

The High Fertility Cycle

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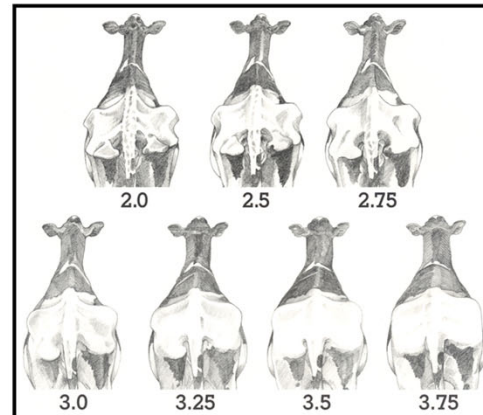
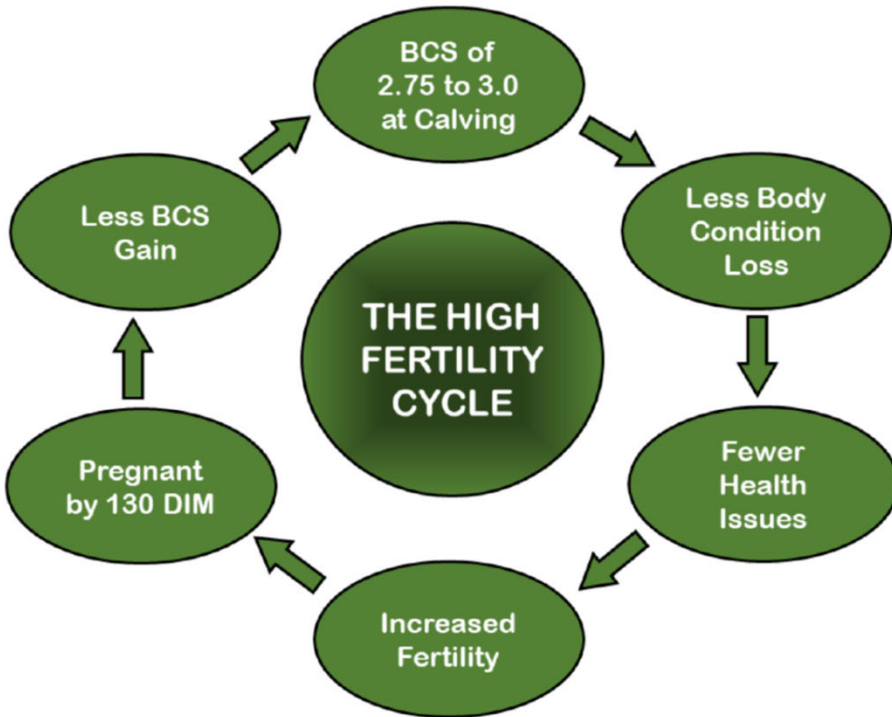


Extension
UNIVERSITY OF WISCONSIN-MADISON



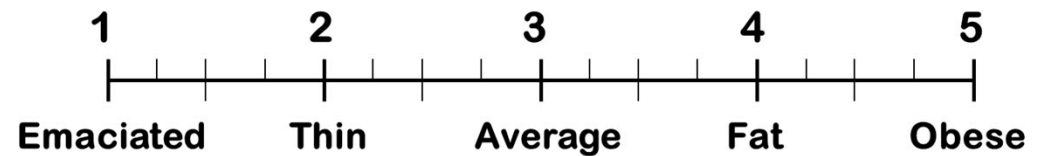
Mini-Review: The high fertility cycle

P. M. Fricke,^{1*} M. C. Wiltbank,¹ and J. R. Pursley²



Body Condition Scoring

- ❑ BCS is a noninvasive method for estimating fat stores in live cows.
- ❑ Define: Ratio between amount of fat to the amount of nonfat matter (water, protein, ash) in the body of a living animal.
- ❑ Body condition change is an easy way to assess energy balance on farms.



