial YIELDS at each amount of carbohydrate in vitro.
2/19/16
U.S. Dairy Forage Research Center
Argyle and Baldwin, 1989


NSC:DIP & Microbial Protein
USDA
G MCP PRODUCED PER DAY
DIETARY NSC:DIP RATIO
54%
37%
25%
54, 37, or 25% NFC in vitro, NSC:DIP ratio of 2 to 9.
More degradable protein gave a greater yield of microbial protein per unit of carbohydrate.
Hoover and Stokes, 1991

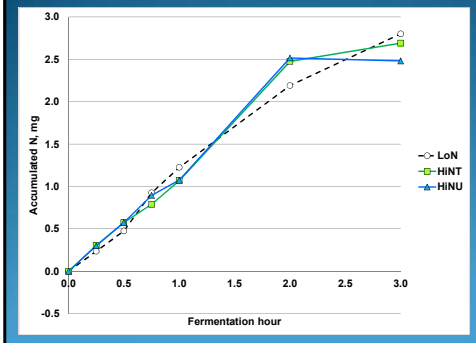

Protein supplementation changed yield of microbial protein from carbohydrate.
How???
2/19/16
U.S. Dairy Forage Research Center


How Microbes Process NFC
Carbohydrates that microbes utilize rapidly.
glucose
fructose
sucrose
lactose
raffinose
fructan
starch
Fermentation tubes
+glucose
-glucose
Readily Available Carbohydrates
=
Organic acids
+ Microbes
+ Gas +
Glycogen
2/19/16


Residual Glucose, mg
Glucose, mg
Fermentation hour
LoN
HiNT
HiNU
P- values
N 0.94
H <.01
NxH 0.93
SED 2.0
2/19/16
U.S. Dairy Forage Research Center
Hall, 2012


Glucose: Glycogen C, mg
Accumulated Glycogen C, mg
Fermentation hour
When microbes have more N they store less glycogen.
LoN
HiNT
HiNU
Max 12-13% of glucose to glycogen
p-values
Maxima
N 0.03
SED 0.04
Lo v Hi 0.02
T v U 0.04
2/19/16
U.S. Dairy Forage Research Center
Hall, 2012

Glucose: Microbial N, mg



P- values
Maxima

N	0.04
SED	0.03
Lo v Hi	0.03
T v U	0.09

Not just a peptide response.

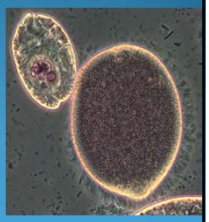
Hall, 2012

2/19/16 U.S. Dairy Forage Research Center

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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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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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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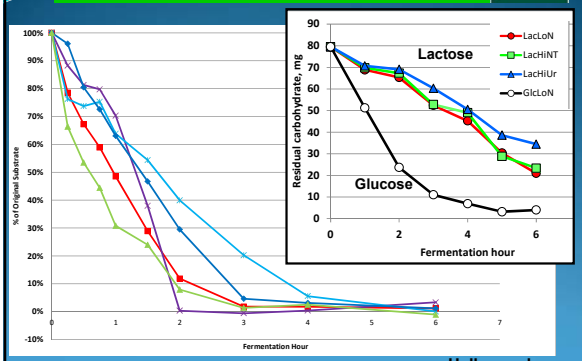
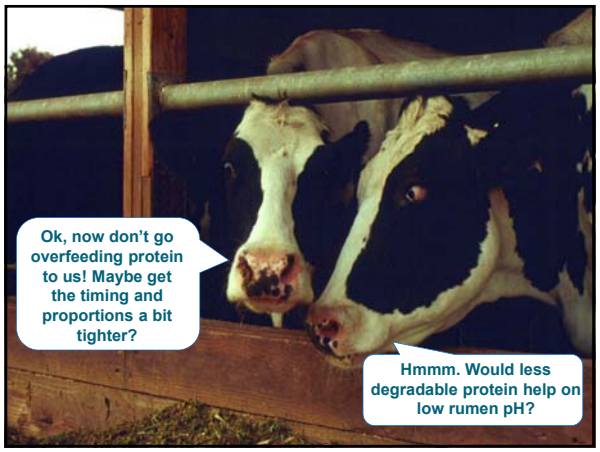
WSC & Rumen Microbes

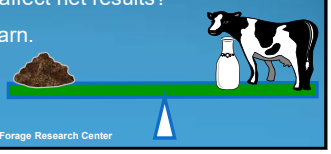


2/19/16 U.S. Dairy Forage Research Center Hall, unpub.



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.



2/19/16 U.S. Dairy Forage Research Center

USDA
United States Department of Agriculture

Questions?

U. S. Dairy Forage Research Center
www.ars.usda.gov/mwa/madison/dfrc

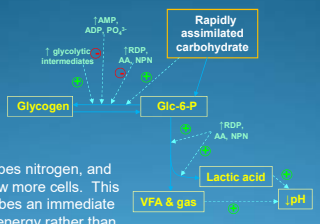
USDA
United States Department of Agriculture

Questions?

U.S. Dairy Forage Research Center

USDA

Ball and Morell, 2003
Williams et al., 1973
Prins and Van Howen, 1977



Give microbes nitrogen, and they will grow more cells. This gives microbes an immediate use for the energy rather than storing substrate for later.

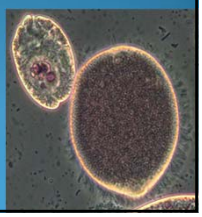
Counotte and Prins, 1981
Malestein et al.,1984

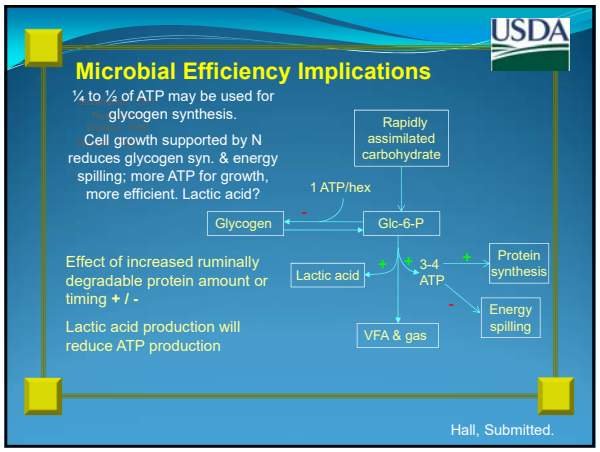
Hall, Submitted.

USDA

Testing Protein Amount & Type

- Glucose as the carbohydrate substrate
- LoN: 12% less N from peptides
- HiNU: N added back with urea
- HiNT: N added back with Tryptone (peptides)
- Microbial N, glycogen, VFA, Glc




USDA
Microbial Efficiency Implications
¼ to ½ of ATP may be used for glycogen synthesis.
Cell growth supported by N reduces glycogen syn. & energy spilling; more ATP for growth, more efficient. Lactic acid?
Rapidly assimilated carbohydrate
1 ATP/hex
Glycogen
Glc-6-P
Effect of increased ruminally degradable protein amount or timing + / -
Lactic acid
3-4 ATP
Protein synthesis
Energy spilling
Lactic acid production will reduce ATP production
VFA & gas
Hall, Submitted.

FSMA Hazard Analysis

- FSMA final rule requires each registered facility to have a written hazard analysis for chemical, physical and microbiological hazards, including the following:
  - Frequency/Probably and Severity
  - Experience
  - Scientific reports
  - Known illness and frequency
  - And the impact of the following:

FSMA Hazard Analysis

- (1) The formulation of the animal food;
- (2) The condition, function, and design of the facility and equipment;
- (3) Raw materials and other ingredients;
- (4) Transportation practices;
- (5) Manufacturing/processing procedures;
- (6) Packaging activities and labeling activities;
- (7) Storage and distribution;

FSMA Hazard Analysis

- (8) Intended or reasonably foreseeable use;
- (9) Sanitation, including employee hygiene; and
- (10) Any other relevant factors such as the temporal (*e.g.,* weather-related)
- And nature of some hazards (*e.g.,* levels of some natural toxins).

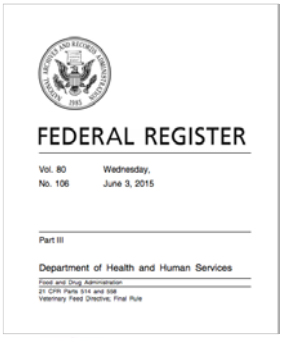
FSMA Hazard Analysis

- Is that enough?
- Can you do it?
- More than a HACCP program requires
- AFIA is partnering with the University of Minnesota's Center for Animal Health and Food Safety to do a generic HA for the feed industry
- Will be available in late October.

FSMA Hazard Analysis

- All AFIA members will receive CAHFS report with details on how to use
- Must have your PCQI review it and make it facility specific and add your mill's experience
- Have invited NGFA to join the project
- This will save each facility considerable resources, as doing a hazard analysis will be expensive
- Funded by AFIA's foundation--IFEEDER

VFD changes: final rule



FEDERAL REGISTER

Vol. 80 Wednesday,
No. 106 June 3, 2015

Part III

Department of Health and Human Services

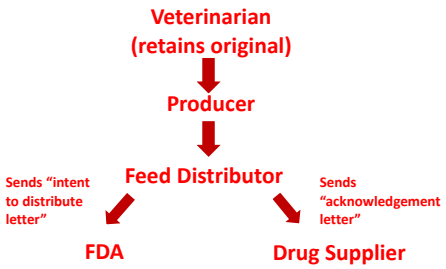
Food and Drug Administration
21 CFR Parts 514 and 558
Veterinary Feed Directive, Final Rule

Animal Drugs Expected to be VFD Drugs

Apramycin (not marketed)
Avilamycin (new VFD)
Chlortetracycline
Erythromycin (not marketed)
Florfenicol (already VFD)
Hygromycin B
Lincomycin
Neomycin
Oleandomycin (not marketed)
Oxytetracycline
Penicillin
Streptomycin
Sulfadimethoxine:Ormetoprim
Tilmicosin (already VFD)
Tylosin
Sulfamerazine
Sulfamethazine
Sulfaquinoxalone
Virginiamycin

List of affected products:
http://www.fda.gov/AnimalVeterinary/SafetyHealth/AntimicrobialResistance/JudiciousUseofAntimicrobials/ucm390429.htm

VFD: The Process



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Page 9

VFD: The Coming Changes

- FDA issued Guidance for Industry documents #209 and #213 that tells drug sponsors to change from growth promotion, feed efficiency and milk production claims to therapeutic/ prevention claims in three years (by Dec. 2016)
- This requires data submission and approval or updates to the claims—likely will remove claims
- There are about 16 chemical entities and 280+ uses affected, not including current VFD drugs.

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VFD: The Coming Changes

- These drugs would come under the control of a veterinarian via VFD
- This would include many feed drugs except dewormers, carbadox, bambermycins, ionophores, bacitracin and a few others
- AFIA has focused on the VFD process and the administrative changes needed to assist in an orderly transition
- VFDs will be required for each use of a drug, including for FFA and 4-H use

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VFD: Practical Issues

- Original VFD form is retained by the veterinarian and copies to the producer and feed distributor
- Faxes (and limited electronic) VFDs are allowed
- Phone-in VFDs are not allowed
- Feed mills can deliver smaller amounts than on VFD and save rest for later
- Delivering a VFD to the farm before the producer has a VFD form is problematic

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VFD: Current Challenges (cont'd.)

- More VFD approvals increases paperwork load and review times for feed mills
- AFIA says say feed mills put at disadvantage when producer customer cannot be served appropriately due to incorrect forms
- Storing VFD drugs prior to use and prior to receiving the VFD is a problem for producers
- AFIA is addressing this issue with FDA

VFD: Concerns

- The following concerns have arisen:
  - Scanned VFDs from the veterinarian must be printed and filed unless the feed distributor has a FDA registered computer (21 CFR, Part 11)
  - Veterinarians must complete a "Veterinarian's Intention Statement"
  - Will allow faxes and pdfs without hard copies, must print, date and file

VFD: Affirmation Statements

Veterinarian must mark one of the following on each VFD form:

1. ``This VFD only authorizes the use of the VFD drug(s) cited in this order and is not intended to authorize the use of such drug(s) in combination with any other animal drugs.''

