PAPILLON

DAIRY EFFICIENCY

SUMMIT

'16

SUMMIT PROCEEDINGS

GREEN BAY | MADISON | 2016

PAPILLON

Feed Efficiently

2016 PAPILLON DAIRY EFFICIENCY SUMMIT

AGENDA

9:00 AM	**Welcome** David Briggs, President Papillon Agricultural Company
9:05 AM	**Tricks and traps for the consultant monitoring production efficiency of their client herd's** Dr. Robert C. Fry, Atlantic Dairy Consulting
9:45 AM	**Finding the maximum margin by efficient feeding and management practices in the "100 lb herd"** Walt Moore, Walmoore Holsteins, Inc.
10:25 AM	**BREAK**
10:40 AM	**Emerging technologies that enhance nutrient utilization efficiencies through precision application of plant nutrients and crop protection products** Jamie Kimbles, Willard Agri-Service
11:20 AM	**Maximizing profit per acre with dairy cows as the center piece of farming operations in the environmentally fragile Chesapeake Bay Watershed** Sean Jones, Lester C. Jones and Sons Inc.
12:00 PM	**LUNCH**
1:00 PM	**Understanding dairy feed efficiency through genomic selection and other management practices as we anticipate an 8th edition of the NRC Nutrient Requirements for Dairy Cattle** Dr. Lou Armentano, University of Wisconsin
1:40 PM	**The Papillon Dairy Initiative: 90 audits completed covering over 50,000 cows. What have we learned? Where are the greatest opportunities?** Clayton Stoffel, Papillon Agricultural Company
2:20 PM	**BREAK**
2:30 PM	**Impact of feeding efficiently on a dairy's income statement and balance sheet. From the CFO's perspective: tips when measuring production efficiency, impact of scale, and the effect of high vs low input management styles on economic efficiency.** Dr. Greg Bethard, Pagel's Ponderosa Dairy
3:10 PM	**Closing** David Briggs, Papillon Agricultural Company

ABOUT US

For over 30 years, Papillon Agricultural Company has worked with dairy nutritionists, feed manufacturers and producers with the sole focus of enhancing feed and farm efficiency of North American dairy operations. Our company is dedicated to providing the industry with consistent, high quality ingredients and products backed by proven research. Our product portfolio includes: Gemini Proteins and Papillon Performance Proteins®, which are our premium bypass protein supplements; Dairyman's Edge® PRO, which optimizes rumen function; and MIN-AD®, our rumen buffer and source of highly available Ca and Mg.

In addition to our innovative products, we also offer the Papillon Dairy Initiative, a nutritional efficiency program designed to measure a dairy's energy, nitrogen, and phosphorus efficiency. The Dairy Initiative provides an objective, science based assessment of a dairy's current nutritional efficiency strengths and opportunities. It also highlights potential economic benefits of efficiency improvements.

To further demonstrate the economic and environmental impact of precision agriculture through efficient dairy feed utilization and land management, we are pleased to introduce the Papillon Dairy Efficiency Summit. With this speaker series we hope to reinforce the value of efficiency throughout the industry.

We deeply appreciate the time and effort put forth by our guest speakers to present the following information and their commitment to strengthening the dairy industry.

PAPILLON
Feed Efficiently

30 N. Harrison Street P.O. Box 1161 Easton, MD 21601 Toll Free: 1-800-888-5688

www.papillon-ag.com

SUMMIT SPEAKERS

Dr. Robert C. Fry graduated from the University of Georgia, College of Veterinary Medicine in 1977. Dr. Fry currently practices veterinary medicine and provides nutritional consulting services to dairy herds in the Northeast focusing on healthy cows and efficient production.

Walt Moore is the President of Walmoore Holsteins, Inc. located in West Grove, PA. The farm operation is home to 880 lactating cows (29,000 RHA), 700 young stock, and 1200 tillable acres.

Jamie Kimbles graduated from the University of Maryland, Baltimore County in 2011 with a B.S. in environmental science. Jamie is a certified nutrient management consultant in the state of Maryland and serves as the Agronomy Lead for Sales Support at Willard Agri-Service, a liquid fertilizer company located in the Mid-Atlantic region.

Sean Jones is the principal manager of Lester C. Jones and Sons Inc. in Massey, MD and has been chosen as one of The Fertilizer Institute's 4R Advocates. The 4R Advocate program highlights farmers who are using 4R Nutrient Stewardship to improve their farms profitability while minimizing potential environmental impacts of nutrient use.

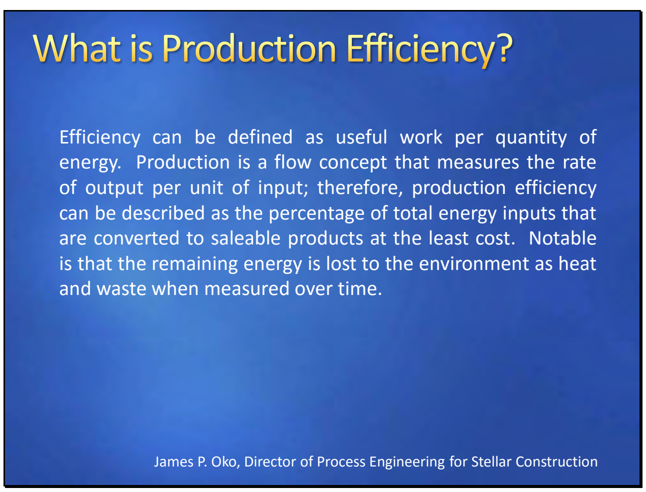
Dr. Lou Armentano is an Emeritus Professor of Dairy Science at the University of Wisconsin. Dr. Armentano has focused his research on liver metabolism in cattle and maintained a program addressing the use of by-product feedstuffs and their role in providing energy, fiber, protein, and fat to dairy cows.

Clayton Stoffel grew up on a dairy farm in Kewaskum, WI and earned his B.S. and M.S. degrees in dairy science, with an emphasis in nutrition, from the University of Wisconsin. Clayton is the Dairy Initiative Project Manager for Papillon Agricultural Company.

Dr. Greg Bethard received his B.S., M.S., and Ph.D degrees from Virginia Tech in dairy nutrition and management. Dr. Bethard is currently the Chief Financial Officer at Pagel's Ponderosa Dairy in Kewaunee, WI.

TRICKS AND TRAPS FOR THE CONSULTANT MONITORING PRODUCTION EFFICIENCY OF THEIR CLIENT HERDS

Dr. Robert C. Fry
Atlantic Dairy Consulting



What is Production Efficiency?

Efficiency can be defined as useful work per quantity of energy. Production is a flow concept that measures the rate of ~~output~~ per unit of ~~input~~; therefore, production efficiency can be described as the percentage of total ~~energy~~ inputs that are converted to ~~saleable products~~ at the least cost. Notable is that the remaining ~~energy is~~ lost to the environment as heat and waste when measured over time.

James P. Oko, Director of Process Engineering for Stellar Construction

What is Production Efficiency?

Efficiency can be defined as useful work per quantity of energy. Production is a flow concept that measures the rate of milk flow per unit of dry matter intake; therefore, production efficiency can be described as the percentage of total nutrient inputs that are converted to milk, fat, and protein at the least cost. Notable is that the remaining nutrients are lost to the environment as heat and waste when measured over time.

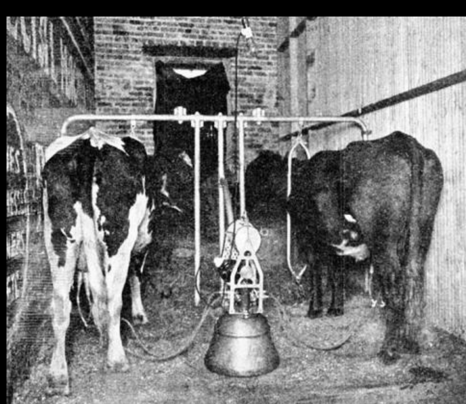
James P. Oko, Director of Process Engineering for Stellar Construction

The Efficiency Movement in Its Relation to Agriculture

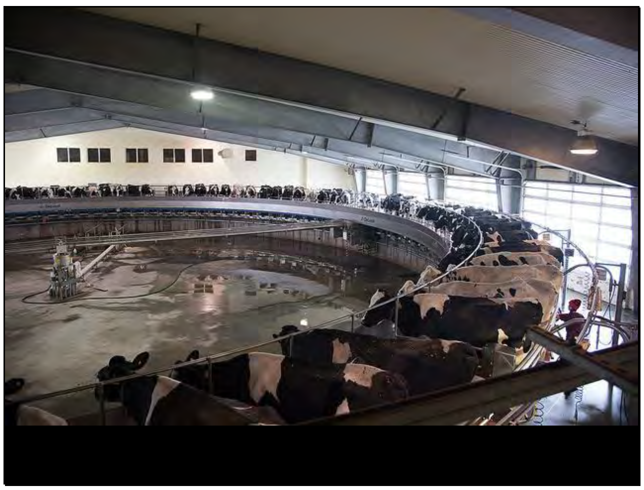
1915 W. J. Spillman , USDA Office of Farm Management
The Annals of the American Academy of Political and Social Science

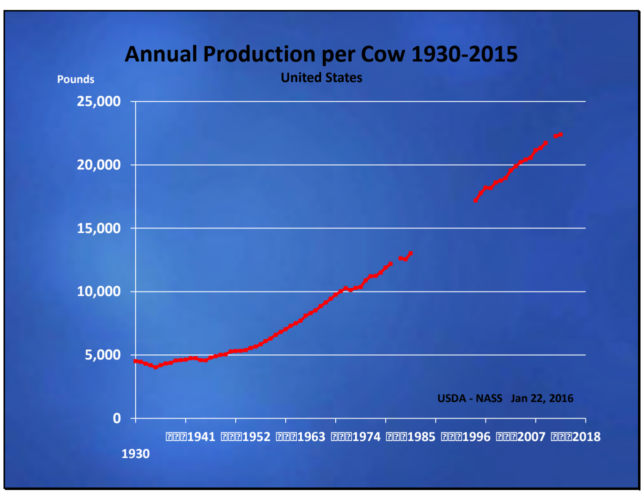
" The average milk production of US cows is about 4,500 lbs a year. If this were increased at a rate of 100 pounds a year, in 45 years the average milk production per cow would be doubled. The present number of cows could then supply sufficient dairy products at the present rate of consumption for considerably more than 200,000,000 people "

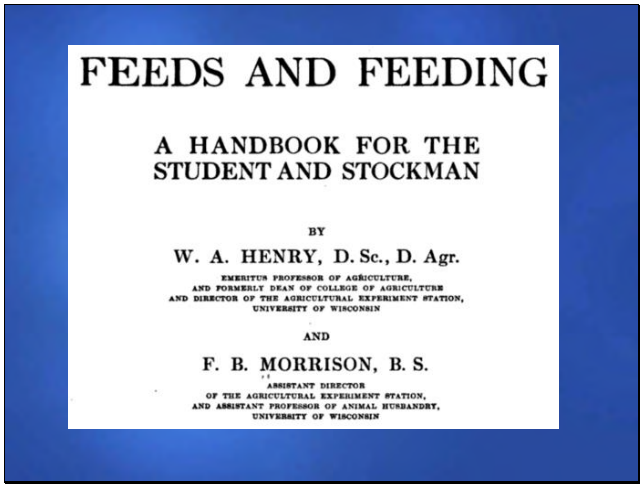
J.C. McDowell US Yearbook of Agriculture 1927




USDA-AMS report Feb 1960 average milk production =21.4 ppcpd
Feeding 5.4 lbs grain & 26.7 lbs DM forage pcpd




Annual Production per Cow 1930-2015
United States
Pounds
25,000
20,000
15,000
10,000
5,000
0
USDA - NASS Jan 22, 2016
1930
1941
1952
1963
1974
1985
1996
2007
2018



FEEDS AND FEEDING

A HANDBOOK FOR THE STUDENT AND STOCKMAN

BY

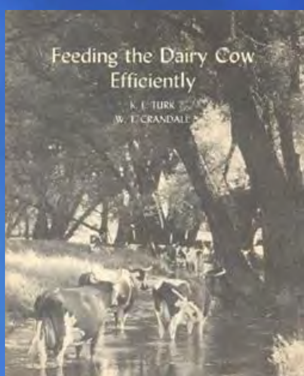
W. A. HENRY, D. Sc., D. Agr.

EMERITUS PROFESSOR OF AGRICULTURE,
AND FORMERLY DEAN OF COLLEGE OF AGRICULTURE
AND DIRECTOR OF THE AGRICULTURAL EXPERIMENT STATION,
UNIVERSITY OF WISCONSIN

AND

F. B. MORRISON, B. S.

ASSISTANT DIRECTOR
OF THE AGRICULTURAL EXPERIMENT STATION,
AND ASSISTANT PROFESSOR OF ANIMAL HUSBANDRY,
UNIVERSITY OF WISCONSIN



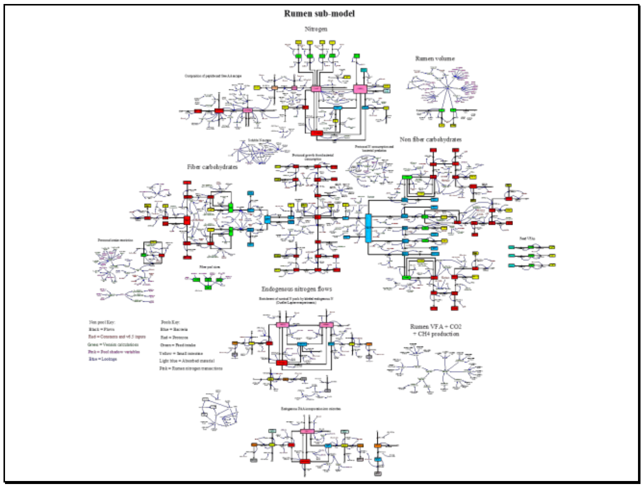
(Cornell Extension Bulletin) Turk & Crandall, 1950

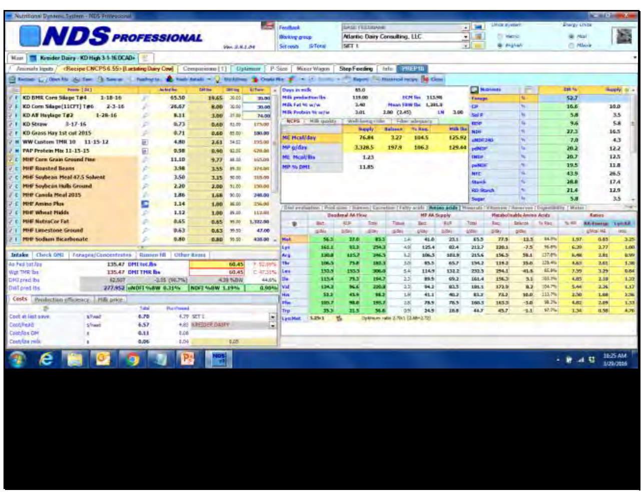
Pete Van Soest and Lane Moore, 1963 USDA, Beltsville, MD

The Cornell Net Carbohydrate and Protein System: Updates to the model and evaluation of version 6.5

M.E. Van Amburgh, E.A. Collao-Saenz, R.J. Higgs, D.A. Ross, E.B. Recktenwald, E. Raffrenato, L.E. Chase, T.R. Overton, J.K. Mills, A. Foskolos

Journal of Dairy Science
Volume 98, Issue 9, Pages 6361-6380 (September 2015)
DOI: 10.3168/jds.2015-9378





Tricks & Traps

Efficiency can be defined as useful work per quantity of energy. Production is a flow concept that measures the rate of output per unit of input; therefore, production efficiency can be described as the percentage of total energy inputs that are converted to saleable products at the least cost.

The numerator

- Accurate
- Meaningful
- Accessible
- Useful

The denominator

- Must answer the question being considered by the numerator
- Must be appropriate for the current managerial situation

Measuring Dairy Production Efficiency and Profit

- ✓ Milk per Cow
- ✓ Feed Cost per Cow
- ✓ Feed Cost per CWT
- ✓ Milk:Feed Ratio
- ✓ MCM per lb. DM Intake
- ✓ ECM per lb. DM Intake ⟵
- ✓ Income Over Feed Cost per Cow

Why ECM per lb. DM Intake?

- ✓ Easy to calculate
- ✓ Easy to understand
- ✓ No lag time related to milk price or feed costs
- ✓ Responsive to diet changes
- ✓ Correlates well to mIOFC

What is EC-DME?

The efficiency at which a dairy cow converts feed to milk (adjusted to 3.5% BF and 3.05% P), maintenance, and manure. In it's simplest form it is the pounds of EC milk divided by the dry matter intake.

Energy Corrected MIlk

Milk lbs*(0.327+(0.072*%protein)+(0.1295*%fat))

Target EC-DME

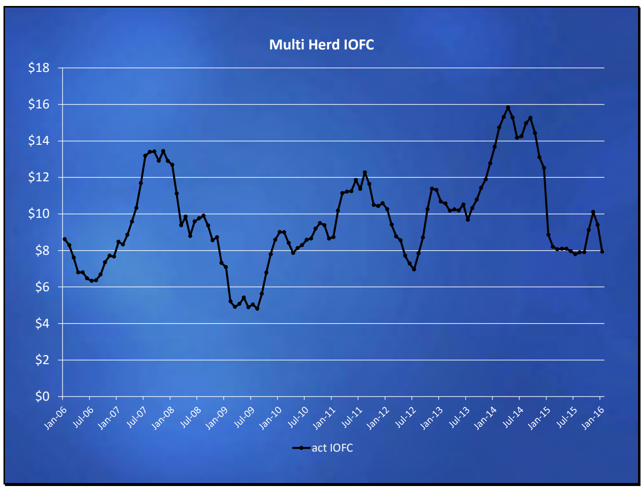
1.6-1.8 lbs EC Milk per lb of Dry Matter Intake

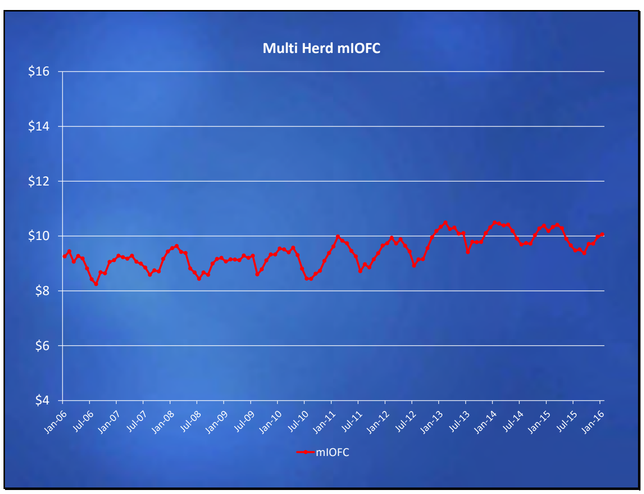
What influences the EC-DME?

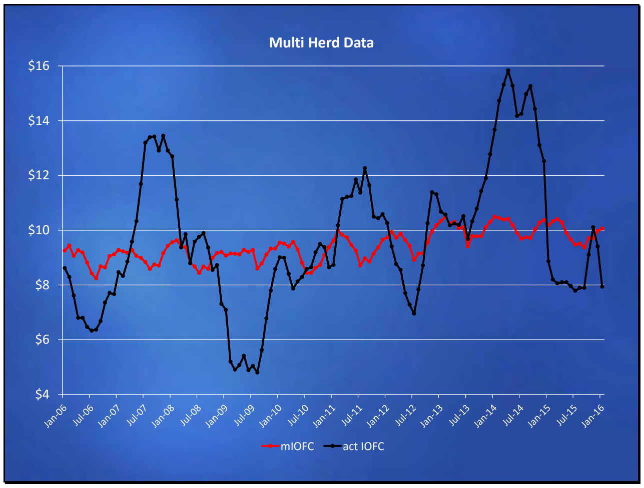
- Cow health
- Herd reproductive wellness
- Diet formulation
- Forage quality
- Feed delivery
- Amino Acid balance
- Rumen bioactives (yeast, monensin, probiotics…)
- Times per day milking
- rBST

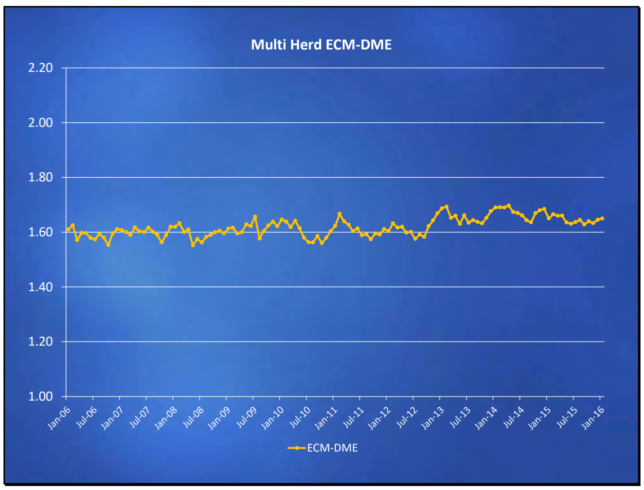
What doesn't influence the EC-DME?