Hierarchy of Scientific Evidence

Scientific Evidence

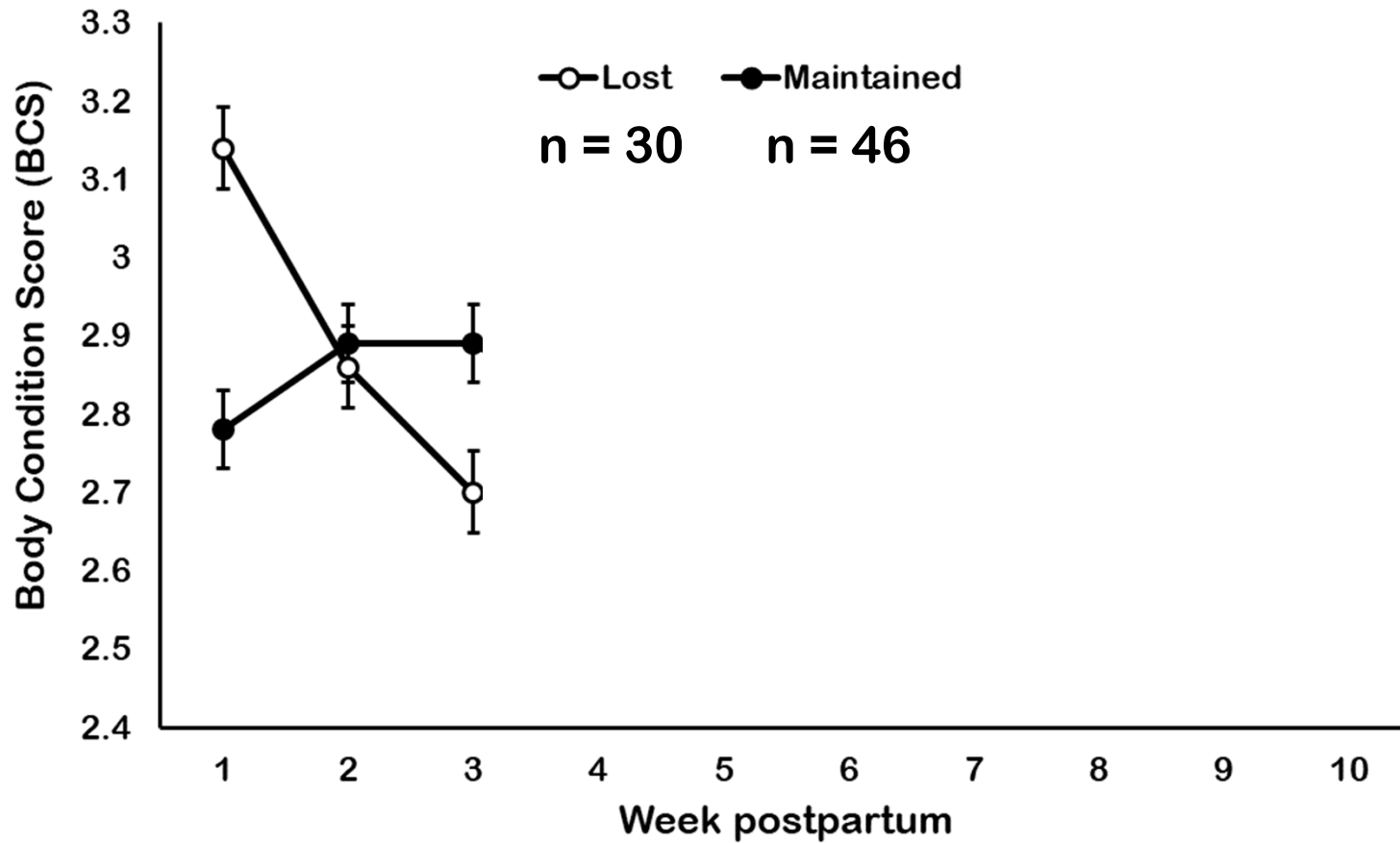


NOT Scientific Evidence

Personal anecdotes
Gut feelings
Grandpa did it
Expert testimonials
Computer models
Most on-farm data