VFD: Affirmation Statements

Veterinarian must mark one of the following on each VFD form:

2. ``This VFD authorizes the use of the VFD drug(s) cited in this order in the following FDA-approved, conditionally approved, or indexed combination(s) in medicated feed that contains the VFD drug(s) as a component.'' [List specific approved, conditionally approved, or indexed combination medicated feeds following this statement.]

VFD: Affirmation Statements

Veterinarian must mark one of the following on each VFD form:

3. ``This VFD authorizes the use of the VFD drug(s) cited in this order in any FDA-approved, conditionally approved, or indexed combination(s) in medicated feed that contains the VFD drug(s) as a component.'' (Sec. 558.6(b)(6)).

VFD: Generic Drug Use

Generics may be used if the drug or tradename is listed and the veterinarian doesn't object.

VFD: The Future Challenges

- **How will this happen: all drugs VFD overnight, phase-in???**
- **Will drug sponsors save these changes and release all the new drugs at once?**
- **Will FDA require training for vets?**
- **Will there be a list of trained vets?**
- **Where will more vets come from?**
- **Will there be enforcement against vets?**

VFD: The Future Challenges

- **We are addressing all these issues with FDA**
- **We hope FDA is amenable to an orderly phase in as there may be the same approved drugs not requiring a VFD with the new approval that requires a VFD in the marketplace.**
- **FDA will likely require "stickering" of old premix bags to note that use of these premixes after 2017 will require a VFD**
- **Will FDA allow those to be exhausted?**

VFD: Timeline

- October 1, new VFD rule effective
- October 31, new VFD form must be implemented
- Summer/Fall 2016, drug sponsors contacting feed companies with label changes
- January 1, 2017, must cease all growth promotion claims and hopefully can use old premixes but must have a valid VFD
- Will likely allow some time exhaust supplies: AFIA is doing a survey

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VFD: Next Steps

- Most drug sponsors seem to be removing the production claims and leaving the therapeutic claims and will contact feed companies
- If data need to be submitted, then review will take longer for the change and resulting drug will not have a generic for some years

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VFD: Next Steps

- FDA told AFIA that these changes must take place January 1, 2017 for new and old drug premixes
- We urged CVM to put out a notice industry-wide
- All old premixes will require a VFD after Jan. 1
- AFIA will be collecting data on amount of premixed in feed mills soon and in November 2016 and possibly six months after that
- This will be the basis of extension requests

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Questions/Discussion

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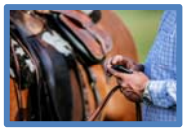
THANK YOU
AFIA'S UPDATED
4 PROMISES
Our Industry. Our Passion. Our Voice.
AFIA
www.afia.org

Challenges and Opportunities in the Beef Industry



70th Annual Convention
2016 Virginia State Feed Association & Nutritional Management Cow College
Roanoke, VA
February 18, 2016

Nevil Speer, PhD, MBA
U.S. Operations
AgriClear, Inc.
Bowling Green, KY

AgriClear

CHALLENGE: MARKET

AgriClear

2015

Tight supplies drive CME live cattle to 6th straight yearly gain

2015 TRENDS: High cattle prices, weather-dependent grain prices predicted by economist

Continued record prices amid tight beef supplies in 2015

TheCityWire.com : Cattle prices will be high in 2015

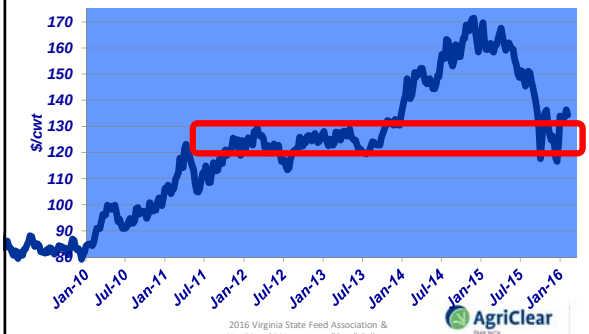
Land prices peaking; cattle still on the rise

Experts: 2015 Cattle Prices May Be Higher Than 2014

AgriClear

Fed Market

Adapted from USDA:AMS



AgriClear

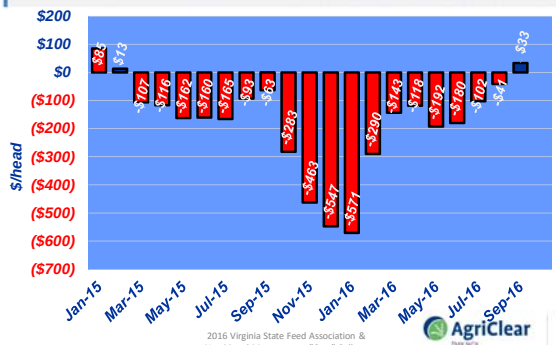
It Didn't Turn Out That Way!

2016 Virginia State Feed Association & Nutritional Management "Cow" College

AgriClear

Feedyard Net Returns ($/head)
Historical and Projected

Adapted from Kansas State University

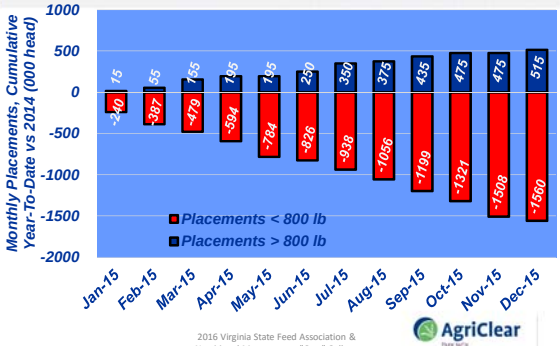


2016 Virginia State Feed Association & Nutritional Management "Cow" College

AgriClear

Cumulative YTD Placement Trends

Adapted from USDA:NASS

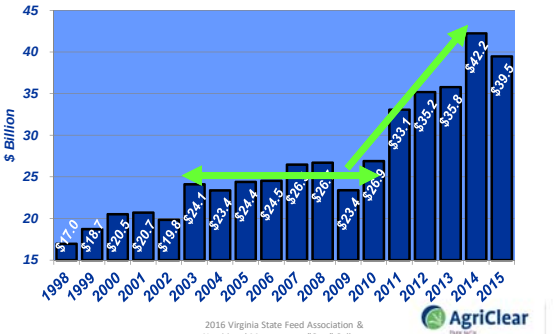


2016 Virginia State Feed Association & Nutritional Management "Cow" College

AgriClear

Annual Feedyard Revenue

Adapted from USDA:AMS and USDA:NASS



2016 Virginia State Feed Association & Nutritional Management "Cow" College

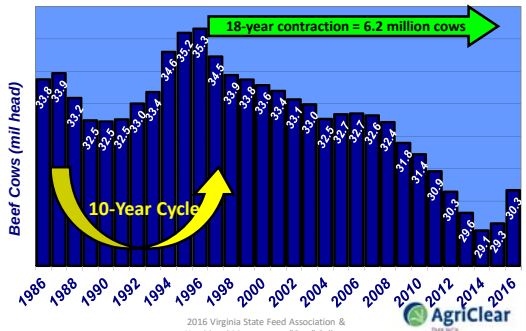
AgriClear

LOOKING AHEAD TO 2016

AgriClear

Jan 1 Beef Cow Inventory (mil cows)

Adapted from USDA:NASS



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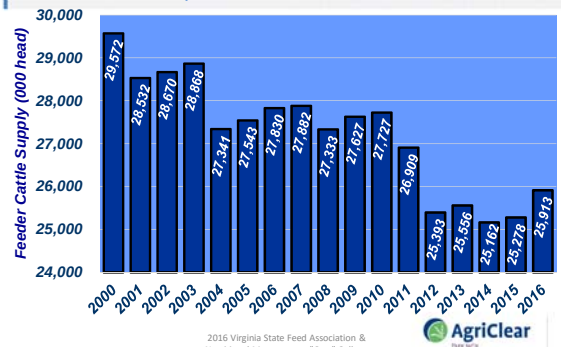
Jan 1 Feeder Cattle Supply Outside Feedlots (000 head)

Adapted from USDA:NASS / USDA:ERS



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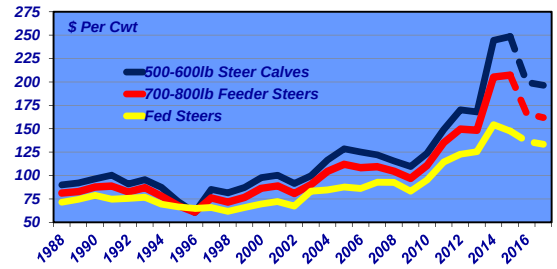
Average Annual Cattle Prices (S. Plains)

Source: LMIC



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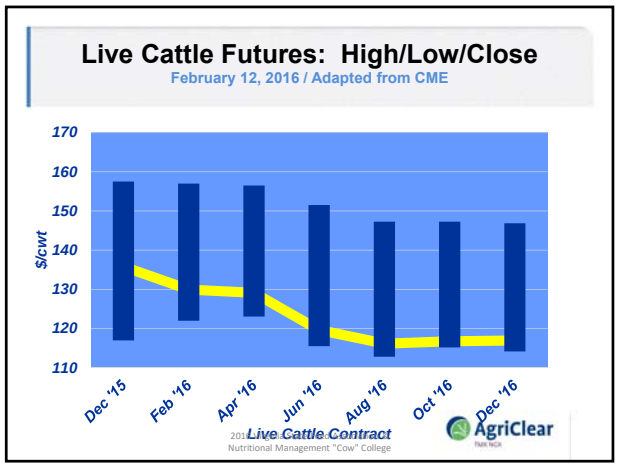
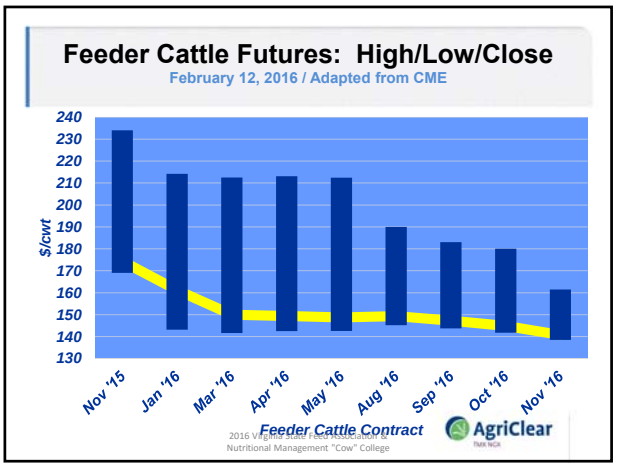
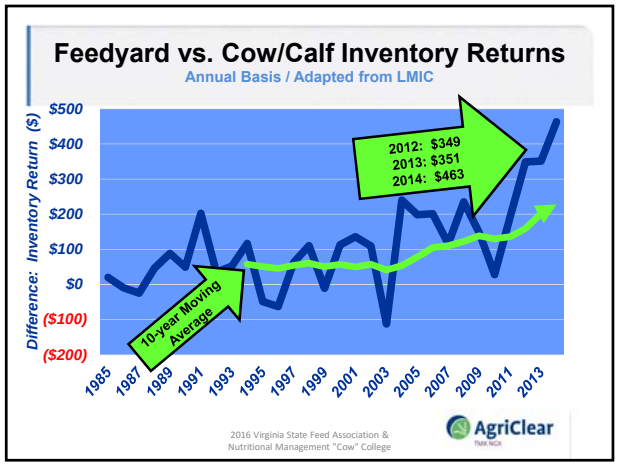
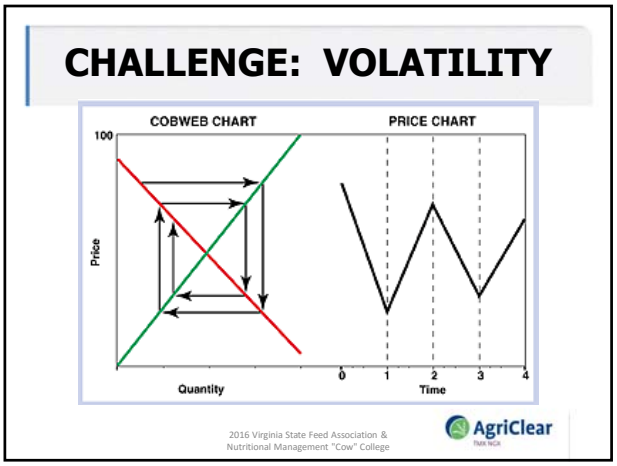

