Misconceptions About Milk Fat Depression in the Southeast (and elsewhere)

Tom Jenkins

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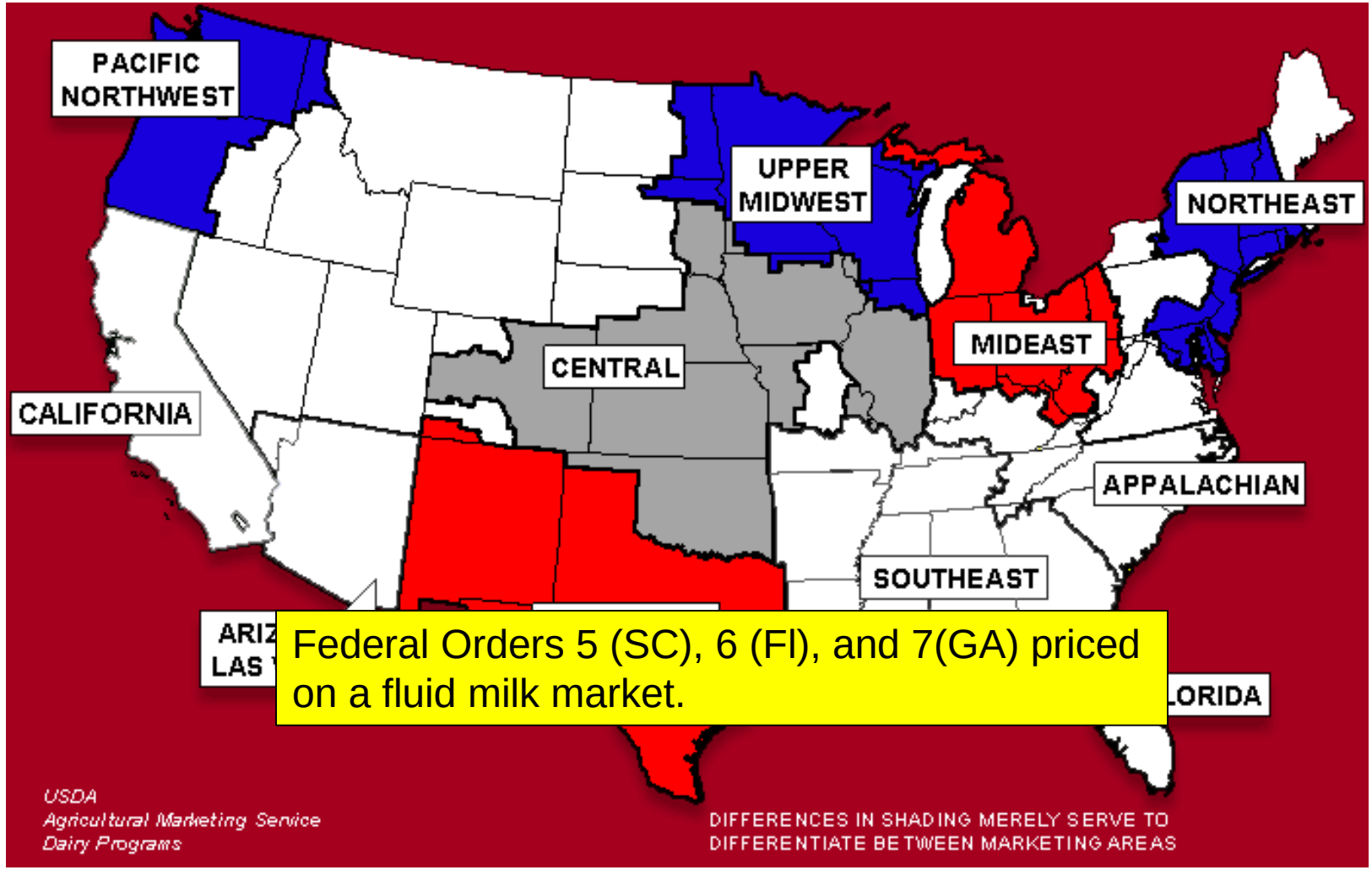
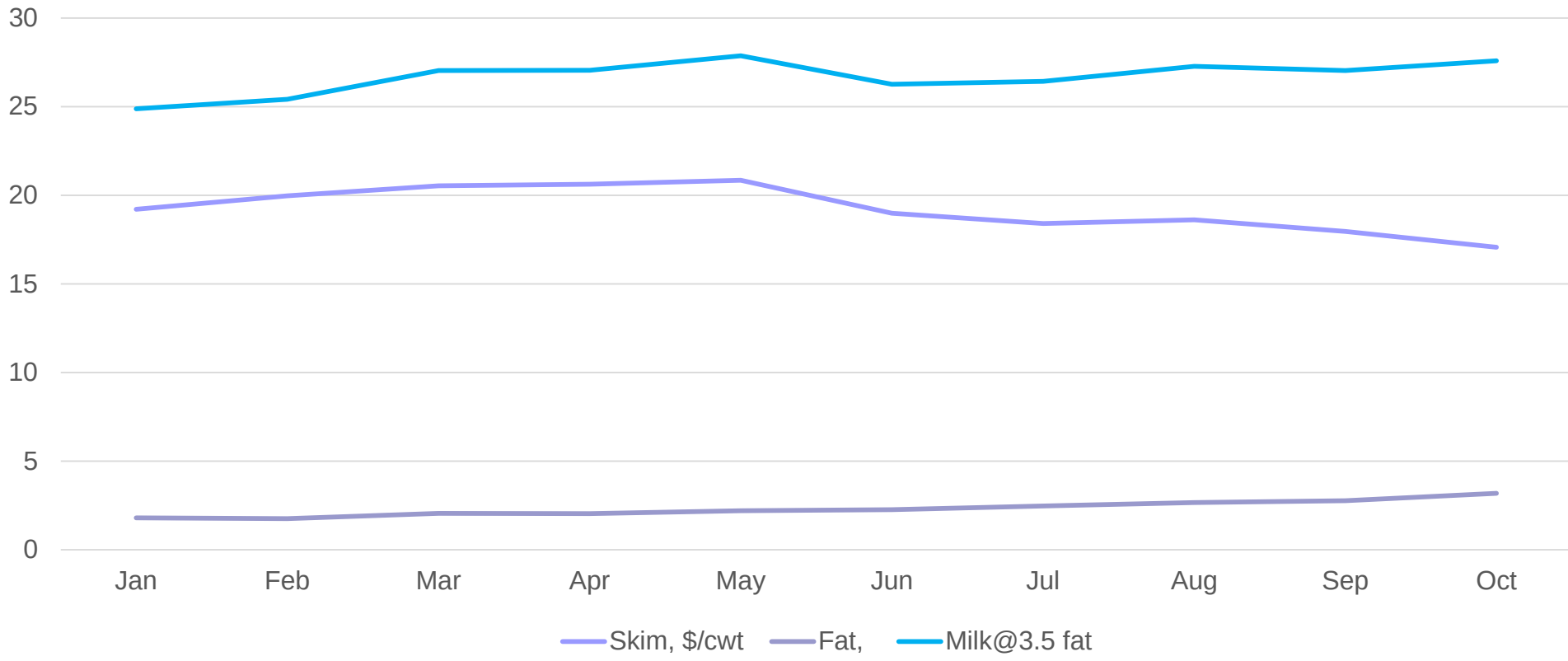
Clemson University

Misconceptions About MFD

1.
2.
3.
4.
5. **The fluid-based milk pricing system in the Southeast means MFD is not a big problem!**


PACIFIC NORTHWEST
UPPER MIDWEST
NORTHEAST
MIDEAST
CENTRAL
CALIFORNIA
APPALACHIAN
SOUTHEAST
Federal Orders 5 (SC), 6 (Fl), and 7(GA) priced on a fluid milk market.
USDA
Agricultural Marketing Service
Dairy Programs
DIFFERENCES IN SHADING MERELY SERVE TO DIFFERENTIATE BETWEEN MARKETING AREAS