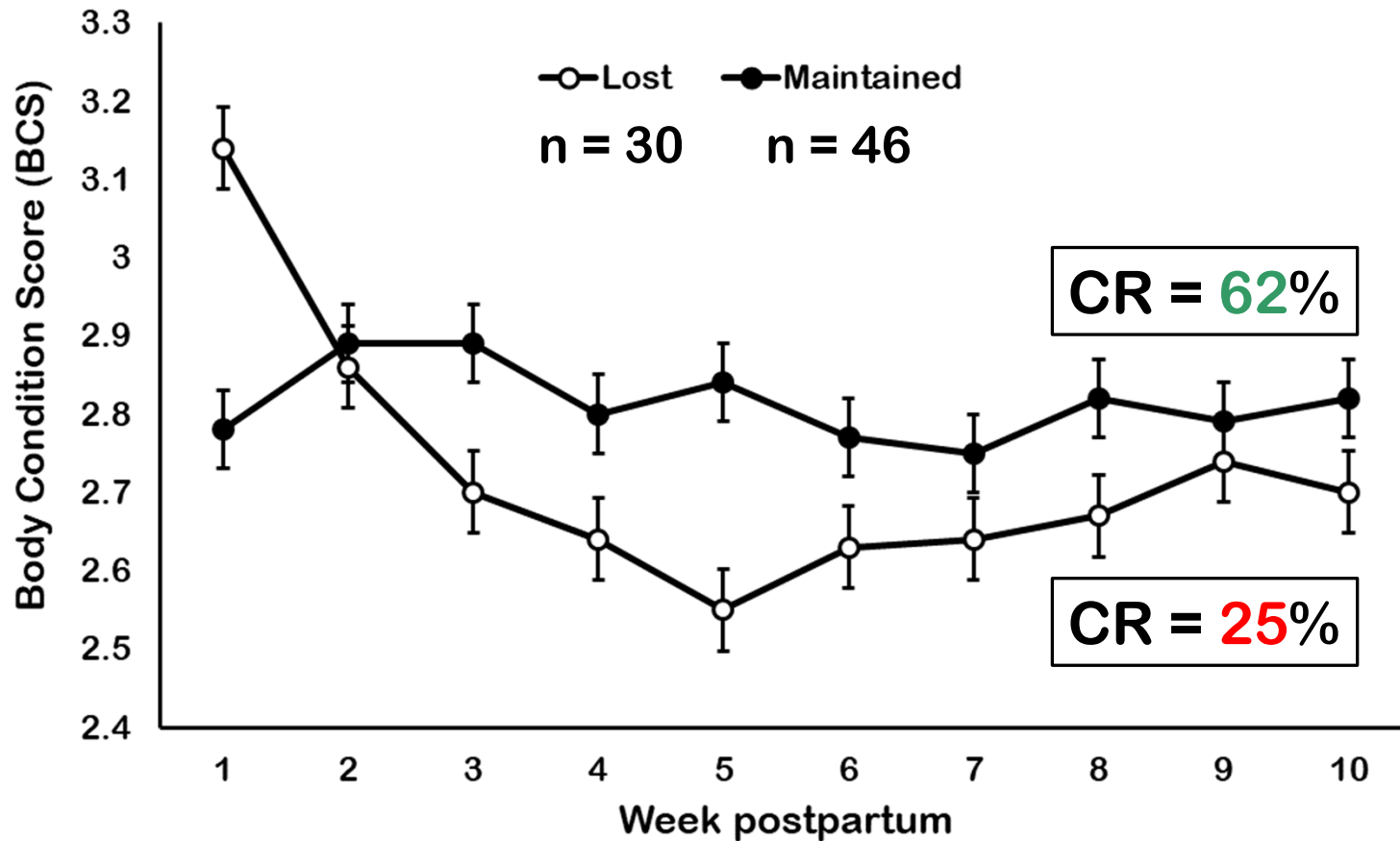
Jack H. Britt

AABP 24th Annual Convention, 1992



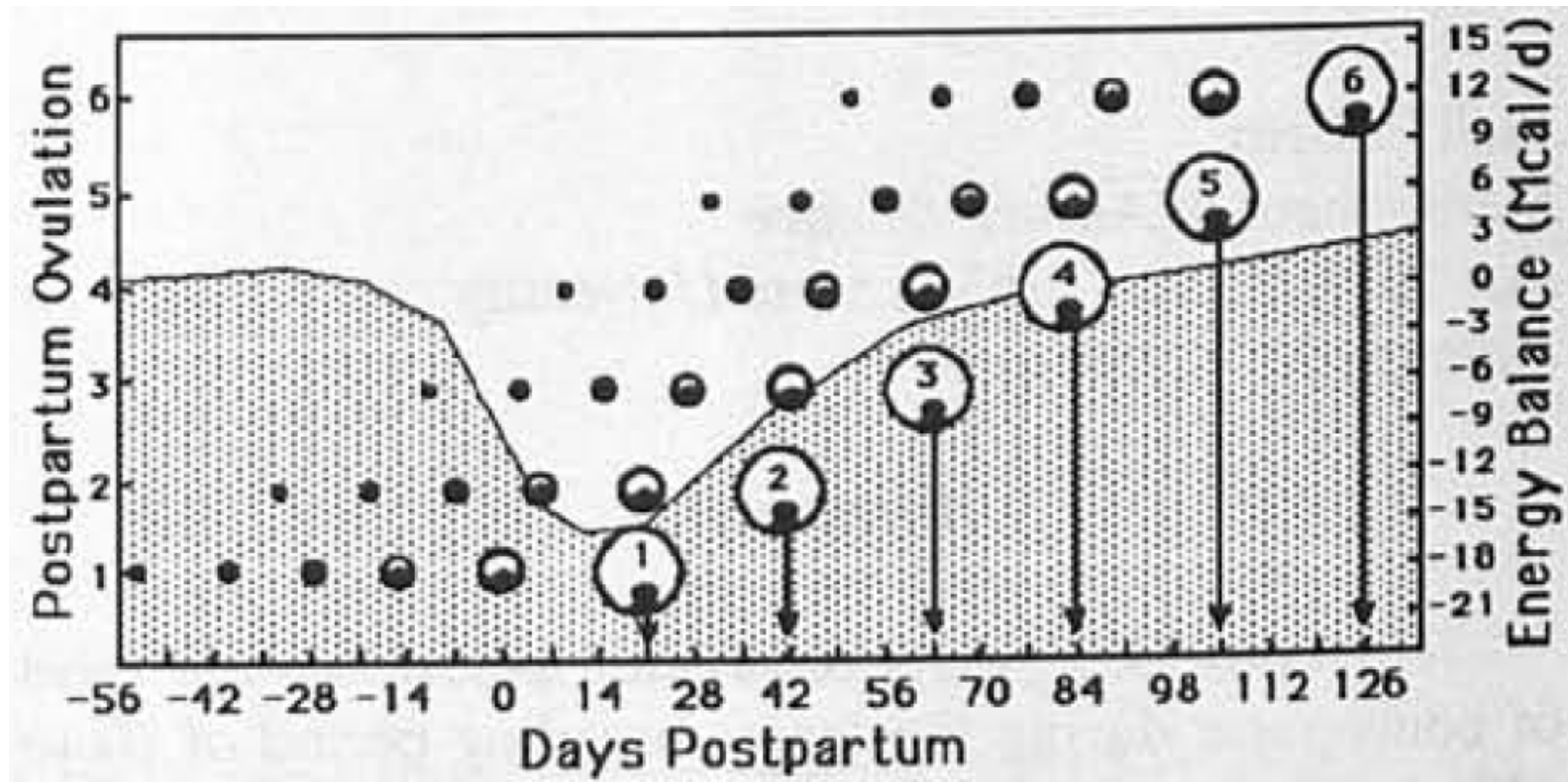
Jack H. Britt

AABP 24th Annual Convention, 1992



Jack H. Britt

AABP 24th Annual Convention, 1992



“The Britt Hypothesis”

