

## Solving milk fat challenges on dairy farms

Thomas R. Overton and Adam L. Lock  
Department(s) of Animal Science  
Cornell University and The University of Vermont

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## Topics

- Brief reminder on biology of low milk fat
- Two Northeast case studies plus a game!!
- Common observations/themes for herds with low milk fat
- Questions / comments

## How Can We Use Our Understanding of the Biology of MFD to Troubleshoot Fat Test on Farms?

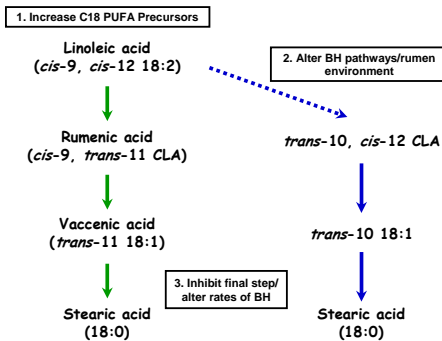
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## Biology of Milk Fat Depression

- **Magnitude of decrease in milk fat (e.g. 3.8 to 3.2%) could be caused by as little as 1.5 to 2.0 g/d of *trans*-10, *cis*-12 CLA or a related intermediate passing to the small intestine**

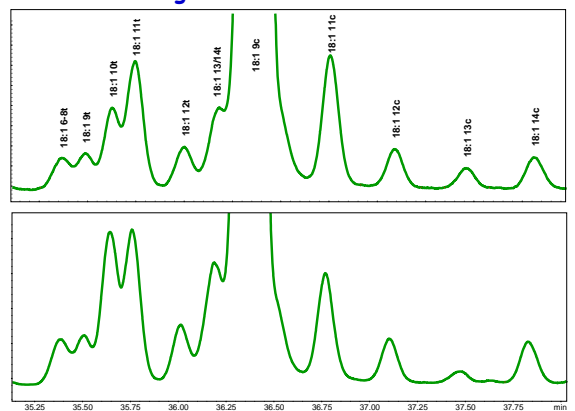
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## Dietary components can impact the risk of MFD in 3 ways



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## Changes in *trans* 18:1 Profile



## Milk Fat Depression

Requires two conditions:

- 1) Dietary presence of PUFA
- 2) Altered rumen fermentation

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## Potential Risk Factors for Reduced Milk Fat

### Supply of PUFA

- Amount (esp. linoleic acid intake)
- Availability
- PUFA:SFA
- Feeding pattern
- Variation in fat content and FA composition of feed ingredients

### Altered Rumen Environment

- Low rumen pH/low peNDF
- Feed particle size
- Fiber
- Starch (NSC)
- Monensin
- Feeding pattern

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## Supply of Unsaturated Fatty Acids

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## Fatty Acid Intake Example

	Fatty Acids - Intake (g/d)						Total
	C16:0	C18:0	C18:1C	C18:2	C18:3	Other	
CrnSilPr35Dm41NdfMed	34.15	4.64	36.84	91.42	15.79	6.50	191.52
AlfSil20Cp40Ndf17LNdf	23.11	4.12	2.52	19.54	47.56	8.14	122.86
WhtStr5Cp79Ndf16LNdf	1.08	0.09	0.17	1.54	3.29	0.28	6.60
Corn6rnFikd24lb	19.99	2.87	35.83	90.29	2.81	1.40	154.66
BeetPulpShrdCp	2.76	0.09	1.20	5.16	0.66	0.43	10.36
SoyPLUS	9.95	3.41	14.67	39.32	6.45	0.82	74.83
ProvAAI	0.85	0.85	1.04	0.59	0.02	0.28	3.95
SugarConfectioners	0.02	0.00	0.05	0.04	0.01	0.00	0.14
EnergyBooster	147.27	149.84	38.29	6.63	0.00	11.71	368.16
SoybeanML47.5Solv	8.06	2.07	6.17	25.28	3.93	0.56	46.67
Ration	247.24	168.00	136.77	279.82	80.52	30.12	979.74

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## Fatty Acid Intake Example

	Fatty Acids - Intake (g/d)					
	C16:0	C18:0	C18:1C	C18:2	C18:3	Total
CS Bunk 4 2006 #4280	55.79	8.93	66.95	66.95	6.70	223.17
GS 3rd bunk 5 #4282	17.07	3.04	1.86	14.43	35.13	90.75
Alfalfa Hay Idaho #4290	3.24	0.52	0.32	2.40	4.77	12.97
Corn meal	18.18	2.79	33.70	63.04	0.85	121.23
DDG Greenfield etoh	48.57	7.35	101.22	228.16	5.31	402.06
SoybeanML47.5Solv	7.68	1.98	5.88	24.07	3.75	44.43
SoybeanHullsGrnd	2.84	1.23	2.79	7.48	2.30	17.54
WheatMidds	5.00	0.34	5.18	16.92	1.38	29.28
MolassesCane	0.78	0.16	0.56	2.39	0.32	4.34
Beef Blood Meal	1.31	1.02	2.28	0.26	0.02	5.62
FatPartHydrogTallow	51.09	93.25	24.92	2.28	1.04	207.69
Ration	212.05	120.73	245.99	429.89	61.81	1161.88