2014 FMMO 5 –Class 1 Milk



Upper Midwest FMMO

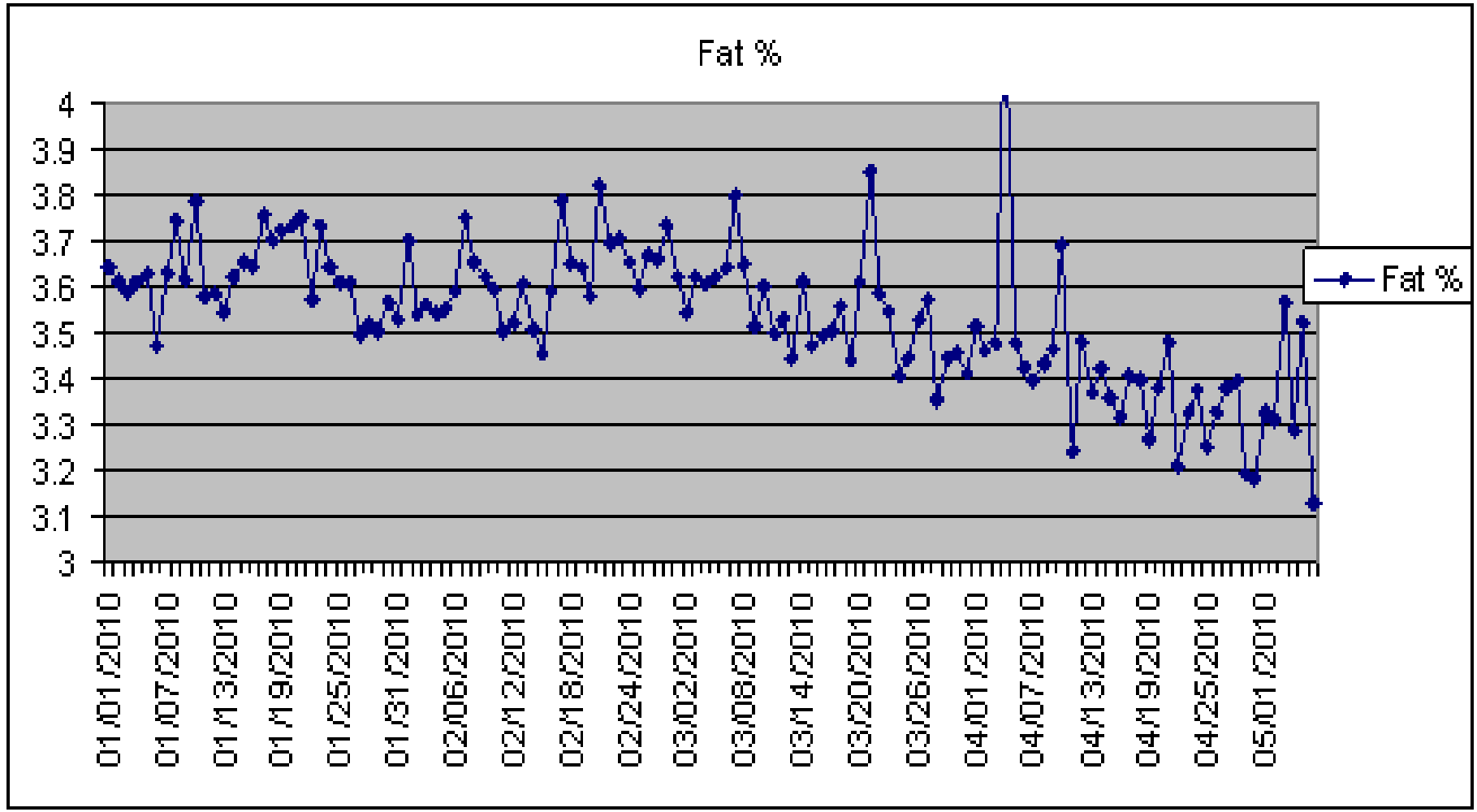
- 1000 cows at 80 lbs/day, 3% protein
  - 3.7% fat - $632,129
  - 3.2% fat - $596, 578
- Loss = $35,551/month

Federal Order 5

	Skim/cwt.	Fat/lb.	**Fat/0.1%**
2009	$9.91	$1.2653	**0.117**
2010	$11.84	$1.8602	**0.174**
2011	$14.55	$2.2380	**0.209**
2014 (Dec)	$19.14	$2.25	**0.210**

What Does MFD Cost in South Carolina?

- Federal Orders 5 (SC), 6 (Fl), and 7(GA) priced on a fluid milk market.
- Lose $0.210/cwt for each 0.1% drop in butterfat.
- Example
  - 1000 cows at 80 lbs/day
  - 0.5 drop in milk fat for 21 days
  - Lose $17,556


Fat %
4
3.9
3.8
3.7
3.6
3.5
3.4
3.3
3.2
3.1
3
01/01/2010
01/07/2010
01/13/2010
01/19/2010
01/25/2010
01/31/2010
02/06/2010
02/12/2010
02/18/2010
02/24/2010
03/02/2010
03/08/2010
03/14/2010
03/20/2010
03/26/2010
04/01/2010
04/07/2010
04/13/2010
04/19/2010
04/25/2010
05/01/2010
Fat %

Misconceptions About MFD

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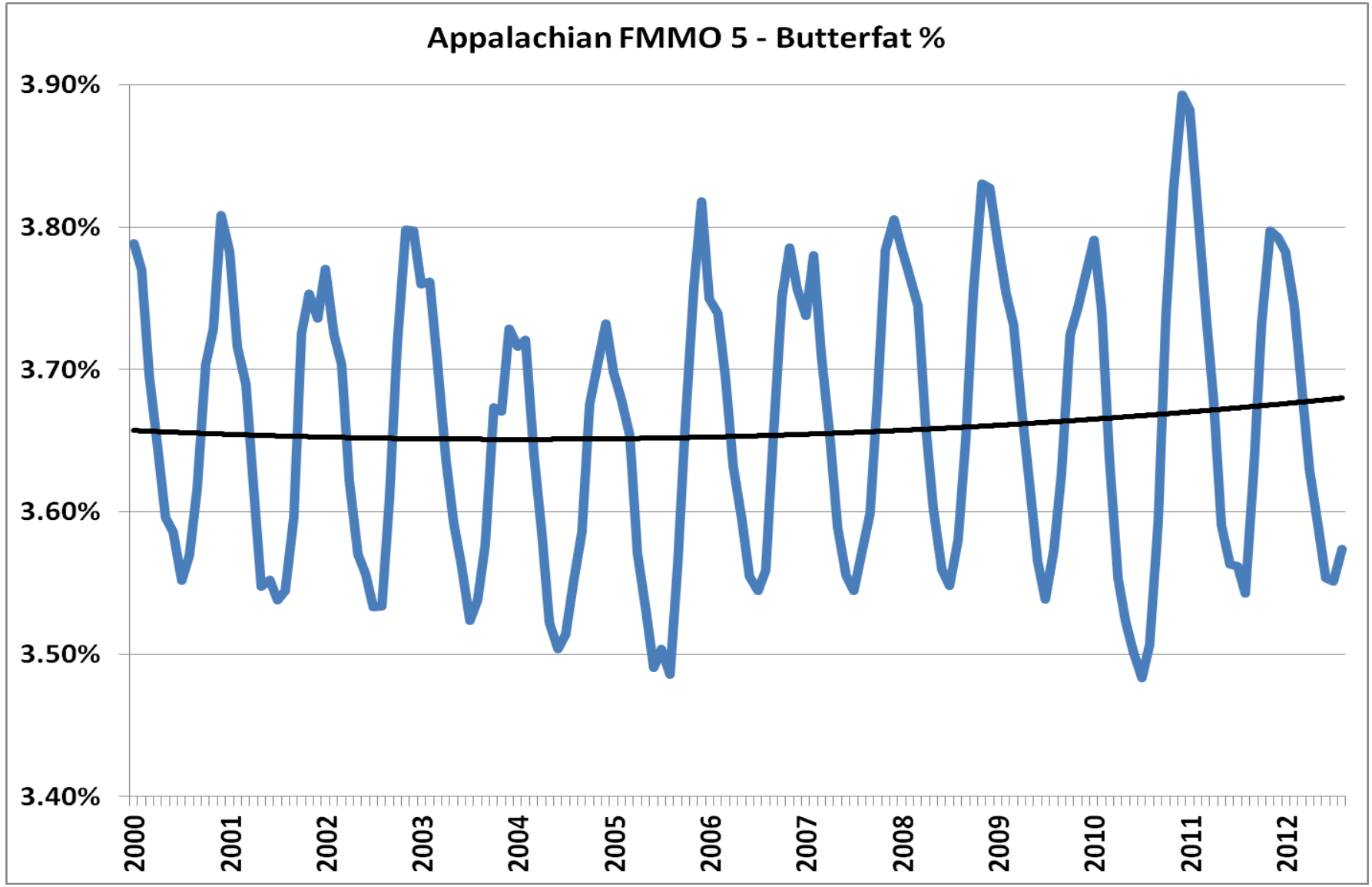
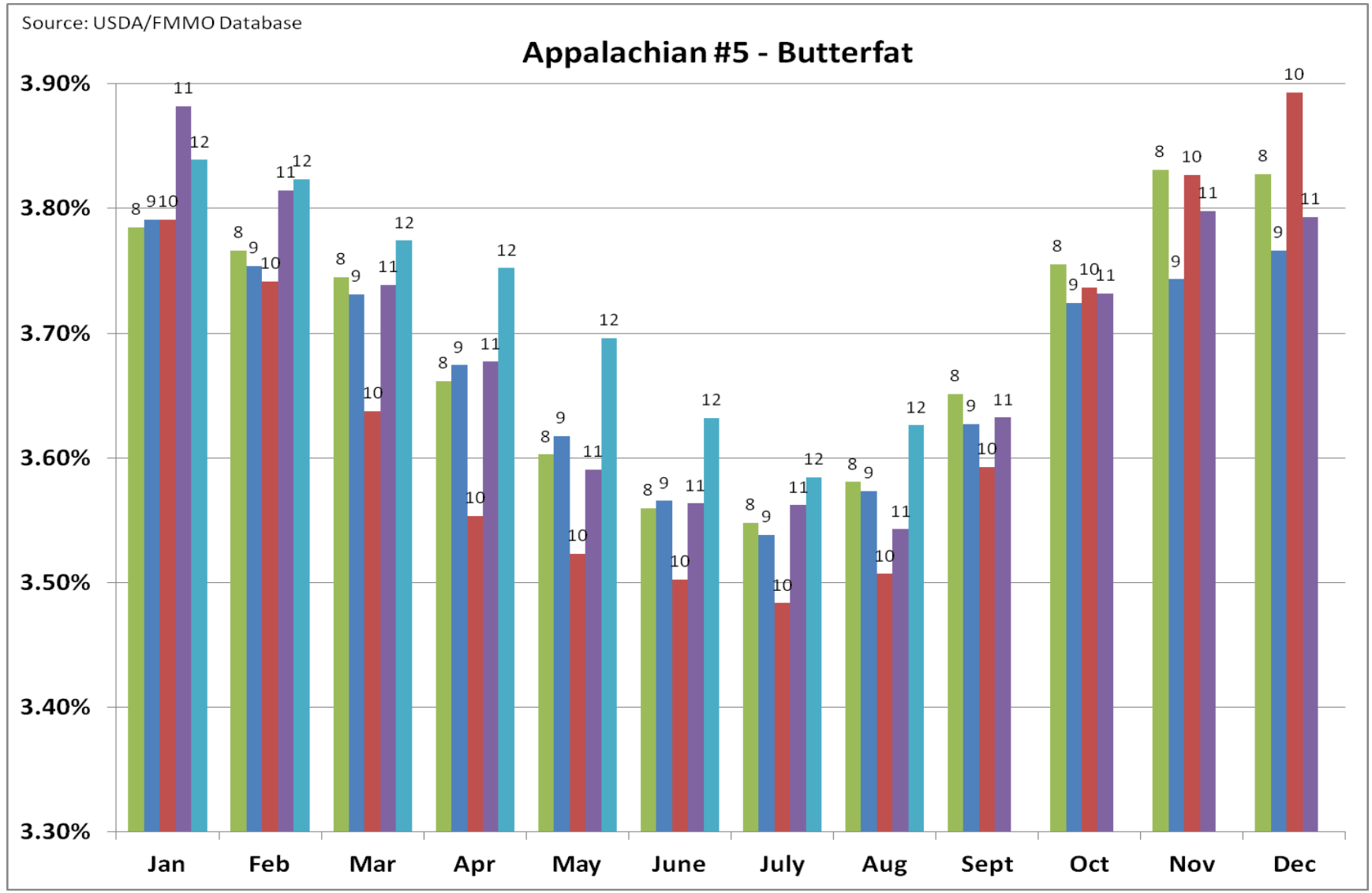
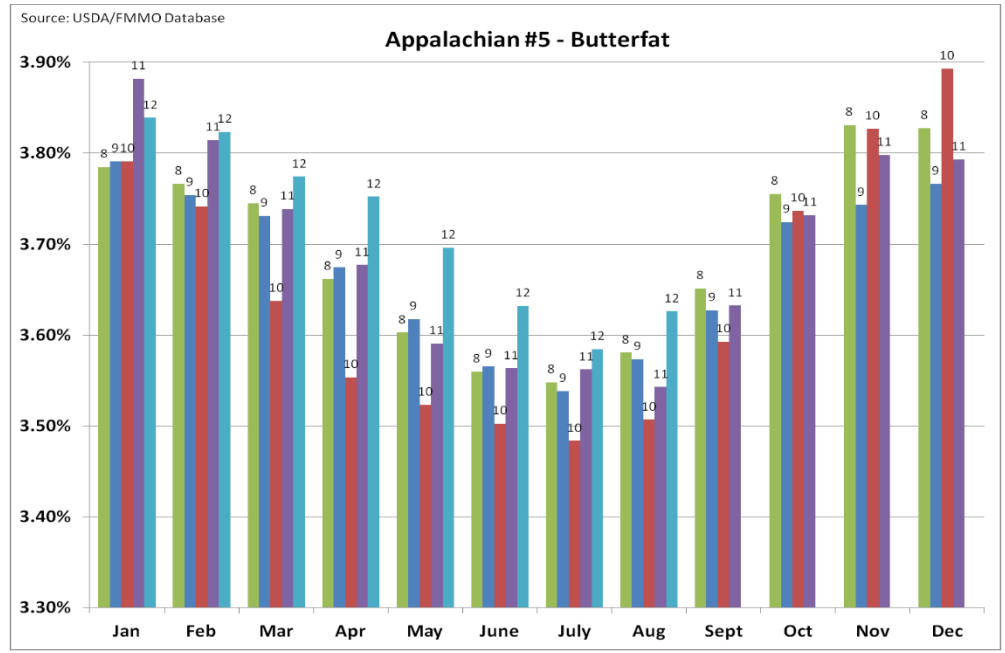
4. Heat stress in the summer makes MFD more of a problem here than anywhere else in the country!