Four Studies:

Relationships among changes in body condition score (BCS) or body weight during the transition period and subsequent reproductive performance in lactating dairy cows

- **Carvalho et al., 2014**
J. Dairy Sci. 97:3666-3683
- **Barletta et al., 2017**
Theriogenology 104:30-36
- **Middleton et al., 2019**
J. Dairy Sci. 102:5577-5587
- **Lauber and Fricke, 2024**
J. Dairy Sci. 107:2524–2542



J. Dairy Sci. 97:3666–3683

<http://dx.doi.org/10.3168/jds.2013-7809>

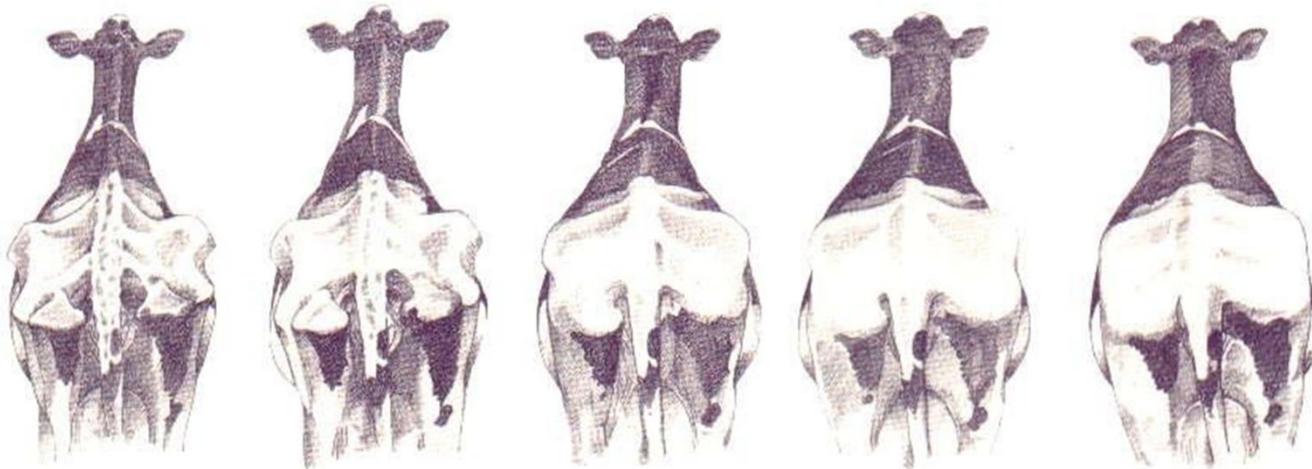
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Relationships between fertility and postpartum changes in body condition and body weight in lactating dairy cows

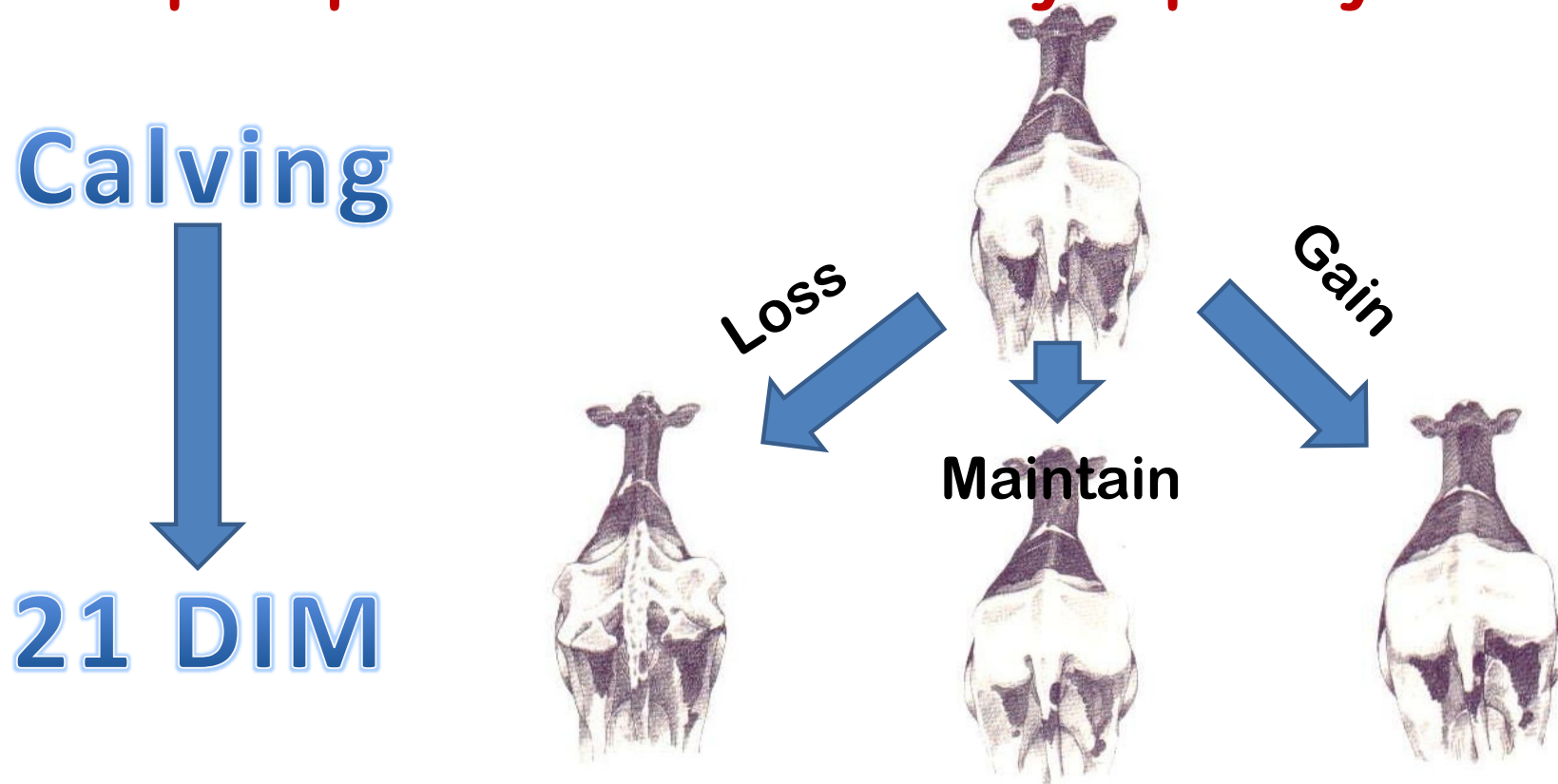
P. D. Carvalho,* A. H. Souza,*¹ M. C. Amundson,* K. S. Hackbart,* M. J. Fuenzalida,* M. M. Herlihy,*
H. Ayres,* A. R. Dresch,* L. M. Vieira,* J. N. Guenther,* R. R. Grummer,† P. M. Fricke,*
R. D. Shaver,* and M. C. Wiltbank*²