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## Additional Considerations

- Ready availability of low-cost byproducts from corn (distillers) or other sources

➢ Tremendous variation in fat content within and among production plants

Ingredient	Min	Median	Max
	% of DM		
Distillers Grains	5.26	8.39	13.06
Corn Meal	2.73	3.03	3.34
Corn Gluten Feed	2.91	3.52	4.14
SBM	0.68	1.37	1.79
Beef Blood	--	--	--
Canola	1.89	2.76	3.31

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## Variation in Fat Content

Ingredient	Mix	Min	Median	Max
% of DM				
Distillers Grains	15	5.26	8.39	13.06
Corn Meal	55	2.73	3.03	3.34
Corn Gluten Feed	5	2.91	3.52	4.14
SBM	15	0.68	1.37	1.79
Beef Blood	5	--	--	--
Canola	5	1.89	2.76	3.31
		2.6	3.4	4.4

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## Effect of Increasing the Unsaturated FA Content of Rumen-Inert Fats

Item	Diet				SEM
	Control	SFA <sup>1</sup>	MUFA <sup>2</sup>	PUFA <sup>3</sup>	
DMI, kg/d	23.8	23.1	22.1	22.0	1.1
Milk, kg/d	36.9	37.3	35.8	34.8	1.4
Fat, %	3.37	3.86	3.32	2.61	0.25
Fat, g/d	1,249	1,436	1,184	911	0.1

<sup>1</sup>SFA = Saturated free fatty acid supplement

<sup>2</sup>MUFA = Ca-salts of palm fatty acid distillate

<sup>3</sup>PUFA = Ca-salts of soybean oil fatty acids

Reiling & Reynolds, 2007

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## Tallow is Less Inert in High Corn Silage Diets

	Treatment		
	CS	CST	AST
DMI, kg/d	27.6	25.9	26.5
Milk, kg/d	44.9	44.3	43.6
Fat, %	3.12	2.68	3.32
Fat, kg/d	1.38	1.17	1.45
†10 18:1, %	0.75	2.15	0.78

CS = 50% corn silage + 50% conc

CST = 50% corn silage + 50% conc + 2% tallow

AST = 25% corn silage + 25% alfalfa silage + 50% conc + 2% tallow

Onetti et al., 2004

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## Alteration of Ruminant Environment

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## Rumen Environment

- Acidosis is NOT a prerequisite for MFD to occur
  - In most situations rumen health appears excellent and there are no overt signs of ruminal acidosis
  - Harvatine and Allen (2006) reported increased duodenal flow of BH intermediates and MFD with no change in ruminal pH measured every 5 seconds over 4 d

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## Effect of Corn Processing

- Careful consideration should be given to the fermentation rate of starch sources when troubleshooting MFD issues

### Effects of Corn Grain Conservation Method at Two Dietary Starch Concentrations

	High Starch		Low Starch	
	High Moisture Corn	Dry Ground Corn	High Moisture Corn	Dry Ground Corn
Milk Yield (kg)	38.8	38.4	33.4	34.3
Milk Fat %	3.05 <sup>b</sup>	3.59 <sup>a</sup>	3.95 <sup>a</sup>	3.73 <sup>a</sup>
Milk Fat Yield (kg)	1.17 <sup>b</sup>	1.35 <sup>a</sup>	1.33 <sup>ab</sup>	1.27 <sup>ab</sup>

Oba & Allen, 2003

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## Influence of Ration Particle Size

	Treatment <sup>1,2</sup>			P
	Fine	Medium	Coarse	
Dry Matter Intake, kg/d	22.4	22.0	22.2	0.88
Milk Yield, kg/d	31.5	32.1	31.1	0.56
Milk Fat, %	3.0	3.6	3.8	0.001
Milk Fat Yield <sup>3</sup>	945	1156	1182	---
Rumen pH	5.3	5.9	6.0	0.1
Rumination Time, min/24 h	374	466	531	0.001
Total Chewing Time, min/24 h	570	671	735	0.001

<sup>1</sup>Arithmetic mean particle size of the fine and coarse silages used in the study were 2.0 and 3.1, respectively.  
<sup>2</sup>Rations formulated on 55:45 silage:concentrate basis.  
<sup>3</sup>Calculated from reported values.