Live Cattle Futures: High/Low/Close
February 12, 2016 / Adapted from CME
$/cwt
170
160
150
140
130
120
110
Dec '15
Feb '16
Apr '16
Jun '16
Aug '16
Oct '16
Dec '16
Live Cattle Contract
AgriClear

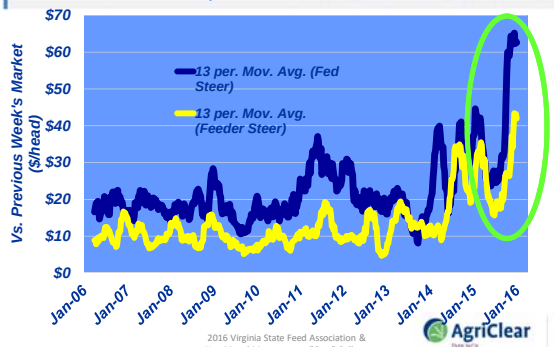

Feeder Cattle Futures: High/Low/Close
February 12, 2016 / Adapted from CME
$/cwt
240
230
220
210
200
190
180
170
160
150
140
130
Nov '15
Jan '16
Mar '16
Apr '16
May '16
Aug '16
Sep '16
Oct '16
Nov '16
Feeder Cattle Contract
AgriClear


Feedyard vs. Cow/Calf Inventory Returns
Annual Basis / Adapted from LMIC
Difference: Inventory Return ($)
$500
$400
$300
$200
$100
$0
($100)
($200)
2012: $349
2013: $351
2014: $463
10-year Moving Average
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
AgriClear


CHALLENGE: VOLATILITY
COBWEB CHART
PRICE CHART
100
Price
Quantity
0
1
2
3
4
Time
AgriClear

Weekly Change: 13-Week Moving Average ($/head)

Adapted from USDA:AMS / CME



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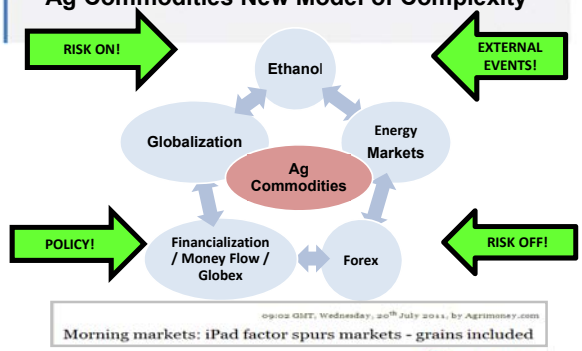
Ag Commodities New Model of Complexity



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Remember The Story?
Dustin Johnson, PGA Championship 2010

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CHALLENGE: RISK

1. Danger
Therefore, need to seek protection

2. Opportunity
Perspective of missing out
(more later….)

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Protecting Against External Risk

- Lock in margins
- Refinance long-term debt
- Pay down debt!
- Increase working capital reserve
- Carefully, conservatively evaluate expansion opportunities (is it a cash trap?)
- Manage costs!

"Managing risk includes the willingness to give up some upside potential to protect against downside risk."

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Kansas Farm Management Assoc.
Profitability Comparison Among Operations

Beef Cow Operation / Sell Calves - 2013

	High 1/3	Mid 1/3	Low 1/3
# of cows	166	104	98
# of calves sold	128	83	89
Avg wt of calves sold	609	608	531
Sale Price ($/cwt)	$ 165	$ 158	$ 162
Gross Income	$ 972	$ 933	$ 817
Feed Costs	$ 290	$ 437	$ 477
Pasture Cost	$ 162	$ 137	$ 151
Total	$ 901	$ 1,109	$ 1,314
Net Return ($/head)	$ 71	$ (176)	$ (497)

"Research suggests that while both production and price do impact profit, but they are much less important in explaining differences between producers than costs."

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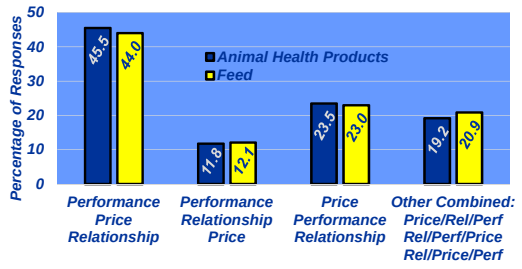
Large Commercial Producer Purchasing Priority Behavior

Adapted from University of Purdue



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OPPORTUNITY: BUSINESS!!

- What's the market going to be?
  - Doing what we've always done
- The right question:
  - What's the business environment telling us?
  - How will we construct our business management decisions around those signals?
  - Where do new opportunities lie?

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FOOD CONSUMERS

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General Customer Demands

James Womack and Daniel Jones: Lean Solutions: How Companies and Customers Can Create Value and Wealth Together, c. 2005

1. Solve my problem completely
2. Don't waste my time
3. Provide exactly what I ***want***
4. Deliver value where I ***want*** it
5. Supply value when I ***want***
6. Reduce the number of decisions I must make!!

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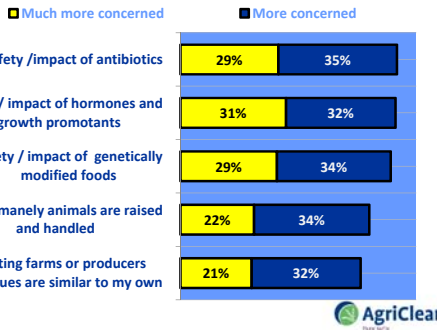
How have your attitudes about the following food issues changed over the past few years?

Adapted from SMG / WFCF



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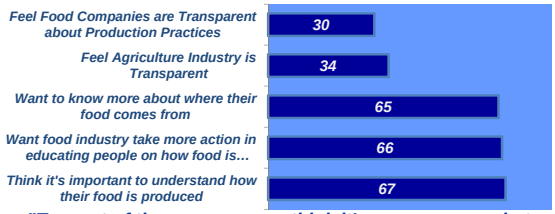
General Attitudes Among Consumers (% respondents)

Adapted from Sullivan, Higdon & Sink - FoodThink



"Two out of three consumers think it's very or somewhat important to understand how their food is produced. "
"And 66 percent want to see more action from the food industry to educate people on how food is produced."

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The Power of the Post Recession Consumer

John Gerzema and Michael D'Antonio, Strategy + Business

- "Say hello to a lifestyle more focused on community, connection, quality and creativity."
- "People are returning to old-fashioned values to build new lives of purpose and connection."
- "They also realize that how they spend their money is a form of power, and are moving from mindless consumption to mindful consumption

increasingly taking care to purchase goods and services from sellers that meet their standards and reflect their values."

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NEW EMPHASIS

Feedstuffs

BOTH!!! QUALITY AND STORY!!!

Change in requirements / focus / emphasis over time

1991	*1995*	*2000*	*2005*	*2011*
External fat	Overall uniformity	Overall uniformity	Traceability	Food safety
Seam fat	Overall palatability	Carcass weights	Overall uniformity	Eating satisfaction
Overall palatability	Marbling	Tenderness	Instrument grading	How, when, where cattle were raised
Tenderness	Tenderness	Marbling	Market signals	Lean, fat, bone
Overall cutability	External and seam fat	Reduced quality due to implants	Segmentation	Weight and size
Marbling	Cut weights	External fat	Carcass weights	Cattle genetics

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MARKET DIFFERENTIATION!!
BEAT THE COMMODITY TRAP

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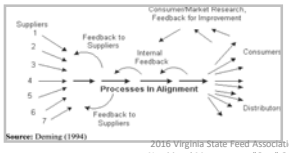
Customer-Centric Thinking: Reverse Traditional Value Chain

- Traditional approach:
  - Start with core competencies (production) and then move downstream through marketing channels and finally to the consumer.
- Consumer-centric approach
  - Bottom-up: start with the customer and then adapt the value chain accordingly.



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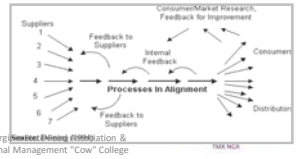
Become A Food-Producer Partner!!!

Shelf-Centered Collaboration
Kauffeld, Sauer and Bergson: Strategy + Business, Autumn 2007

- The overarching goal is for each function and each business in the value chain to think end-to-end about the entire network of participants, from the first supplier to the ***end consumer***.
- [by doing so] ***they can now contribute to making the entire value chain more effective and responsive.***

outside.in



2015 Video Sale Average Premium ($/cwt)

	Heifers	Steers
SAV	7.83	1.90
NHTC	9.03	7.73
VNB	5.81	1.83
GAP	10.95	8.53
Organic	42.77	24.52

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OPPORTUNITY: BEEF QUALITY - KEY TO PROSPERITY

"The path to sustainable, profitable growth begins with creating more promoters [happy customers] and few detractors [unhappy customers]….It's that simple and that profound."

Frederick Reichheld, Harvard Business Review, Dec. 2003

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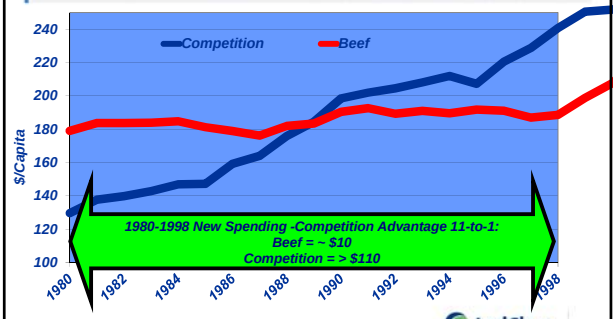
What Went Wrong?
Per Capita Meat Expenditures: Beef vs. Pork/Poultry
(Adapted from USDA:ERS)



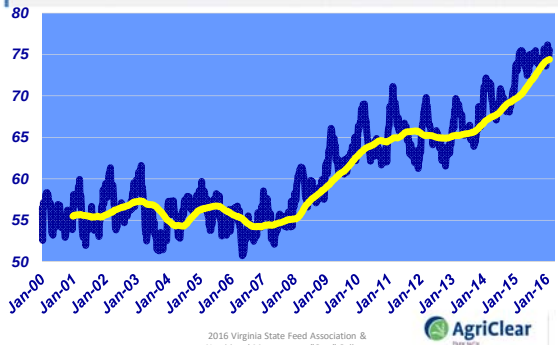
Beef Was Working In A *Commodity* Mindset
"Where We've Been"

- Traditional Supply Chain
  - Adversarial relationships
  - Win-lose negotiations
  - Short term focus
  - Primary emphasis on cost
  - Little concern for added value
  - Limited communication
  - Volatile
  - Unresponsive

Beef Was Losing Market Share

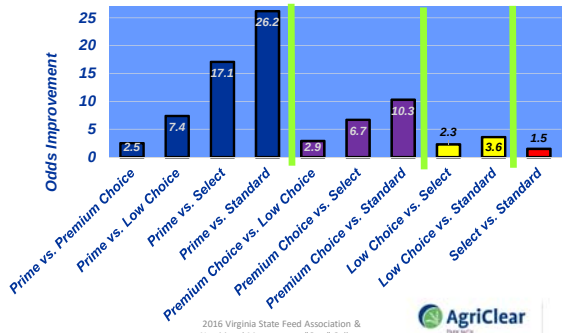
- Health
- Convenience
- Price / value
- Era of increasing consumer empowerment!
- Quality /Taste!!!!!