*Department of Dairy Science, University of Wisconsin-Madison, Madison 53706

†Balchem Corporation, New Hampton, NY 10958



Does Body Weight change early postpartum affect embryo quality?

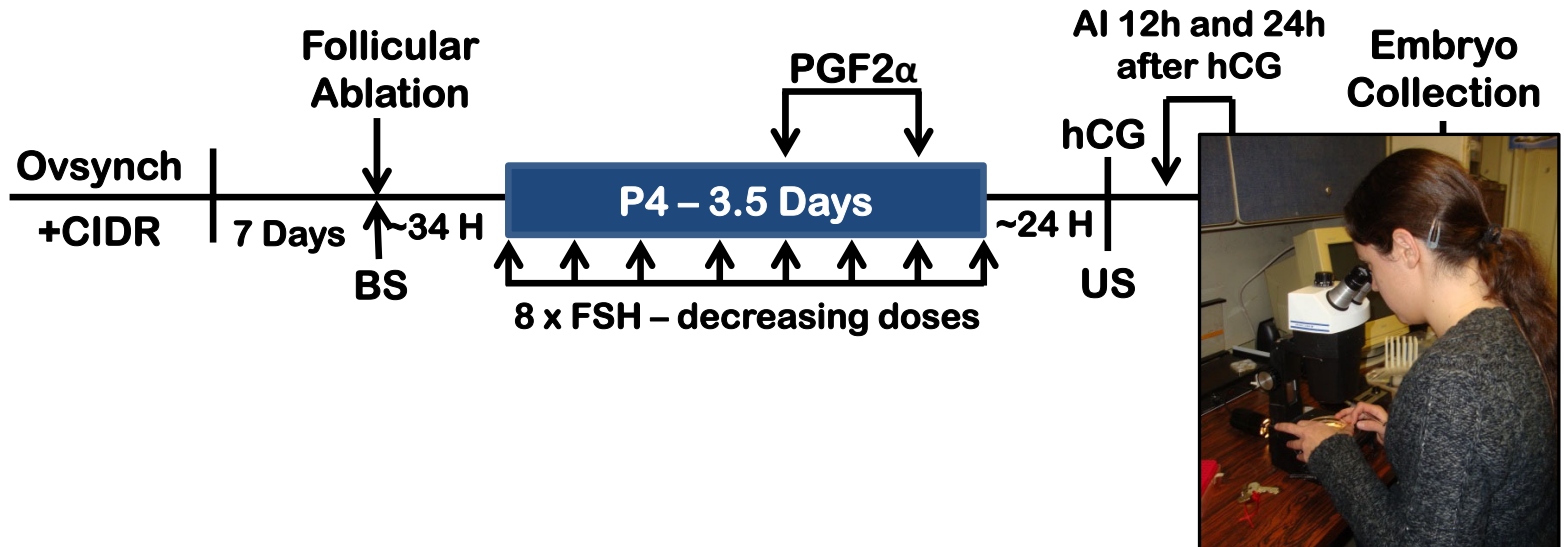


Cows losing more BW early postpartum will have poor embryo quality

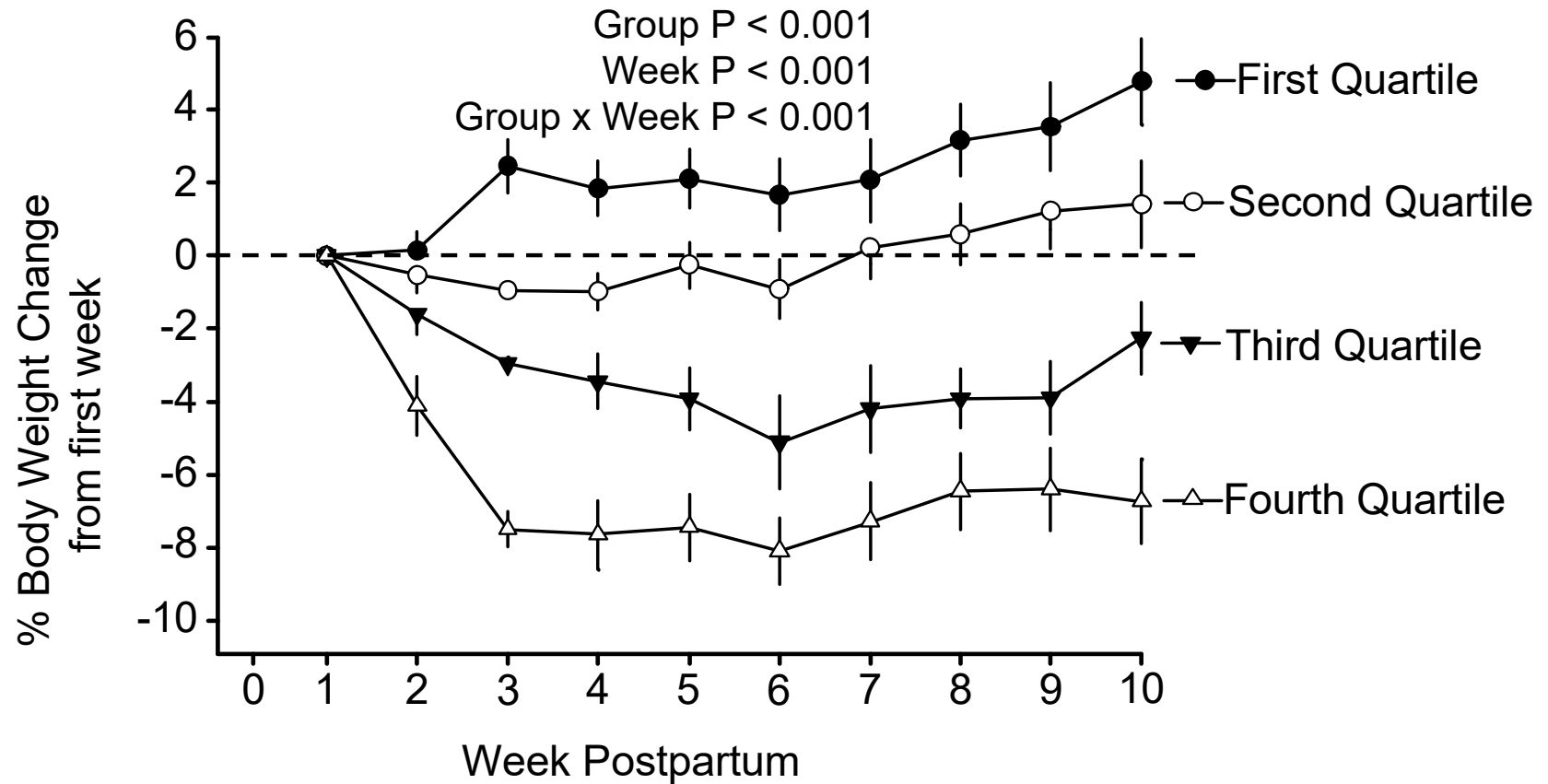
Materials & Methods



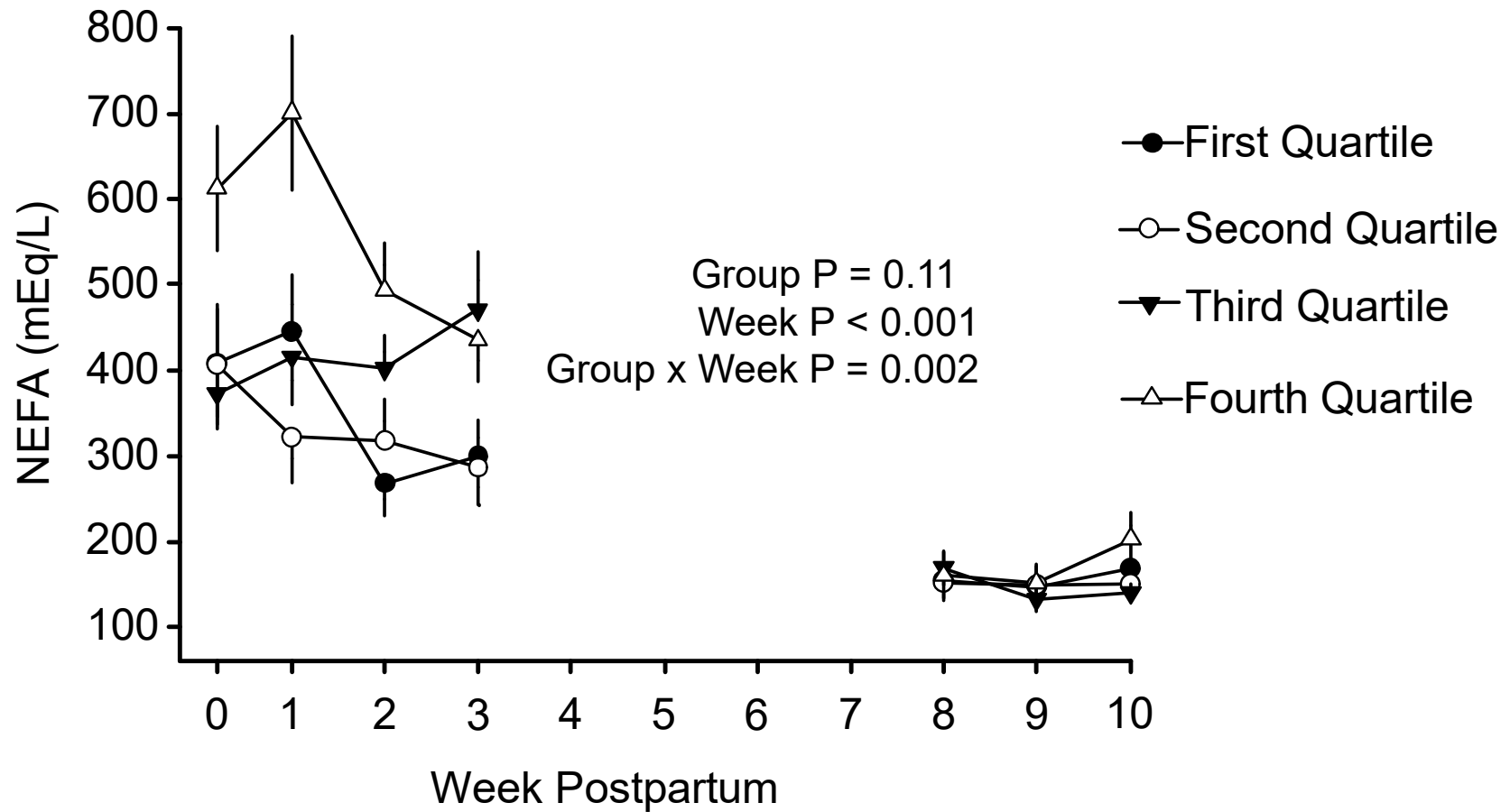
100 dairy cows from 10 farms were selected and superstimulated.



% Body weight change