Grant et al., 1990

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## Intake, Milk Yield, and Milk Composition by Stocking Rate (Miner Institute)

Item	Stocking Rate, %				SE	P-value
	100	113	131	142		
DMI <sup>1</sup> , kg/d	24.4	24.8	25.0	25.3	0.65	0.69
Milk, kg/d	41.4	40.7	41.5	41.1	0.32	0.39
Fat, %	3.84 <sup>a</sup>	3.77 <sup>ab</sup>	3.77 <sup>ab</sup>	3.67 <sup>b</sup>	0.05	0.03
Protein, %	3.05	3.03	3.03	3.03	0.02	0.66
Lactose, %	4.89	4.88	4.90	4.90	0.01	0.42
SCS <sup>2</sup>	3.2	3.1	3.4	3.6	0.39	0.62

<sup>1</sup> DIM = Dry matter intake

<sup>2</sup> SCS = Somatic cell score

<sup>a,b</sup> Means within rows with different superscripts differ (P < 0.05)

## Topics

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- Two Northeast case studies plus a game!!
- Common observations/themes for herds with low milk fat
- Questions / comments

## Case study #1

- 70-cow dairy
- Production average ~ 90 lbs
- Milk fat consistently running ~3.0 to 3.1%

Report.txt Page { \$PAGE }  
 - Dairy Comp 305 -----  
 - Command : SUM MILK PCTF PCTP DIMTD BY LCTGP FOR LCTGP>0  
 - Expanded: -----  
 - Valley Ag Software ----- 4/ 9/07---

By LCTGP	%COW	#COW	Av MILK	Av PCTF	Av PCTP	AvDIMTD
1	31	22	83	2.8	3.0	180
2	23	16	81	2.8	3.1	242
3	46	33	100	2.8	3.0	158
Total	100	71	91	2.8	3.0	183

Case study #1

Sample	RF	Prot	MOU	SEF	Lact	SCS	DDC
04/25/07	2.89	12.80	9.0	18.70	14.85	1.130	C
04/22/07	2.89	12.80	9.0	18.70	14.85	1.130	C
04/20/07	2.82	13.00	12.4	18.77	14.91	1.143	C
04/18/07	3.07	12.80	9.0	18.70	14.85	1.130	C
04/16/07	3.09	13.00	9.9	18.70	14.85	1.130	C
04/12/07	3.12	13.00	12.2	18.70	14.85	1.140	C
04/10/07	3.18	12.80	10.3	18.74	14.89	1.140	C
04/08/07	3.18	12.80	10.3	18.74	14.89	1.140	C
04/02/07	3.18	12.80	10.3	18.74	14.89	1.140	C
03/31/07	3.21	13.00	9.4	18.80	14.86	1.170	C
03/28/07	3.26	13.00	9.4	18.80	14.86	1.170	C
03/27/07	3.32	13.00	10.5	18.70	14.89	1.140	C
03/23/07	3.27	12.80	9.4	18.70	14.89	1.140	C
03/22/07	3.28	12.84	9.7	18.70	14.87	1.140	C
03/19/07	3.28	12.84	9.7	18.70	14.87	1.140	C
03/18/07	3.29	13.00	10.3	18.70	14.89	1.140	C
03/15/07	3.26	12.84	9.4	18.70	14.89	1.140	C
03/11/07	3.29	13.00	12.2	18.70	14.89	1.140	C
03/07/07	3.18	13.00	12.2	18.80	14.89	1.120	C
03/06/07	3.02	13.00	12.7	18.49	14.85	1.130	C
03/03/07	3.06	13.00	12.3	18.74	14.87	1.130	C
02/28/07	2.99	13.00	12.8	18.70	14.89	1.140	C
02/23/07	3.04	13.00	12.8	18.74	14.86	1.130	C
02/19/07	3.08	13.00	12.7	18.70	14.87	1.170	C
02/17/07	3.09	13.00	12.7	18.70	14.86	1.130	C
02/16/07	3.11	13.07	12.4	18.77	14.89	1.130	C
02/15/07	3.07	13.00	12.2	18.70	14.84	1.170	C
02/07/07	3.04	13.04	12.4	18.74	14.89	1.130	C
02/06/07	3.08	13.04	12.8	18.74	14.86	1.130	C
02/01/07	3.11	13.00	12.7	18.80	14.90	1.140	C
01/28/07	3.03	13.00	12.3	18.80	14.90	1.120	C
01/26/07	3.04	13.00	12.4	18.80	14.90	1.120	C
01/24/07	3.09	13.00	12.3	18.80	14.90	1.130	C
01/22/07	3.07	13.04	12.3	18.82	14.90	1.170	C
01/20/07	3.04	13.00	12.2	18.80	14.89	1.130	C
01/18/07	3.09	13.00	12.7	18.80	14.90	1.130	C
01/16/07	3.04	13.00	12.3	18.74	14.87	1.170	C
01/09/07	3.09	13.00	12.4	18.74	14.86	1.170	C
01/08/07	3.08	13.00	12.4	18.74	14.86	1.170	C
12/27/06	3.19	13.00	12.3	18.74	14.84	1.220	C
12/26/06	3.32	13.00	12.7	18.74	14.89	1.140	C
12/21/06	3.29	13.00	12.4	18.74	14.89	1.140	C
12/19/06	3.39	13.00	12.4	18.77	14.86	1.140	C
12/17/06	3.36	13.00	12.4	18.74	14.89	1.140	C
12/15/06	3.50	13.00	12.9	18.80	14.84	1.140	C
12/11/06	3.50	13.00	12.9	18.80	14.89	1.130	C
12/09/06	3.50	13.00	12.9	18.80	14.89	1.130	C
12/07/06	3.51	13.00	13.0	18.84	14.89	1.130	C
12/06/06	3.51	13.00	13.0	18.84	14.89	1.130	C