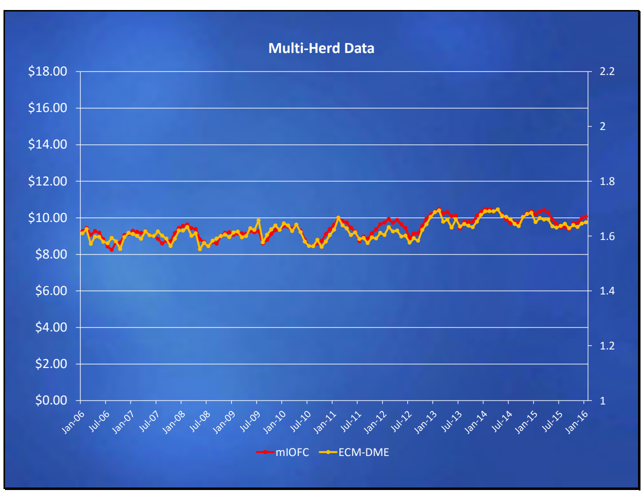
- Milk price
- Feed cost

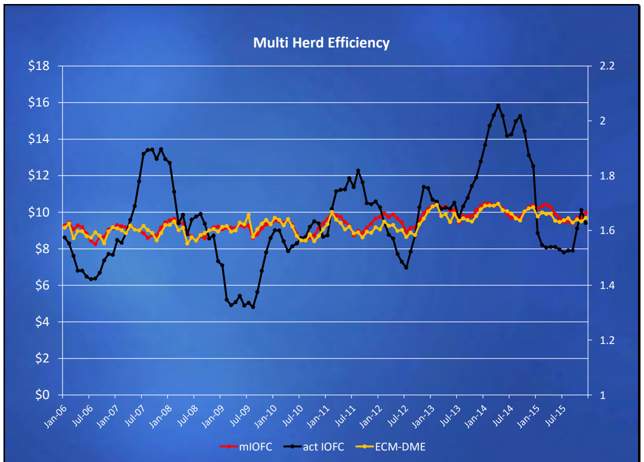





Multi Herd Data
$16
$14
$12
$10
$8
$6
$4
Jan-06 Jul-06 Jan-07 Jul-07 Jan-08 Jul-08 Jan-09 Jul-09 Jan-10 Jul-10 Jan-11 Jul-11 Jan-12 Jul-12 Jan-13 Jul-13 Jan-14 Jul-14 Jan-15 Jul-15 Jan-16
mIOFC
act IOFC


Multi Herd ECM-DME
2.20
2.00
1.80
1.60
1.40
1.20
1.00
Jan-06 Jul-06 Jan-07 Jul-07 Jan-08 Jul-08 Jan-09 Jul-09 Jan-10 Jul-10 Jan-11 Jul-11 Jan-12 Jul-12 Jan-13 Jul-13 Jan-14 Jul-14 Jan-15 Jul-15 Jan-16
ECM-DME


Multi-Herd Data
$18.00
$16.00
$14.00
$12.00
$10.00
$8.00
$6.00
$4.00
$2.00
$0.00
2.2
2
1.8
1.6
1.4
1.2
1
Jan-06 Jul-06 Jan-07 Jul-07 Jan-08 Jul-08 Jan-09 Jul-09 Jan-10 Jul-10 Jan-11 Jul-11 Jan-12 Jul-12 Jan-13 Jul-13 Jan-14 Jul-14 Jan-15 Jul-15 Jan-16
mIOFC
ECM-DME



Why ECM per lb. DM Intake?

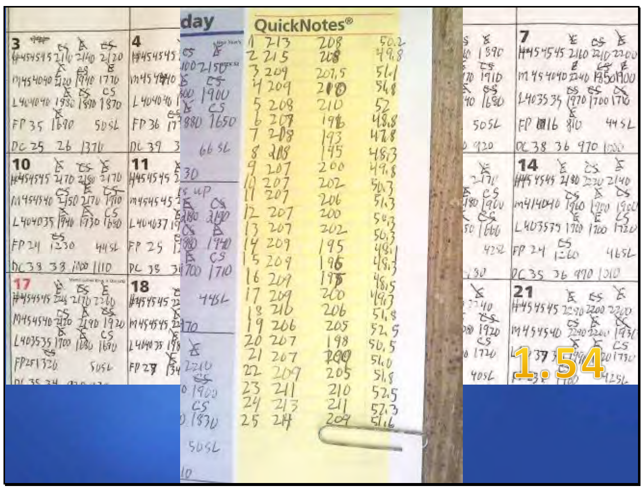
- ✓ Easy to calculate
- ✓ Easy to understand
- ✓ No lag time related to milk price or feed costs
- ✓ Responsive to diet changes
- ✓ Correlates well to mIOFC

Why is it important?

- 500 cow herd
- ECM-DME ↑↓ 0.05
- In one month…

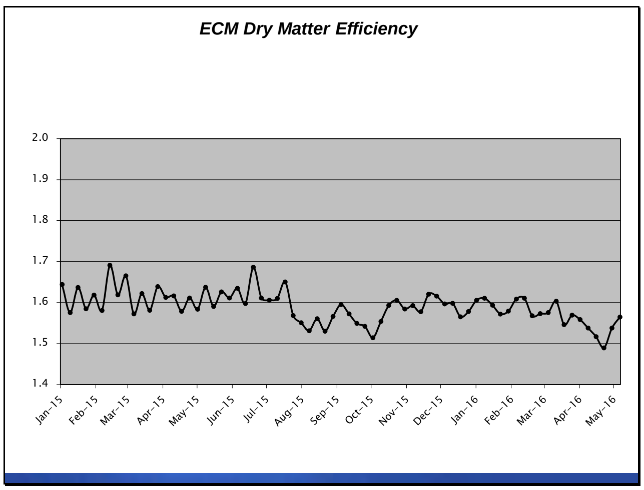
Examples...

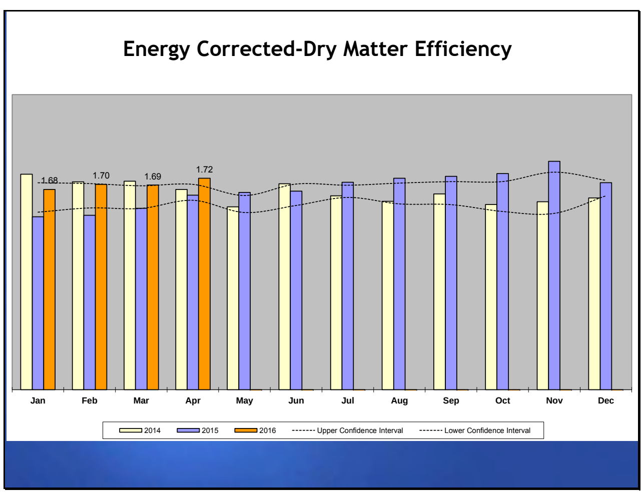
Real Cows & Real People



Daily Data								Weekly Average			
Date	Tank Milk	Total Cows in Tank	Total Feed	Refusal	TMR%DM	Tank Fat	Tank Protein	Milk-6	DMI-7	ECM-7	ECM-DME
14-Feb	55,541	645	62,700	2,000	45%			82			
15-Feb	47,122	645	69,900	2,000	45%			81			
16-Feb	51,302	645	73,500	4,000	45%			81			
17-Feb	42,607	645	77,000	5,000	45%	3.94	2.98	79	48.0	83.6	1.74
18-Feb	58,048	630	71,500	4,000	45%			77			
19-Feb	42,607	630	69,500	2,000	45%			78			
20-Feb	56,769	635	74,000	2,000	45%			77			
21-Feb	42,607	635	77,000	2,000	45%			78			
22-Feb	56,708	630	74,500	3,000	45%			77			
23-Feb	42,113	630	73,500	5,000	45%			79			
24-Feb	58,615	630	74,000	3,000	45%	3.95	3.00	79	49.1	83.2	1.70
25-Feb	47,014	630	74,000	2,000	45%			79			
26-Feb	58,630	630	73,500	2,000	40%			80			
27-Feb	46,907	630	69,500	2,000	40%			81			

Date	Pen	Count	DMI	Milk	Milk/DM	FCM/DM	MCM/DM	ECM/DM	DIM
	1	199	61.0	103.4	1.70	1.74	1.74	1.73	167
	2	199	47.6	88.6	1.86	1.93	1.93	1.91	157
	3	198	54.5	91.7	1.68	1.76	1.76	1.76	248
	4	199	60.4	104.7	1.73	1.74	1.74	1.73	159
	5	198	46.7	59.6	1.28	1.43	1.43	1.43	297
	6	192	42.6	90.4	2.12	2.38	2.37	2.29	38
3/14/2016	Herd	1185	52.2	89.7	1.73	1.83	1.83	1.80	178
	1	199	61.1	103.1	1.69	1.75	1.75	1.73	166
	2	199	48.6	89.7	1.85	1.92	1.92	1.90	162
	3	198	56.5	92.3	1.63	1.73	1.73	1.72	251
	4	199	62.0	106.1	1.71	1.74	1.74	1.73	157
	5	198	46.3	60.1	1.30	1.47	1.46	1.46	301
	6	192	43.1	92.6	2.15	2.32	2.32	2.25	39
3/21/2016	Herd	1185	53.0	90.7	1.72	1.82	1.82	1.80	180





Using EC-DME to Enhance Your Services

- Team Building
- Debottlenecking
- Pinpointing Opportunities
- Monitoring
- Motivating

EC-DME

- It is important
- It is simple to calculate
- It is directly correlated to mIOFC
- It is a valuable link for team building between owner-nutritionist-management
- Try It!

Traps

- Unknown cow numbers
- Not accounting for refusals
- Not accounting for hospital pen
- Not adjusting for fat & protein

Tricks for maximizing ECM DME

- Accurately as absolutely possible include in your model
  - Animal description
  - Forage assay results
  - Grain and forage costs
- Use the optimizer
- Remember all models are wrong, just that some are more useful than others.

Example Tricks & Traps using the CNCPS model

AMTS

RUM&N NDS PROFESSIONAL

Developed using licensed technology from Cornell University and in collaboration with Cornell Department of Animal Science.

CNCPS Version
- CNCPS 6.5
- CNCPS 6.55

CNCPS Version 6.55

CNCPS v.6.5
60 lbs DMI

Days in milk	153.0			
Milk production lbs	106.50	ECM lbs	109.97	
Milk Fat % w/w	3.85	Mean FBW lbs	1,490.0	
Milk Protein % w/w	3.27	3.04 (2.67)	LN	2.90

NCPS | Milk quality | Well-being risks | Fiber adequacy

	Supply	Balance	% Req.	Milk lbs
ME Mcal/day	73.44	-1.79	97.6	102.97
MP g/day	3,173.3	-10.5	99.7	105.99
ME Mcal/lbs	1.22			
MP % DMI	11.62			

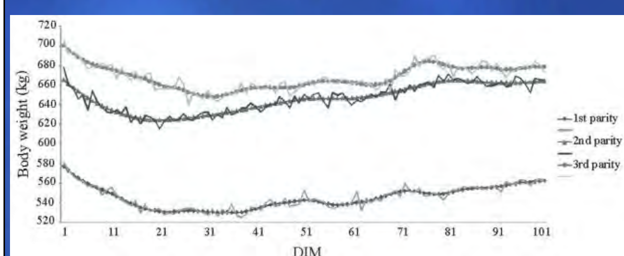
CNCPS v.6.55
60 lbs DMI

Days in milk	153.0			
Milk production lbs	106.50	ECM lbs	109.97	
Milk Fat % w/w	3.85	Mean FBW lbs	1,490.0	
Milk Protein % w/w	3.27	3.04 (2.67)	LN	2.90

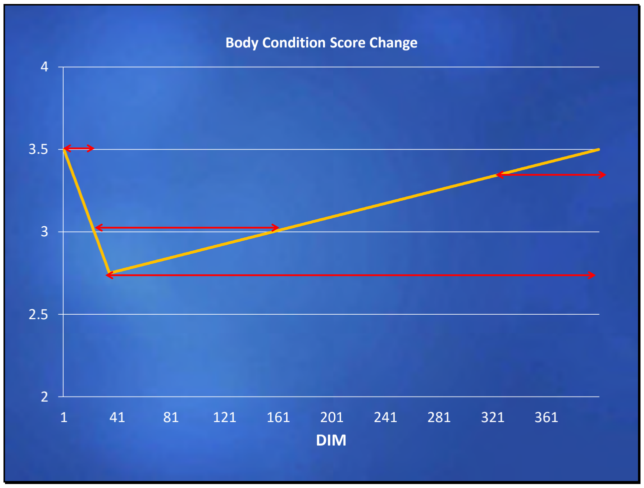
NCPS | Milk quality | Well-being risks | Fiber adequacy

	Supply	Balance	% Req.	Milk lbs
ME Mcal/day	76.08	1.07	101.4	108.61
MP g/day	3,189.8	60.4	101.9	109.43
ME Mcal/lbs	1.26			
MP % DMI	11.68			

Lactation number	n	2.90
Calving interval	months	13.00
Age at first calving (AOFC)	months	21.00
Age (actual average)	months	55.00
Mean FBW	lbs	1,490.0
Mature FBW	lbs	1,503.0
Days since calving (DIM)	days	153.0
Days pregnant	days	50
Daily milk production	lbs	106.50
Milk fat	% w/w	3.78
Milk total protein	% w/w	3.27
Milk true protein	% w/w	3.04
Casein	% w/w	2.67
Milk lactose	% w/w	4.65
BCS (1-5)		2.25
Target BCS		3.25
Days to reach target BCS	days	210
Calf birth weight	lbs	88.0
ADG	lbs/day	0.086



Poncheki, et al R. Bras. Zootec., 44(5):187-192, 2015



Days in milk	153.0			
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Milk Protein % w/w	3.27	3.04 (2.67)	LN	2.90

NCPS | Milk quality | Well-being risks | Fiber adequacy

	Supply	Balance	% Req.	Milk lbs
ME Mcal/day	76.08	1.07	101.4	108.61
MP g/day	3,189.8	60.4	101.9	109.43
ME Mcal/lbs	1.26			
MP % DMI	11.68			

Actual pen avg cow description especially BCSΔ, fat % & protein %
3.85
3.04
2.25→3.25 210d

Incorrect components and BCSΔ

3.50
3.15
3.25→3.25 210d

Days in milk	153.0			
Milk production lbs	106.50	ECM lbs	106.03	
Milk Fat % w/w	3.50	Mean FBW lbs	1,490.0	
Milk Protein % w/w	3.39	3.15 (2.77)	LN	2.90

NCPS | Milk quality | Well-being risks | Fiber adequacy

	Supply	Balance	% Req.	Milk lbs
ME Mcal/day	76.08	6.34	109.1	119.47
MP g/day	3,189.8	88.0	102.8	110.63
ME Mcal/lbs	1.26			
MP % DMI	11.68			

Days in milk	153.0			
Milk production lbs	106.50	ECM lbs	109.97	
Milk Fat % w/w	3.85	Mean FBW lbs	1,490.0	
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NCPS | Milk quality | Well-being risks | Fiber adequacy

	Supply	Balance	% Req.	Milk lbs
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MP g/day	3,189.8	60.4	101.9	109.43
ME Mcal/lbs	1.26			
MP % DMI	11.68			

Actual pen avg cow description especially BCSΔ, fat % & protein %
3.85
3.04
2.25→3.25 210d

Incorrect components and BCSΔ, DSB

4.00
3.15
3.25→3.25 210d
210 DSB

Days in milk	153.0			
Milk production lbs	106.50	ECM lbs	112.85	
Milk Fat % w/w	4.00	Mean FBW lbs	1,490.0	
Milk Protein % w/w	3.39	3.15 (2.77)	LN	2.90

NCPS | Milk quality | Well-being risks | Fiber adequacy

	Supply	Balance	% Req.	Milk lbs
ME Mcal/day	76.08	-0.85	98.9	104.87
MP g/day	3,189.8	-94.8	97.1	102.05
ME Mcal/lbs	1.26			
MP % DMI	11.68			

Optimizer settings

Objectives of Optimization

Primary
- ( ) Minimize Total Ration Cost
- ( ) Minimize Purchased Ration Cost
- (•) Maximize IOFC
- ( ) Maximize IOpurFC

Secondary
- [x] Maximize Milk Efficiency
- [ ] Maximize Milk Production
- [ ] Maximize Productive Nitrogen
- [ ] Maximize Forages Content

Amino acid optimization

	Supply	Balance	% Req.	Milk lbs
ME Mcal/day	75.93	1.38	101.8	109.24
MP g/day	3,191.2	58.9	101.9	109.36
Met g	76.6	-0.7	99.1	2.40 %MP
Lys g	217.6	-2.0	99.1	6.82 %MP
Lys:Met		2.84:1		
Total EAA g/day	1,515.3	41.9	102.8	47.49 %MP
Met g/Mcal ME	1.01	-0.10		1.11 opt.
Lys g/Mcal ME	2.87	-0.07		2.94 opt.
Total EAA g/Mcal ME	19.96			

PREP10 Evaluation – Ver. 4.0.1

Animals Inputs | <Recipe CNCPS 6.55> [Lactating Dairy Cow] | Comparisons [1] | Optimizer | P-Size | Mixer Wagon | Step Feeding | Info | PREP10

Ingredients	DM lbs	% DM
Triticale Silage 2016	18.00	36.00
Corn Silage 2-29-16	7.00	14.00
Corn Silage [HEIFER] 2-29-16	3.00	6.00
Corn Grain, ground fine	12.94	25.88
Soybean meal	4.00	8.00
Roasted Soybeans, whole	3.00	6.00
Soybean Hulls	0.51	1.03
Molasses	0.04	0.09
Lactating Mineral 3-15-16	1.50	3.00
Totals	**50.00**	

CNCPS Summary	Supply	% Req.	Milk lbs
ME Mcal/day	61.64	111.6	85.98
MP g/day	2,562.3	115.3	89.90
ME Mcal/lbs	1.23		
MP % DMI	11.30		

PAPILLON Feed Efficiently

Hannigan, White, et al 2016 (submitted JDS)

Date	Milk	Fat-7	Prot-7	TMR DM lbs	EC-DME	DMI-7	ECM-7
6-May	73.9						
7-May	73.6						
8-May	73.0						
9-May	73.5	3.63	2.97	50.1	**1.48**	**50.1**	**74.0**
10-May	73.3						
11-May	72.6						
12-May	74.8						
13-May	76.5						
14-May	73.2						
15-May	71.6						
16-May	72.2	3.62	2.98	50.0	**1.48**	**50.0**	**73.9**
17-May	70.3						
18-May	68.9						
19-May	70.0						

Date	Milk	Fat-7	Prot-7	TMR DM lbs	EC-DME	DMI-7	ECM-7
6-May	73.9						
7-May	73.6						
8-May	73.0						
9-May	73.5	3.63	2.97	50.1	**1.48**	**50.1**	**74.0**
10-May	73.3						
11-May	72.6						
12-May	74.8						
13-May	76.5						
14-May	73.2						
15-May	71.6						
16-May	72.2	3.62	2.98	50.0	**1.48**	**50.0**	**73.9**
17-May	70.3						
18-May	68.9						
19-May	70.0						

Traps

- Getting so caught up in precision feeding that we miss the big picture associated with feeding efficiently
  - Don't forget what happens at the feed centers

Feeding Efficiently –What is most important?