Weekly Combined Prime / Choice %
Trendline = 52-week Moving Average, Adapted from USDA:AMS



Effects of UpGrading to Improve Odds of Favorable Eating Experience

Adapted from Tatum, 2015 – *Recent Trends: Beef Quality, Value and Price*



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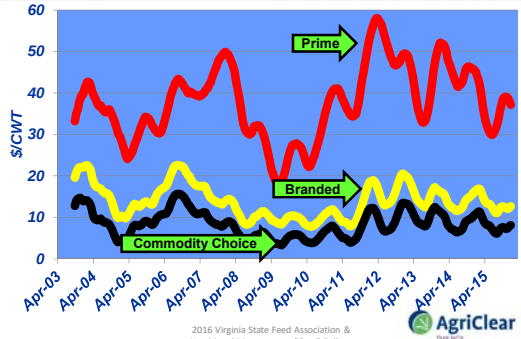
Comprehensive Cutout Price Spreads (Versus Select) – 26-week moving averages

Adapted from USDA:AMS



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FINAL DEMAND: ECONOMIC GAME CHANGER

20 years of work =

Enhanced beef quality and consistency

More responsive precision and efficiency of product delivery to various consumer segments.

Bottom-line: improved customer satisfaction that's anchoring spending in these challenging times.

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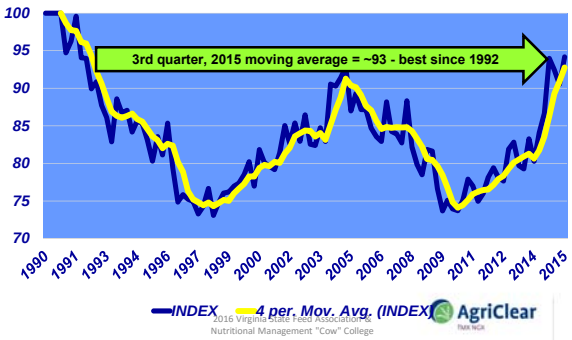
Quarterly All-Fresh Retail Beef Demand Index

Adapted from Kansas State Univ



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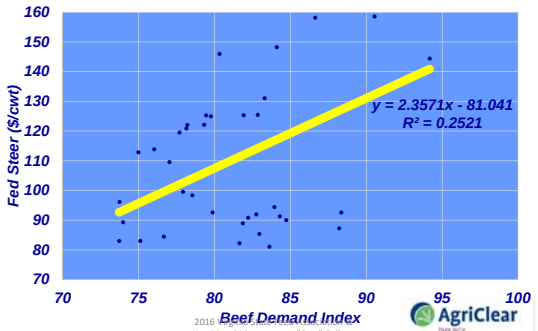
Quarterly Beef Demand vs Fed Steer Price 2006 – thru – 3rd Quarter 2015

Adapted from USDA:AMS and Kansas State Univ



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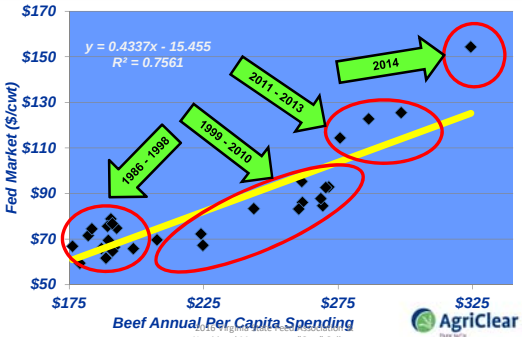
Fed Market vs Annual Beef Spending: 1986 thru 2014

Adapted from USDA



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OPPORTUNITY: BeaT the Commodity Trap

Adapted from Sheth

- Deterioration: low-cost players disrupt the status quo
- Can't match low-end rival
  - Economies of scale
  - Cost structure
  - Experience curve
  - Even if you could, simply accelerates the deterioration when low-end discounter uses its muscle to punish the challenger
- Turn the trap to your advantage:
  - "Contain the low-end players market power to the low end."

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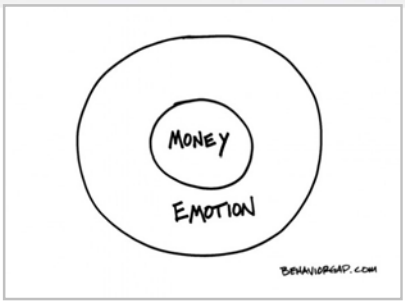
What NOT To Do!



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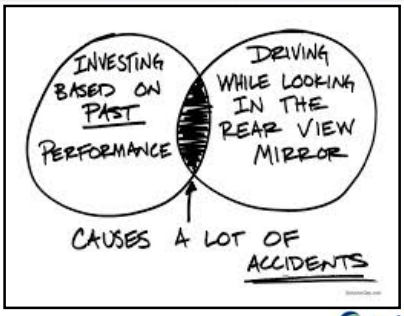
What To Do!

Invest time AND resources into obtaining objective information and performing disciplined review!

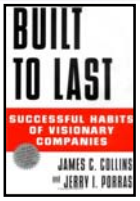
Complacency Is Not An Option



PRESERVE THE CORE / STIMULATE PROGRESS

If an [industry] is to meet the challenges of a changing world, it must be prepared to change everything about itself except [its basic] beliefs…

The only sacred cow in an organization should be its basic philosophy of doing business.



Introduction to AgriClear

AgriClear is a transformational web-based platform that connects North American Cattle Producers. Marketers can now securely list, transact, and be assured of payment from their computer, phone, or tablet.

Benefits of AgriClear

- ☑ Cost Savings
  Lower cost structure at $6/head/side, with no listing fee.
- ☑ Expanded Marketplace
  Access to a broad network of verified North American buyers and sellers.
- ☑ Attribute Based Marketing
  Provides greater ability to capture more value from your genetic and/or management inputs.
- ☑ Payment Assurance
  Market across North America with financial certainty. Sale proceeds are paid in advance by the buyer, and held until both parties confirm satisfactory completion of the contract.

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Counter-Party Risk

What happens if the guy you've known for 20 years in the ag community – you've always known he's good for it – what if one day he's not good for it?

How will that affect your business?

Don't let someone else's financial problems become your problems.

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B Feedstuffs, December 22, 2014 **Opinion**

Food doesn't happen by accident

"From my perspective, the scene was profound. It served as a reminder of the behind-the-scenes intricacy involved in getting food to our tables – something we often take for granted. The fact that we can take it for granted is something for which we all should be thankful."

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QUESTIONS / COMMENTS?

Nevil Speer, PhD, MBA

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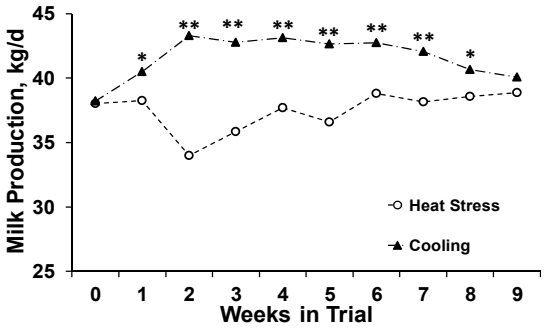
Managing heat stress in transition cows and calves

Tao. S*., A. P. A. Monteiro*, X-S. Weng*, J. Laporta†, G. E. Dahl†, J. K. Bernard*

*Department of Animal and Dairy Science, University of Georgia;
†Department of Animal Sciences, University of Florida

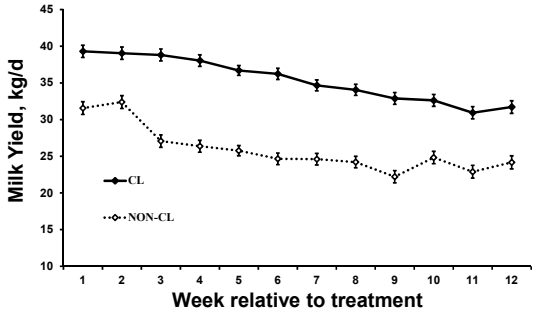
THE UNIVERSITY OF GEORGIA
COLLEGE OF AGRICULTURAL & ENVIRONMENTAL SCIENCES

Heat stress reduces milk production of early lactating cows



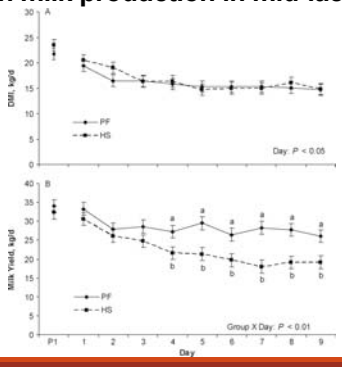
Tao and Dahl, Unpublished

Heat stress reduces milk production of mid and late lactation cows



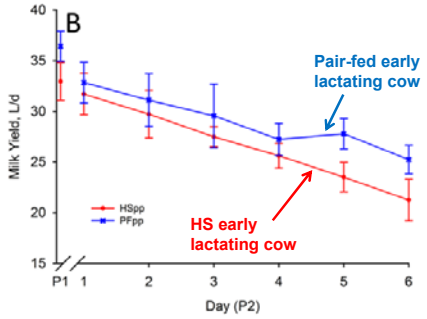
Weng and Tao, Unpublished

Reduction in DMI accounts for 50% decrease in milk production in mid-lactation



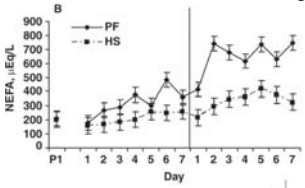
Rhoads et al., 2009

Reduction in DMI accounts for ALL decrease in milk production in early-lactation

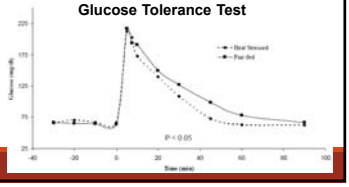


Lamp et al., 2015

Heat-stressed mid-lactating cows have blunted adipose tissue mobilization and increased whole body glucose utilization