5. The way milk is priced in the Southeast means MFD is not a big problem!


Appalachian FMMO 5 - Butterfat %
3.90%
3.80%
3.70%
3.60%
3.50%
3.40%
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012


Source: USDA/FMMO Database
Appalachian #5 - Butterfat
3.90%
3.80%
3.70%
3.60%
3.50%
3.40%
3.30%
Jan
Feb
Mar
Apr
May
June
July
Aug
Sept
Oct
Nov
Dec


Source: USDA/FMMO Database
Appalachian #5 - Butterfat
3.90%
3.80%
3.70%
3.60%
3.50%
3.40%
3.30%
Jan
Feb
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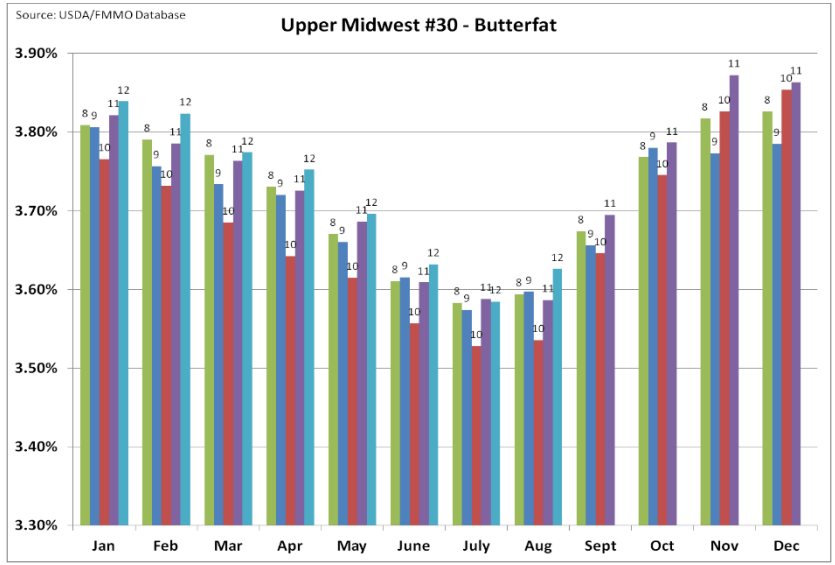
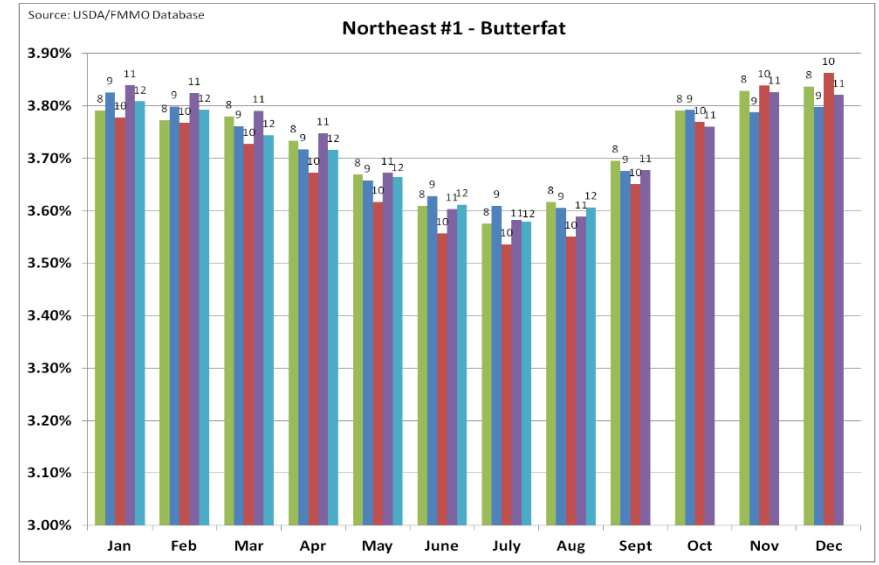

Source: USDA/FMMO Database
Upper Midwest #30 - Butterfat
3.90%
3.80%
3.70%
3.60%
3.50%
3.40%
3.30%
Jan
Feb
Mar
Apr
May
June
July
Aug
Sept
Oct
Nov
Dec


Source: USDA/FMMO Database
Northeast #1 - Butterfat
3.90%
3.80%
3.70%
3.60%
3.50%
3.40%
3.30%
3.20%
3.10%
3.00%
Jan
Feb
Mar
Apr
May
June
July
Aug
Sept
Oct
Nov
Dec

What Should We Do During the Summer Slump?

- Recognize it happens
  - 2 to 3 points is typical
  - Don’t panic by making big changes
- Work on lessening its impact
  - Don’t aggravate it with other management problems
    - overcrowding, inadequate forage quality, over feeding fat or starch, etc.
  - Fight heat stress
    - shading, cooling, DCAD, K status

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3. MFD is caused by inadequate rumen acetate when I don't feed enough fiber!

4. Our heat stress in the summer MFD more of a problem here than anywhere else in the country!

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Diet Effects on Milk Fat

	High Forage	High Grain	P <
Milk Fat, %	3.36	2.49	0.01
Rumen Ac/Pr	3.08	1.67	0.01

From Griinari et al. 1998. J. Dairy Sci. 81:1251.