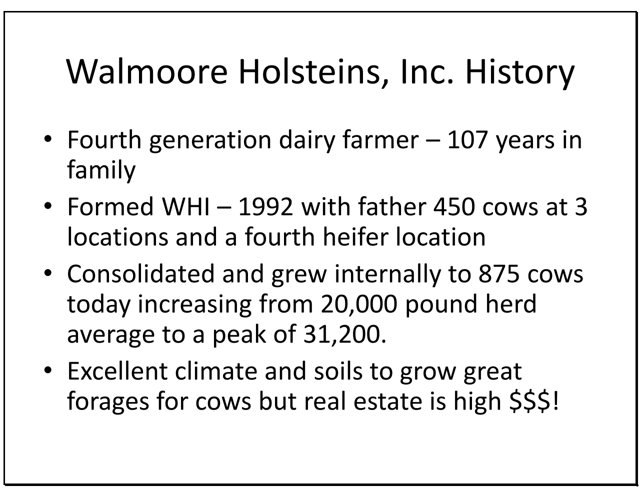
- The cows
- The feeder
- Forage moisture adjustments
- Knowing your model and software platform
- Accurate description of animal inputs
- Forage analysis details
- Ration formulation expertise

Thank You

ATLANTIC DAIRY CONSULTING

FINDING THE MAXIMUM MARGIN BY EFFICIENT FEEDING AND MANAGEMENT PRACTICES IN THE "100 LB HERD"

Walt Moore
Walmoore Holsteins, Inc.



Walmoore Holsteins, Inc. History

- Farm approximately 1750 acres.
- Excellent climate and soils to grow great forages for cows but real estate is high $$$!

Walmoore Holsteins, Inc.
5 Key areas to strive for 100 pounds

- Transition cow management
- Forage quality
- Milk quality/Cow comfort
- Reproduction
- Team – management and labor

Walmoore Holsteins, Inc.

- **Consistency, consistency, consistency**
- Critical in all aspects of the dairy – cows want it and thrive when their routine is as consistent as possible

WHI Transition Cow Management

- Transition cow barn
  - Excellent cow comfort and **LOW** stress environment
  - diet formulated just for this group

WHI Transition Cow Management

- Calving Barn – "just in time calving"
  - Calving protocols are key here
  - Clean and well maintained pens

WHI Transition Cow Management

- Grouping
  - All cows are dried off with a dry cow therapy and Orbeseal and put in "Far-off" dry group with a "bulky" diet until…
  - They are put in the pre-fresh group 3-4 weeks prior to due date
  - Pre-fresh group is fed a low calcium diet higher in energy and protein than "Far-off" group.

WHI Transition Cow Management

- Springing heifers
  - We take the entire pre-fresh group through the parlor 2X per week to run them through the footbath. This helps the heifers get comfortable with the parlor prior to her ever being milked – LOWERS STRESS

WHI Transition Cow Management

- Post fresh group
  - The cows and heifers are housed together in this group, they are milked 3X and they stay in here for a maximum of 3 weeks. Then they are sorted to a first lactation pen or mature cow pen.

WHI Forage Management

- We mainly grow 3 types of forages for our herd
- Corn Silage, Alfalfa/grass Haylage mixture and Triticale
- I am the primary Chopper operator – can "micromanage" on the fly

WHI Forage Management

- Corn Silage – we use the PDMP trials to help us select excellent CS varieties that work well in my geographical area
  - I like varieties that show consistency over 2 or more years with high starch and high NDFD

WHI Forage Management

- Corn Silage
  - At harvest we have the nutritionist at the bunk checking LOC, moisture (I like 64-67%), and processing until we "dial in" the harvester for that years crop

WHI Forage Management

- Corn Silage
  - Inventory – we like to have enough carry over to last until at least December 1st each year. This really helps keep production consistent as we transition from old crop to new.
  - Plan to have enough of a variety to fill a bunker so that it is consistent through the whole bunk.

WHI Forage Management

- Haylage
  - We intercede tall fescue with our alfalfa
  - We mow in wide swaths and try to cut as much the same day or shortest window possible to capture the sugars,
  - Prefer 60% moisture but we won't harvest greater that 65% moisture

WHI Forage Management

- Haylage
  - We cut 4 times per year instead of 5 or 6 – we would rather grow NDF for the cows than have to buy it in the form of low quality hay or straw – also cuts down on harvest costs
  - Cure Haylage at least 3 weeks
  - Partition lower quality Haylage by field or load to heifer bunk

WHI Forage Management

- Analysis
  - Don't skimp on analysis – we like to run NIR for quick results then follow up with a wet chem to "dial it in"
  - Run Dry matters on forages at least weekly – more often as transitioning into a new bunk

WHI Forage Management

- PACK, PACK, PACK!!

WHI Feeding Management

- Consistency:
  - Feeding time, forages, other ingredients, weights, mixing time etc.
  - We record refusals daily and track DMI daily for all groups
  - We like upright bins for more accurate weights and less shrink and spoilage of feeds
  - Use a bunk defacer – keeps face straight, consistent and doesn't introduce oxygen prematurely to the bunk face.

WHI Feeding Management

- Grouping
  - We have 2 dry cow groups
    - Far off
    - Springer
  - We have 4 lactating groups
    - Post fresh
    - High mature cow
    - High first lactation
    - Low groups both multiparous and uniparous

WHI Feeding Management

- MUN's – our Coop provides MUN's on every tanker load – we monitor to help determine if the ration is "dialed in"
- Fecal Starch – we periodically check this the same day we take a TMR sample to compare the passage rate of the starch

WHI Feeding Management

- Shop commodities – buy right
- Some "by-products" not really a bargain.

WHI Record Keeping

- We have done enterprise accounting for >30 years
- Our four areas
  - Dairy
  - Young stock
  - Corn
  - Alfalfa/Triticale

WHI Record Keeping

- Enterprise accounting helps us:
  - Know our cost to raise a ton of CS or Alfalfa haylage
  - Know the cost of a replacement heifer
  - Know the cost of production
  - Knowing the cost to raise your feeds more accurately allows the nutritionist and the computer software "to OPTIMIZE" my diets

WHI Record Keeping

- Do you know what the addition of that particular ingredient costs you?
- If I can optimize my diet and save $.25 per cow per day with out giving up milk production – I save $80,000 per year in feed cost!

WHI Record keeping

- Marginal Milk
  - This is the milk that is made after all other expenses and overhead is covered.
  - Basically the only cost in this "marginal milk" is the maintenance cost for that cows feed.
  - At $16.00 milk we calculate that every additional pound of marginal milk nets us $31,000 annually.

WHI Milk Quality

- Cow cleanliness:
  - Starts with clean comfortable cows!
  - We bed with recycled sand 2X/week
  - Groom stalls every milking
  - Flush barns 3X per day – keeps very clean

WHI Milk Quality

- Sand bedding
  - Designated person to manage our sand lanes and sand quality – communicates with Herd manager
  - Use recycled every where except pre-fresh group
  - Needs to be as dry as possible going back into barn

WHI Milk Quality

- Sand bedding
  - Added benefit is good footing in the barns
  - In-organic – doesn't promote bacterial growth

WHI Milk Quality

- Milking routine
  - Clean cows
  - Must have a consistent milking routine among all milkers
  - Use cloth towels
  - Good quality teat dip
  - Calm, comfortable, consistent parlor environment to stimulate excellent letdowns

WHI Cow comfort

- Ventilation
  - High side walls with adjustable curtains
  - BIG fans to move a lot of air
  - Sprinklers that soak cattle quickly
  - FANS and Sprinklers are extremely important in the holding pen

WHI Cow comfort

- Other
  - Foot trimming – all cows are maintenance trimmed 2X per year
  - Footbaths – all cows go through a footbath 2X week
  - Heifers greater than 10 months old go through a foot bath 2X per month

WHI Reproduction

- Use Ovysnc with resync program
  - Must adhere to the program and be consistent for it to drive Pregnancy rate
  - critical to get cows bred back timely so they are in the peak of their lactation curve
  - 70 day VWP
  - Our goals – Percent of the herd bred by 80 DIM = 100%, percent of herd pregnant by 150 DIM = 80%
  - Preg rate goal – on Rep Mon scale – 30%

WHI Reproduction

- Young stock
  - Bred off of standing heats
  - Start breeding at 12.5 months at our farm – must grow them so they are big enough
  - Age at first calving is 22-23 months

WHI Reproduction

- Inseminators
  - Must be well trained and performance monitored

WHI Labor Management

- At Walmoore
  - I am General manager and specifically oversee crops and nutrition
  - Charlene – Herd and young stock manager
  - Enrique – assistant to Charlene
  - Charlie – shop manager
  - Donny - Sand and manure management manager
  - Judy – office/safety manager

Walmoore Holsteins, Inc.
Mission Statement

Produce high quality milk in a fun and team spirited manner, while we make a profit, provide a comfortable standard of living for the owners and employees and positively impact our environment and community.

WHI Labor Management

- S.M.A.R.T. Goals

  - Annual goals

Walmoore Holsteins, Inc.

1826 HowellMoore Road
West Grove, PA 19390
610-869-3940
FAX 610-869-2076

2013 Goals:

- 23,700,000 lbs of milk
- Less than 150,000 SCC average for the year
- Greater than a 28% pregnancy rate for year
- Finish the year with >850 cows with a 30% non-dairy cull rate
- Ship 75,000 pounds in a day
- Increase actual Herd average to >29,000 pounds per cow
- Average 100 lbs per cow per day for a week
- Average >95 pounds for at least 2 months
- Ship at least 1.85 million pounds every month
- Harvest all corn silage in the 64-68% moisture range and process to the new standards
- Harvest enough corn for all grain needs
- Corn silage yield average to exceed 26 tons/acre
- Increase multi crop acres to maximize yield per acre
- Have all haylage test better than 19% protein and yield >18 tons per acre
- Service equipment on a more timely basis
- Redefine breeding and culling parameters and implement
- Reduce unnecessary mistakes, repairs, and down time
- Have no lost work time do to injury
- Continue to have fun
- Continue to make a profit
- Celebrate our successes!

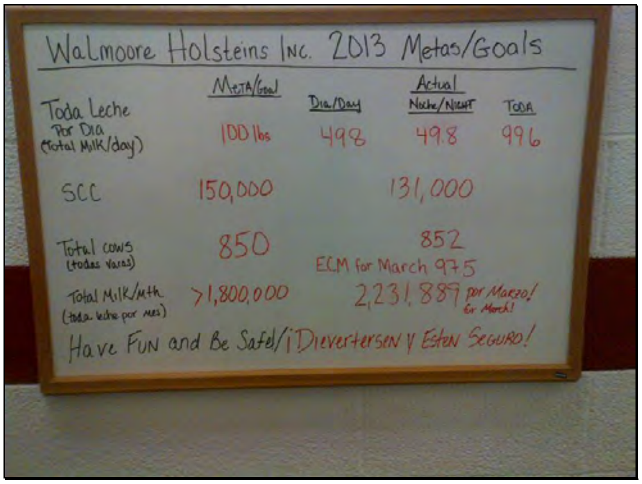
Walmoore Holsteins Moosletter
November 2014

Milk quality: The SCC averaged 119,000 this month. (Target is 150,000 or less). This is 4,000 lower than last month. The bacteria counts were excellent in October.
Cow of the month: 6661 topped the charts for this month with an average of 172 lbs.! She gave 172 pounds on 10/26! We had 372 cows over 100 lbs. during the last week (an increase of 58 from last month) leaving the record at **416** cows over 100!
Out in the fields: We planted 100 acres of Triticale and Crimson Clover as well as 14 acres of wheat. We harvested approximately 200 acres of corn for grain with the first yielding 215 bushels per acre on a dry basis! We emptied the first stage lagoon at Unit 2, both pickets at unit 2 and 3 as well as the unit 4 lagoon twice!
Barn projects: The demolition of the pig barn started and the excavation for the new 108 stall heifer barn should start Monday! We also plan to pour a concrete floor in the liquid side of the Unit 3 lagoon this month.
Herd the News: The cows averaged a record breaking **99.6** pounds per cow during the month of October which is up 4.7 pounds from September's average!! We had 31 days over 90lbs and 29 days over 95lbs and 17 over 100! This is a new record for most days over 100 and for the monthly average - **Unbelievable!!** Our single day shipment record stands at **76,880** pounds on April 10th, 2014. Our cow number record stands at **864!** We set a new milk per cow record of a whopping **102.7** lbs per cow on **May 10th, 2014!** March 2013 sets the record as Walmoore's biggest single shipment month ever at **2,231,889** lbs!
Total volume of milk shipped goal: **26,000,000** lbs.: January = 2,228,622, February=1,973,425, March = 2,217,375, April=2,224,867 May=2,237,363 June=2,073,296 July= 2,106,646 August=2,127,671September=2,082,049 October=2,247,512
This is 82.8**%** of our goal! Whereas 83.3 % of the goal period has elapsed.

- Bulk tank Somatic Cell Count **Goal = <150,000 avg.**(SCC)-YTD- avg. = 149,625
- To maintain a **30%** non-dairy cow culling rate or less-January 1 to date = 35.9%
- Pregnancy rate **Goal > 24%** Rolling pregnancy rate = 22%, YTD = 21%
- Cull cows sold in first 60 DIM **Goal < 8%** Actual = 2.6%
  - Reduce lame cows to less than 12 per month average. 16/month October
  - Reduce mastitis incidence to less than 3% rolling average. October = 3.91%
  - Average at least **850** cows - Year to date avg. = 839.3
  - Average 2.5 serv/conc or less at Unit 2 –October = 2.6
  - Average 1.8 serv/conc or less at Unit 3 – October = 1.5
  - To achieve the highest milk quality bonuses possible. January 2nd , February 2nd, March 2nd, April 3rd May 3rd, June 3rd, July 3rdAugust 3rd September 3rd
  - We are up to 290 lost time injury free days. KEEP BEING SAFE!

Holiday Party at Walt and Ellen's home on December 13th
Happy Birthday! – Luke on the 18th

2014 Goals: Produce 26,000,000 lbs. of milk, make an average of 97 lbs/cow/day for at least 2 months, make 100 lbs. average for at least a week, increase our herd average to > 30,000 pounds per cow, ship more than 2 million pounds every month, maintain herd size >850cows, continue to reduce mastitis incidence and average 150,000 or less SCC, make excellent quality forages making sure we optimally process the corn silage, and achieve greater than 17 lbs. per cubic foot of silage in the bunkers, try different cropping practices to maximize the yield from our acres, explore new manure handling options, celebrate our successes and continue to improve our farm's aesthetics and neighbor relations, and finally, BE SAFE, HAVE FUN and make a PROFIT!



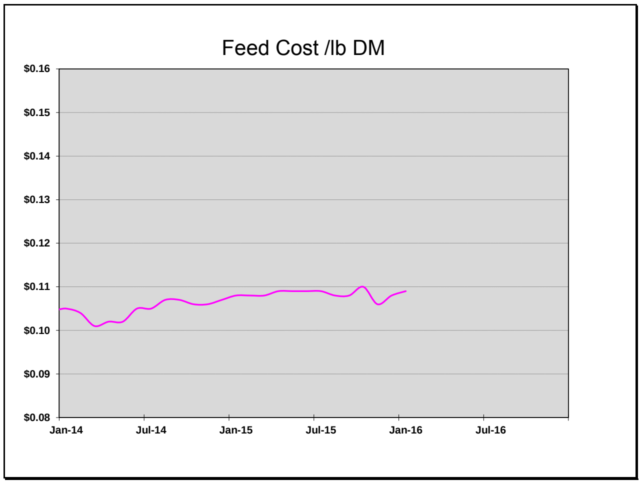
WHI Labor Management

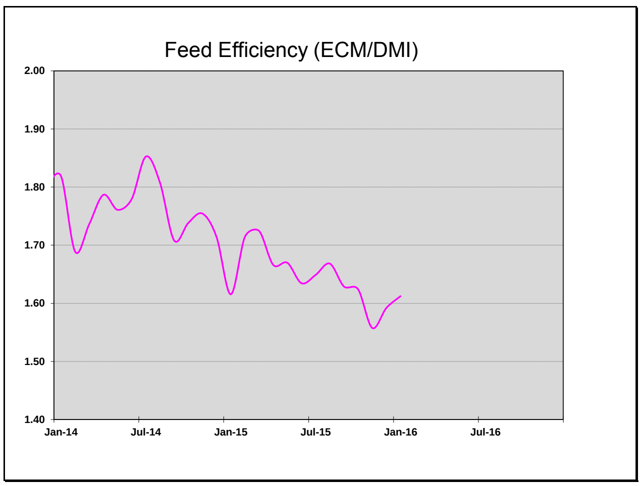
- Staff meetings
- Monday morning meetings
- Safety meetings
- Monthly schedules posted with routine jobs and a person assigned to it.
- Need to have engaged and empowered team.
- Hard to <u>communicate</u> too much!

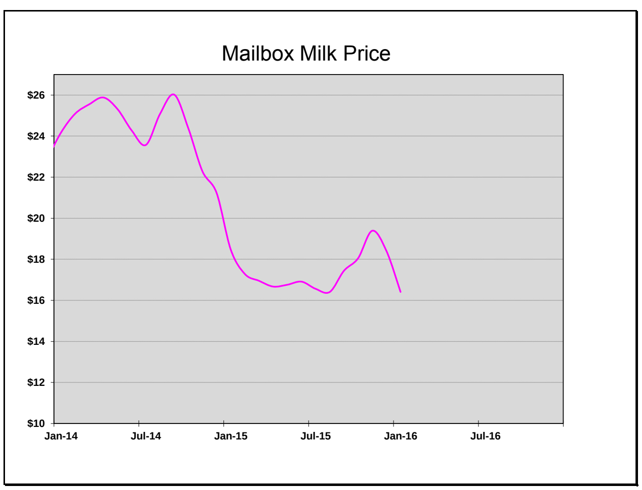
WHI Labor Management

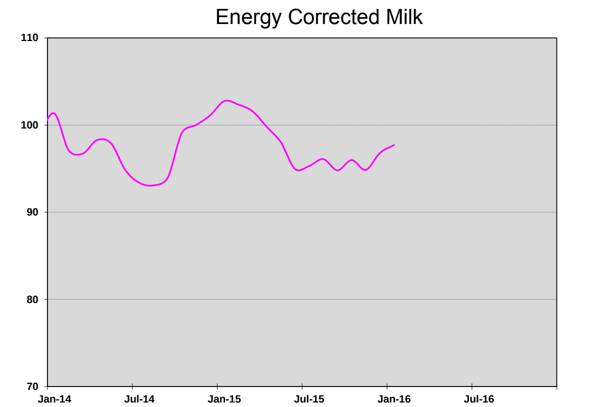
- Have fun!
- Celebrate successes!