Case study #1

CORN SILAGE		303   11028750		CORN SILAGE		303   11028750	
ANALYSIS RESULTS				ANALYSIS RESULTS			
N Moisture	64.8			N Moisture	64.7		
N Dry Matter	35.2	1.3		N Dry Matter	35.1	19.8	
N Crude Protein	7.4	4.9		N Crude Protein	9.1	19.8	
N Insoluble Protein	2.4	2.3		N Insoluble Protein	8.6	18.8	
N Adjusted Crude Protein	2.4	2.3		N Adjusted Crude Protein	9.1	19.8	
Soluble Protein & CP	2.6	4.1		Soluble Protein & CP	13.3	48.9	
N Acid Detergent Fiber	12.8	34.6		N Acid Detergent Fiber	12.8	43.0	
N Neutral Detergent Fiber	0	2.8		N Neutral Detergent Fiber	0	5.7	
N Lignin	0	0		N Lignin	11	3.1	
Lignin & NDF	0	0		Lignin & NDF	11	3.1	
N Crude Fat	1.2	1.5		N Crude Fat	2.3	1.1	
ADCP & CP	5.3	4.3		ADCP & CP	5.3	16.3	
MDCP & CP	13.5	13.1		MDCP & CP	19.9	19.9	
N NFC	12.2	36.4		N NFC	12.9	27.9	
NHC (NDFcr Sol. Corch.)	1.8	1.5		NHC (NDFcr Sol. Corch.)	2.4	1.5	
N SSC (Simple Sugar)	1.5	1.2		N SSC (Simple Sugar)	2.1	4.6	
N Starch	16.5	41.4		N Starch	2.6	24.4	
ME <sub>1</sub> (Mcal/Lb)	26	27		ME <sub>1</sub> (Mcal/Lb)	33	35	
N TDN	67	77		N TDN	33	35	
ME <sub>2</sub> (Mcal/Lb)	17	18		ME <sub>2</sub> (Mcal/Lb)	15	16	
ME <sub>3</sub> (Mcal/Lb)	17	18		ME <sub>3</sub> (Mcal/Lb)	17	18	
N Calcium	0.08	0.08		N Calcium	0.14	0.08	
N Phosphorus	0.08	0.08		N Phosphorus	0.14	0.08	
N Magnesium	0.08	0.08		N Magnesium	0.14	0.08	
N Potassium	0.08	0.08		N Potassium	1.02	1.21	
N Sodium	0.08	0.08		N Sodium	0.19	0.17	
Degradable Protein SCP	82			Degradable Protein SCP	60		
N Chloride Ion	0.06	0.10		N Chloride Ion	0.16	0.07	
N Ammonia (Protein Equiv)	132	145		N Ammonia (Protein Equiv)	146	100	
N Lactic Acid	1.81	5.16		N Lactic Acid	2.31	5.01	
N Acetic Acid	0.60	1.71		N Acetic Acid	0.81	1.30	
CC (SODASol/LiTV)	2.92	2.92		CC (SODASol/LiTV)	2.94	2.94	
FA Sapon	0.46	0.46		FA Sapon	0.17	0.17	
FA Sapon 90	0.46	0.46		FA Sapon 90	0.17	0.17	
N ADCP	1.3	1.5		N ADCP	1.8	1.0	
N MDCP	13.5	13.1		N MDCP	19.9	19.9	
197D Duv. & of DM	36			197D Duv. & of DM	36		
MDP Duv. & of MDP	36			MDP Duv. & of MDP	36		
ME <sub>1</sub> (Mcal/Lb) of DM	16.2			ME <sub>1</sub> (Mcal/Lb) of DM	16.2		
ME <sub>2</sub> (Mcal/Lb) of DM	16.2			ME <sub>2</sub> (Mcal/Lb) of DM	16.2		
ME <sub>3</sub> (Mcal/Lb) of DM	16.2			ME <sub>3</sub> (Mcal/Lb) of DM	16.2		
ME <sub>1</sub> (Mcal/Lb) of DM	16.2			ME <sub>1</sub> (Mcal/Lb) of DM	16.2		
ME <sub>2</sub> (Mcal/Lb) of DM	16.2			ME <sub>2</sub> (Mcal/Lb) of DM	16.2		
ME <sub>3</sub> (Mcal/Lb) of DM	16.2			ME <sub>3</sub> (Mcal/Lb) of DM	16.2		
N Lysine	0.06	0.06		N Lysine	0.06	0.06	
N Methionine	0.04	0.04		N Methionine	0.04	0.04	

Case study #1

## Observations

- Results of Particle size analysis (Cornell Separator, 200 g of sample)

TMR top 8%  
mid 20%  
bottom 72%

CS top 9.5%  
mid 38%  
bottom 52.5%

MML top 33%  
mid 18%  
bottom 49%

Cud chewing: We observed 85% of 27 non-eating cows chewing cud.