Carbon Sources for Milk Fat

- 50% from diet fatty acids
- 50% from mammary gland synthesis
  - Acetate from carbohydrate fermentation in the rumen
  - Fiber fermentation yields more acetate
  - Grain fermentation yields more propionate
- MFD – not enough acetate from fiber

Acetate Shortage NOT Cause of MFD

	Normal diet	HG Diet
Rumen Production, moles/d		
Acetate	**29.4**	**28.1[a]**
Propionate	**13.3**	**31.0[b]**
B-hydroxybutyrate	**7.0**	**9.1[c]**

[a]Davis et al. 1967

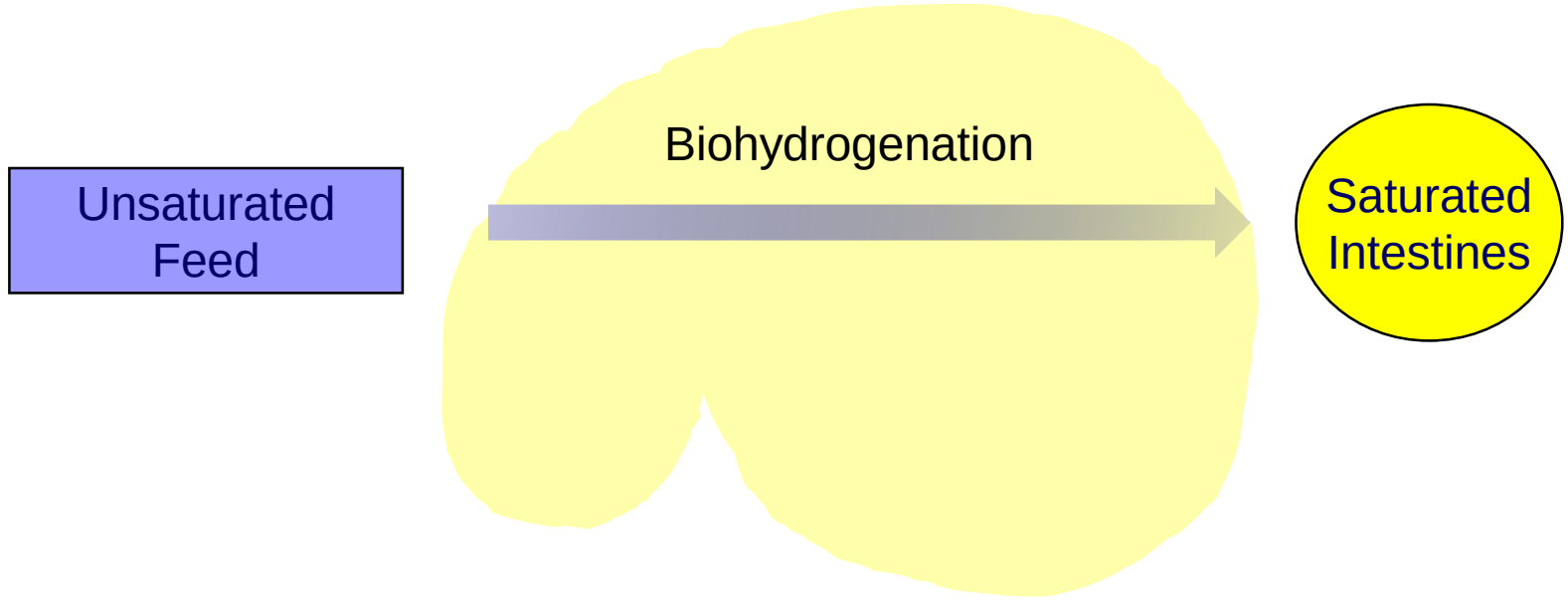
[b]Bauman et al. 1971

[c]Palmquist et al. 1969

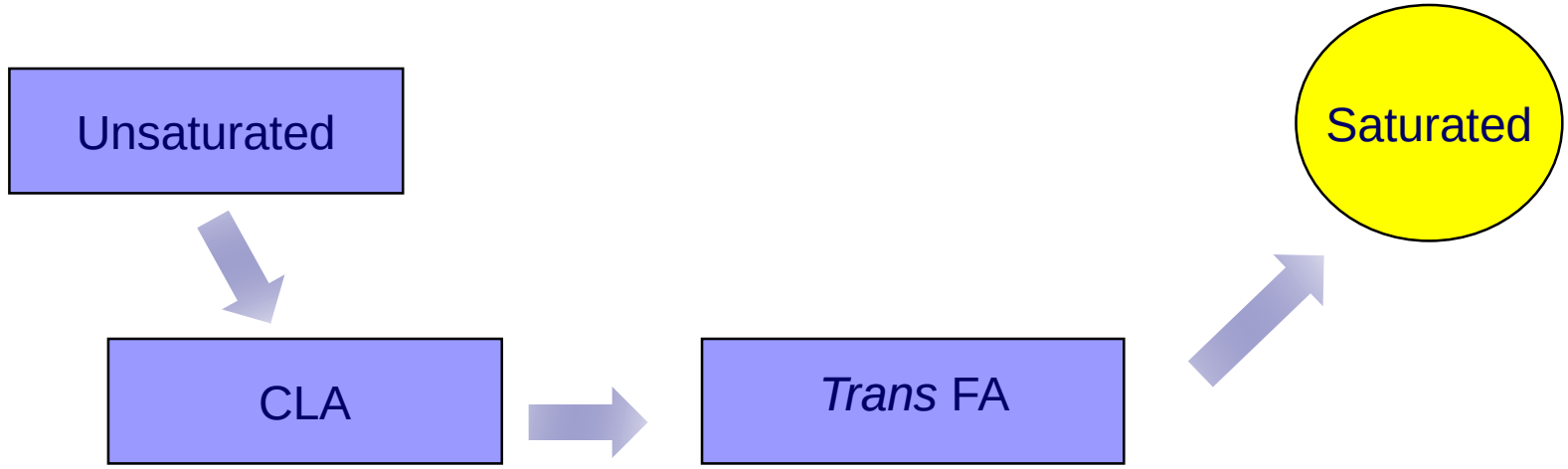
Milk Fat Depression

Caused by Changes in Dietary Lipid as it Passes Through the Rumen?