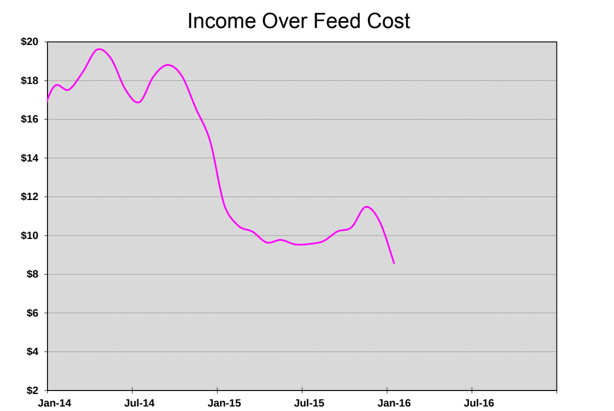

EMPLOYEE RIGHTS
Walt


Feed Cost /lb DM
$0.16
$0.15
$0.14
$0.13
$0.12
$0.11
$0.10
$0.09
$0.08
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16


Feed Efficiency (ECM/DMI)
2.00
1.90
1.80
1.70
1.60
1.50
1.40
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16


Mailbox Milk Price
$26
$24
$22
$20
$18
$16
$14
$12
$10
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16





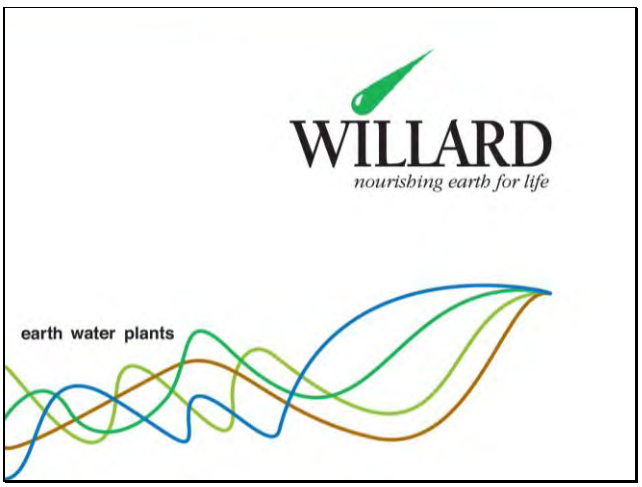
WHI 2015 Metrics

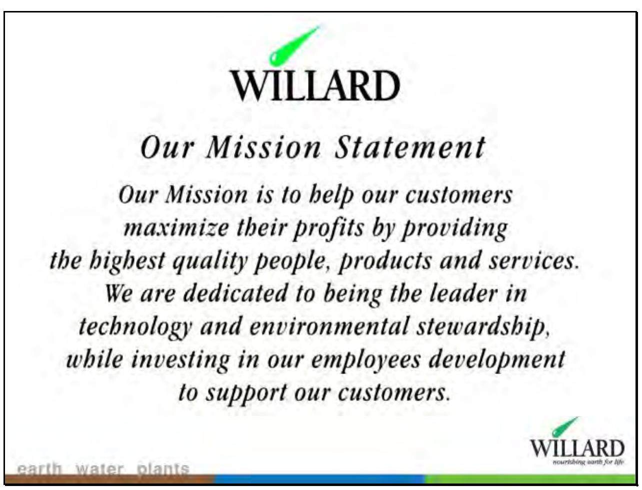
- 30,600 pound herd average on 880 cows – 70% milked 3X – with rBST for 9 months
- BF – 3.7%, 3.0% protein – 2051 pounds combined solids
- Culls in the first 60 DIM < 5%
- 29.6% Rep Mon preg rate
- 133,000 SCC average for 2015 – last 3 months average less than 100,000
- Age at first calving – 22.5 months


WALMOORE HOLSTEINS INC

EMERGING TECHNOLOGIES THAT ENHANCE NUTRIENT UTILIZATION EFFICIENCIES THROUGH PRECISION APPLICATION OF PLANT NUTRIENTS AND CROP PROTECTION PRODUCTS

Jamie Kimbles
Willard Agri-Service





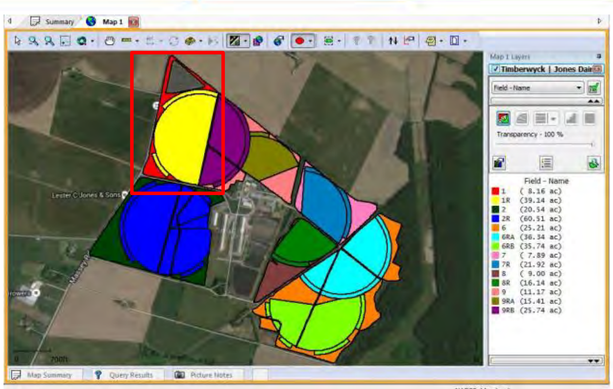
Improving Yield and Feed Quality

- **Balanced Nutrition**
  - Soil and Manure Testing
  - Yield Goal (Attainable)
- **New Technology**
  - Variable Rate (If Necessary)
  - Bio-stimulants
  - Nitrogen Modeling

Balanced Nutrition: Back to the Basics

- **Soil Sampling**
  - Still a very critical step to establish a nutrient recommendation.
  - How should I be sampling my fields? Can I take one composite sample or do I need to break my field into different management zones?
  - What are some different management zones?
    - High Yield vs. Low Yield
    - Soil Type
    - **Irrigation vs. Dryland**

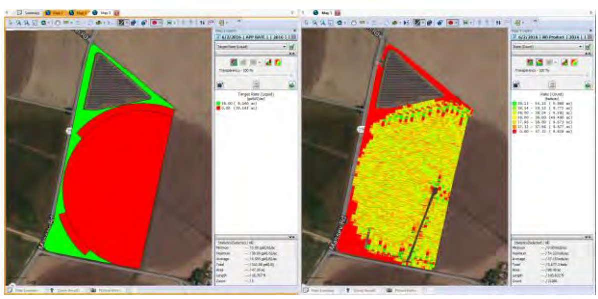
Management Zones:



Irrigated vs. Dryland (Yield)

WILLARD
nourishing earth for life

Variable Rate Technology



WILLARD
nourishing earth for life

Balanced Nutrition: Back to the Basics

- **Manure Sampling**
  - Manure is extremely inconsistent
  - When and How are you sampling? How often do you sample?
  - Do you really know what you are getting out of the manure? How much of the OrgN is actually mineralizing in a particular year?

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Balanced Nutrition: Back to the Basics

– **Yield Goals**
  - Are your yield goals Actual, Attainable, or Frontier Yield Goals
  - Is your yield potential consistent across your entire field? If not, how are you accounting for those differences?
  - Are you meeting your yield goals?

Balanced Nutrition

Nutrient Inputs need to be balanced to sustain the system at optimum productivity through the life of the crop.

Manure

Starter Fertilizers

Broadcast or Pre-Plant Nutrients

Side-dress

Starter Fertilizers w/ Nutrient Enhancers

biogrowth-NE

Ascend®

WINFIELD

biogrowth-NE + Ascend + Starter

Starter Only

Nutrient Enhancers

Untreated: Starter Only

biogrowth-NE + Ascend® + Starter

WILLARD

Balanced Nutrition

Nutrient Inputs need to be balanced to sustain the system at optimum productivity through the life of the crop.

- Manure
- Starter Fertilizers
- Broadcast or Pre-Plant Nutrients
- Side-dress

WILLARD

- Modeling…

ECO N®

an ecological nutrient system

earth water plants

WILLARD

Current Nitrogen Management

Estimated Yield Based Recommendations

- Can't predict yield in April
- Yield Potential changes throughout the year

In-Season N Management

- PSNT
- Tissue Sampling
- Greenseeker, OptRx
- **Educated Guess**
- Stalk Nitrate Testing (End of season)

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ECO N Nitrogen Model

Modeling/Monitoring N throughout the growing season

Making a better, more informed N management decision in-season

WILLARD

What are we modeling?

- Crop Growth
- Nitrogen Uptake
- Nitrogen Availability/Loss

WILLARD

Demand ...of the crop

Supply ...capacity of the soil

earth water plants

WILLARD

The model – 4 Key inputs…

- Field Characteristics
- Crop Management
- Nitrogen Applications
- Daily Weather data for N Mineralization

earth water plants

WILLARD

Why Should we Monitor/Model Nitrogen?

The SOIL

One key concept is this:

All fields vary in the ability to store water

& therefore the ability to supply N !

WILLARD

Key Points…

A Model is no better than the data you put into it!!!

We have the ability correct the data in our model if it is inaccurate!

earth water plants

WILLARD

What makes Modeling Unique for Dairy operations?

- **Manure Utilization**
- **Nutrient Use Efficiency**
- **Zone Management**
- **In-Season Plant Tissue Testing**

earth water plants

WILLARD

Improving Feed Quality

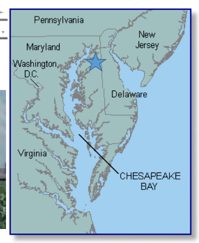
- **Balanced Nutrition**
  - Soil and Manure Testing
  - Yield Goal (Attainable)
- **New Technology**
  - Variable Rate (If Necessary)
  - Stabilizers and Biostimulants
  - Nitrogen Modeling

WILLARD

MAXIMIZING PROFIT PER ACRE WITH DAIRY COWS AS THE CENTER PIECE OF FARMING OPERATIONS IN THE ENVIRONMENTALLY FRAGILE CHESAPEAKE BAY WATERSHED

Sean Jones
Lester C. Jones and Sons Inc.

JONES FAMILY FARM
LESTER C. JONES & SONS, INC.
Massey , Maryland



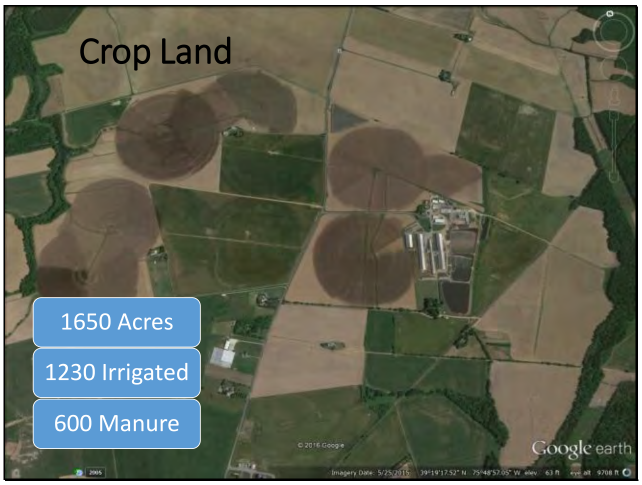
Maximizing profit per acre with dairy cows as the center piece of farming operations in the environmentally sensitive Chesapeake Bay Watershed.

Cows

- 1220 Milking
- 130 Dry Cows
- 1400 Replacements
- 38 Million Pounds Milk

JONES FAMILY FARM

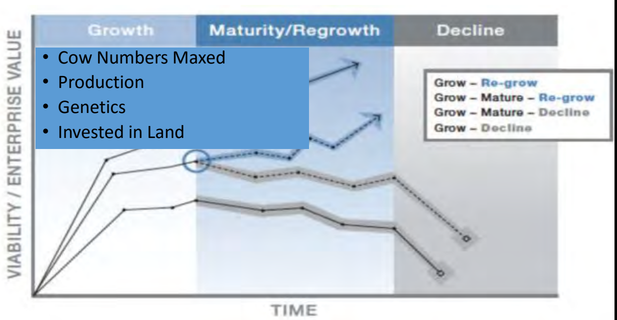
Crop Land



- 1650 Acres
- 1230 Irrigated
- 600 Manure

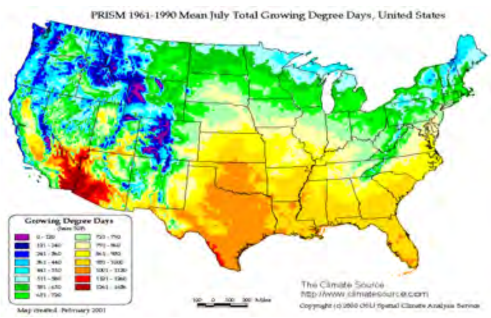
Mature Business

- Cow Numbers Maxed
- Production
- Genetics
- Invested in Land



JONES FAMILY FARM

Utilize Growing Degree Days



JONES FAMILY FARM

Cropping Decisions

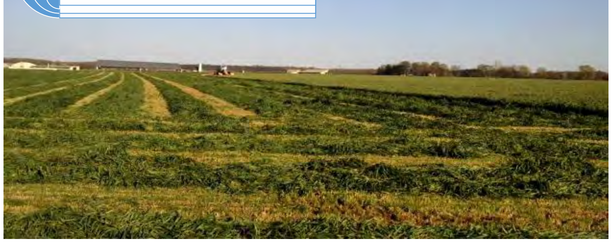
Forage First

- Quality
- Quantity
- Match Nutritional Needs of Animals

JONES FAMILY FARM

Boot Stage Silage

- Rye – 179 Acres
- Triticale – 480 Acres
- Wheat – 90 Acres

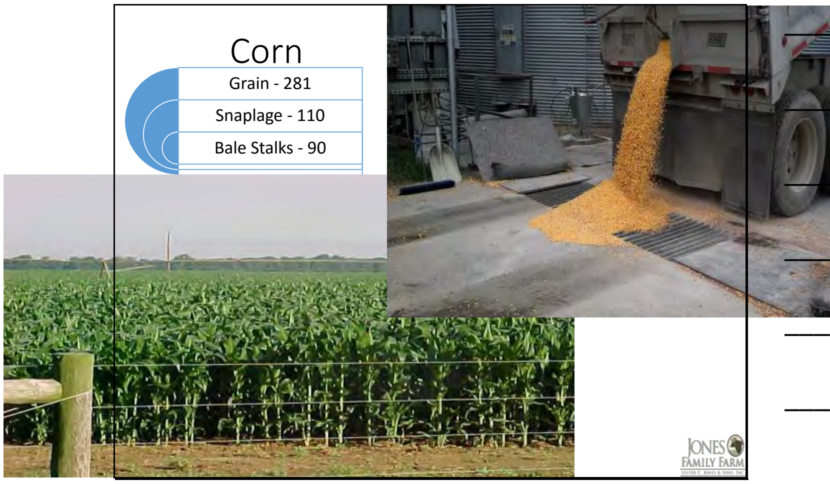


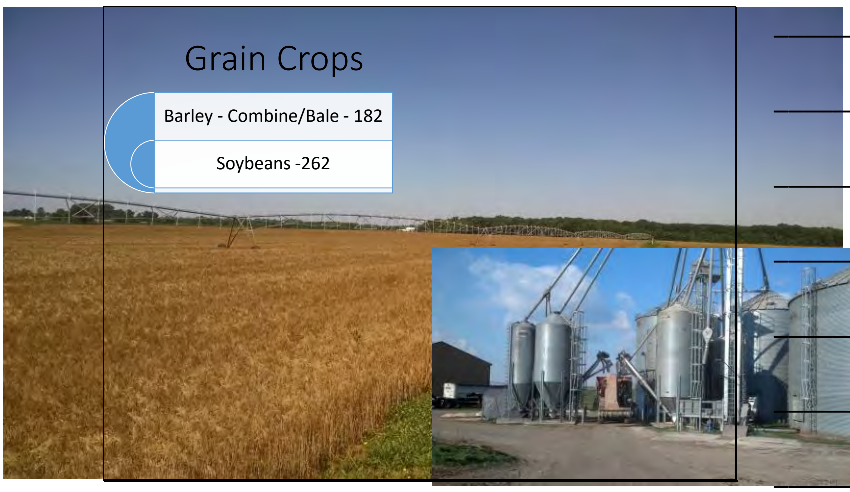
JONES FAMILY FARM

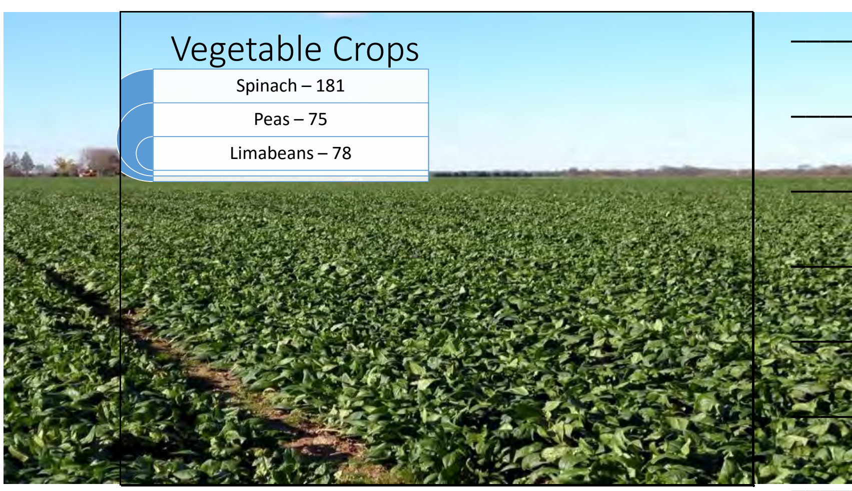

Direct Cut Dough Silage
Barley -293 Acres
Triticale – 34 Acres
JONES FAMILY FARM


Corn - Silage
506 Acres Conventional
410 Acres BMR
89-120 DRM

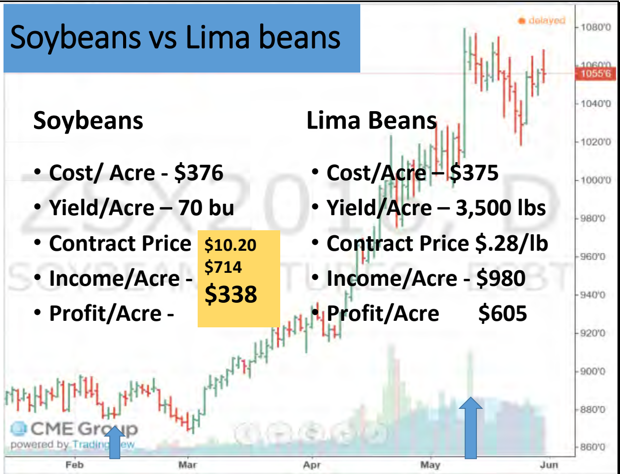

Other Forage
• MasterGraze – 20 Acres
• Spring Triticale – 50 Acres


Corn
Grain - 281
Snaplage - 110
Bale Stalks - 90
JONES FAMILY FARM


Grain Crops
Barley - Combine/Bale - 182
Soybeans -262


Vegetable Crops
Spinach – 181
Peas – 75
Limabeans – 78

Soybeans vs Lima beans



Soybeans

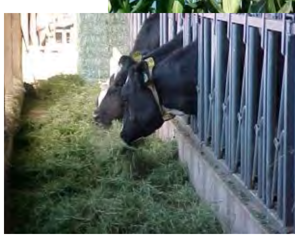
- Cost/ Acre - $376
- Yield/Acre – 70 bu
- Contract Price $10.20
- Income/Acre - $714
- Profit/Acre - $338

Lima Beans

- Cost/Acre – $375
- Yield/Acre – 3,500 lbs
- Contract Price $.28/lb
- Income/Acre - $980
- Profit/Acre $605

Cows vs Crops

- Good Genetics
- Balanced Nutrition
- Good Health
- Luck



JONES FAMILY FARM

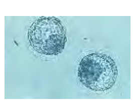
Genetics

Cows

- AI
- Genetic Selection
- IVF

Crops

- Seed Selection



WILLARD HighQ

PDMR Professional Dairy Managers of Pennsylvania

DEKALB

SELECT SIRES

CLARIFIDE plus Click here for more information.