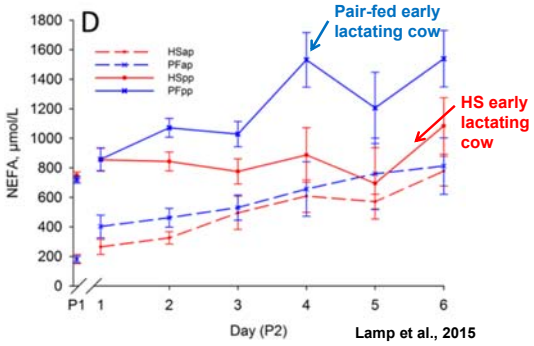


Glucose Tolerance Test



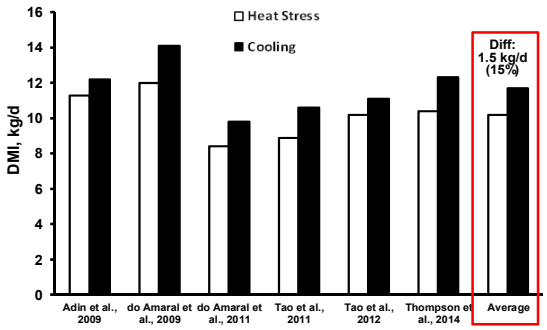
Wheelock et al., 2010

Heat stress blunts fat mobilization in early lactating cows

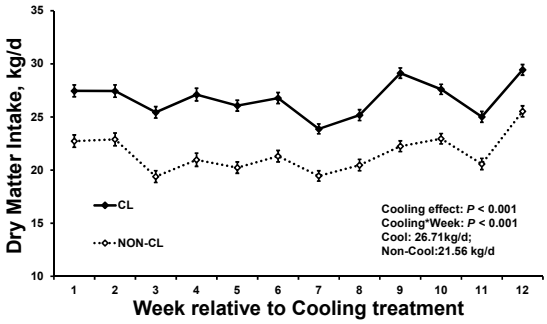


Lamp et al., 2015

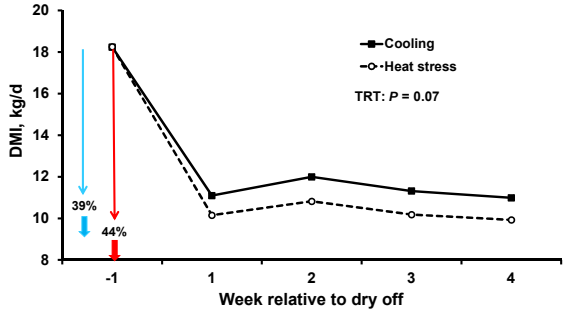
Cooling during the ENTIRE dry on DMI



Cooling during mid to late lactation on DMI

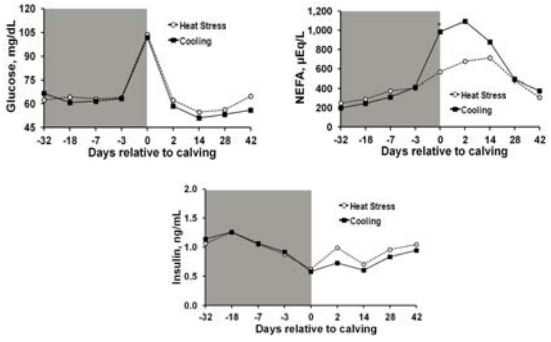


Heat stress exaggerates the decrease in DMI from lactating to dry

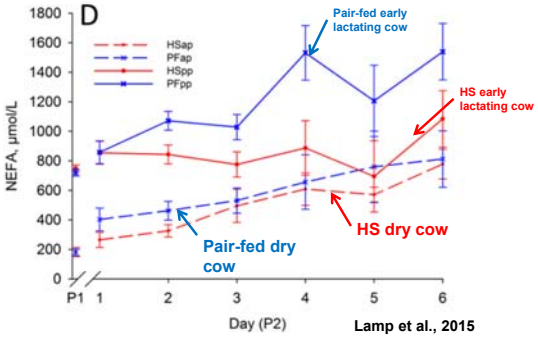


Ahmed and Dahl, unpublished

Heat stress doesn't affect blood metabolites and insulin of dry cows

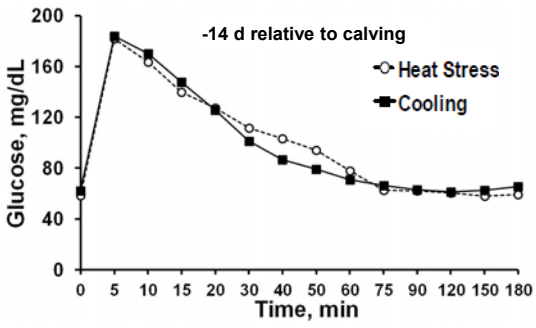


Heat stress doesn't affect fat mobilization of dry cows

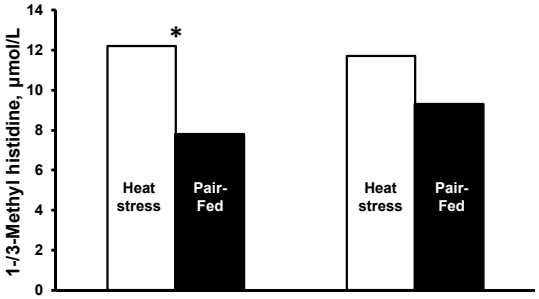


Lamp et al., 2015

Heat stress doesn't affect glucose tolerance of dry cows

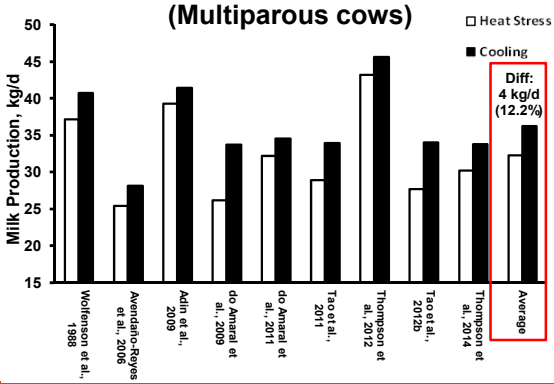


Heat stress increases protein mobilization of dry cows



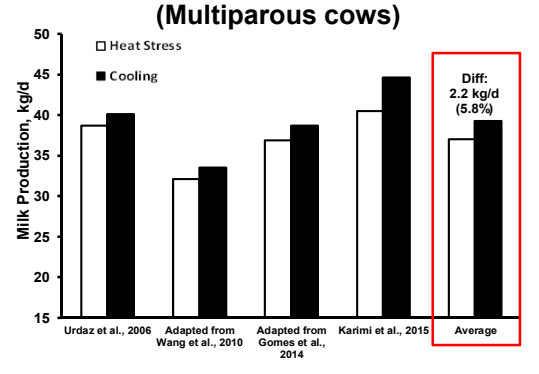
Adapted from Lamp et al., 2015

Cooling during the ENTIRE dry on milk yield (Multiparous cows)

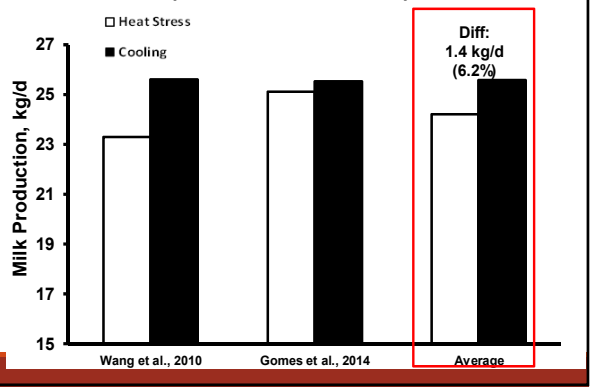


Adapted from Tao and Dahl, 2013

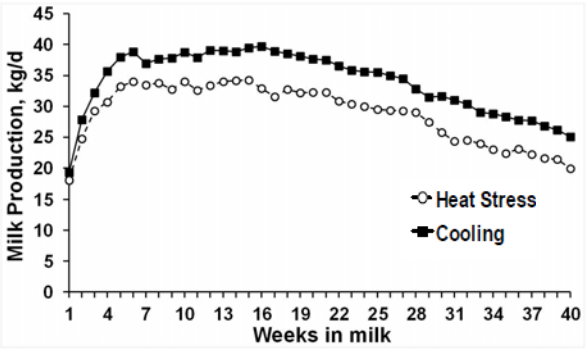
Cooling during the Close-up on milk yield (Multiparous cows)



Cooling during the late gestation on milk yield (~ 1month, Heifers)