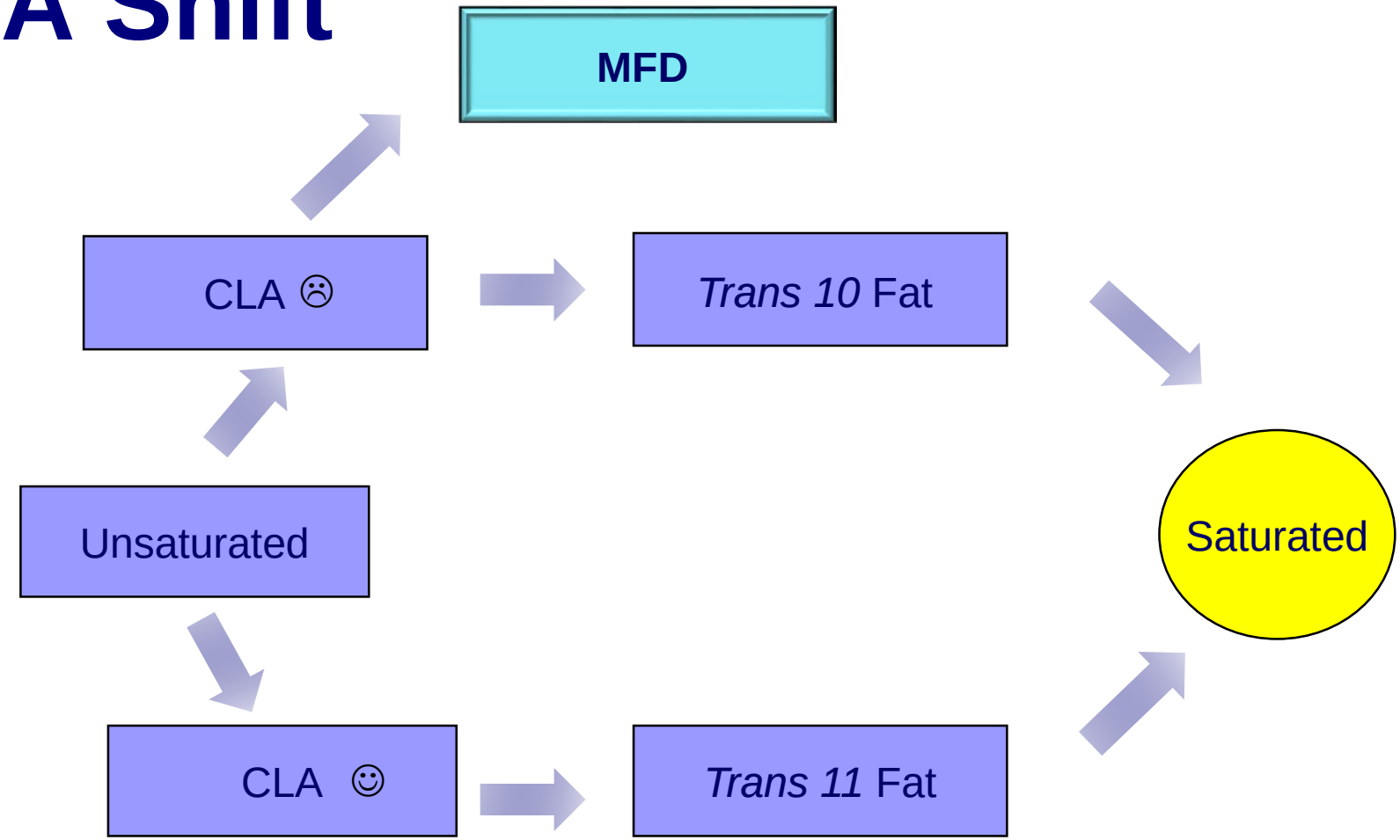
Rumen Lipid Changes



Biohydrogenation Intermediates



CLA Shift



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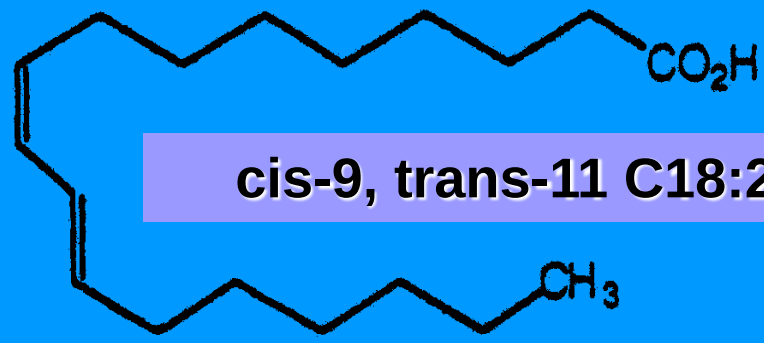
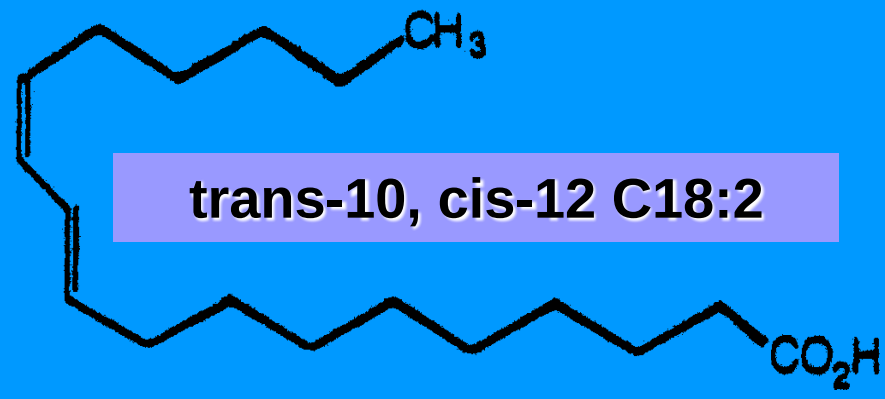


cis-9, trans-11 C18:2

Positive Health Benefits

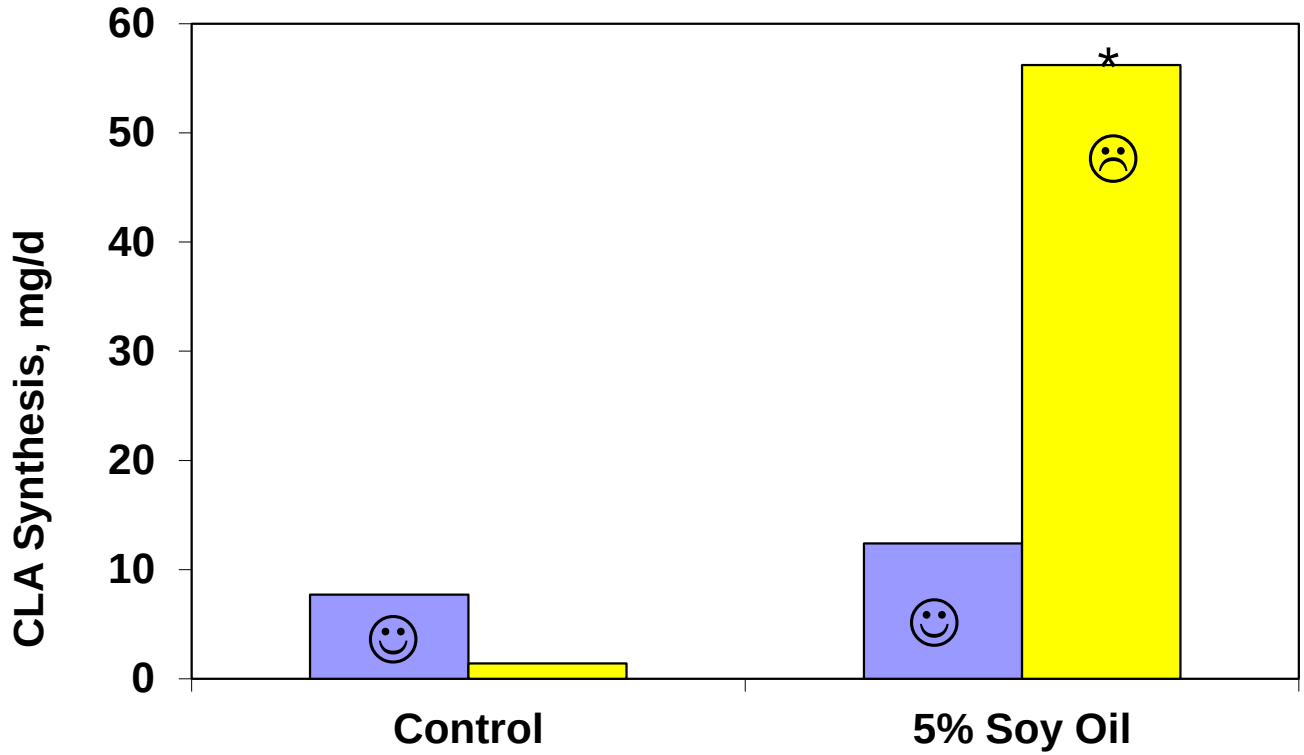
☹



trans-10, cis-12 C18:2

Reduce Milk Fat %

CLA Production vs Fat Level



Unpublished data from continuous culture studies at Clemson University (n=6)

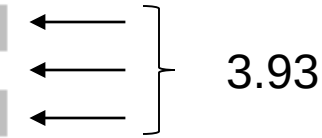
Example of Labs (2012 prices)

Fat (Ether Extract)	$9.00.	$9.50	$10.00
Fat (Acid Hydrolysis)	$17.00	$29.00.	$28.00
Fatty Acid Profile	$34.00	$89.50.	$120.00

Dry Matter: 54.2%
Moisture: 45.8%

	As Sampled %	Dry Matter Basis %
Fat (ether extract)	N/A	N/A
Fat (acid hydrolysis)	N/A	N/A
Total Fatty Acid	3.00	5.54

		Relative Basis %	Dry Matter Sample Basis %
C12:0	Lauric Acid	0.09	0.01
C14:0	Myristic Acid	0.68	0.04
C16:0	Palmitic Acid	23.47	1.30
C16:1	Palmitoleic Acid	0.47	0.03
C18:0	Stearic Acid	2.84	0.16
C18:1	Oleic Acid	25.06	1.39
C18:2	Linoleic Acid	41.90	2.32
C18:3	Linolenic Acid	4.03	0.22
C20:0	Arachidic Acid	0.53	0.03
C20:1	11-Eicosenoic Acid	0.16	0.01
C20:2	11-14 Eicosadienoic Acid	N/D	N/D
C22:0	Behenic Acid	0.38	0.02
C22:1	Erucic Acid	N/D	N/D
C24:0	Lignoceric Acid	0.42	0.02
C24:1	Nervonic Acid	N/D	N/D
Total		100.0	5.54



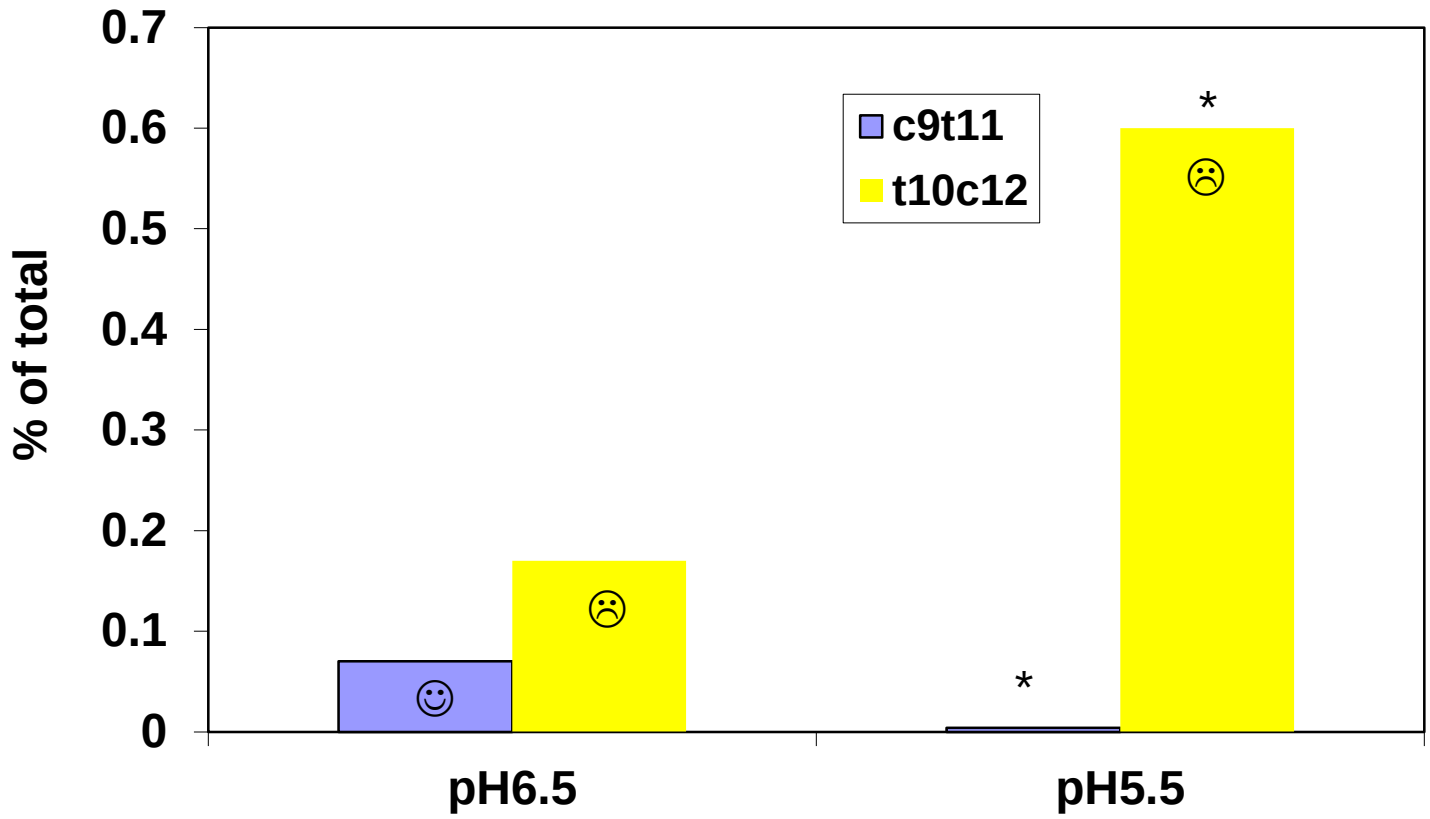
RUFAL

(18:1 + 18:2 + 18:3)