semex

Dow AgroSciences Mycogen Seeds

PIONEER A DuPont Company

JONES FAMILY FARM

Nutrition

Cows

NDS

Crops

EcoN
an ecological nutrient system

Jones Family Farm

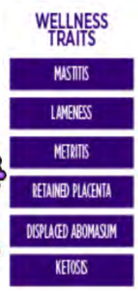
Health

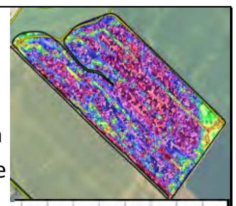
Cows

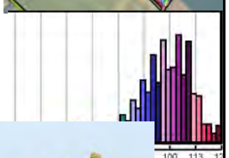
- Transition Cow
- DWP$
- Vaccine

Crops

- Irrigation
- Fungicide



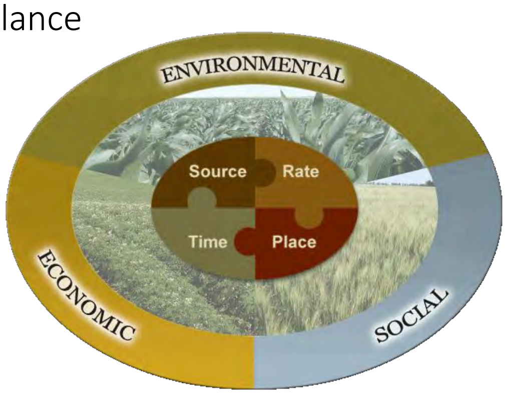




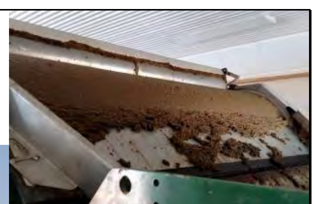
Jones Family Farm

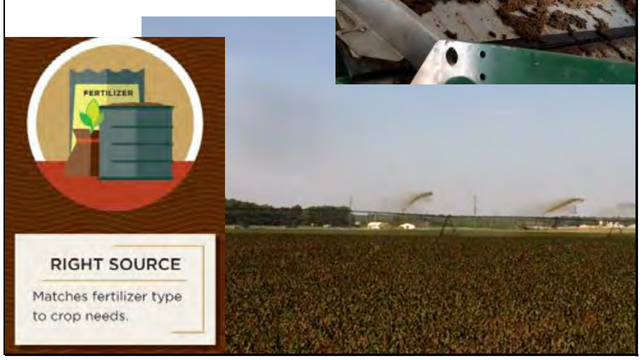
Challenge

Balance



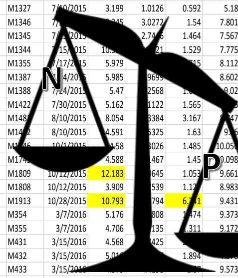
Source -Manure





Rate - Sampling

Type	Number	Date	Total N	Ammonium	P205	K20	Available N	Organic N	N/P
Calf Barn	M1132	6/1/2015	38.652	18.5749	14.244	57.698	16.31444	20.0771	1.14535
Solids	M1270	6/25/2015	7.781	2.2811	2.812	4.221	3.065515	5.4999	1.09015
Calf Barn	M1610	9/4/2015	37.892	23.1397	15.326	58.467	16.73316	14.7523	1.09181
Solids	M1600	9/17/2014	5.158	1.73	1.43	3.426	2.0648	3.428	1.44391
L1	M1271	6/25/2015	8.886	3.9941	4.227	8.442	3.709215	4.8919	0.87750
L1	M1129	6/1/2005	11.02	5.9556	5.415	11.052	4.75034	5.0644	0.87725
L1	M1914	10/28/2015	10.081	5.2377	3.438	11.968	4.314005	4.8433	1.25480
L2	M1295	7/2/2015	3.715	1.3976	1.64	7.297	1.50989	2.3174	0.92066
L4R	M1294	7/2/2015	5.932	1.3774	0.634	5.473	2.28281	4.5546	3.60064
L2	M1328	7/10/2015	5.716	2.7865	1.36	7.5	2.418575	2.9295	1.77836
L4R	M1327	7/10/2015	3.199	1.0126	0.592	5.18	1.27154	2.1864	2.14787
L2	M1346	[illegible]	[illegible]	3.0272	1.54	7.801	3.72483	6.3178	2.41872
L2	M1345	[illegible]	[illegible]	[illegible]	1.464	7.567	3.34644	5.6404	2.2858
L2	M1344	[illegible]	[illegible]	[illegible]	1.529	7.775	4.168715	7.5219	2.72643
L2	M1355	[illegible]	5.979	[illegible]	[illegible]	8.112	2.61723	2.4818	1.52608
L2R	M1387	[illegible]	5.985	[illegible]	[illegible]	8.602	2.540235	3.0151	1.63044
L2R	M1388	[illegible]	5.47	[illegible]	[illegible]	[illegible]	2.40302	2.2132	1.4751
L2	M1422	7/30/2015	5.162	[illegible]	1.565	[illegible]	2.27353	2.0498	1.45273
L2	[illegible]	8/10/2015	8.054	[illegible]	3.167	[illegible]	3.31966	4.7156	1.04820
L2	[illegible]	8/10/2015	[illegible]	[illegible]	1.63	[illegible]	1.986725	2.0585	1.2188
L2R	[illegible]	[illegible]	[illegible]	[illegible]	1.485	[illegible]	2.09839	1.2774	1.41305
L2	[illegible]	[illegible]	4.588	[illegible]	1.45	[illegible]	2.077805	1.4413	1.43296
L2R	M1809	10/12/2015	12.183	[illegible]	[illegible]	9.661	[illegible]	9.1185	4.48596
L2	M1808	10/12/2015	3.909	[illegible]	[illegible]	8.983	[illegible]	1.1551	1.5805
L3	M1913	10/28/2015	10.793	[illegible]	[illegible]	9.431	[illegible]	5.5136	0.67786
L3	M354	3/7/2016	5.176	[illegible]	[illegible]	9.373	[illegible]	0.8952	1.66466
L3R	M355	3/7/2016	4.706	[illegible]	[illegible]	9.172	[illegible]	0.571	1.72948
Solids	M431	3/15/2016	4.568	[illegible]	[illegible]	[illegible]	[illegible]	2.8255	0.80007
Solids	M432	3/15/2016	[illegible]	[illegible]	1.894	[illegible]	1.892505	4.1033	0.99921
L3	M433	[illegible]	[illegible]	[illegible]	[illegible]	9.573	2.26712	0.1492	1.35755
L3R	M434	3/15/2016	6.48	4.547	1.299	9.179	2.95005	1.933	2.27101
L3R	M447	3/18/2016	5.816	4.0546	1.474	9.025	2.64379	1.7614	1.79361
L3	M446	3/18/2016	6.839	4.1628	1.542	9.249	3.01807	2.6762	1.95724



Fluidized Bed Reactors – Struvite Removal

Time-Manure Irrigation

34,000,000 Gallons

	Lbs per 1000 Gals	As Recv	Lbs per Ton
% MOISTURE		99.1	
% SOLIDS		0.9	
% TOTAL NITROGEN	4.579	0.055	1.090
% AMMONIUM NITROGEN	4.4298	0.0527	1.0547
% P2O5	1.670	0.020	0.398
% K2O	9.573	0.114	2.279

CONSIDERATIONS

FOR THE USE OF

MANURE IRRIGATION PRACTICES

Report from the Wisconsin Manure Irrigation Workgroup

Manure irrigation in Great Lakes states

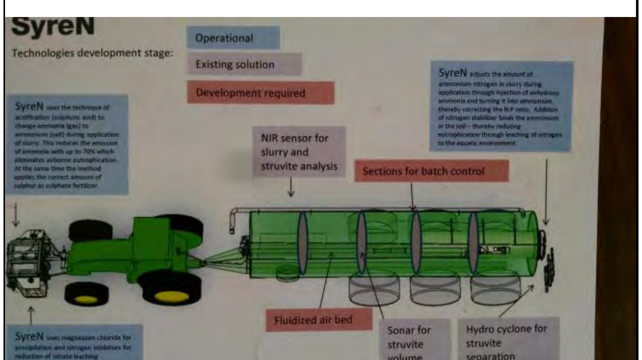
Ninety-five percent of the big swine farms in North Carolina irrigate crops with liquid manure, though it's now restricted for new or expanding operations. In the Great Lakes, the practice is still relatively rare.

State	Extent of use	Setbacks include	Other restrictions	Complaints
Illinois	Used on a few farms	1/4 mile, or 1,320 ft., from homes	If applied within 1/4 mile of home, must be incorporated same day	odor
Indiana	Unknown	100 ft. from surface waters	20 inches of soil over bedrock required to spray	none
Iowa	Used on some farms	750 ft. from other homes	Manure from lagoon must be diluted: 15 parts water, 1 part manure	odors, drift, health concerns
Michigan	Used on a few farms	100 ft. from surface waters	No application on grassed waterways that lead to surface waters	odors, flies, hydrogen sulfide poisoning, drift
Minnesota	Used on a few farms	300 ft. from lakes, streams	Prohibited in 10 counties	none
Ohio	Used on a few farms	100-300 feet from various water, land features like wells	Soil types, weather, season considered	odor
Wisconsin	Used on 14 CAFOs	500 ft. from homes	5 feet soil depth to bedrock required	odor, over-spraying, drift, health conc.

Source: Andrew Craig, Wisconsin Department of Natural Resources. The restrictions shown are a small sample of the rules in each state. Reporting: Ron Seely; graphic: Kate Golden, Wisconsin Center for Investigative Journalism.

Denmark

- SyreN
- SyreN+



Solar

UNDERSTANDING DAIRY FEED EFFICIENCY THROUGH GENOMIC SELECTION AND OTHER MANAGEMENT PRACTICES AS WE ANTICIPATE AN 8TH EDITION OF THE NRC NUTRIENT REQUIREMENTS FOR DAIRY CATTLE

Dr. Lou Armentano
University of Wisconsin

Considerations for improving feed efficiency in dairy cattle.

Lou Armentano
Kent Weigel
University of Wisconsin-Madison
Mike VandeHaar
Michigan State University

NIFA dairy feed efficiency team

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K. Weigel,
R. Shaver,
V. Cabrera
M. Wattiaux,
F. Contreras,
S. Bertics,
U. Wisconsin-Madison

M. VandeHaar,
R. Tempelman,
D. Beede,
R. Pursley,
M. Weber-Nielsen
Michigan State University

D.M. Spurlock,
Iowa State University

R. Veerkamp,
J. Dikstra,
Wageningen UR

C. Staples,
U. Florida

M. Hannigan,
Virginia Tech

M. Worku
NCA&T

Many metrics or units possible for milk:feed efficiency

- pounds milk/pound Dry matter intake
- Mcal Milk/lb feed
  - Or Mcal Milk/Mcal (GE? DE? ME? NE?) Feed
- Milk N/ feed N
  - Maximizing this ratio is NOT a profitable choice for deciding dietary protein level for a specific string of cows
  - This ratio **always** drops as increase diet protein to maximize milk and profit
- Waste/milk also decreases with increased efficiency
  - Less manure, less methane, etc. per lb milk

More ways to express milk efficiency

- $ Milk/$Feed
  - ratio above is NOT income 'over' feed cost (IOFC)
  - Note $ value of a Mcal Protein > $ value of Mcal Fat or Lactose in a cheese market
  - Important ratio, **but not the same as Income minus feed cost**
- Should consider feed costs for 'non-milking' part of herd as well:
  - Dry days
  - (Heifer feed + feed for lactating cow growth) – cull value
    - This is (almost?) always a negative number
    - Cull value of a big cow is higher, but cost to raise and maintain her more than negates this

Ways to express Milk energetically

	4.0 FCM	3.5 FCM	ECM
1.0 kg Milk =	0.75 Mcal	0.70 Mcal	0.69 Mcal
1.0 Mcal Milk =	1.33 kg	1.43 kg	1.45 kg

Mcal milk = kg fat * 9.29 + kg true protein * 5.63 + kg lactose * 3.95

Being simple minded, when I want to put milk on an energy basis, I use Mcal, a unit of energy

Even if you get paid the same for a POUND of MILK fat as for a POUND of milk protein YOU ARE GETTING PAID MORE FOR EACH Mcal of protein

Gross efficiency based on NE

- Note: 1 Mcal NEL consumed above maintenance → 1 Mcal milk
  This partial efficiency (slope) = 1
- This is HOW NEL is defined, but realize NEL/lb of feed DM does drop with higher intakes due to digestion depression
- Because some NE is used for maintenance, gross efficiency (Milk energy yield/NE consumed) is always less than 1.0
- High producing cows get closer to this theoretical limit of 1.0
- But each subsequent increase in productivity gives less increase in gross efficiency

Gross vs. marginal (partial, net, true) efficiency

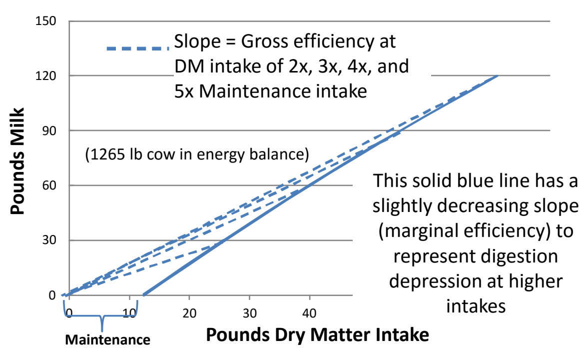
- Marginal efficiency
  Milk out/ (total intake – intake used for maintenance)
- Therefore
  Gross efficiency = marginal efficiency * (total – maint) / total

So as intake and production increase relative to maintenance, multiplier approaches 1;
gross efficiency therefore approaches marginal efficiency

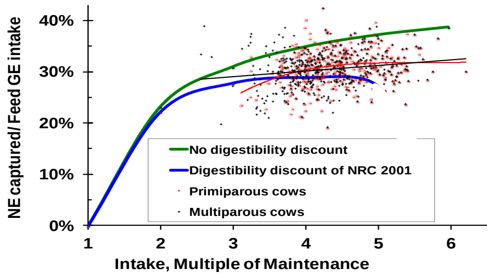
If include 'dry period' feed as maintenance; intake as multiple of maintenance and gross efficiency are both lower

By selecting for milk we got greater gross feed efficiency

not quite so much anymore



Potential that future productivity gains will increase feed efficiency is much less than in past



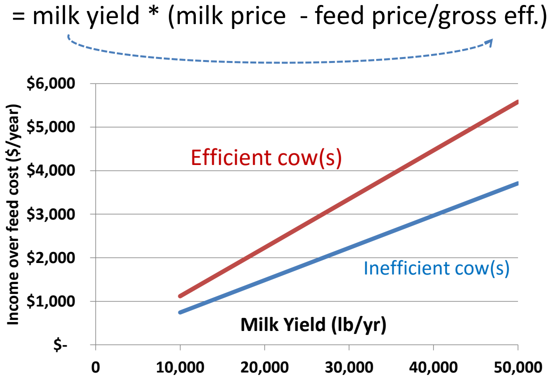
VandeHaar et al, ADSA 2012

Income "over" feed cost

- Income over feed cost (income – feed cost) is a function of:
  - Direct effect of milk production on income
  - Value of milk
  - Cost of feed
  - Gross efficiency
- Gross efficiency is a function of milk production:
  - Ratio of production to maintenance
  - Marginal efficiency
    - (marginal = true, partial, biological etc.)
- So increased milk production per cow increases IOFC by two routes:
    - Increased milk yield and revenue
    - Increased gross efficiency which reduces feed costs

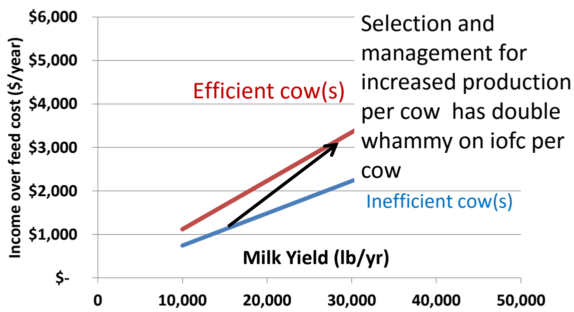
IOFC = income - feed cost

= milk yield * (milk price - feed price/gross eff.)

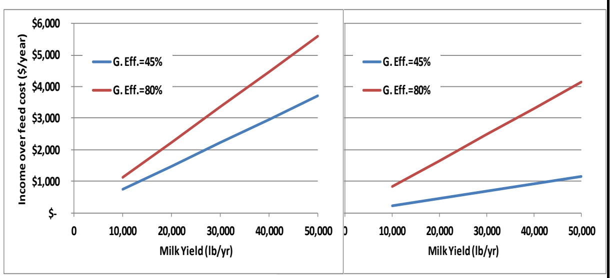


IOFC = income - feed cost

= milk yield * (milk price - feed price/gross eff.)



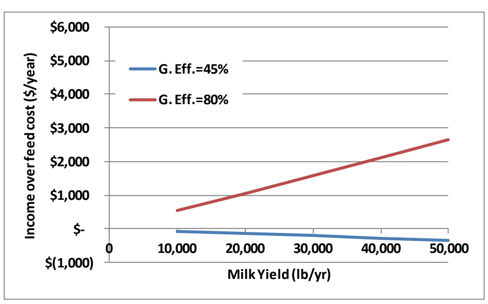
Efficiency more important with higher feed prices (or lower milk price)



$0.0901 per lb feed DM
$16/cwt Milk

$0.146 per lb feed DM
$16/cwt Milk

When prices ridiculous, only efficiency helps



$0.146 per lb feed DM
$13/cwt Milk

To put this in perspective: 2 cows at energy balance

- A 1500 lb cow
- Eating 56 lbs of DM
- With an energy density of .75 Mcal/lb
- Producing 100 lbs of 3.5% fat, 3.0% protein, 5.0% lactose milk
- About .75 milk NE per NE intake (75% gross efficiency, while lactating)
- 1.8 lbs ECM/lb dry feed

- At 120 lbs milk and 64.5 lbs milk intake
  1.9 lb ECM/lb intake, .78 milk NE per NE intake

Production or efficiency?

	marginal efficiency	intake	milk	gross eff	iofc per cow	increase over basal
Basal	normal	56.0	100	0.75	$ 9.40	
More milk	normal	64.5	120	0.78	$11.55	$2.15
				milk $/lb	$0.15	
				feed $/lb	$0.10	

Production or efficiency?

	marginal efficiency	intake	milk	gross eff	iofc per cow	increase over basal	
Basal	normal	56.0	100	0.75	$ 9.40		
More milk	normal	64.5	120	0.78	$11.55	$2.15	
More milk, no change gross efficiency	lower	67.2	120	0.75	$11.28	$1.88	
Basal milk, increase gross efficiency	higher	53.8	100	0.78	$ 9.63	$0.23	
				milk $/lb	$0.15		$0.10
				feed $/lb	$0.10		$0.15

Production or efficiency?

	marginal efficiency	intake	milk	gross eff	iofc per cow	increase over basal	iofc per cow	increase over basal
Basal	normal	56.0	100	0.75	$ 9.40		$1.60	
More milk	normal	64.5	120	0.78	$11.55	$2.15	$2.33	$ 0.73
More milk, no change gross efficiency	lower	67.2	120	0.75	$11.28	$1.88	$1.92	$ 0.32
Basal milk, increase gross efficiency	higher	53.8	100	0.78	$ 9.63	$0.23	$1.94	$ 0.34
				milk $/lb	$0.15		$0.10	
				feed $/lb	$0.10		$0.15	

Production or efficiency?

	marginal efficiency	intake	milk	gross eff	iofc per cow	increase over basal	iofc per cow	increase over basal
Basal	normal	56.0	100	0.75	$ 9.40		$1.60	
More milk	normal	64.5	120	0.78	$11.55	$2.15	$2.33	$ 0.73
even more milk	normal	73.0	140	0.80	$13.70	$4.30	$3.05	$ 1.45
				milk $/lb	$0.15		$0.10	
				feed $/lb	$0.10		$0.15	

Production or efficiency?

	marginal efficiency	intake	milk	gross eff	iofc per cow	increase over basal	iofc per cow	increase over basal
Basal	normal	56.0	100	0.75	$ 9.40		$1.60	
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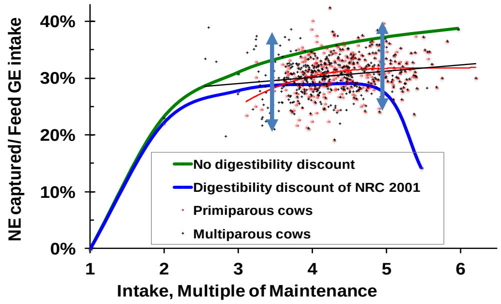
More milk, no change gross efficiency	lower	67.2	120	0.75	$11.28	$1.88	$1.92	$ 0.32
Basal milk, increase gross efficiency	higher	53.8	100	0.78	$ 9.63	$0.23	$1.94	$ 0.34
even more milk	normal	73.0	140	0.80	$13.70	$4.30	$3.05	$ 1.45
				milk $/lb	$0.15		$0.10	
				feed $/lb	$0.10		$0.15	

There is a great deal of unexplained variation in marginal feed efficiency in this data!