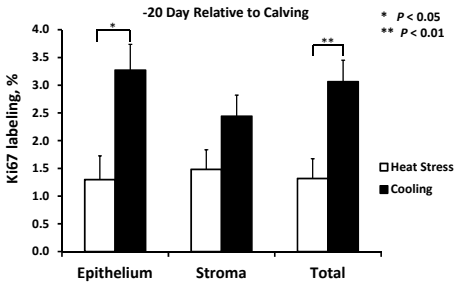


Dry period heat stress decreases MY

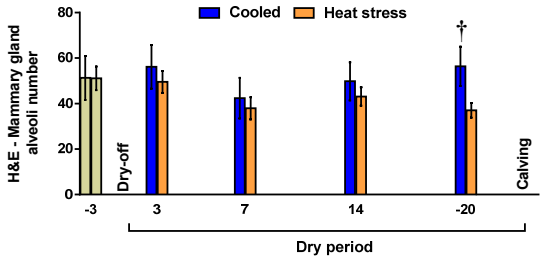


Tao et al., 2011

Cooling improves mammary growth in the late dry period

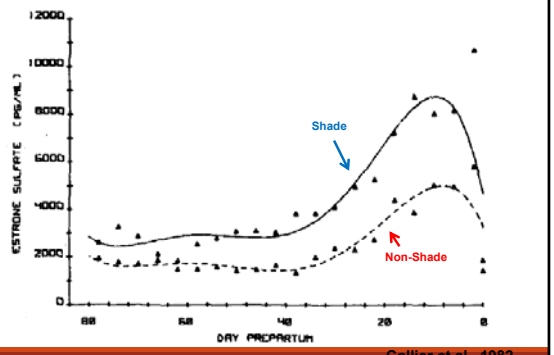


Preliminary Data: Cooling increases alveoli number



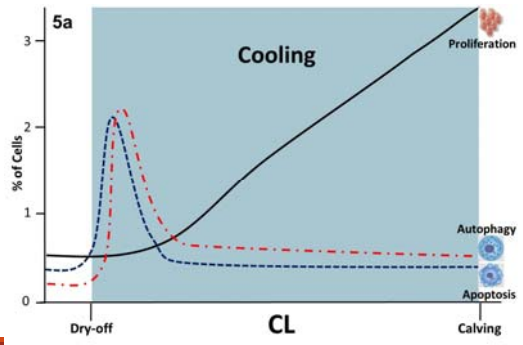
Laporta and Dahl, Unpublished

Late gestation heat stress decreases estrone sulfate

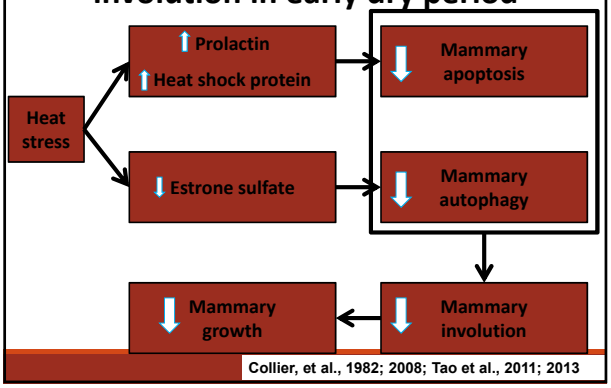


Collier et al., 1982

Mammary gland development during the dry period

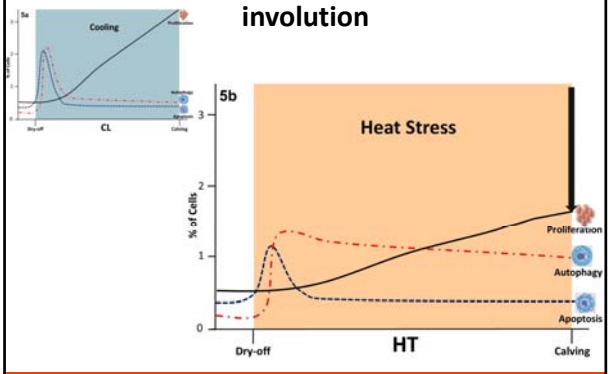


Heat stress may alter mammary involution in early dry period

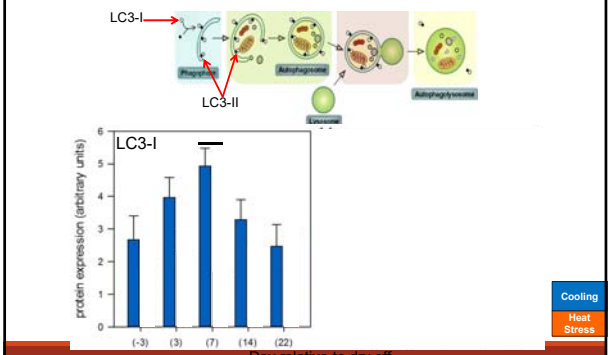


Collier, et al., 1982; 2008; Tao et al., 2011; 2013

Hypothesis: Heat stress impairs mammary involution

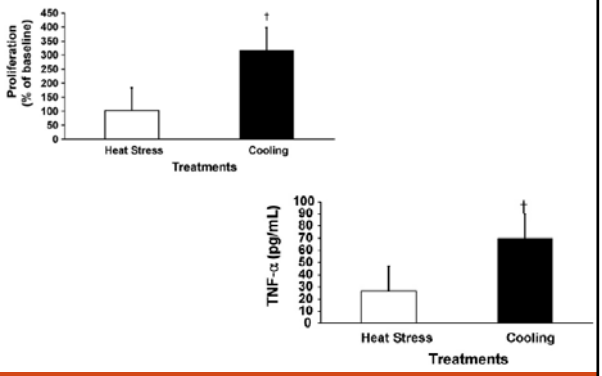


Heat stress blunts mammary autophagy during the early dry period



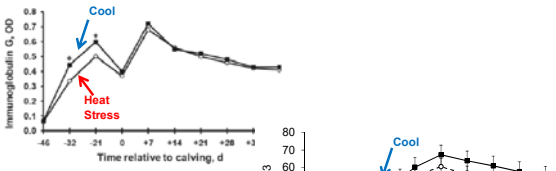
Wohlgemuth et al., 2015

Heat stress impairs lymphocyte proliferation

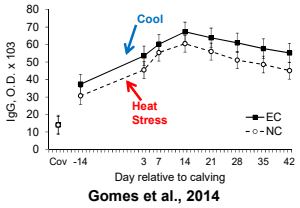


do Amaral et al., 2011

Heat stress impairs IgG responses against ovalbumin challenge

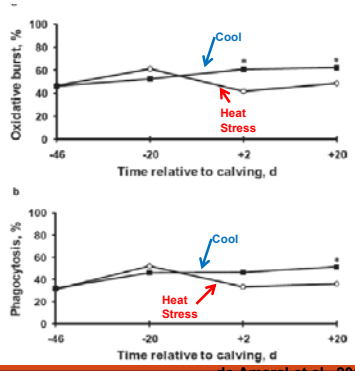


do Amaral et al., 2011



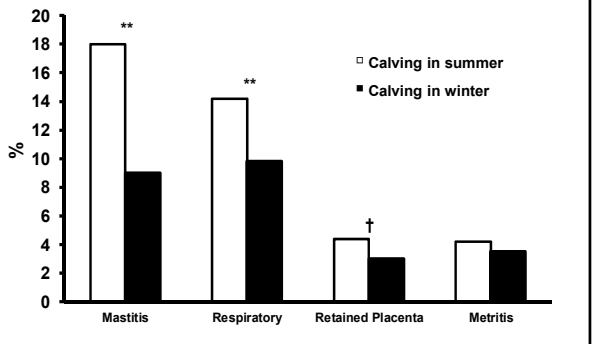
Gomes et al., 2014

Heat stress impairs neutrophil function



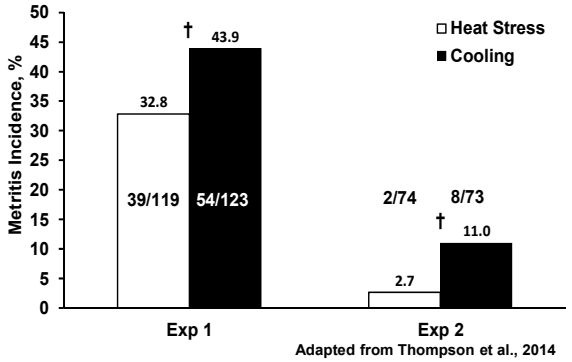
do Amaral et al., 2011

Calving season on cow health (up to 60 DIM)



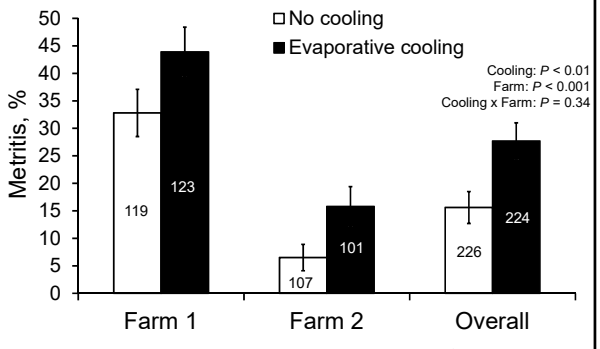
Adapted from Thompson and Dahl., 2012

Prepartum cooling increases metritis



Adapted from Thompson et al., 2014

Prepartum cooling increases metritis

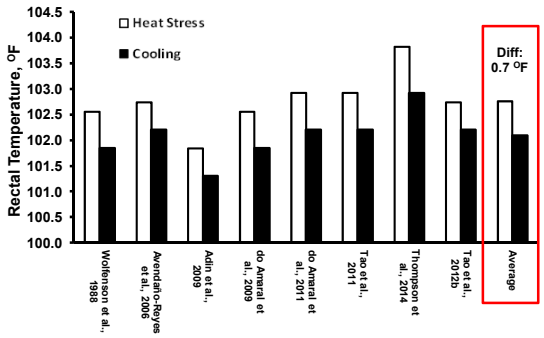


Santos et al., 2014

Prepartum cooling is the key

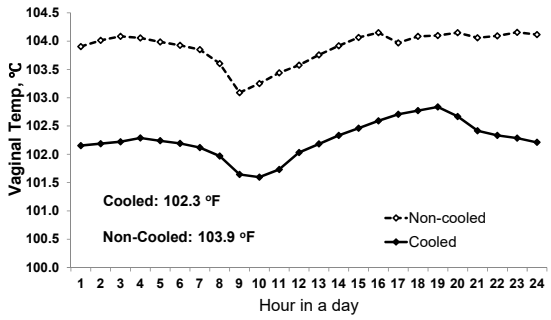
- **Most effective approach**
- **Slight reduction in body temperature can have strong impact on subsequent lactation**

Prepartum cooling slightly reduces cow body temperature



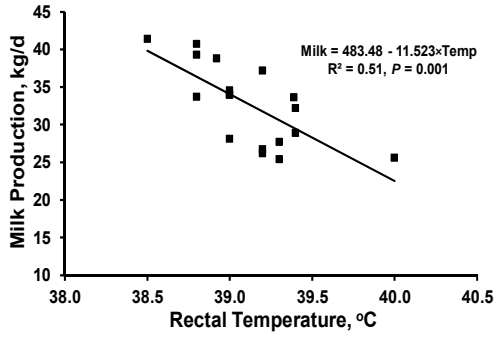
Adapted from Tao and Dahl, 2013

Cooling during lactation largely reduces body temperature



Weng and Tao, Unpublished

Reduction in body temperature when dry improves subsequent milk yield



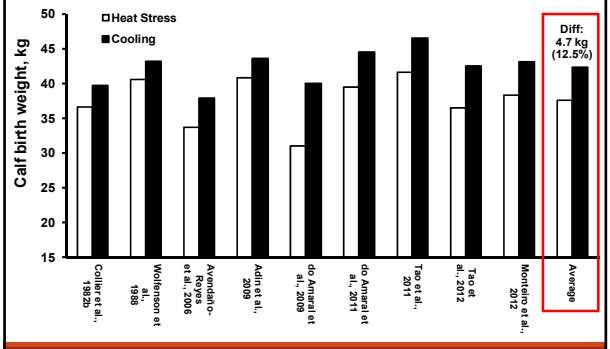
Tao and Dahl, 2013

Summary – Heat stress during the dry period on cow

- ❑ Impairs mammary growth during the dry period
- ❑ Decreases milk production in the next lactation
- ❑ Alters metabolic responses during transition
- ❑ Compromises immune function during transition
- ❑ Cooling dry cow is the key