A Way to Account for The High Risk Fatty Acids

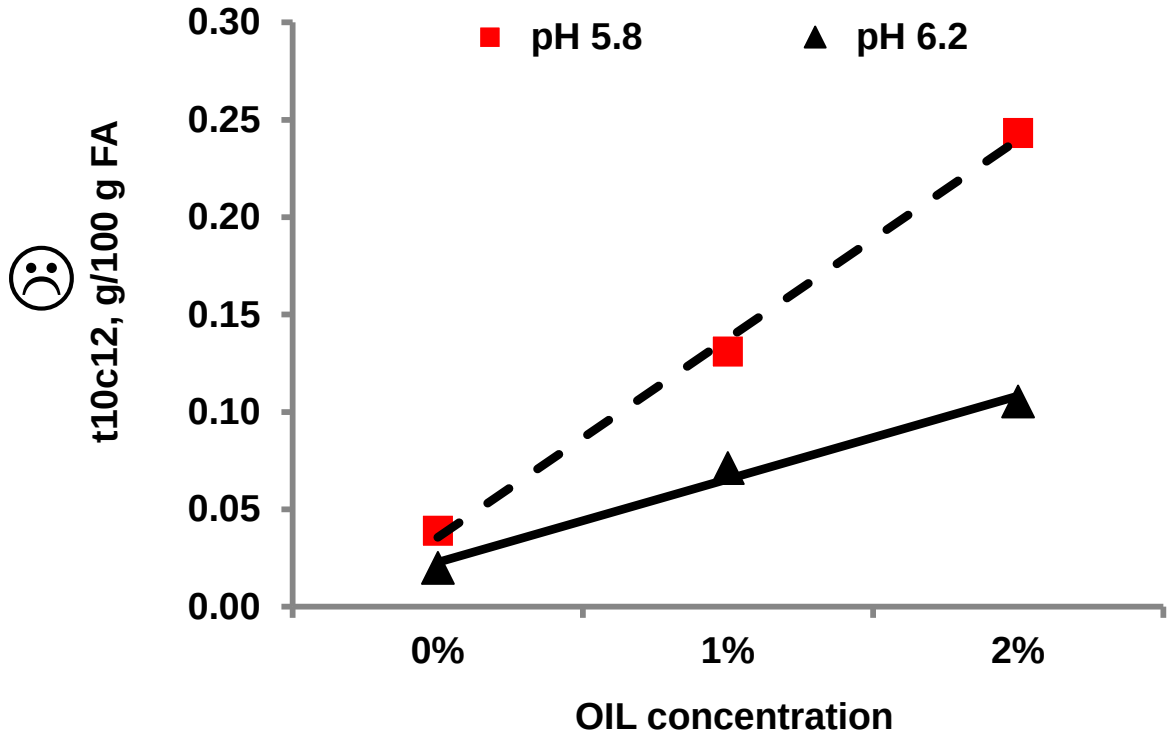
- RUFAL < 3%
  - Total FA intake on lower side
  - IF have MFD look for other causes first
  - Might have room for more fat if production numbers are good.
- RUFAL > 3%
  - Total FA intake on higher side
  - See where fat is coming from
  - Consider backing off a bit if MFD problems

CLA Production vs pH



Continuous culture data taken from Fuentes et al, 2009.

pH & Corn Oil Interactions

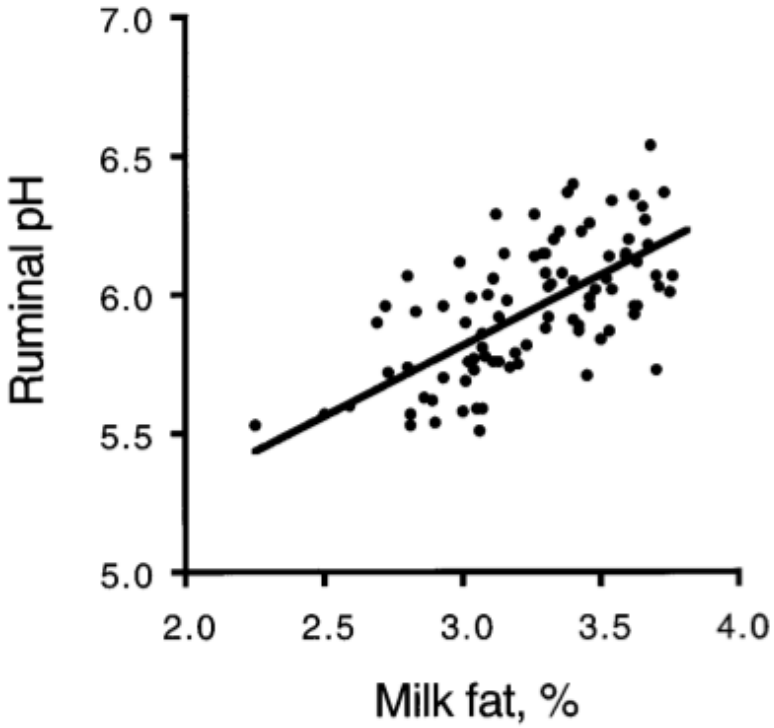


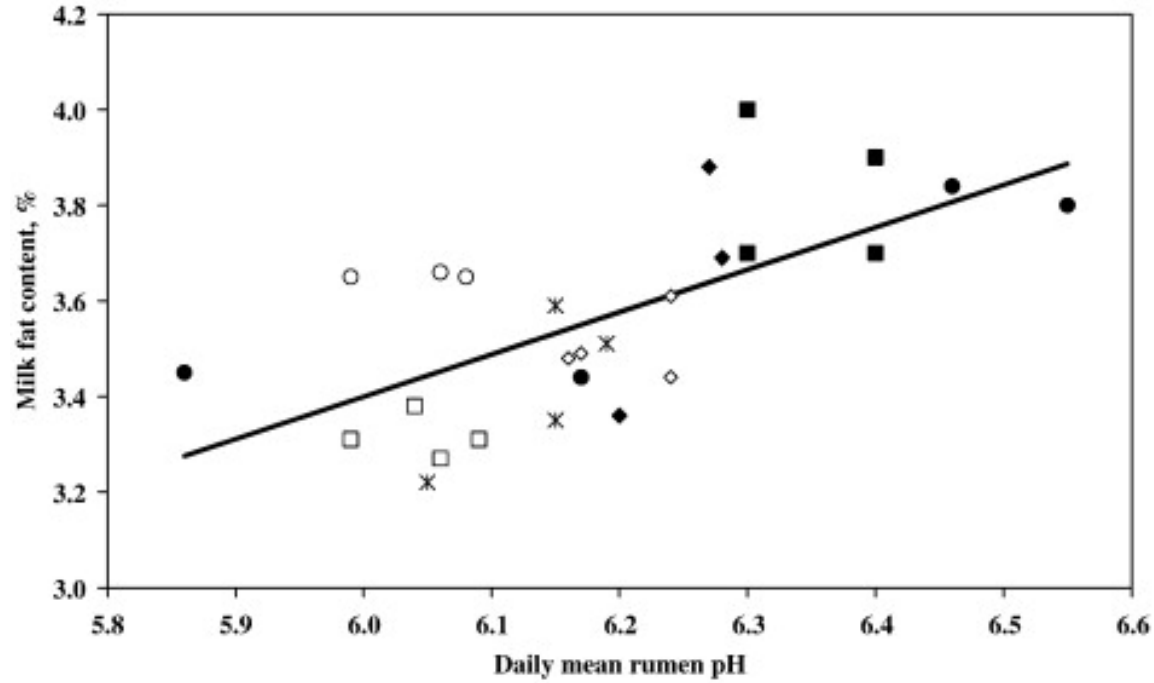
Slide courtesy of Dr. Adam Lock

Tom Jenkins, Clemson University

Sun et al. 2014. J. Dairy Sci. 97 (E-Suppl. 1): 319.

Rumen pH vs Milk Fat





Allen, 1997 J. Dairy Sci. 80:1447

Zebell et al. 2010. Livestock Science 127:1-10.

Resolve MFD – Manage Rumen pH

- Effective fiber
- Grain – amount, kd, source
- Buffers
- Management
  - TMR mixing
  - Crowding

Misconceptions About MFD

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4. Our heat stress in the summer MFD more of a problem here than anywhere else in the country!