NEFA concentrations



Embryo Characteristics

	Quartile				P-value
	Fourth Q Lost +	Third Q Lost	Second Q Maintain	First Q Gain	
CL (no.)	18.4 ± 2.6	18.4 ± 1.7	19.0 ± 1.7	16.0 ± 2.0	0.67
Fertilized embryos (%)	76.9 ± 7.1	77.0 ± 6.6	77.6 ± 7.6	78.4 ± 7.1	0.99
Quality 1 & 2 embryos (%)	38.0 ± 8.7	61.3 ± 8.2	60.6 ± 9.4	63.4 ± 8.6	0.14
Degenerate embryos (%)	35.2 ± 8.5 ^a	12.6 ± 4.6 ^b	14.5 ± 6.3 ^b	9.6 ± 3.7 ^b	0.02
Qual 1 & 2 of Fertilized (%)	48.4 ± 9.5 ^a	78.3 ± 6.6 ^b	72.6 ± 9.5 ^b	77.7 ± 7.4 ^b	0.05
Degenerate of Fertilized (%)	46.9 ± 9.6 ^{a,A}	17.4 ± 6.4 ^{b,B}	24.8 ± 9.3 ^{ab,A}	16.2 ± 7.0 ^{b,B}	0.04



J. Dairy Sci. 93:1596–1603

doi:10.3168/jds.2009-2852

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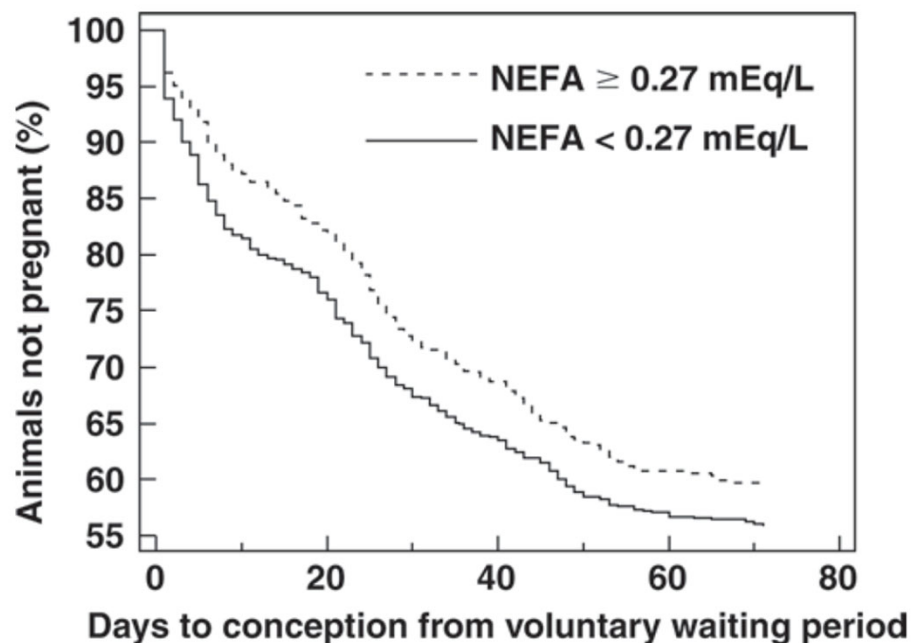
Associations of elevated nonesterified fatty acids and β -hydroxybutyrate concentrations with early lactation reproductive performance and milk production in transition dairy cattle in the northeastern United States