Hock scoring (method found at Pro-Dairy web site): Score 1 = 50%; Score 2 = 46%; Score 3 = 4%

### Manure:

- Generally consistent. Would score about 3 on Mich. State system  
- Attached photo was typical of washed sample. No apparent starch or grain. Just CS particles, mostly <3/8" long

Case study #1



Case study #1

## Original diets

Feed Name	DM (lbs/day)	As-Fed (lbs/day)
MML - Bag - 48% top 2 scr.	16.999	36.874
Corn Silage - 28% top 2 scr	14.648	41.614
Tallow (618)	0.218	0.220
Distillers Gr. - + solubles (515) Fine	6.386	7.018
Soybean - Meal - 47.5 (525) Finely Gound	4.214	4.682
Corn Gnd. - Grain56 (407) Fine Meal	7.417	8.428
Zimpro 4-Plex	0.014	0.015
Manganese - Oxide (817)	0.076	0.077
Sodium - Bicarbonate (832)	0.518	0.518
Salt (831)	0.187	0.187
Magnesium Sulfate	0.130	0.133
Limestone (813)	0.518	0.518
Calcium - Sulfate (806)	0.086	0.089
Minvit2	0.149	0.151

Case study #1

### Intake and Performance Predictions

Predicted Dry Matter Intake: 50.0 (lbs/day)  
Actual Dry Matter Intake: 51.6 (lbs/day)

Target ADG (with Concepts): 0.00 (lbs/day)  
ME Allowable Gain (with Concepts): 0.00 (lbs/day)  
MP Allowable Gain (with Concepts): 0.00 (lbs/day)  
MET Allowable Gain (with Concepts): 0.00 (lbs/day)  
LYS Allowable Gain (with Concepts): 0.00 (lbs/day)  
Days to Gain 1 Condition Score: 171  
Milk/Feed: 1.8

### Diet Concentrations and Rumens Balances

Physically Effective NDF Req.: 11.9 (lbs/day)  
Physically Effective NDF Sup.: 9.7 (lbs/day)  
Physically Effective NDF Bal.: -2.2 (lbs/day)  
peNDF: 19 (%DM)  
NDF in Ration: 32.2 (%DM)

Diet ME: 1.23 (Mcal/lb DM)  
Diet NEI: 0.79 (Mcal/lb DM)  
Diet NEm: 0.79 (Mcal/lb DM)  
Diet NEg: 0.53 (Mcal/lb DM)

Ruminal N Balance: 121 (g/day)  
Peptide Balance: 19 (g/day)  
Methionine Balance: -2 (g/day)  
Lysine Balance: -7 (g/day)

Predicted Maximum Forage Intake: 33.8 (lbs/day)  
Entered Forage Intake: 31.6 (lbs/day)

Entered Milk Production: 93.1 (lbs/day)  
ME Allowable Milk: 102.9 (lbs/day)  
MP Allowable Milk: 83.2 (lbs/day)  
MET Allowable Milk: 86.5 (lbs/day)  
LYS Allowable Milk: 87.3 (lbs/day)  
Daily Weight Change due to Reserves: 1.3 (lbs/day)

MP From Bacteria: 1327 (g/day), 52 (% MP Sup.)  
MP From Undeg. Feed: 1218 (g/day), 48 (% MP Sup.)  
Diet CP: 18.0 (%DM)  
Ration Dry Matter: 51%  
NDF: 1.2 (% Body Weight)

Total DIP: 61.1 (% CP)  
Soluble Protein: 34.3 (% CP)  
Total NFC in Ration: 40.7 (% DM)  
Total Fat in Ration: 5.1 (% DM)

Ruminal N Balance: 134 (% of Req.)  
Peptide Balance: 110 (% of Req.)  
Methionine: 95% of Required  
Lysine: 96% of Required

Forage = 61%; Starch = 27.0%; Rumensin ~320 mg/d

Case study #1

# What would you do??

## Revised diets

Feed Name	DM (lbs/day)	As-Fed (lbs/day)
MML - Bag - 48% top 2 scr.	17.400	37.744
Corn Silage - 28% top 2 scr	16.800	47.727
Existing grain mix - Tallow (618)	0.205	0.207
Existing grain mix - Soybean - Meal - 47.5 (525) Finely Gound	3.330	3.700
Existing grain mix - Corn Gnd - Grain56 (407) Fine Meal	7.395	8.403
Existing grain mix - Zipro 4-Plex	0.014	0.015
Existing grain mix - Manganese - Oxide (817)	0.075	0.076
Existing grain mix - Sodium - Bicarbonate (832)	0.474	0.474
Existing grain mix - Salt (831)	0.185	0.185
Existing grain mix - Magnesium Sulfate	0.128	0.131
Existing grain mix - Limestone (813)	0.474	0.474
Existing grain mix - Calcium - Sulfate (806)	0.085	0.088
Existing grain mix - Minvit2	0.148	0.149
Soy Plus (901) Finely Gound	3.000	3.344
Soybean - Hulls (617) Loose	1.786	1.963