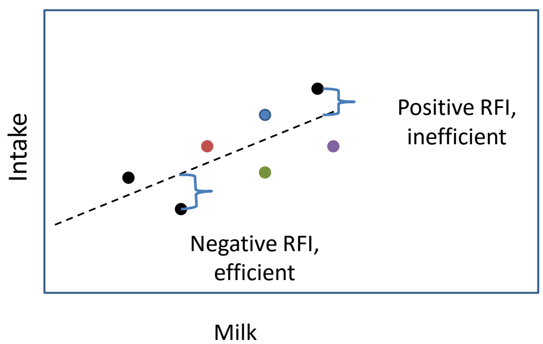


VandeHaar et al, ADSA 2012

(note NRC stops discount at 60%TDN, this graph did not)

Residual Feed Intake: RFI

(measures efficiency at a 'common' production level)

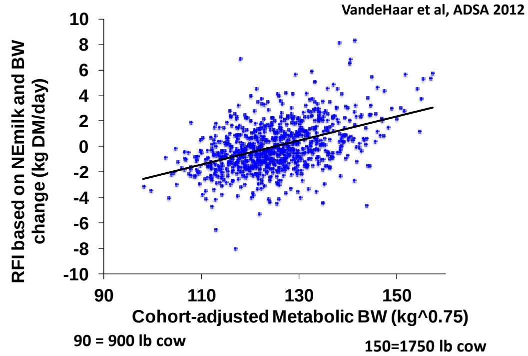


We hope to use genomic information to predict RFI

- Purpose of RFI is to get a measure of feed efficiency NOT related to milk production
- Cannot constantly measure RFI in routine progeny testing as we do for milk yield
- RFI is heritable
- Can select cows genomically for negative RFI, at least for some time
- BUT negative RFI will not increase IOFC if we sacrifice production
- Breeding Index weights for RFI and production must be assigned accordingly
- RFI is a genetics tool to measure marginal efficiency, not a daily management tool

Using RFI based on milk (and body weight change) but not excusing big cows for extra body weight

Shows **bigger cows are inefficient** (more positive RFI)



USDA AIPL Genetic information

	PTA trait					
PTA Trait	Milk	Fat	Protein	PL	SCS	Body size
Milk	**0.301**	0.45	0.81	0.08	0.2	−0.10
Fat	0.69	**0.3**	0.6	0.08	0.15	−0.09
Protein	0.9	0.75	**0.3**	0.1	0.2	−0.10
PL	0.15	0.14	0.17	**0.08**	−0.38	−0.16
SCS	−0.10	−0.10	−0.10	−0.15	**0.12**	−0.11
Body size	0.06	0.06	0.06	0.03	−0.11	**0.4**

Genetic correlation above diagonal

Heritability

Phenotypic correlation below diagonal

Bottom line: Selecting for fluid milk, protein, fat or productive life does not give you bigger cows

USDA AIPL NM$

Trait	Units	Standard deviation (SD)	Value ($/PTA unit) NM$	Relative value (%) NM$
Protein	Pounds	19	3.41	16
Fat	Pounds	27	2.89	19
Milk	Pounds	723	0.001	0
PL	Months	2.5	35	22
SCS	Log	0.23	−182	−10
Udder	Composite	0.9	32	7
Feet/legs	Composite	1.03	15	4
Body size	Composite	1.03	−23	−6
DPR	Percent	1.7	27	11
CA$	Dollars	20	1	5

Net Merit $ specifically selects for smaller Body Size, but for other type traits

But top 100 bulls still bigger than breed average!

Trait	Top 100 by NM$ 2012
PTAT (Composite Type)	0.79
Stature	0.19
UDC (Udder)	0.62
FLC (Feet & Legs)	0.98
Dairy Form	0.15

USDA base changes over 5 years: 2010 .60 body size units
2015 .61
About 50# gain in body size over a decade
Minnesota breeding experiment, "small" line did not shrink

But cows still keep getting bigger

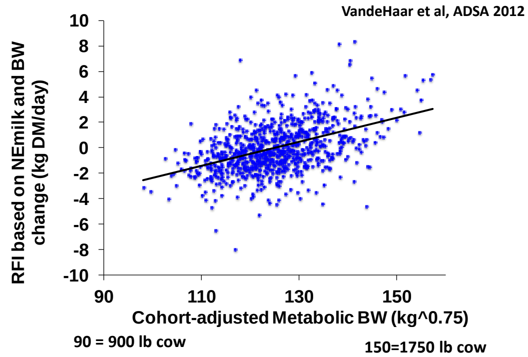
- Although cows do not have to get bigger to give more milk (genetically)
- Highest producing sires are also getting bigger
- Why?
- Choice as industry should be to stop or reverse increased body size
- Each producer must choose from bulls available
  - Producers face constraints within bulls offered
  - My opinion is these constraints are not reasonable

Select for more negative RFI or smaller cows? Or neither?

- An improvement in daily RFI of 1 lb feed per day
- Is roughly same in theory as cow going from 1760 to 1690 lbs (reverse about 15 years of size increase)
- Data set will tell us actual relationship of RFI vs body weight impact
  - Size data easier to get than individual feed intake
  - Size more heritable
- Production trumps both!
- Breeding indexes are used to avoid 'either or' scenarios

Using RFI based on milk (and body weight change) but not excusing big cows for extra body weight

Shows **bigger cows are inefficient** (more positive RFI)



Selective pressure, and genetic correlation not the same thing!!

- Selecting for a trait reduces selective pressure on other traits, even if those traits are total uncorrelated
  - Selecting for small cows (more efficient) gives up some pressure on yield
  - But **we are currently selecting for big cows**, reducing positive pressure on yield while selecting **against** feed efficiency
    - This is a lose-lose scenario!

Selective pressure, and genetic correlation not the same thing!!

- Size and yield not genetically correlated
  - Cows are not getting bigger because they are pulled by yield
  - Some of our selective pressure is being used up to to produce bigger, less efficient cows
- Genomics greatly enhances rate of genetic change
  - Good decisions → more rapid progress
  - Bad decision → more rapid loss
  - Ability to make reasonable progress on lower heritability traits (like RFI)

$ of feed ≠ kg of feed eaten

- Ways to reduce price of feed without lowering milk yield

  Herd management:
  - Group feeding

    tailor N supplementation to production level of cow

    limit expensive additives only to appropriate cows
  - Least cost rations with same nutrient supply

    Remove unnecessary constraints when optimizing rations

  Feed procurement/production/management:
  - Pre-feeding waste increases cost of kg feed eaten!
    - Good agronomic practices
    - Silage, feed, and mixed feed shrink
    - Bunk management/refusals

Magnitude of feed loss!

(Holmes, 2013; Jaderborg and DiCostanzo, 2012)

- **DM loss from harvest to feed-out**
  - **Haycrop silage: 17-64%**
  - **Corn silage: 12-23%**
- **Hauling feeds in loader bucket**
  - **1 to 5% loss = $0.20 to $1.00⁺ loss per trip**

Courtesy of Rick Grant, Miner Institute

Feed loss in different storage structures (Kertz, 1998)

Ingredient	Uncovered open piles	Covered 3-sided bay	Closed bin
Distillers, dry	15-22	7-10	3-5
Distillers, wet	15-40	15-40	---
Dry grains, typical	5-8	4-7	2-4
Alfalfa, chopped	10-20	5-10	---

Courtesy of Rick Grant, Miner Institute

Table 1. Impact of selected management changes on energy and protein efficiency for a farm with 9600 kg milk/cow/year[1]

	Energy	Protein
Base feed efficiency	21%	28%
Reduce age at first calving 2 months	+0.3%	+0.3%
Reduce calving interval 1 month	+0.4%	+0.4%
Feed cows >150 DIM 2% lower CP diet	+0.0%	+1.3%
Increase production by 1000 kg/year	+0.7%	+0.4%
Increase longevity from 3 to 4 lactations	+0.6%	+0.5%

[1] The added benefit of any of these generally decreases with each successive improvement. This is especially true for milk productivity. These figures are based on the model used in VandeHaar (1998).

Summary - Yield

- Increased milk yield per cow has, and continues, to increase feed efficiency
  - But future gains through dilution of maintenance are decreasing
- Increased production doubly increases IOFC per COW, not only through increased efficiency
  - Usually more important than feed efficiency alone!
  - As margin between milk price and feed price narrows, feed efficiency importance increases some
  - If total milk limited by something other than cow numbers (feed, waste, regulation, pasture etc.) need to consider total IOFC not per cow

Summary – feed efficiency

- Increasing feed efficiency without sacrificing production is always a good thing
  - Reduce feed shrinkage from harvest or purchase to feeding
  - Precision feeding to requirement, but no more!
    - Precision feeding herd is aided by grouping cows
    - Precision feeding requires consistent feeds, analyzed feeds, accurate feeding system
  - Reduce BW of cows
    - decision shared by producers and bull studs
  - Select for more negative RFI as part of overall breeding goals

THE PAPILLON DAIRY INITIATIVE: 90 AUDITS COMPLETED COVERING 50,000 COWS. WHAT HAVE WE LEARNED? WHERE ARE THE GREATEST OPPORTUNITIES?

Clayton Stoffel
Papillon Agricultural Company

Why Efficiency

- Traditional goal – maximize DMI
- Limits to how much:
  - A cow can consume
  - A producer can feed
  - Manure a producer can handle
- Increased feed efficiency
  - Addresses these limits
  - Maintains production

Program Requirements

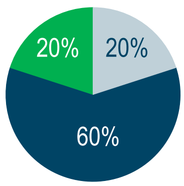
Herd	• Rolling Avg. Holsteins >22k • Rolling Avg. Jerseys >16k
Ration	• TMR feeding system • Formulated by nutritionist
Evaluations	• DMI corrected for refusals • Bulk Tank Milk Information

The Audit Process

- Pre-audit interview (30 Minutes)
- On farm audit
  - Management / nutrition interview (1 Hour)
  - Observations & TMR / fecal sampling
    - 20 – 30 minutes per group of lactating cows
- Results Discussion with Nutritionists
- Results presentation (1 Hour)

Papillion Efficiency Index (PEI)

Management Influencers | Compliance Testing



Nutrient Utilization Efficiency
Energy, Nitrogen, & Phosphorus

Producer Interview

- Milking Frequency
- Lighting
- Dry Period Length
- Forage Analysis
- DMI Calculation
- Moisture Testing
- Pregnancy Rate
- Feed Delivery/Push Up
- DMI Accuracy
- Mixer Maintenance
- Feeding Group Strategy
- Time Away From Pen

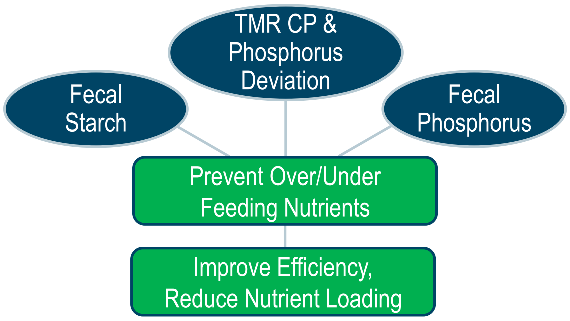
Influence whole herd feed efficiency

Auditor Observations

- Bunker Face
- Bunker Cover
- Commodity Storage
- Stall Design
- Body Condition
- Cow Comfort
- Heat Abatement
- Stocking Density
- Water Availability
- Bunk Space

Influence whole herd feed efficiency

Compliance Testing



Audits To Date

Region	Audits	Cows
Northeast	10	6,060
Mid Atlantic	6	2,184
Great Lakes	29	18,088
Midwest	44	25,539
Total	89	51,871

Audits To Date

Parameter	Average	Range
Audits	89	
Milking Cows	583	57 – 5100
Milk (lb.)	78.0	55 – 105
Fat (%)	3.79	3.1 – 4.2
Protein (%)	3.07	2.8 – 3.4

- 366 Pens of cows

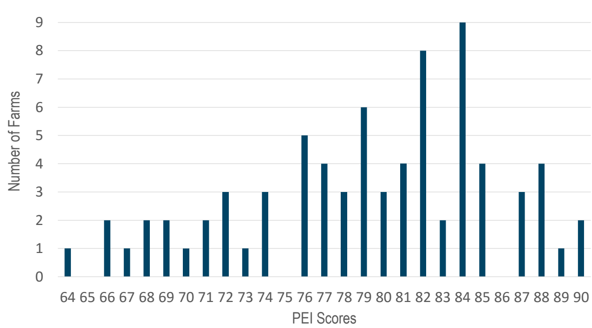
Basic Observations

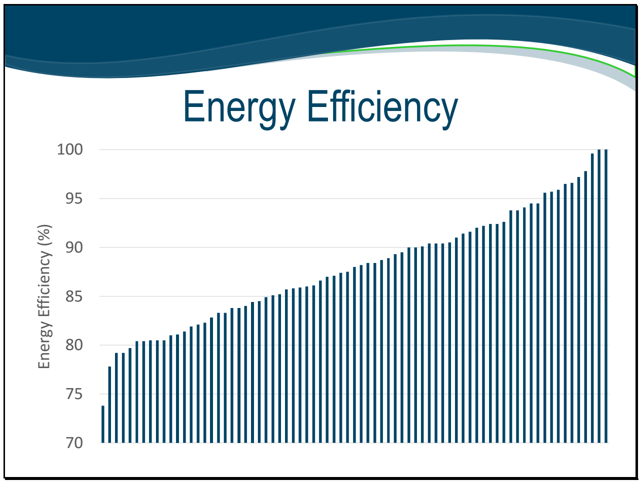
Parameter	Average	Range
ECDM Efficiency	1.56	1.31 – 1.78
Formulated CP	16.7%	14.6 – 18.3
Measured CP	16.6%	13.2 – 19.5
Formulated P	0.38%	0.29 – 0.57
Measured P	0.41%	0.21 – 0.58
ECM (lb.)	82.1	62.6 – 108.4

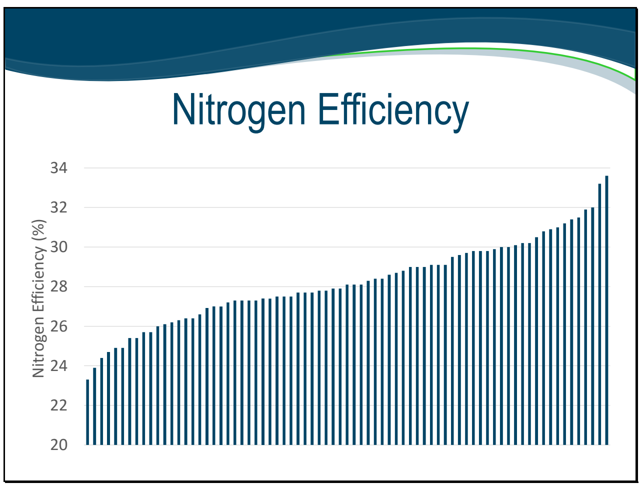
Basic Observations

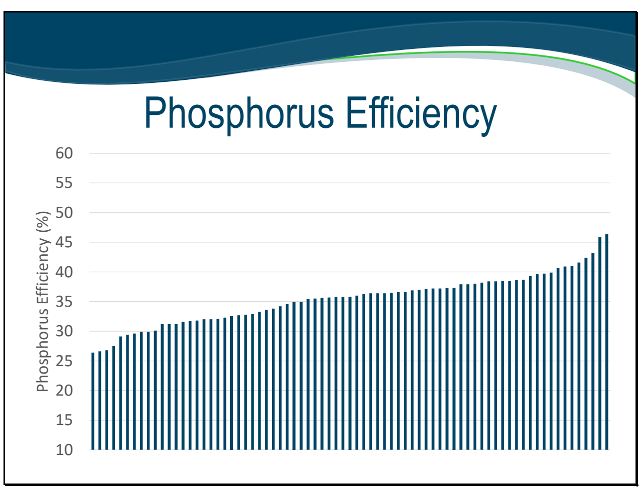
Parameter	Frequency
Milking > 2x	63%
Milking > 3x	5.3%
Feeding > 1x	54%
Have Fresh Pen	59%
Overcrowd Fresh Pen (>80%)	73%
Overcrowd Non Fresh Pen (>120%)	28%
Provide adequate water (Pens)	47%

Distribution of PEI Scores

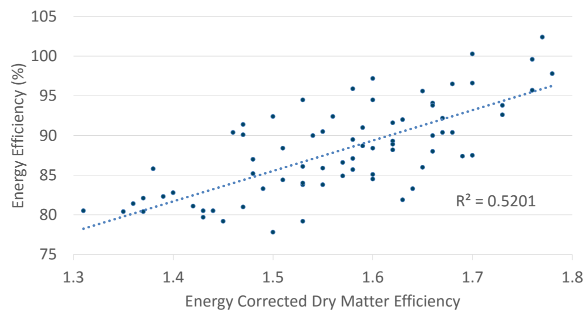



Energy Efficiency
Energy Efficiency (%)
100
95
90
85
80
75
70

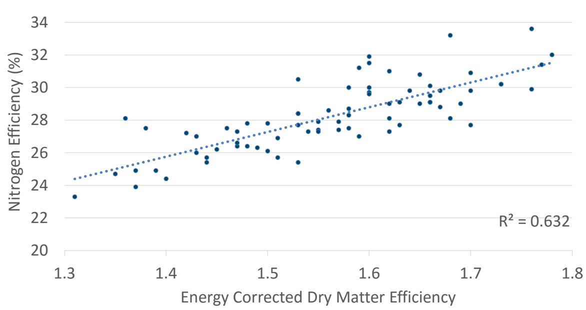

Nitrogen Efficiency
Nitrogen Efficiency (%)
34
32
30
28
26
24
22
20


Phosphorus Efficiency
Phosphorus Efficiency (%)
60
55
50
45
40
35
30
25
20
15
10

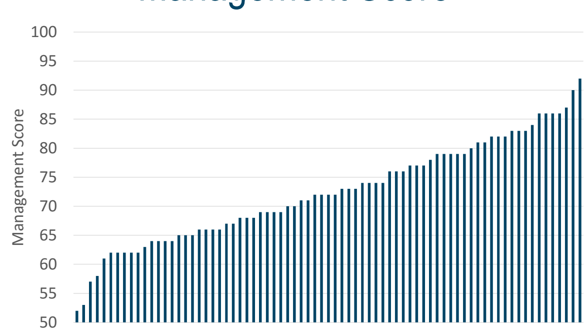
ECM Dry Matter Efficiency vs Energy Efficiency



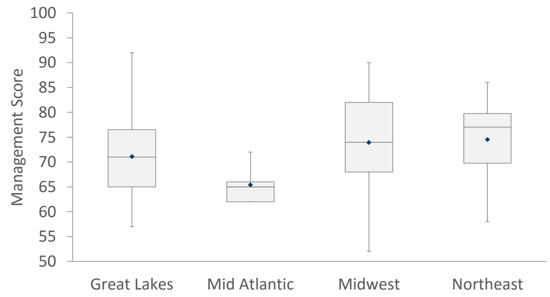
ECM Dry Matter Efficiency vs Nitrogen Efficiency