5. The way milk is priced in the Southeast means MFD is not a big problem!

Fatty Acid Sources

Ingredient	DMI, lb/d	RUFAL, g/d
Corn Silage, Med Chppd	21.95	
AlfHay2 20Cp40Ndf17LNDF	5.78	
CrnGrn56DryFine	9.34	
Citrus Pulp Grnd	1.03	
Cottonsd WLint	2.30	
Megalac	0.29	
Soybean ML 47.5 Solv	6.95	
Other (mineral, vitamin, trace supplements)	1.32	
Total	48.96	573
RUFAL, % DM		2.57

Fatty Acid Sources

Ingredient	DMI, lb/d	RUFAL, g/d
Corn Silage, Med Chppd	21.95	152
AlfHay2 20Cp40Ndf17LNDF	5.78	26
CrnGrn56DryFine	9.34	139
Citrus Pulp Grnd	1.03	6
Cottonsd WLint	2.30	142
Megalac	0.29	48
Soybean ML 47.5 Solv	6.95	60
Other (mineral, vitamin, trace supplements)	1.32	0
Total	48.96	573
RUFAL, % DM		2.57

Forage FA Variation

FA, % DM	Netherlands[1]		USA[2]
	Grass Silage	Corn Silage	Corn Silage
Mean	1.9	2.0	2.5
Minimum	0.8	1.2	1.6
Maximum	3.3	3.5	3.6

[1]Khan et al., 2012 Anim Feed Sci Tech. 174: 36-45
[2]Klein, Ploetz, Jenkins*, & Lock.2013 ADSA Abstract #73*

Ingredient	1.5 % CS	3.5 % CS
Corn Silage, Med Chppd	152	
AlfHay2 20Cp40Ndf17LNDF	26	
CrnGrn56DryFine	139	
Citrus Pulp Grnd	6	
Cottonsd WLint	142	
Megalac	48	
Soybean ML 47.5 Solv	60	
Other (mineral, vitamin, trace supplements)	0	
Total	573	
RUFAL, % DM	2.57	

Ingredient	1.5 % CS	3.5 % CS
Corn Silage, Med Chppd	152	349
AlfHay2 20Cp40Ndf17LNDF	26	26
CrnGrn56DryFine	139	139
Citrus Pulp Grnd	6	6
Cottonsd WLint	142	142
Megalac	48	48
Soybean ML 47.5 Solv	60	60
Other (mineral, vitamin, trace supplements)	0	0
Total	573	770
RUFAL, % DM	2.57	3.47

Fatty Acids in Rye and Annual Ryegrass Pasture

Pasture	Planted	Grazed	Initial FA, % DM	Final FA, % DM
Rye	October	Nov 18- Mar 17	6.8	4.7
Annual ryegrass	October	Mar 17 – June 3	4.5	1.8

Freeman-Pounders et al. 2009. Forage and Grazinglands. doi: 10.1094/FG-2009-0130-01-BR.

Predicted vs. Actual Dietary Fat Contents

Farm	Wet Chem (% DM)	Model (% DM)	Actual Difference (% DM)	% Difference
1	6.7	5.5	**1.2**	**17%**
2	7.7	6.1	**1.6**	**21%**
3	6.9	5.3	**1.6**	**23%**
4	7.2	6.0	**1.2**	**17%**
5	6.0	5.0	**1.0**	**17%**
6	5.4	5.7	-0.3	-6%
7	5.3	5.3	-	-
8	5.3	5.8	-0.5	-9%

Slide courtesy of Dr. Adam Lock

Misconceptions About MFD

1. A single bad event caused my MFD– fix it and the problem goes away.

2. I don't feed much fat so MFD should not be a problem!

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Higher Risk Corn Silage

- High yeasts and molds. Alarms go off with yeast counts approaching 1 million cfu/g.

CUMBERLAND VALLEY ANALYTICAL SERVICES, INC. April 16, 2009
PO Box 669 Maugansville, MD 21767 301-790-1980 Sample No : 8980042

A N A L Y S I S R E S U L T S

CORN SILAGE	As Sampled	Dry Matter	Unit
Moisture	73.7		%
Dry Matter	26.3		%

Mold and Yeast counts are on an as-received basis

Mold Count < 1000 col/gm

Yeast Count > 100,000,000 col/gm

Too Much RUFAL (Unsaturated Fat)

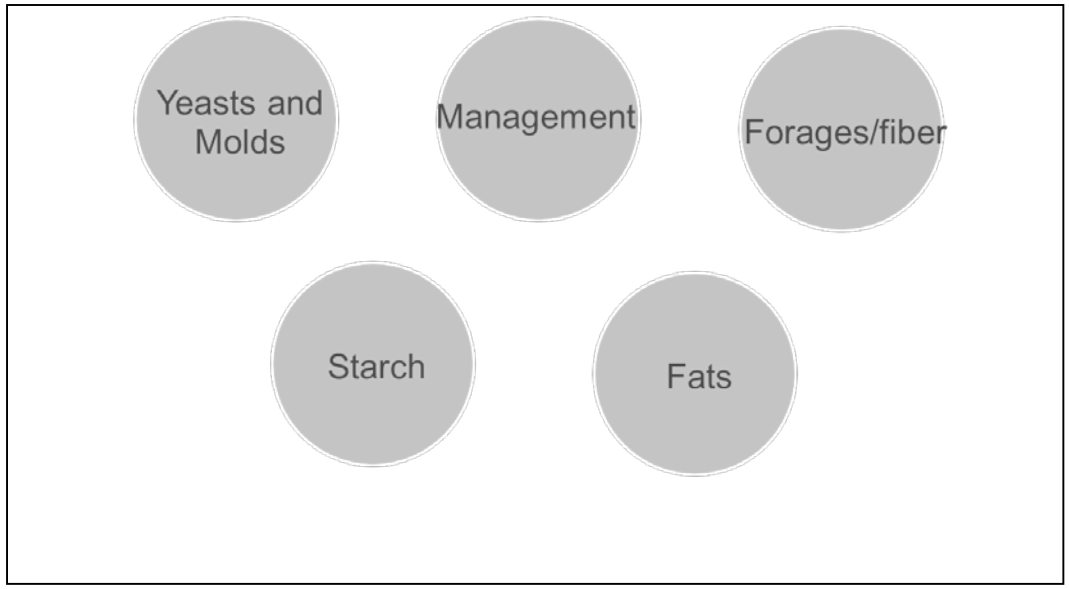
5% Soybean Oil

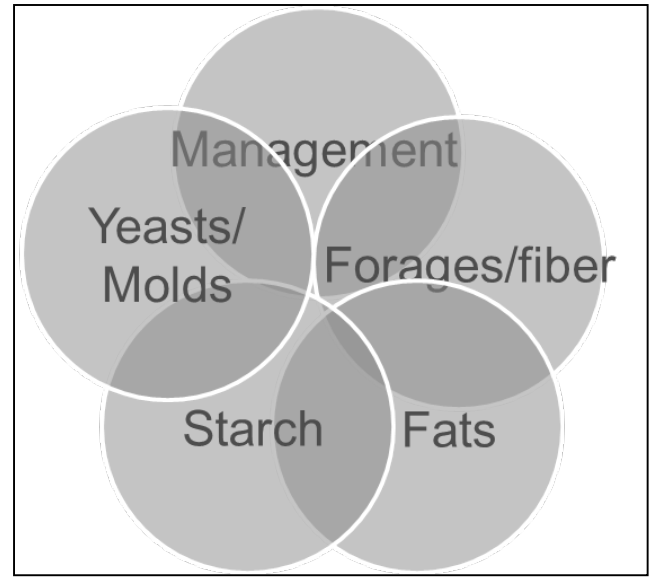
	CON	SBO
Milk, kg/d	21.5	19.8
Milk Fat, kg/d	1.12	0.85*
Milk fat, %[a]	3.53	2.73*

*CON and FAT diets differed ($P < 0.05$).

From Huang et al., 2008. J. Dairy Sci. 91:260–270.

Why Do I Still Sometimes Have MFD Problems Even When I Follow All The Proper Guidelines?





4 x 4 Latin Square
2 wk washout/2 week trt
JDS 96:451-459. 2013.