Case study #1

## Intake and Performance Predictions

Predicted Dry Matter Intake : 52.1 (lbs/day)  
Actual Dry Matter Intake : 51.5 (lbs/day)

Predicted Maximum Forage Intake : 32.7 (lbs/day)  
Entered Forage Intake : 34.2 (lbs/day)

Target ADG (with Conceptus) : 0.00 (lbs/day)  
ME Allowable Gain (with Conceptus) : 0.00 (lbs/day)  
MP Allowable Gain (with Conceptus) : 0.00 (lbs/day)  
MET Allowable Gain (with Conceptus) : 0.00 (lbs/day)  
LYS Allowable Gain (with Conceptus) : 0.00 (lbs/day)  
Days to Gain 1 Condition Score : 957  
Milk/Feed: 1.8

Entered Milk Production : 93.1 (lbs/day)  
ME Allowable Milk : 94.7 (lbs/day)  
MP Allowable Milk : 99.7 (lbs/day)  
MET Allowable Milk : 94.9 (lbs/day)  
LYS Allowable Milk : 105.1 (lbs/day)  
Daily Weight Change due to Reserves: 0.2 (lbs/day)

## Diet Concentrations and Rumen Balances

Physically Effective NDF Req. : 11.8 (lbs/day)  
Physically Effective NDF Sup. : 11.3 (lbs/day)  
Physically Effective NDF Bal. : -0.6 (lbs/day)  
pNDF : 22 (%DM)  
NDF in Ration : 32.7 (%DM)

Diet ME : 1.22 (Mcal/lb DM)  
Diet NE1 : 0.79 (Mcal/lb DM)  
Diet NEem : 0.79 (Mcal/lb DM)  
Diet NEg : 0.52 (Mcal/lb DM)

Ruminal N Balance : 121 (g/day)  
Peptide Balance : 12 (g/day)  
Methionine Balance : 1 (g/day)  
Lysine Balance : 15 (g/day)

MP From Bacteria: 1436 (g/day), 54 (% MP Sup.)  
MP From Undig. Feed: 1226 (g/day), 46 (% MP Sup.)  
Diet CP : 18.0 (%DM)  
Ration Dry Matter : 49%  
NDF : 1.3 (% Body Weight)

Total DIP : 65.5 (% CP)  
Soluble Protein : 35.6 (% CP)  
Total NFC in Ration : 39.6 (% DM)  
Total Fat in Ration : 4.0 (% DM)

Ruminal N Balance : 131 (% of Req.)  
Peptide Balance : 106 (% of Req.)  
Methionine : 101% of Required  
Lysine : 109% of Required

Forage = 66%; Starch ~ 26.0%; Rumensin ~320 mg/d

Case study #1

## Case study #2

- 90-cow dairy
- Production average ~ 60 lbs
- Milk fat
  - Spring 2007 – 3.7 to 3.8%
  - June 2007 – 3.5%
  - July 2007 – 3.3%
  - August 2007 – 3.2%

## Observations (9/07)

- 59% forage in TMR
- TMR particle size analysis
  - 21.0% top
  - 28.7% middle
  - 50.3% bottom
- ~50% of cows chewing

Case study #2

"Old" corn silage 9/07

ANALYSIS RESULTS			
Corn silage	As Sampled	Dry Matter	Unit
Moisture	64.2		%
Dry Matter	35.8		%
Crude Protein	2.7	7.7	% DM
Adjusted Protein	2.7	7.7	% DM
Soluble Protein		59.9	% CP
Degradable Protein (calc.)		79.9	% CP
Ammonia		21.5	% CP
TMN	26.0	72.7	% DM
Net Energy Lactation	0.27	0.76	Mcal/lb
Net Energy Maintenance	0.28	0.78	Mcal/lb
Net Energy Gain	0.18	0.50	Mcal/lb
Acid Detergent Fiber	8.1	22.7	% DM
Neutral Detergent Fiber	13.0	36.4	% DM
Ash	1.8	5.0	% DM
NFC	17.3	48.4	% DM
Calcium	0.10	0.28	% DM
Phosphorus	0.08	0.23	% DM
Magnesium	0.04	0.13	% DM
Potassium	0.41	1.13	% DM
Sodium	0.002	0.006	% DM
Iron	178	496	PPM
Manganese	9	24	PPM
Zinc	10	28	PPM
Copper	4	11	PPM
pH	3.9		