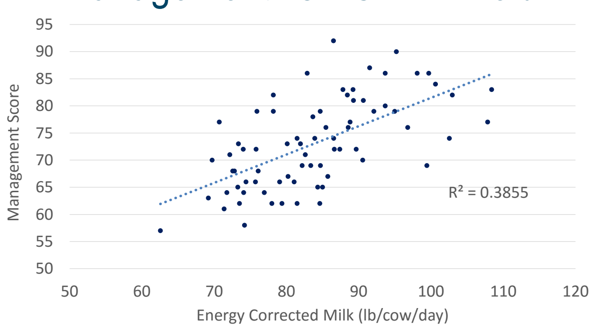
Management Score



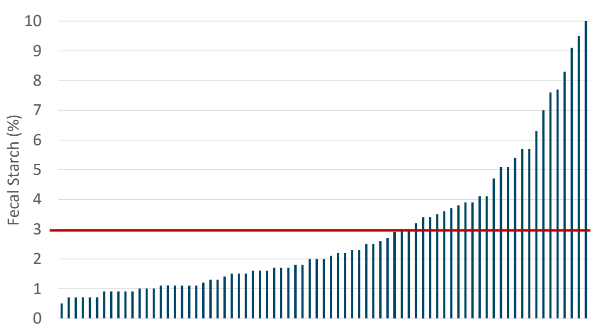
Management Score By Region

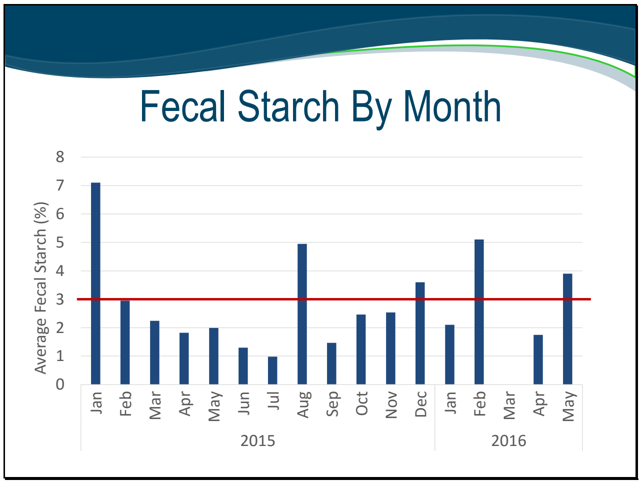


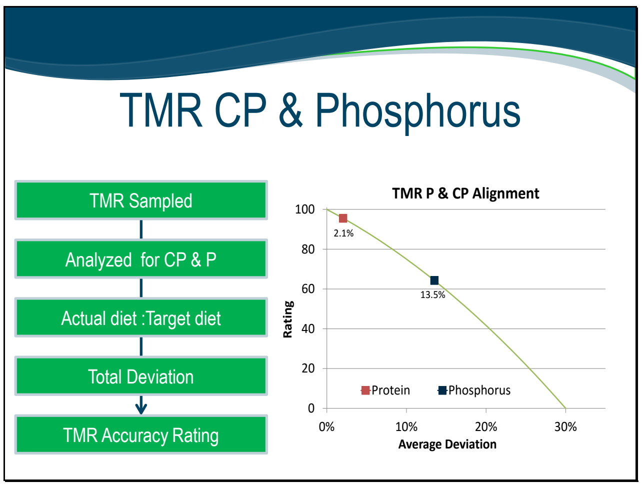
Management vs EC Milk Yield

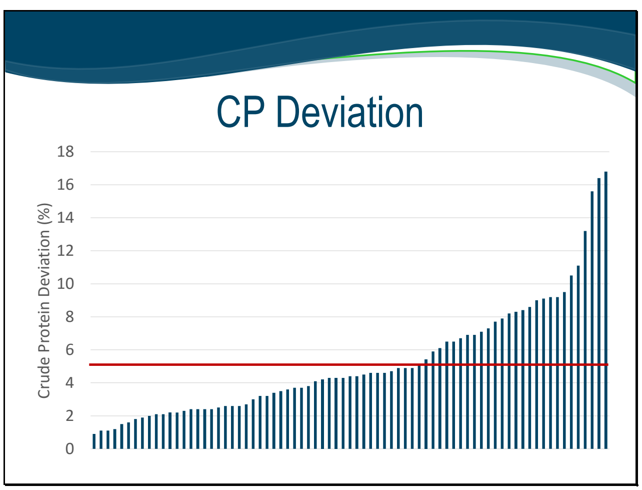


Fecal Starch

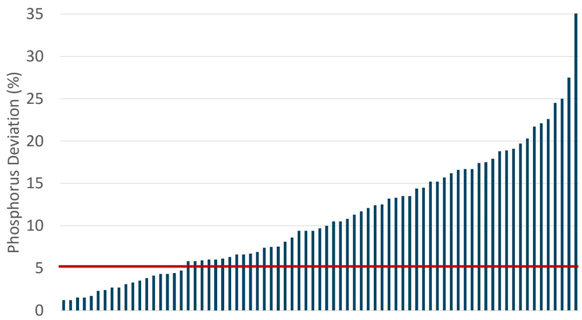



Fecal Starch By Month
Average Fecal Starch (%)
8
7
6
5
4
3
2
1
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
2015
2016

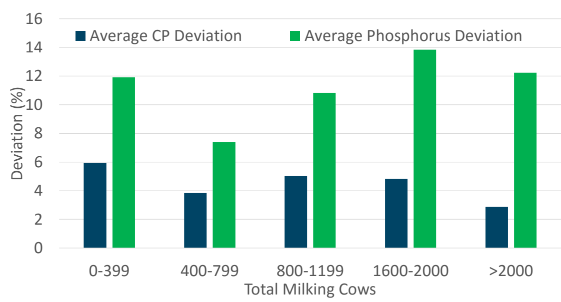

TMR CP & Phosphorus
TMR Sampled
Analyzed for CP & P
Actual diet :Target diet
Total Deviation
TMR Accuracy Rating
TMR P & CP Alignment
100
80
60
40
20
0
Rating
2.1%
13.5%
Protein
Phosphorus
0%
10%
20%
30%
Average Deviation


CP Deviation
Crude Protein Deviation (%)
18
16
14
12
10
8
6
4
2
0

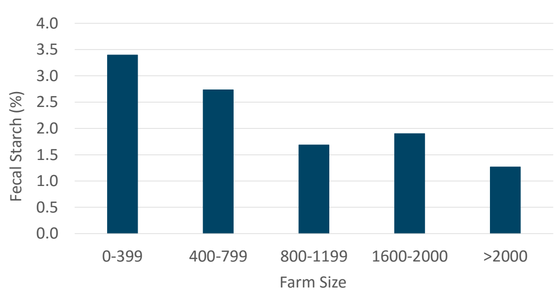
Phosphorus Deviation



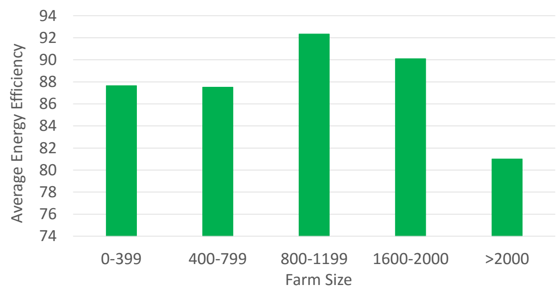
CP and P Deviation by Farm Size



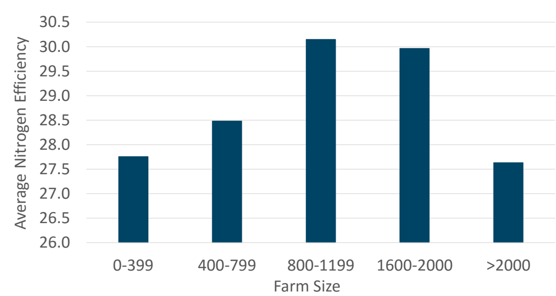
Fecal Starch By Farm Size



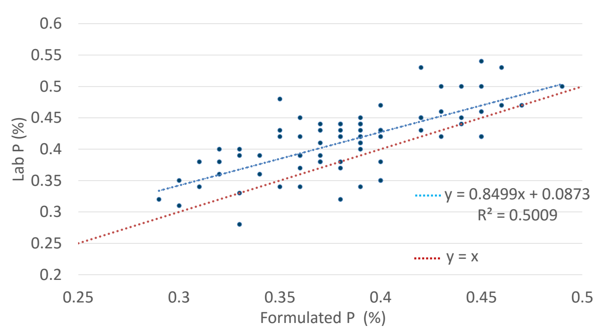
Energy Efficiency By Farm Size

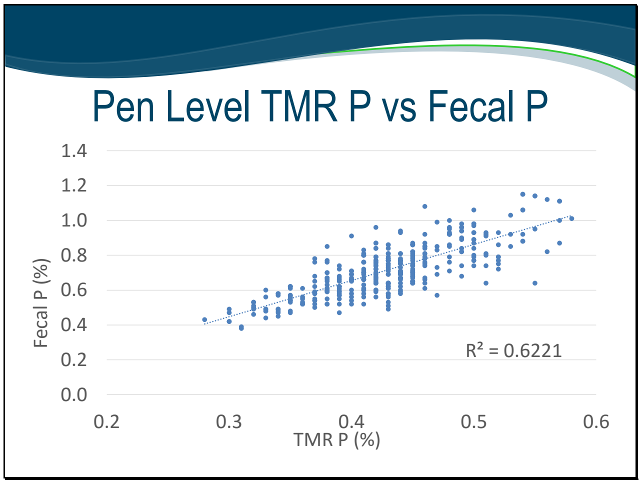


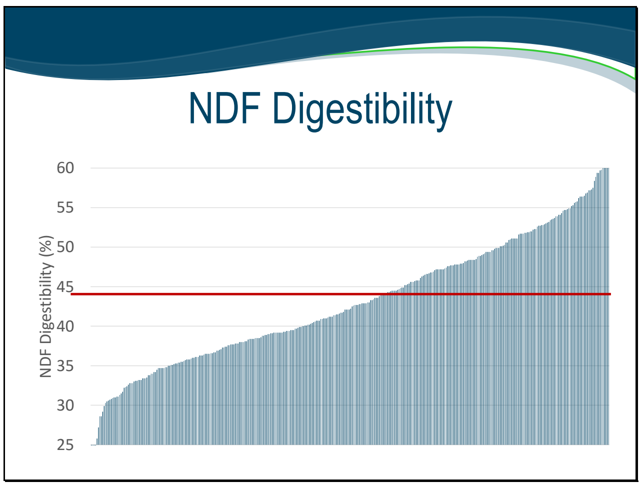
Nitrogen Efficiency by Farm Size

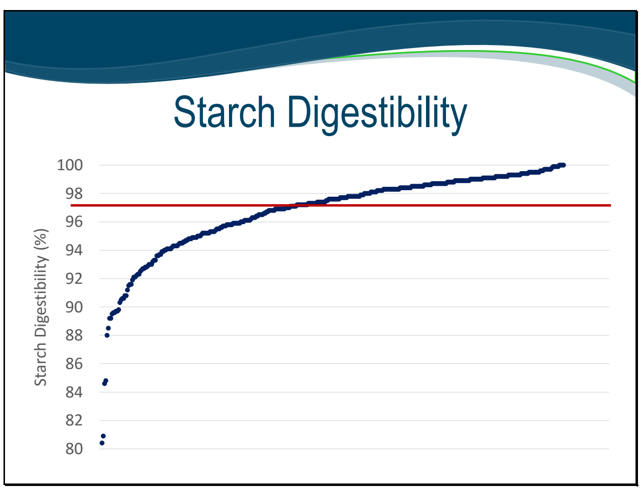


Lab P vs Formulated P




Pen Level TMR P vs Fecal P
Fecal P (%)
TMR P (%)
R² = 0.6221
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.2
0.3
0.4
0.5
0.6


NDF Digestibility
NDF Digestibility (%)
60
55
50
45
40
35
30
25


Starch Digestibility
Starch Digestibility (%)
100
98
96
94
92
90
88
86
84
82
80

Economic Example

Current Parameters	
Feed Cost	$0.10 / lb DM
Milk Price	$14.20 / CWT
Energy Efficiency	88.40%
Nitrogen Efficiency	26.90%

Economic Example

Parameter	DMI Decrease Only	Milk Production Increase Only
Increased Energy Efficiency	+3 Percentage Units	
DMI Change	- 1.2 lb	None
Milk Yield Change	None	+ 2.4 lb
Economic Impact / Cow / Day	$0.12	$0.33
Economic Impact / Year	$8,659	$24,674

Economic Example

Parameter	DMI Decrease Only	Milk Production Increase Only
Increased Nitrogen Efficiency	+1 Percentage Unit	
DMI Change	- 1.8 Lb	None
Milk Yield Change	None	+ 2.6 Lb
Economic Impact / Cow / Day	$0.18	$0.37
Economic Impact / Year	$13,256	$27,040

The Future

- Improved geographical benchmarks
- Auditing additional attributes
  - Whole Farm
  - Environmental
- Published Data

IMPACT OF FEEDING EFFICIENTLY ON A DAIRY'S INCOME STATEMENT AND BALANCE SHEET. FROM THE CFO'S PERSPECTIVE: TIPS WHEN MEASURING PRODUCTION EFFICIENCY, IMPACT OF SCALE, AND THE EFFECT OF HIGH VS LOW INPUT MANAGEMENT STYLES ON ECONOMIC EFFICIENCY.

Dr. Greg Bethard
Pagel's Ponderosa Dairy

Impact of Feeding Efficiency on the Income Statement

Greg Bethard, Ph.D.
CFO
Pagel Family Businesses
Kewaunee, WI

PAGEL'S PONDEROSA DAIRY
John T. Pagel Family

DAIRY DREAMS

COLEMAN PONDEROSA

Ron's
Wisconsin Cheese

HANDCRAFTED CHEESE
PONDEROSA FARMSTEAD
KEWAUNEE • WISCONSIN

The CANNERY
PUBLIC MARKET
Green Bay Wisconsin

- Restaurant
- Bar
- Market
- Deli

Concepts

- Dairy is a commodity manufacturing business
- Most Dairies have 3 enterprises
  - Replacement, Farming, Milking Cows
- Feed Efficiency (Milk:Feed) doesn't matter
- Margins matter, ratios don't
- IOFC is king
- Milk/cow is an outdated measure of cow performance

Land, People, Water

	US	EU	China	India	Africa
Population (2013)	300 mil	500 mil	1,357 mil	1,276 mil	1,100 mil
% < Age 15	19%	16%	16%	30%	41%
2025 estimate	346 mil	517 mil	1,406 mil	1,443 mil	1,464 mil
2050 estimate	400 mil	517 mil	1,314 mil	1,651 mil	2,431 mil
Arable land, ha (2011)	160 mil	108 mil	110 mil	157 mil	226 mil
Water, km^3/yr	2,800	1,500	2,800	1,450	3,931

Sources:
Population: fao.org
Arable Land: fao.org
Water = FAO 2013 AQUASTAT database

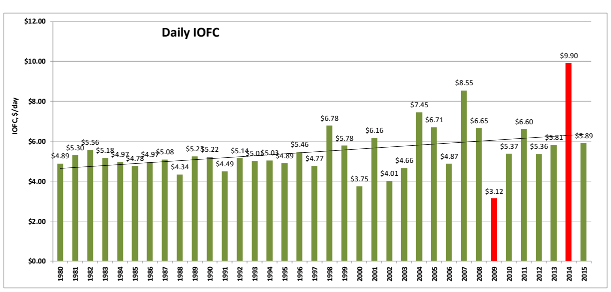
"It is tough to make predictions, especially about the future"

Yogi Berra

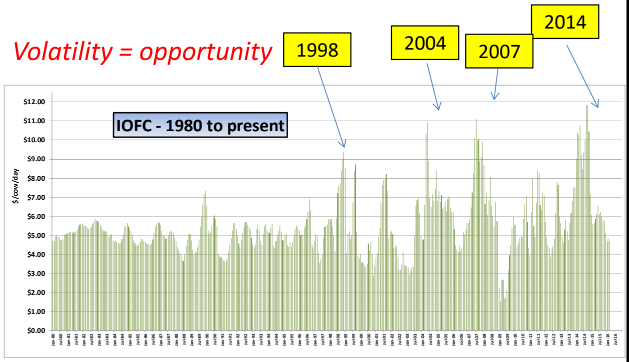
2014

A Black Swan Year in the Dairy Industry

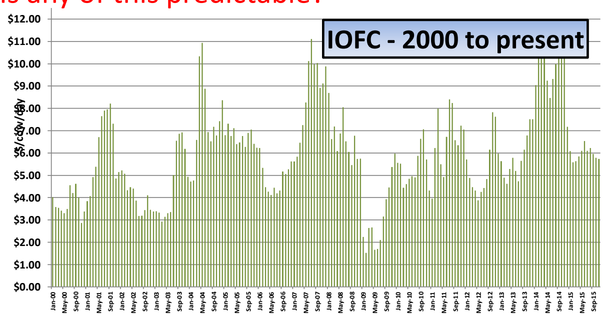
IOFC 1980 to 2015



Volatility = opportunity



Is any of this predictable?



Top 10 Keys to a good P&L

1. The solution to pollution is dilution
    - Ship a lot of Money Corrected Milk™
    - keep a “full” barn
    - stay at “100%” every day
2. Healthy fresh cows
3. Minimize Replacement Costs
    - Offer a career change to unprofitable cows
    - Replace broken or inefficient cows with new ones
    - Don’t break cows
    - Don’t wait until cows are worn out to sell them
4. Realize quality and component premiums

Top 10 Keys to a good P&L

5. Maximize Income Over Feed Cost
   - Per Day and Per Cow
6. Procure High Quality Forages
7. Generate Pregnancies (Cow and Heifer)
   - Cow Flow, lactation demographics
8. Cut costs intelligently
9. Control Labor Costs/cwt
10. Minimize Shrink (impact of 10% shrink?)

Goal – Lower breakeven!!

Problem with Cost/cwt

- Don't benchmark to other herds
- Ignores income
  - Holstein versus Jersey
  - Premiums
- Is cull cow income part of income?
  - should be part of replacement cost
- Is milk hauling a cost?
- No industry standard
- Best Single Number? Breakeven milk price

Were we better off with cheaper feed?

- Old days
  - Ration: $0.08/lb DM
  - Milk: $14
  - 75 lbs milk, 50 lbs DMI
    - IOFC = $6.50
- Today
  - Ration: $0.14/lb DM
  - Milk: $20
  - 75 lbs milk, 50 lbs DMI
    - IOFC = $8.00

Were we better off with cheaper feed?

- Old days
  - Ration: $.08/lb DM
  - Milk: $14
  - 75 lbs milk, 50 lbs DMI
    - IOFC = $6.50
    - Feed Cost/cwt: $5.93
- Today
  - Ration: $0.14/lb DM
  - Milk: $20
  - 75 lbs milk, 50 lbs DMI
    - IOFC = $8.00
    - Feed Cost/cwt: $9.93

15% dry cows,
$3.00/d dry cow feed cost

Feed Cost/cwt

- Definition: Milking and dry *accrual* consumption using *market values* for forages
- Limitations
  - Ignores milk income
  - It may cost more to produce milk of higher value
- *Don't benchmark to other herds!*

Farming is profitable…is Dairy?

- Is the Dairy, or the Farm making money?
- Would the dairy be better selling cows and growing corn?
- Avoid having the farm profit overwhelm the dairy and disguise an inefficient business.