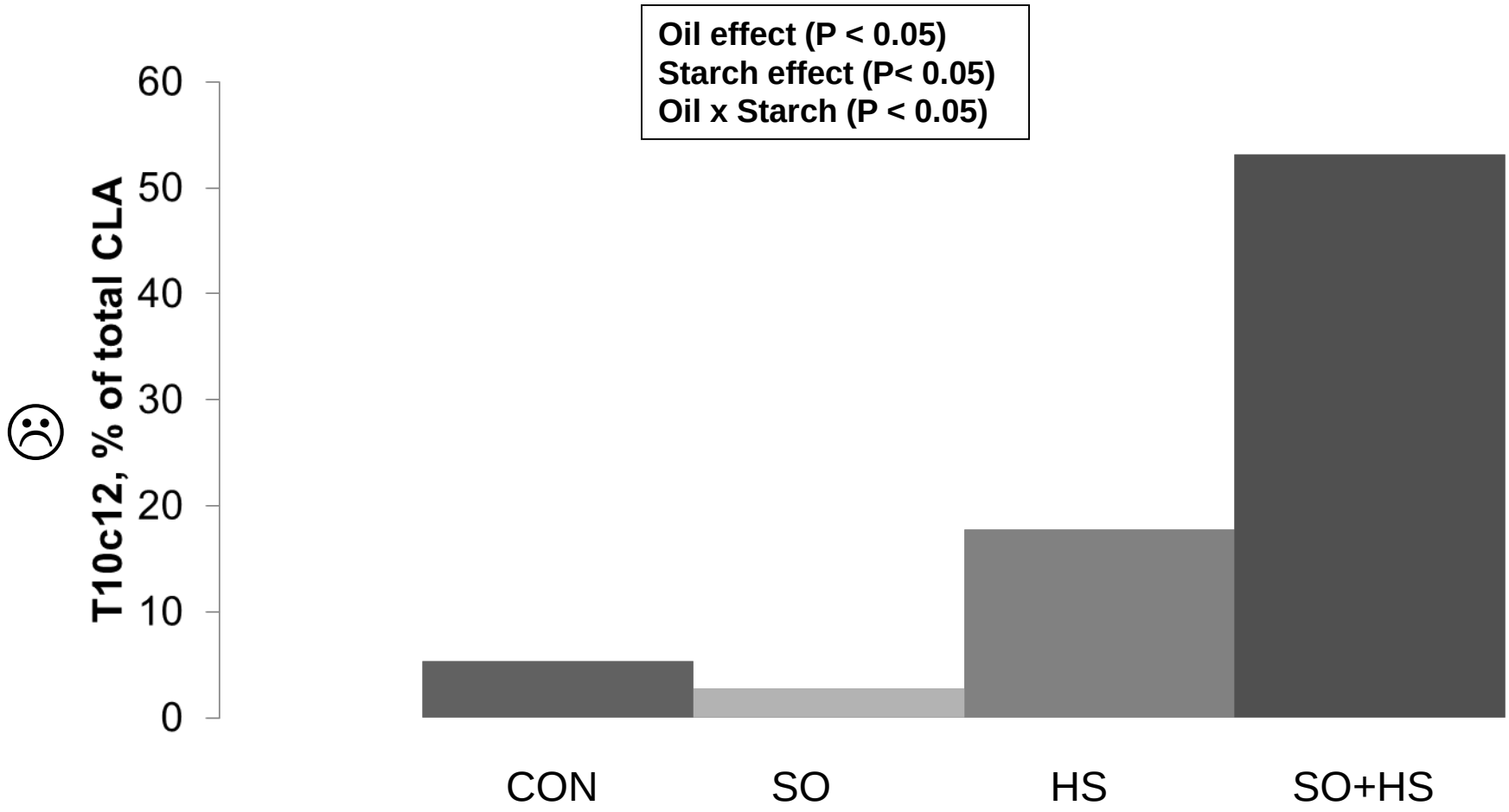
Table 1. Ingredients and nutrient composition of diets

	Diet[1]			
Item	CON	OL	HS	HS+OL
Ingredient, % of DM				
Corn silage	68.7	63.2	37.7	32.3
Alfalfa hay	14.3	14.3	0.0	0.0
Wheat + barley	0.0	0.0	48.5	48.5
Soybean meal	15.5	16.2	12.4	13.1
Sunflower oil	0.0	4.8	0.0	4.7
Mineral-vitamin premix[2]	1.5	1.5	1.5	1.5
Composition, % of DM				
CP	14.6	14.6	14.2	14.2
NDF	39.7	37.3	30.9	28.6
Starch	21.5	19.8	34.8	33.1
Crude fat	2.9	7.6	2.7	7.3
FA composition, % of DM				
cis-9 C18:1	0.3	1.4	0.2	1.3
cis-9,*cis*-12 C18:2	0.9	3.4	0.9	3.4
cis-9,*cis*-12,*cis*-15 C18:3	0.1	0.1	0.1	0.1

[1]CON = control diet; HS = high-starch diet; OL = sunflower oil diet; HS+OL = HS plus OL diet.

[2]Contained (per kilogram of premix, DM basis) P: 40 g, Ca: 260 g, Mg: 50 g, Na: 20 g, Zn: 5 g, Mn: 4 g, Cu: 1 g, I: 40 mg, Co: 20 mg, Se: 20 mg, vitamin A: 450,000 IU, vitamin D_3: 100,000 IU, and vitamin E: 1,500 IU.

☹ CLA in Rumen of Cows



From Zened et al. 2013. JDS 96:451-459.

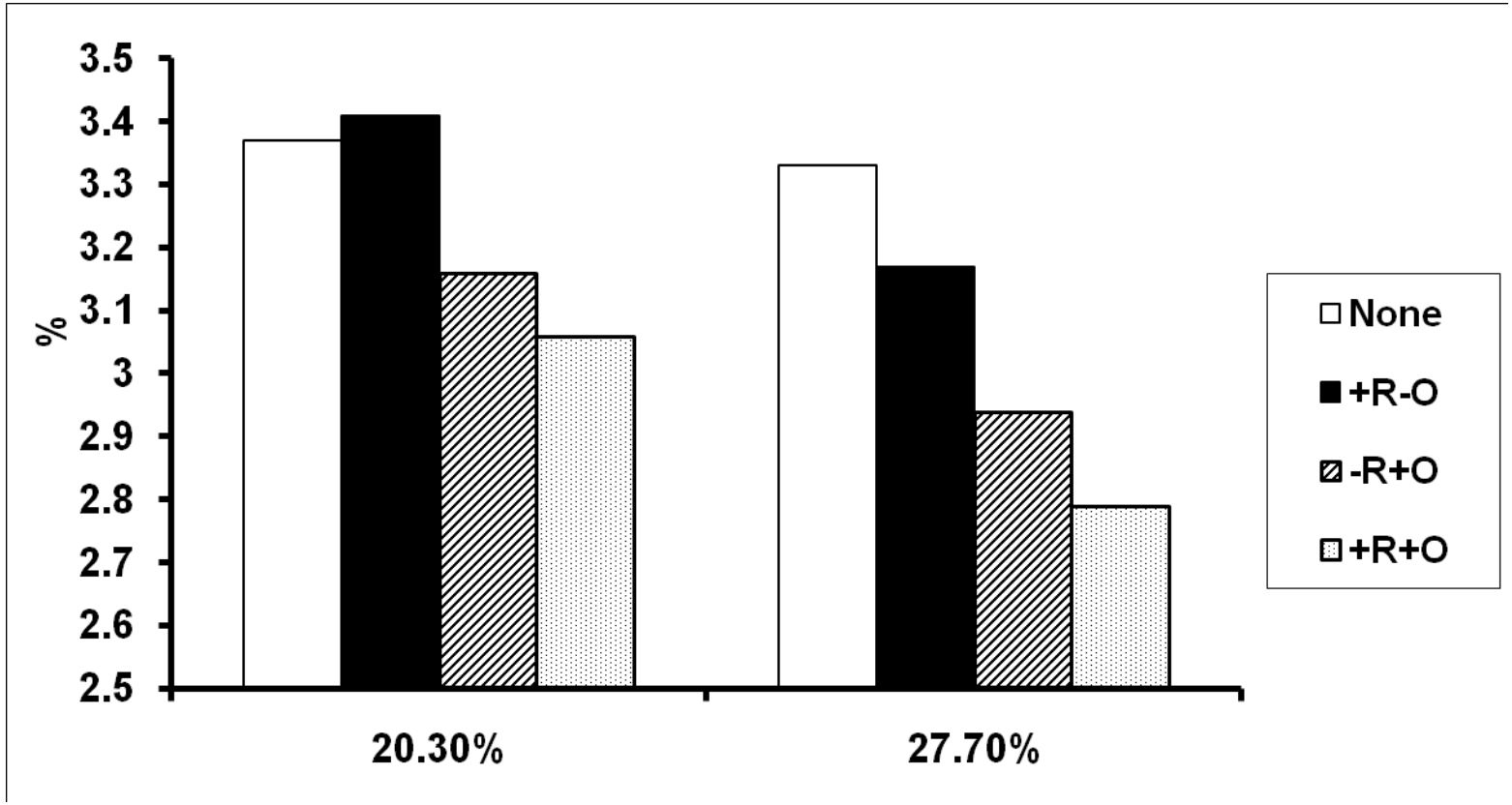
Tom Jenkins, Clemson University

Grain x Monensin x Fat Interactions – Cow Study

- 80 Holsteins
- 2 x 2 x 2 factorial design
  - Two starch levels (27.7 and 20.3% of TMR)
  - 0 vs 13 ppm Rumensin
  - 0 vs 1.25% corn oil

Van Amburgh et al., 2008. Cornell Nutr. Conf.

Milk Fat %



Van Amburgh et al., 2008. Cornell Nutr. Conf.

Anything We Can Put in the Feed to Move Milk Fat Upward?

Palmitate (C16)[1] Effects on Milk Fat

	Milk Fat, %			
g added C16	- C16	+ C16	P <	Reference
412	3.44	3.93	0.05	Mosley et al. 2012
361	3.88	4.16	0.05	Lock et al., 2013
545	3.29	3.40	0.05	Piantoni et al, 2013
384	3.75	3.60	0.05	Warntges et al., 2008

[1]All supplemented sources were > 85% C16.

K Carbonate[1] Effects on Milk Fat

	Milk Fat, %			
Δ TMR K	- K	+ K	P <	Reference
1.2 to 2.0%	4.01	4.38	0.05	Harrison et al. 2012
1.2 to 2.2 % (LF)	2.74	2.99	0.05	Kamar and Weiss, 2013
1.2 to 2.2 % (HF)	2.39	2.64	0.05	Kamar and Weiss, 2013
1.8 to 2.3%	4.06	4.28	0.05	Ma et al., 2013

[1]Added as K carbonate sesquihydrate (DCAD Plus, C&D, Inc.)

Thank You!!!