Case study #2

"Old" corn silage 9/07

## ANALYSIS RESULTS

Mold and Yeast counts are on an as-received basis

Mold count 1000 col/gm

Yeast count = 1000 col/gm

Feeding risks at various mold spore counts

Mold spore count per gram Feeding risks and cautions  
 .....  
 Air-dried  
 Under 500,000 ..... Relatively low count  
 5 to 1 million ..... Relatively safe  
 1 to 2 million ..... Stipulate energy (x.95)  
 Feed with caution  
 2 to 3 million ..... Closely observe animal and performance  
 Stipulate energy (x.95)  
 3 to 5 million ..... Elute with other feeds  
 Stipulate energy (x.95)  
 Observe closely  
 Over 5 million ..... Stipulate feeding

## QUALITATIVE FORAGE ANALYSIS

Corn silage	Value	Unit	Range
Dry Matter	35.8	%	31.0 - 36.2
pH	3.91		4.00 - 4.56
Titratable Acidity	10.42	meq/100gm	6.75 - 10.55
Lactic acid	5.2		4.0 - 6.4
Acetic acid	4.41	% DM	1.99 - 3.82
Propionic acid	0.59	% DM	0.16 - 0.59
Iso-butyric acid	< 0.01	% DM	0.17 - 0.55
Butyric acid	< 0.01	% DM	0.00 - 0.23
Total VFA	10.20	% DM	
Lactic acid/VFA	50.98	%	
Ammonia, CPE*	0.9	% DM	0.4 - 1.0
	11.5	% CP	

Case study #2

"New" corn silage 9/07

ANALYSIS RESULTS			
Corn silage	As Sampled	Dry Matter	Unit
Moisture	59.6		%
Dry Matter	30.4		%
Crude Protein	2.4	8.0	% DM
Adjusted Protein	2.4	8.0	% DM
Soluble Protein		47.7	% CP
Degradable Protein (calc.)		73.8	% CP
Ammonia		7.8	% CP
TIN	22.5	73.9	% DM
Net Energy Lactation	0.24	0.77	Mcal/lb
Net Energy Maintenance	0.24	0.80	Mcal/lb
Net Energy Gain	0.16	0.51	Mcal/lb
Acid Detergent Fiber	6.5	21.2	% DM
Neutral Detergent Fiber	11.3	37.0	% DM
Ash	1.4	4.5	% DM
NFC	14.6	48.0	% DM
Calcium	0.07	0.24	% DM
Phosphorus	0.06	0.21	% DM
Magnesium	0.05	0.16	% DM
Potassium	0.41	1.35	% DM
Sodium	0.002	0.007	% DM
Iron	53	175	PPM
Manganese	8	25	PPM
Zinc	13	42	PPM
Copper	3	10	PPM
pH	4.1		

Case study #2

"New" corn silage 9/07

ANALYSIS RESULTS			
Mold and Yeast Counts are on an as-received basis			
Mold Count	1,500,000	col/gm	
Yeast Count	2,500,000	col/gm	
Feeding risks at various mold spore counts			
Mold spore count per gram	Feeding risks and cautions		
Under 500,000	Relatively low count		
5 to 1 million	Relatively safe		
1 to 2 million	Discontin. energy (x.95)		
2 to 3 million	Feed with caution		
3 to 5 million	Closely observe animals and performance		
Over 5 million	Discontin. energy (x.85)		
	Diets with other feeds		
	Discontin. energy (x.75)		
	Observe closely		
	Discontinue feeding		
QUALITATIVE FORAGE ANALYSIS			
Corn silage	Value	Unit	Range
Dry Matter	30.4	%	31.0 - 36.2
pH	4.14		4.00 - 4.56
Titratable Acidity	4.02	meq/100gm	6.75 - 10.55
Lactic acid	3.8		4.0 - 4.4
Acetic acid	2.88	% DM	1.99 - 3.82
Propionic acid	< 0.01	% DM	0.16 - 0.59
Iso-butyric acid	< 0.01	% DM	0.17 - 0.55
Butyric acid	< 0.01	% DM	0.50 - 0.23
Total VFA	4.68	% DM	
Lactic acid/VFA	54.89	%	
Ammonia, CP*	0.6	% DM	0.4 - 1.0
	7.8	% CP	

Case study #2

HMSC analysis 9/07

ANALYSIS RESULTS			
Shelled corn	As Sampled	Dry Matter	Unit
Moisture	26.1		%
Dry Matter	73.9		%
Crude Protein	6.3	8.5	% DM
Adjusted Protein	6.3	8.5	% DM
Soluble Protein		46.8	% CP
Degradable Protein (calc.)		68.1	% CP
Ammonia		3.6	% CP
TIN	42.7	84.8	% DM
Net Energy Lactation	0.64	0.90	Mcal/lb
Net Energy Maintenance	0.75	0.95	Mcal/lb
Net Energy Gain	0.49	0.64	Mcal/lb
Acid Detergent Fiber	4.4	6.0	% DM
Neutral Detergent Fiber	12.4	16.8	% DM
Ash	1.4	2.1	% DM
NFC	50.1	67.8	% DM