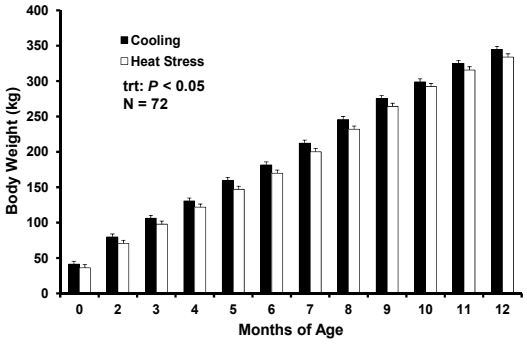
Maternal heat stress on calf

Late gestation heat stress decreases birth weight



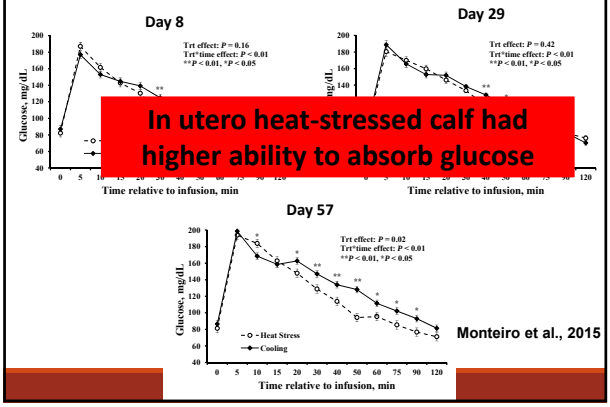
Adapted from Tao and Dahl, 2013

Late gestation heat stress affects calf body weight



Monteiro et al., 2013

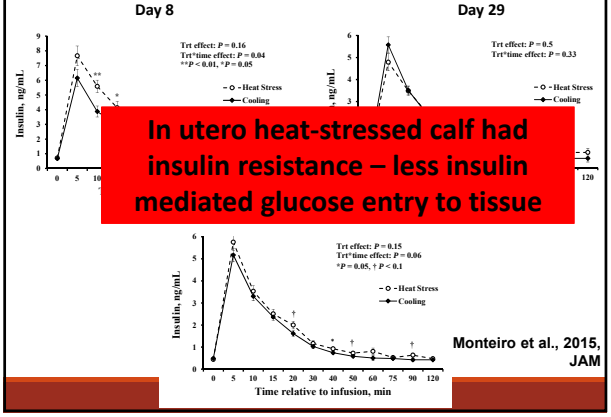
Glucose clearance to glucose infusion



In utero heat-stressed calf had higher ability to absorb glucose

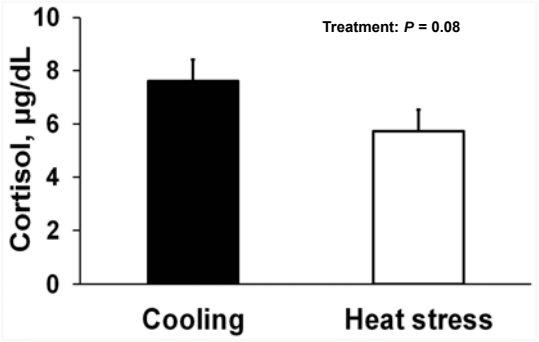
Monteiro et al., 2015

Insulin clearance to insulin infusion



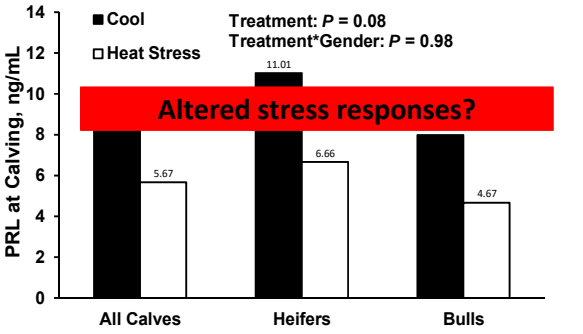
Monteiro et al., 2015, JAM

Cortisol at Calving



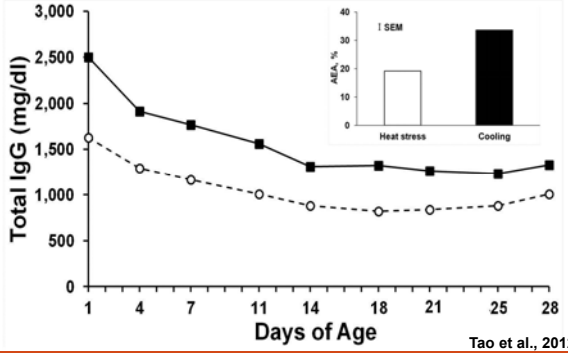
Tao et al., 2012

Prolactin at Calving



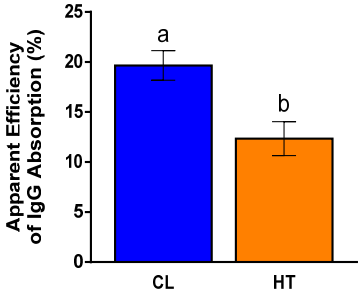
Monteiro, Dahl and Tao, Unpublished

Maternal heat stress decreases serum total IgG of calves



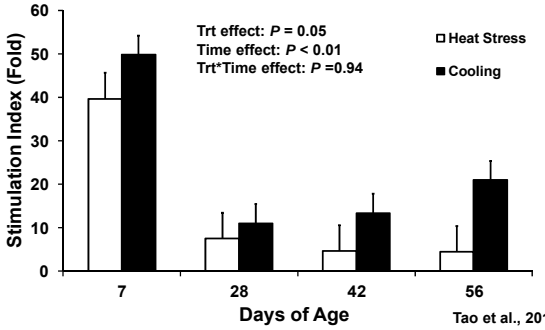
Tao et al., 2012

Preliminary data: Maternal heat stress decreases AEA



Laporta and Dahl, Unpublished

Maternal heat stress affects lymphocyte function of calves



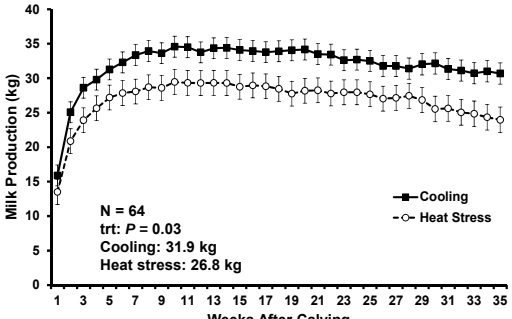
Tao et al., 2012

Maternal heat stress decreases calf survival

Parameter	Cooling AI	Cooling IVF	Cooling Total	Cooling %	Heat stress AI	Heat stress IVF	Heat stress Total	Heat stress %	*P* Trt
Bull calves, n	30	1	31	---	28	2	30	---	---
Heifer calves, n	29	12	41	---	29	15	44	---	---
DOA[4]	0	0	0	0.0	2	1	3	4.1	0.25
Males mortality by 4 mo of age	1	0	1	3.2	3	0	3	10.0	0.35
Heifers leaving herd before puberty	1	4	5	12.2	3	7	10	22.7	0.26
Due to sickness, malformation or growth retardation	1	0	1	2.4	3	5	8	18.2	0.03
Heifers leaving herd after puberty, before first lactation	1	0	1	2.4	3	0	3	6.8	0.62
Heifers completing first lactation	27	8	35	85.4	22	7	29	65.9	0.05

Monteiro and Dahl, unpublished

Maternal heat stress decreases offspring's milk production



Monteiro, et al., 2013

Summary – Heat stress during the dry period on calf

- Impairs fetal growth and lowers birth weight
- Compromises immune function before weaning
- Decreases milk production in the first lactation

Acknowledgements

Feed and Diet Composition Varies

Knowing why it varies and what to do about it can prevent lost milk

Bill Weiss
Normand St-Pierre

Buckeyes enjoy visiting Virginia

Goals of Feed Sampling/Analysis

1. Getting the right number
   - Value that approximates the mean over at least several days

2. Getting an estimate of variance
   - Why should you care ?

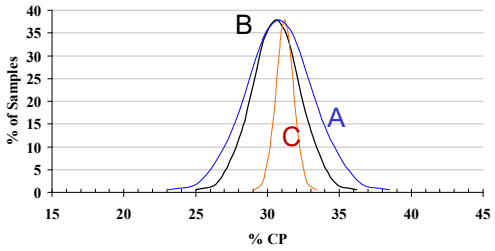
Why do we care about SD ?

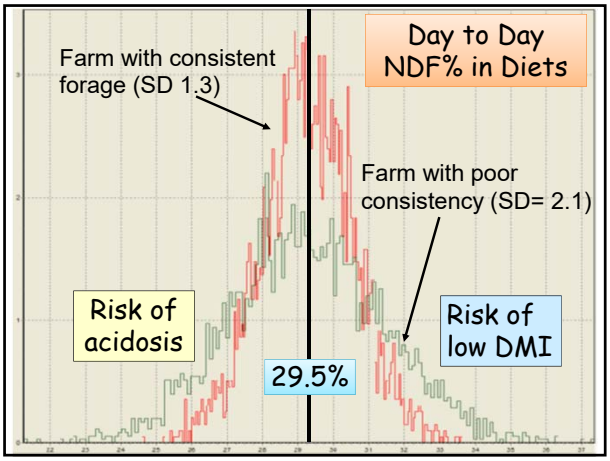
1. Economic value of feeds

2. Ration formulation specs

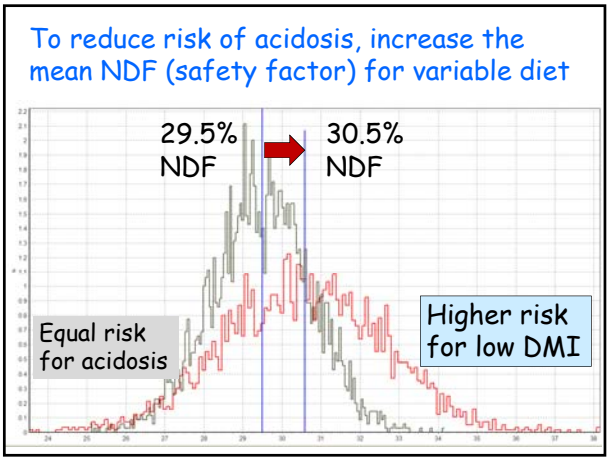
3. Risk management

CP content of distillers from 3 sources





To reduce risk of acidosis, increase the mean NDF (safety factor) for variable diet



Multiple databases are available

Dairy One www.dairyone.com

CORN SILAGE, Accumulated Crop Years: 5/1/2000 - 4/30/2014

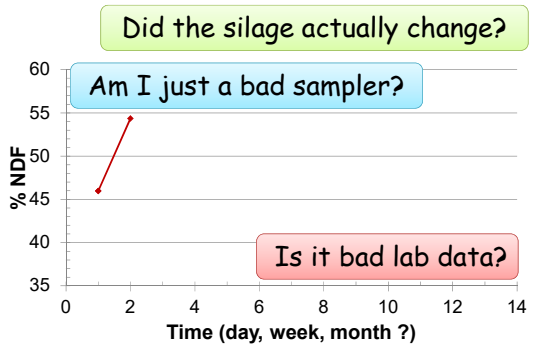
N >210,000

	Mean	SD
DM, %	33.7	9.5
NDF, %		
Starch, %		

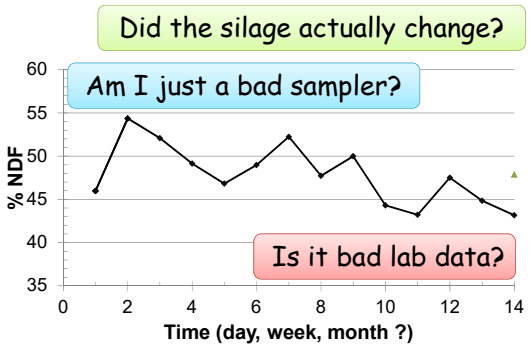
All variances are not created equal

Year
Soil
Hybrid
Harvest
Sampling
Lab . . .

Haylage NDF (1 Farm)



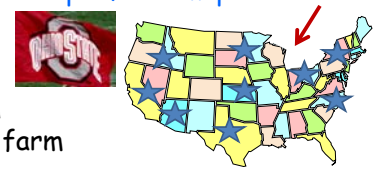
Haylage NDF (1 Farm)



OSU Project: Quantify variation in feed composition on dairy farms

- Silage sampled daily (14 d, 11 farms OH, VT)
- 47 farms from across US (20 from OH)
- Feeds sampled monthly (12 months)

Our "perfect" map



★=region with cooperating farm

The Data Set (corn and hay silage)

11 farms
14 consecutive days
2 samples/day
2 assays/sample
504 numbers for each nutrient

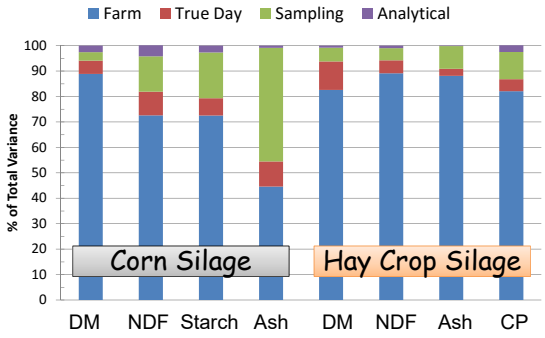
	Corn silage		
DM	37.0%	SD=	5.23
NDF	39.1%		4.03
Starch	32.8%		4.33

6.0

Partitioning Variation

Total Variation = Farm to farm variation +
Sampling variation +
Analytical variation +
True day to day variation

Farm to farm is major source of variation in silages



Farm to Farm Variation is Huge

1. You need to sample silage from each client's farm
2. Don't use a book value
3. But this is not true for all feedstuffs

Sampling Non-Forages on Farms

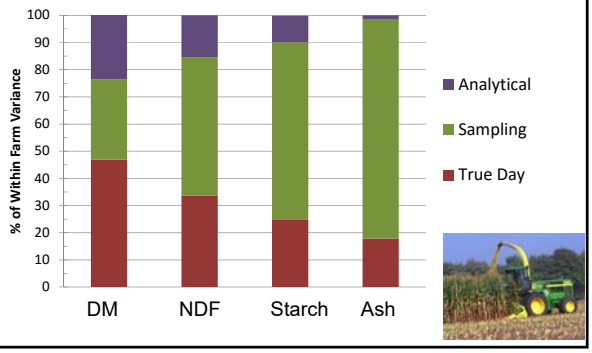
All wet feeds tested WCGF, WBG, WDG HM corn	Farm was significant source of variation
Dry corn, SBM, DCGF canola meal, whole cottonseed	Farm was NOT a significant source of variation
DDGS	Farm was OFTEN not an important source of variation

Within Farm SD (14 days)
Variation is still large

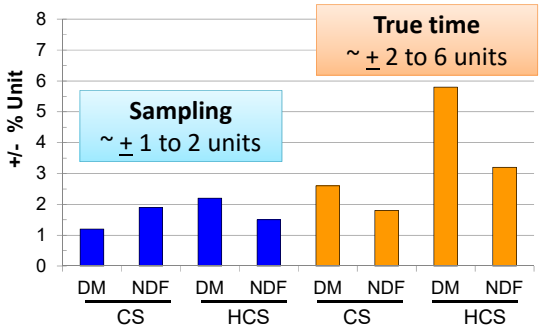
Nutrient	Corn silage		Haycrop Silage	
	Mean	SD	Mean	SD
DM, %	37.0	1.7	41.7	3.3
NDF, %	39.1	2.1	49.9	2.2
Starch, %	32.8	2.3*	…	…
CP, %	7.6	0.3	16.3	1.0

* On 5 out of 14 days, starch would be <30.5 or >35.1%

Within Farm Variation
Corn Silage over 14 days



Average Ranges for Corn and Alfalfa Silage (over 12 months)



TMR Sampling:
Useful tool or random number generator?