USDA Milk:Feed Ratio

- If milk is $0.20/lb and feed is $0.10/lb, then the ratio is 2.0
  - Feed goes down to $0.08/lb, then ratio is 2.5
  - Feed goes up to $0.12/lb then ratio is 1.67
- Higher ratio is supposedly better

Margins matter, ratios don't

Milk $/cwt	Feed $/lb DM	Feed $/cwt	Feed Cost per cow	Milk:Feed	Margin (IOFC) $/cwt	Margin (IOFC) $/day
15.00						
18.00						
21.00						
23.00						
25.00						

75 lbs milk, 50 lbs DMI,

Margins matter, ratios don't

Milk $/cwt	Feed $/lb DM	Feed $/cwt	Feed Cost per cow	Milk:Feed	Margin (IOFC) $/cwt	Margin (IOFC) $/day
15.00	0.05					
18.00	0.09					
21.00	0.11					
23.00	0.13					
25.00	0.15					

75 lbs milk, 50 lbs DMI,

Margins matter, ratios don't

Milk $/cwt	Feed $/lb DM	Feed $/cwt	Feed Cost per cow	Milk:Feed	Margin (IOFC) $/cwt	Margin (IOFC) $/day
15.00	0.05	3.33				
18.00	0.09	6.00				
21.00	0.11	7.33				
23.00	0.13	8.67				
25.00	0.15	10.00				

75 lbs milk, 50 lbs DMI,

Margins matter, ratios don't

Milk $/cwt	Feed $/lb DM	Feed $/cwt	Feed Cost per cow	Milk:Feed	Margin (IOFC) $/cwt	Margin (IOFC) $/day
15.00	0.05	3.33	2.50			
18.00	0.09	6.00	4.50			
21.00	0.11	7.33	5.50			
23.00	0.13	8.67	6.50			
25.00	0.15	10.00	7.50			

75 lbs milk, 50 lbs DMI,

Margins matter, ratios don't

Milk $/cwt	Feed $/lb DM	Feed $/cwt	Feed Cost per cow	Milk:Feed	Margin (IOFC) $/cwt	Margin (IOFC) $/day
15.00	0.05	3.33	2.50	3.00		
18.00	0.09	6.00	4.50	2.00		
21.00	0.11	7.33	5.50	1.91		
23.00	0.13	8.67	6.50	1.77		
25.00	0.15	10.00	7.50	1.67		

75 lbs milk, 50 lbs DMI,

Margins matter, ratios don't

Milk $/cwt	Feed $/lb DM	Feed $/cwt	Feed Cost per cow	Milk:Feed	Margin (IOFC) $/cwt	Margin (IOFC) $/day
15.00	0.05	3.33	2.50	3.00	11.67	
18.00	0.09	6.00	4.50	2.00	12.00	
21.00	0.11	7.33	5.50	1.91	13.67	
23.00	0.13	8.67	6.50	1.77	14.33	
25.00	0.15	10.00	7.50	1.67	15.00	

75 lbs milk, 50 lbs DMI,

Margins matter, ratios don't

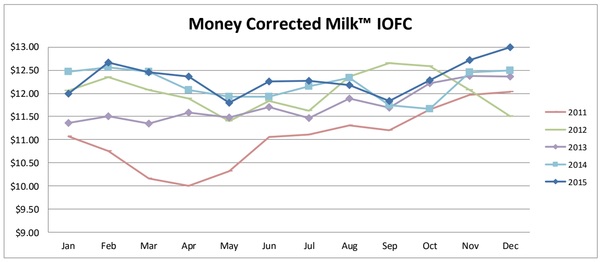
Milk $/cwt	Feed $/lb DM	Feed $/cwt	Feed Cost per cow	Milk:Feed	Margin (IOFC) $/cwt	Margin (IOFC) $/day
15.00	0.05	3.33	2.50	3.00	11.67	8.75
18.00	0.09	6.00	4.50	2.00	12.00	9.00
21.00	0.11	7.33	5.50	1.91	13.67	10.25
23.00	0.13	8.67	6.50	1.77	14.33	10.75
25.00	0.15	10.00	7.50	1.67	15.00	11.25

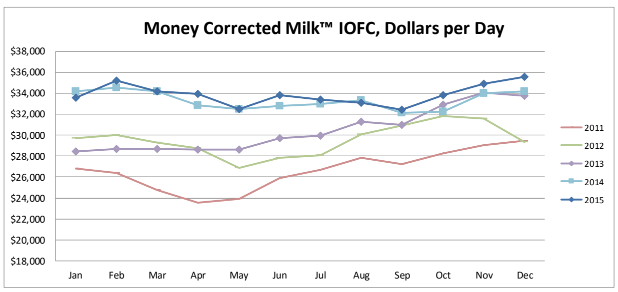
75 lbs milk, 50 lbs DMI,

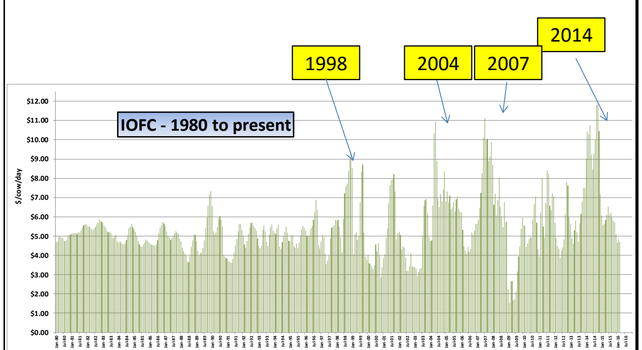
IOFC Methodology

- Milk Income minus feed costs
  - (80 lbs milk x $20) – (50.0 lbs DM x 0.12/lb) = $16.00 - $6.00 = $10.00/cow/day
- IOFC has cow factors and market factors
- *1st IOFC Graph*
  - Market factors fixed, cow factors changing
  - Tells story of cow performance
- *2nd IOFC Graph*
  - Cow factors fixed, market factors changing
  - Tells story of market conditions

Static IOFC: Market fixed, cow factors changing







What is the benchmark for Feed Conversions (Milk:Feed)?

- Milk lbs/DMI
- 1.5?
- 1.7?
- What is numerator?
  - Fat corrected milk?
  - Energy corrected milk?
  - Money Corrected Milk™?

Goals for Feed Efficiency?

Milk Production (Lbs/cow per d)	*Target* GFE
55.0	1.25
60.0	1.32
65.0	1.38
70.0	1.44
75.0	1.49
80.0	1.54
85.0	1.58
90.0	1.63

BW = 1,500; fat = 3.6%; protein = 3.1%; other solids = 5.7%

Normand St. Pierre, 2011

What about Days in Milk?
What about Value of Milk?

Which Cow Would You Rather have?

- 75 lbs MCM with 42 lbs DMI?
- 95 lbs MCM with 58 lbs DMI?

Which Cow Would You Rather have?

- Assume:
  - MCM = 20 cents/lb
  - TMR = 10 cents/lb DM
- 75 lbs MCM with 42 lbs DMI?
  - Milk:Feed = 1.79
- 95 lbs MCM with 58 lbs DMI?
  - Milk:Feed = 1.63

Which Cow Would You Rather have?

- Assume:
  - MCM = 20 cents/lb
  - TMR = 10 cents/lb DM
- 75 lbs MCM with 42 lbs DMI?
  - $15.00 - $4.20 = $10.80
  - Milk:Feed = 1.79
- 95 lbs MCM with 58 lbs DMI?
  - 19.00 – $5.80 = $13.20
  - Milk:Feed = 1.63

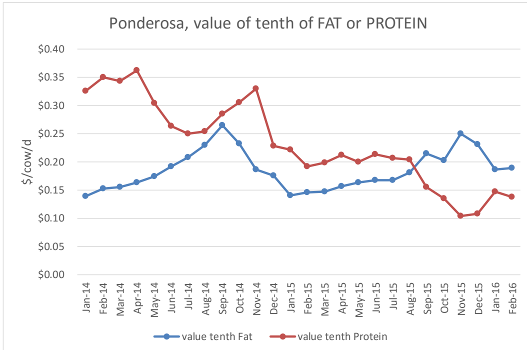
What about Components?

Issues with High Component Milk

- Cost/cwt is skewed
- Feed cost/cwt is skewed
- Hedging is skewed
- Not always sure if balance of components and milk is "right"

What is a point of protein worth?

Protein-->	3.30	3.40	Diff
Tank Average	80.0	80.0	0.0
Fat%	4.00	4.00	0.00
Prot%	3.30	3.40	0.10
Other Solids%	5.70	5.70	0.00
Dry Matter Intake	54.0	54.0	0.0
Money Corrected Milk™	89.9	91.7	1.8
Money Corrected Milk™ IOFC	$9.47	$9.80	$0.32
MCM™ conversions	1.66	1.70	0.03
Pounds sold/mo	12,276,000	12,276,000	0
Daily lbs	396,000	396,000	0
Daily MCM lbs	444,926	453,983	9,058
Cows	4950	4950	0
IOFC/d	46,898	48,506	1,608
MCM Lbs/stall/hour	166	169	3
MCM cwts/mo	137,927	140,735	2,808
cwts/mo	122,760	122,760	0
MCM Factor	1.12	1.15	0.02
Income per day	15.95	16.28	0.32
Milk Price per cwt	19.94	20.35	0.41
Milk Price per MCM cwt	17.75	17.75	0.00



What is Feed Cost/cwt?

- Feed Cost
  - Milk Cows = 54 x .12 = $6.48/d x 5100 = $32,400
  - Dry Cows = $3.00 x 550 = $1,650
  - Total = $34,050
- Cwts = 3960
- $34,050/3960 = $8.60
- Same if protein is 3.00 or 3.30 or 3.40

What is Feed Cost/MCM™ cwt?

- Feed Cost
  - Milk Cows = 54 x .12 = $6.48/d x 5100 = $32,400
  - Dry Cows = $3.00 x 550 = $1,650
  - Total = $34,050
- Unadjusted cwts
  - Cwts – 3960
  - $34,050/3960 = $8.60
- 3.30 protein
  - MCM Cwts = 4449
  - $34,050/4449 = $7.65
- 3.40 protein
  - MCM Cwts = 4540
  - $34,050/4540 = $7.50

Biological measure of efficiency vs economics

- Biology
  - 3.5% Fat corrected Milk
    - (0.515 x milk lbs) + (13.86 * fat lbs)
  - 4.0% Fat corrected Milk
    - (0.40 x milk lbs) + (15.00 * fat lbs)
  - Energy Corrected Milk
    - (0.323 x milk lbs) + (12.82 * fat lbs) + (7.13 x prot lbs)
  - Feed efficiency (milk:feed ratio)
    - (FCM lbs) / (dry matter intake lbs)

Biological measure of efficiency vs economics

- Economics
  - Income Over Feed Cost
    - Value of milk generated relative to cost of feed
    - Value of milk and feed vary with markets
    - Units: $/cow/day
  - Money Corrected Milk™ IOFC
    - Value of milk generated relative to cost of feed
    - Value of milk and feed held constant over time
    - Units: $/cow/day
  - Money Corrected Milk™
    - Value of milk produced relative to 3.5% fat, 3.0% protein and static component values
    - Units: pounds per day

Example

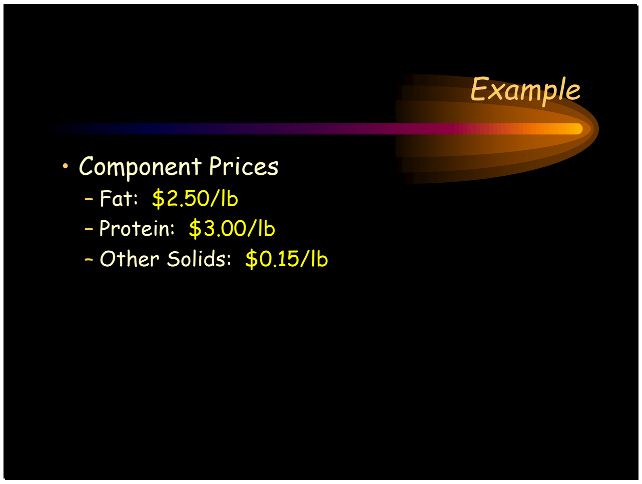
Herd A

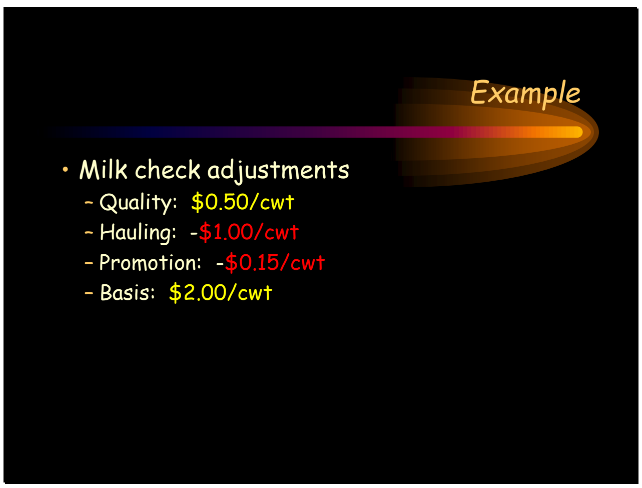
- 71 lbs milk
- 3.95% fat
- 3.26% protein
- 5.70% other solids

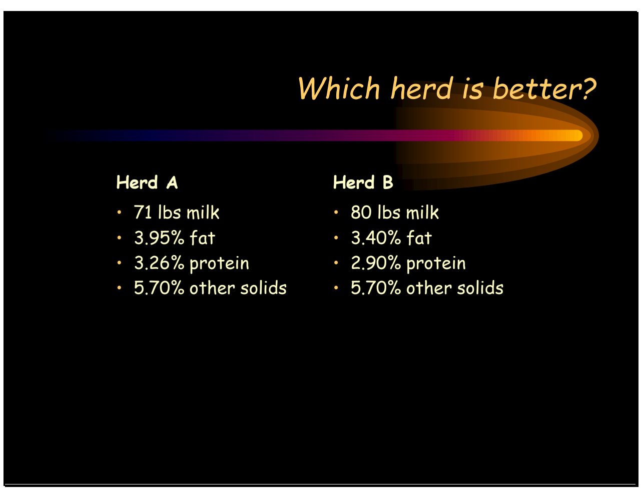
Herd B

- 80 lbs milk
- 3.40% fat
- 2.90% protein
- 5.70% other solids

Who is better?


Example
• Component Prices
– Fat: $2.50/lb
– Protein: $3.00/lb
– Other Solids: $0.15/lb


Example
• Milk check adjustments
– Quality: $0.50/cwt
– Hauling: -$1.00/cwt
– Promotion: -$0.15/cwt
– Basis: $2.00/cwt


Which herd is better?
Herd A
• 71 lbs milk
• 3.95% fat
• 3.26% protein
• 5.70% other solids
Herd B
• 80 lbs milk
• 3.40% fat
• 2.90% protein
• 5.70% other solids

Which herd is better?

Herd A
- 71 lbs milk
- 3.95% fat
- 3.26% protein
- 5.70% other solids
- FCM: 75.4 lbs

Herd B
- 80 lbs milk
- 3.40% fat
- 2.90% protein
- 5.70% other solids
- FCM: 78.9 lbs

FCM = 3.5% Fat Corrected Milk

Which herd is better?

Herd A
- 71 lbs milk
- 3.95% fat
- 3.26% protein
- 5.70% other solids
- FCM: 75.4 lbs
- ECM: 75.4 lbs

Herd B
- 80 lbs milk
- 3.40% fat
- 2.90% protein
- 5.70% other solids
- FCM: 78.9 lbs
- ECM: 77.3 lbs

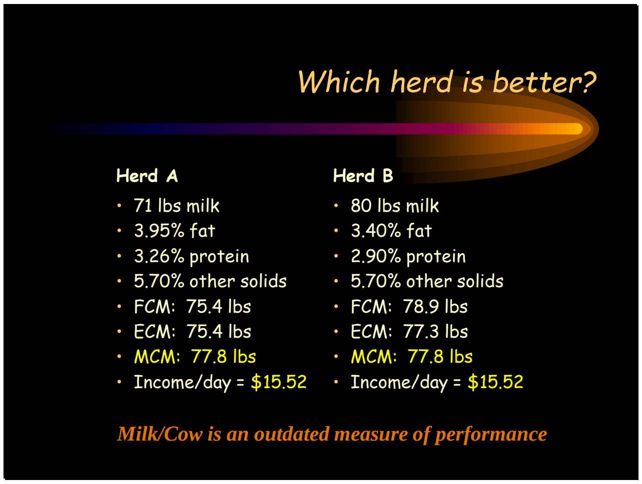
ECM = Energy Corrected Milk

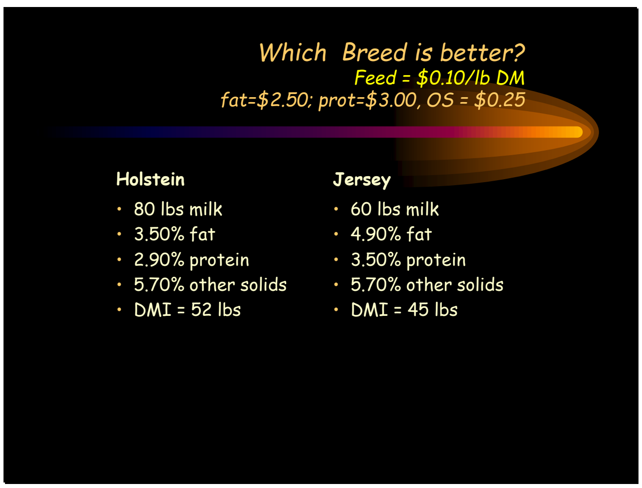
Which herd is better?

Herd A
- 71 lbs milk
- 3.95% fat
- 3.26% protein
- 5.70% other solids
- FCM: 75.4 lbs
- ECM: 75.4 lbs
- MCM: 77.8 lbs

Herd B
- 80 lbs milk
- 3.40% fat
- 2.90% protein
- 5.70% other solids
- FCM: 78.9 lbs
- ECM: 77.3 lbs
- MCM: 77.8 lbs

MCM = Money Corrected Milk


Which herd is better?
Herd A
• 71 lbs milk
• 3.95% fat
• 3.26% protein
• 5.70% other solids
• FCM: 75.4 lbs
• ECM: 75.4 lbs
• MCM: 77.8 lbs
• Income/day = $15.52
Herd B
• 80 lbs milk
• 3.40% fat
• 2.90% protein
• 5.70% other solids
• FCM: 78.9 lbs
• ECM: 77.3 lbs
• MCM: 77.8 lbs
• Income/day = $15.52
Milk/Cow is an outdated measure of performance


Which Breed is better?
Feed = $0.10/lb DM
fat=$2.50; prot=$3.00, OS = $0.25
Holstein
• 80 lbs milk
• 3.50% fat
• 2.90% protein
• 5.70% other solids
• DMI = 52 lbs
Jersey
• 60 lbs milk
• 4.90% fat
• 3.50% protein
• 5.70% other solids
• DMI = 45 lbs


Which Breed is better?
Feed = $0.10/lb DM
fat=$2.50; prot=$3.00, OS = $0.25
Holstein
• 80 lbs milk
• 3.50% fat
• 2.90% protein
• 5.70% other solids
• DMI = 52 lbs
• MCM = 78.9
Jersey
• 60 lbs milk
• 4.90% fat
• 3.50% protein
• 5.70% other solids
• DMI = 45 lbs
• MCM = 74.7

Which Breed is better?

Feed = $0.10/lb DM
fat=$2.50; prot=$3.00, OS = $0.25

Holstein

- 80 lbs milk
- 3.50% fat
- 2.90% protein
- 5.70% other solids
- DMI = 52 lbs
- MCM = 78.9
- MCM Conversion: 1.52

Jersey

- 60 lbs milk
- 4.90% fat
- 3.50% protein
- 5.70% other solids
- DMI = 45 lbs
- MCM = 74.7
- MCM Conversion: 1.66

Which Breed is better?

Feed = $0.10/lb DM
fat=$2.50; prot=$3.00, OS = $0.25

Holstein

- 80 lbs milk
- 3.50% fat
- 2.90% protein
- 5.70% other solids
- DMI = 52 lbs
- MCM = 78.9
- MCM Conversion: 1.52
- MCM IOFC = $10.98

Jersey

- 60 lbs milk
- 4.90% fat
- 3.50% protein
- 5.70% other solids
- DMI = 45 lbs
- MCM = 74.7
- MCM Conversion: 1.66
- MCM IOFC = $10.82

Which Breed is better?

Feed = $0.10/lb DM $0.15/lb DM
fat=$2.50; prot=$3.00, OS = $0.25

Holstein

- 80 lbs milk
- 3.50% fat
- 2.90% protein
- 5.70% other solids
- DMI = 52 lbs
- MCM = 78.9
- MCM Conversion: 1.52
- MCM IOFC = $10.98
- MCM IOFC = $8.38

Jersey

- 60 lbs milk
- 4.90% fat
- 3.50% protein
- 5.70% other solids
- DMI = 45 lbs
- MCM = 74.7
- MCM Conversion: 1.66
- MCM IOFC = $10.82
- MCM IOFC = $8.57

Which Breed is better?

Feed = $0.10/lb DM $0.15/lb DM

fat=$2.50; prot=$3.00 $4.00; OS = $0.25

Holstein

- 80 lbs milk
- 3.50% fat
- 2.90% protein
- 5.70% other solids
- DMI = 52 lbs
- MCM = 78.9
- MCM Conversion: 1.52
- MCM IOFC = $10.98
- MCM IOFC = $8.38
- MCM IOFC = $10.70

Jersey

- 60 lbs milk
- 4.90% fat
- 3.50% protein
- 5.70% other solids
- DMI = 45 lbs
- MCM = 74.7
- MCM Conversion: 1.66
- MCM IOFC = $10.82
- MCM IOFC = $8.57
- MCM IOFC = $10.67

10 Efficiencies that matter

1. Money Corrected Milk/cow, total/d
   - Goal?
2. Static IOFC/cow, total/d
   - Goal – grow each year
3. % of Capacity over 12-mo period
   - Goal >98%
4. Margin/cwt
   - Goal: >$2.00 over the long term
5. Replacement
   - Goal <$1.50/cwt

10 Efficiencies that matter

6. Actual IOFC/cwt
   - >$10.00 should make lots of money
   - >$9.00 profitable
   - <$7.00 losses
7. Labor cost/cwt
   - Goal <$1.50
8. Non-Big 3 (and hauling) costs/cwt
   - <$4.00/cwt
9. Milk/stall/hour
   - Capacity: >150 lbs parallel, >200 lbs rotary
10. Residual DMI
   - < 1.0 lb after refusals

Questions??