ANALYSIS RESULTS			
Mold and Yeast Counts are on an as-received basis			
Mold Count	8,500,000	col/gm	
Yeast Count	4,500,000	col/gm	
Feeding risks at various mold spore counts			
Mold spore count per gram	Feeding risks and cautions		
Under 500,000	Relatively low count		
5 to 1 million	Relatively safe		
1 to 2 million	Discontin. energy (x.95)		
2 to 3 million	Feed with caution		
3 to 5 million	Closely observe animals and performance		
Over 5 million	Discontin. energy (x.85)		
	Diets with other feeds		
	Discontin. energy (x.75)		
	Observe closely		
	Discontinue feeding		

Case study #2

### Ration ingredients (lbs DM)

Item	7/07	8/07	9/07	10/07
"Old" corn silage	12.8	5.7	7.1	6.0
"New" corn silage	---	9.2	8.3	14.6
Haylage	14.4	---	---	---
Baleage	---	9.9	---	---
Alfalfa hay	---	---	11.5	5.6
HMSC (fine)	7.9	6.1	7.6	5.2
Roasted beans (finely ground)	3.4	3.2	3.2	3.6
Distillers	1.0	---	---	---
Soybean hulls	---	1.9	1.9	
AminoPlus	1.9	1.9	2.3	
Dairy concentrate mix	3.6	3.6	2.2	7.7

### Ration nutrients

Item	7/07	8/07	9/07	10/07
CP, %	19.0	19.3	18.1	17.7
Soluble CP, % of CP	36.2	36.7	n/a	n/a
NDF, %	30.0	31.6	31.4	32.7
ADF, %	18.8	19.1	19.1	19.1
NEL, Mcal/lb	0.77	0.78	0.78	0.78
Crude fat, %	4.5	4.6	4.4	4.6
NFC, %	39.0	37.2	37.6	37.0
Starch, %	25.3	20.9	22.2	21.7
Sugar, %	3.5	3.9	4.2	3.2

- ### Current status of herd
- Still feeding HMSC and roasted beans
  - Butterfat now running ~3.5%
  - Made progress, but probably will not fully escape until HMSC transitions entirely into new HMSC

## A game!!!

- Jersey herd
- Late winter seasonal calving with rotational grazing
- During past 5 years, herd butterfat has fluctuated from a low of 3.88% to a high of 5.43% and 20/60 months have been under 4.25%
- You get to rank the butterfat percentage and yield with nutritional situation!!

## Six scenarios...

1. Feeding 22 lb DM CS, 1.5 lb grass hay, R @ 240 mg/d, 20 lbs grain, 28% starch
2. Feeding max lush spring grass, R @ 320 mg/d, 5 lb DM CS, zero hay, 17.5 lbs grain, 22% starch
3. Feeding summer grass, 5 lb DM CS, R @ 320 mg/d, 17.5 lbs grain, 21% starch
4. Feeding summer grass, 3 lb DM CS, R @ zero, 17.3 lbs grain, 24% starch
5. Feeding max lush spring grass, R @ zero, 10 lb DM CS, 14.3 lbs grain, 24% starch
6. Feeding 20 lb DM CS, zero hay, R @ zero, 15.5 lbs grain, 25% starch

Rank from highest to lowest based upon expected milk fat %

## Six scenarios...

1. Feeding 22 lb DM CS, 1.5 lb grass hay, R @ 240 mg/d, 20 lbs grain, 28% starch  
5.29% fat; 2.89 lbs fat; Nov 2006
2. Feeding max lush spring grass, R @ 320 mg/d, 5 lb DM CS, zero hay, 17.5 lbs grain, 22% starch  
4.40% fat; 2.70 lbs fat; May 2006
3. Feeding summer grass, 5 lb DM CS, R @ 320 mg/d, 17.5 lbs grain, 21% starch  
3.88% fat; 2.21 lbs fat; July 2006
4. Feeding summer grass, 3 lb DM CS, R @ zero, 17.3 lbs grain, 24% starch  
3.91% fat; 2.36 lbs fat; July 2003
5. Feeding max lush spring grass, R @ zero, 10 lb DM CS, 14.3 lbs grain, 24% starch  
4.49% fat; 2.84 lbs fat; April 2004
6. Feeding 20 lb DM CS, zero hay, R @ zero, 15.5 lbs grain, 25% starch  
5.18% fat; 2.57 lbs fat; Nov 2003

## Common observations/themes for low milk fat

- Factors that cause altered ruminal biohydrogenation
  - NDF and NFC interrelationships
  - Altered corn silage fermentation profiles (high acetic acid)
  - Mycotoxins in forages or high moisture corn
  - Elevated mold/yeast counts in high-moisture corn
- Factors that result in high availability of linoleic acid
  - Unsaturated fat source, amount, and processing
- Factors that slow rates of biohydrogenation
  - Fish fatty acids
  - Rumensin
  - High C18:1 intake??
- Factors that result in high rates of passage
  - High production/DMI