1. Extreme sampling challenge
   - heterogeneous particles
     -shape, density, nutrients

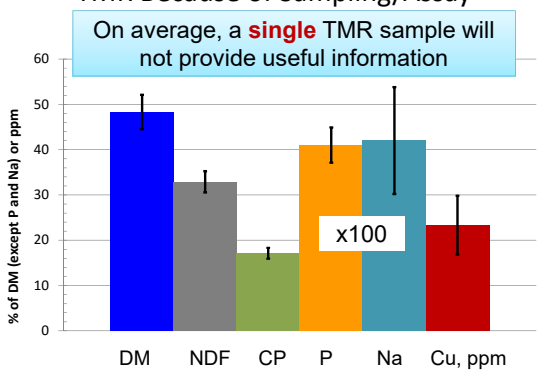
2. Added sources of variation
   - Feeder
   - Mixer

3. Lower sampling/assay costs (vs. feeds)

All particles are not created equal

Range (80%) of Nutrient Composition of TMR Because of Sampling/Assay

On average, a **single** TMR sample will not provide useful information



How do you reduce sampling error (or how do you reduce its impact) ?

1. Use good sampling technique

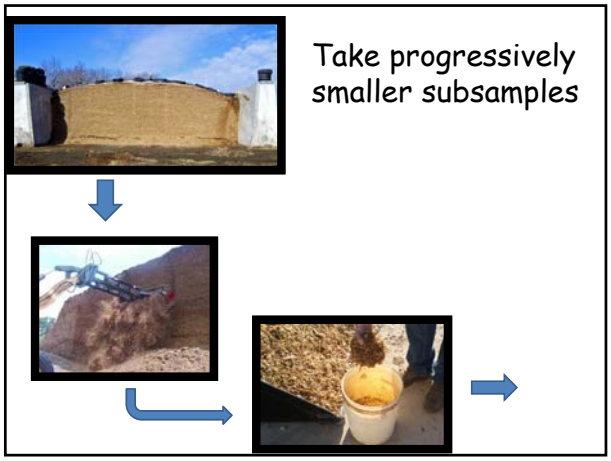
2. Take duplicate samples

Good Sampling Practices

1. Mix as much as possible BEFORE sampling

vs.

2. Take progressively smaller subsamples
3. Use good handling procedures
4. Develop SOP for sampling
5. Evaluate SOP by multiple samples



Don't Die Getting A Sample

'Borrowed' Images

Good Sampling Technique

Use procedures that reduce particle bias in the sample

Starch and NDF in different particle fractions of processed corn silage

	DM Basis		
NDF	54%	38%	29%
Starch	13%	19%	53%

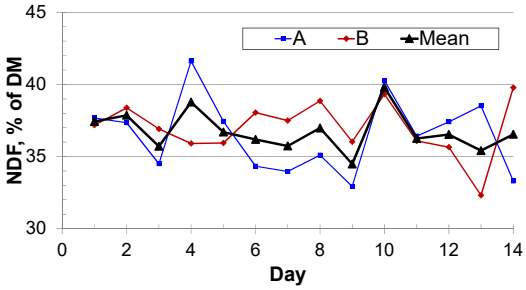
Collect sample properly

How do you reduce sampling error (or how do you reduce its impact) ?

1. Use good sampling technique

2. Take duplicate **independent** samples

The value of duplicate samples (corn sil)



Mean = 36.5% (all)
SD(a) = 2.6 SD(b) = 1.9 SD(m) = 1.4

Does Variation Affect Cows ?

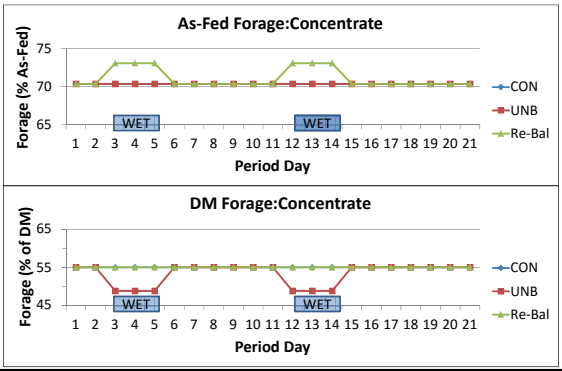
4 experiments conducted at
OARDC to examine this question

DM, LCFA, fNDF, CP

Does a transient change in silage DM affect cows ? (McBeth et al., J. Dairy Sci. 2013)

DM% of silage can abruptly change

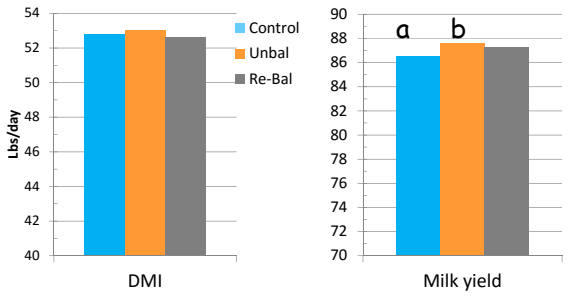
Treatments
Control, Re-Balanced, Unbalanced



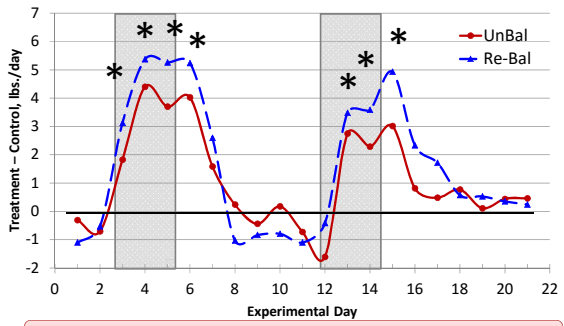
Nutrient Composition of Diets, % of DM			
	CON	UNB	Re-BAL
DM%	66.2	63.9	60.7
fNDF%	23.6	21.0	23.6
Starch%	28.4	30.4	28.4
CP%	14.8	14.7	14.8

UNB and Re-BAL reflect diets during wet bouts only

21 day period averages (diets differed on only 6 days)

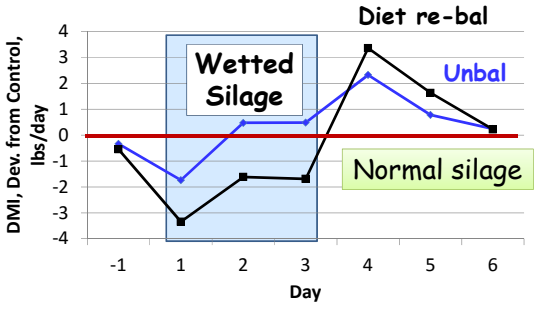


As-Fed Intake, Deviation from Control



Note the lag at the start and end of the bouts

Effect of Abrupt Addition of Wetted Silage

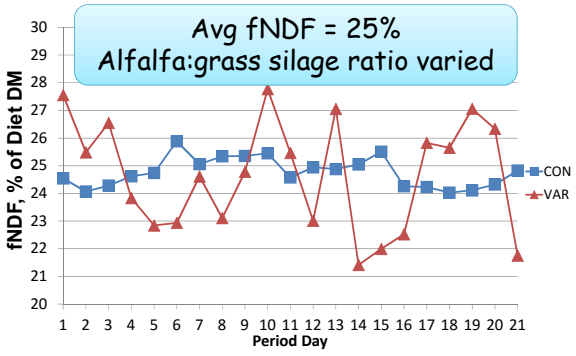


Feed delivery was increased

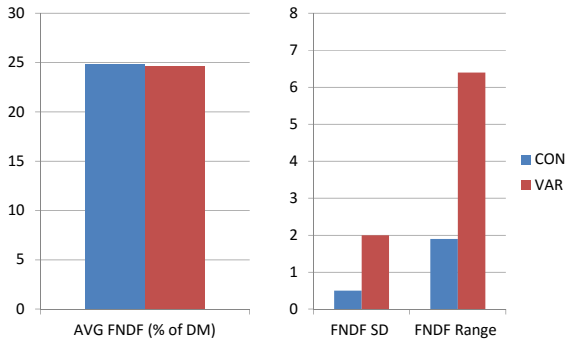
Does **extreme** variation in fNDF affect cows ? (Yoder et al., J. Dairy Sci. 2013)

Things Happen

Variable and Control Treatments, fNDF %



Diet FNDF (% of DM)



High day to day variation in fNDF had little effect on average production

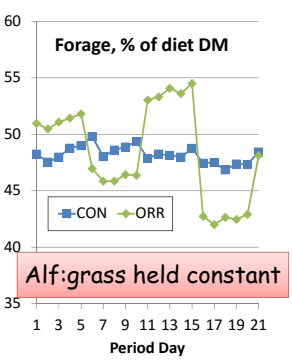
	Control	Variable
DMI, lbs/day	53.9	53.4
Milk, lbs/day	94.2	94.8
Milk (mature) lbs/d	106.2	105.6
Milk fat, %	3.49	3.51

↑ SD

Feed offered was adjusted so daily refusal was usually ~5%

Overreacting Treatment

Changing % forage in response to a new analysis (every 5 days) that was either above or below true population mean NDF



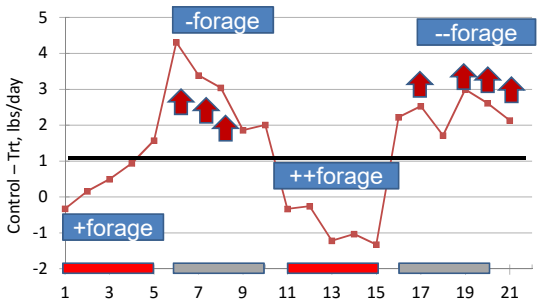
Alf:grass held constant

5 days of a 'bad' diet didn't do much ?

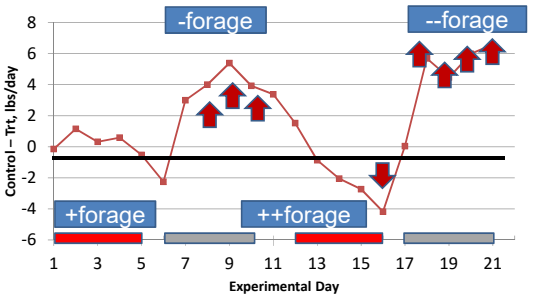
	Control	OverReact
DMI, lbs/d	53.9	55.2*
Milk, lbs/d	94.2	95.9
Milk, lbs/d (multi)	106.2	106.5
Milk fat, %	3.49	3.54

Over 10 days both diets are equal

DMI, Over-react, deviation from Control



ECM, Over-react deviation from Control



Is Day to Day Variation in Diet Composition Bad ?

Maybe (but it may be good)

1. Can 'controlled' variation be used to reduce costs ?
2. Can 'controlled' variation be used to increase production ?

No matter what, don't feed a bad diet for too long

Conclusions

1. Sampling is a substantial source of within farm variation in silages and TMR
2. High sampling error = low confidence in single sample: **USE MEANS!**
3. Time can be important source of variation
   - know how much your feeds vary
   - don't over-smooth
   - don't change too quickly

Diet Variation in Cows

Substantial, short term variation (DM, fat, CP, fNDF) did not affect cows **when cows were allowed to eat**

Take Home Message

Increase feed delivery rates when you suspect high day to day variation in diet composition

Diet Variation in Cows

Longer term (>2 days) feeding of unbalanced diet has affected cows

Take Home Message

Before re-formulating, make sure the feeds really have changed but don't wait too long

THE OHIO STATE UNIVERSITY OARDC EXTENSION

OARDC Dairy Nutrition Lab

USDA United States Department of Agriculture

National Institute of Food and Agriculture

This project was supported by National Research Initiative Comp. Grant No. 2009-55206-05242 from the USDA National Institute of Food and Agriculture.