P. A. Ospina,* D. V. Nydam,†¹ T. Stokol,† and T. R. Overton*

*Department of Animal Science, College of Agriculture and Life Sciences, and

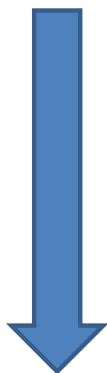
†Department of Population Medicine and Diagnostic Sciences, College of Veterinary Medicine, Cornell University, Ithaca, NY 14853

- Cows from 91 dairy herds were sampled for NEFA and BHBA prepartum ($n = 1,164$) or postpartum ($n = 1,095$).
- Cows with NEFA concentrations > 0.27 mEq/L resulted in **16% decreased risk** of conception within 70 d after the VWP ($P = 0.05$).

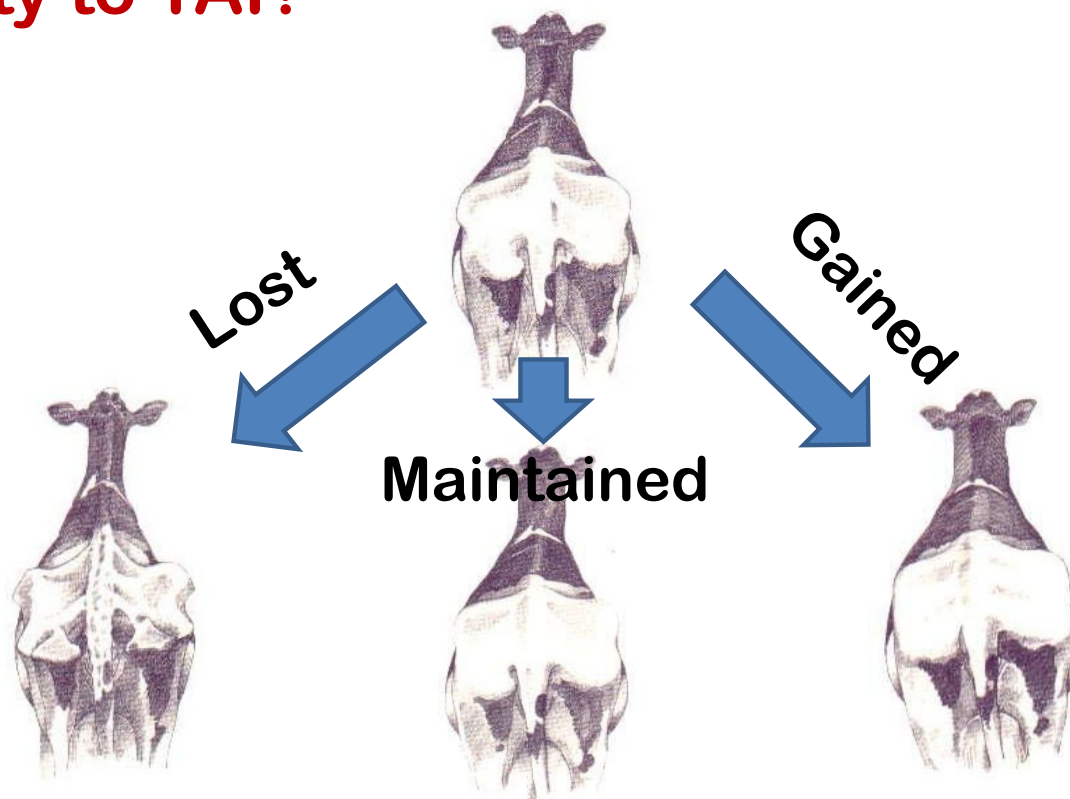


Does a change in BCS early postpartum affect fertility to TAI?

Calving



21 DIM



Cows losing more BCS early postpartum will have decreased fertility at first TAI

J. Dairy Sci. 92:1412–1422

doi:10.3168/jds.2008-1289

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Effects of additional prostaglandin $F_{2\alpha}$ and estradiol-17 β during Ovsynch in lactating dairy cows

D. J. Brusveen, A. H. Souza, and M. C. Wiltbank¹

Department of Dairy Science, University of Wisconsin, Madison 53706

Sun	Mon	Tue	Wed	Thu	Fri	Sat
					GnRH	
					PGF	
	GnRH					
	GnRH					
	PGF	PGF	GnRH	TAI		

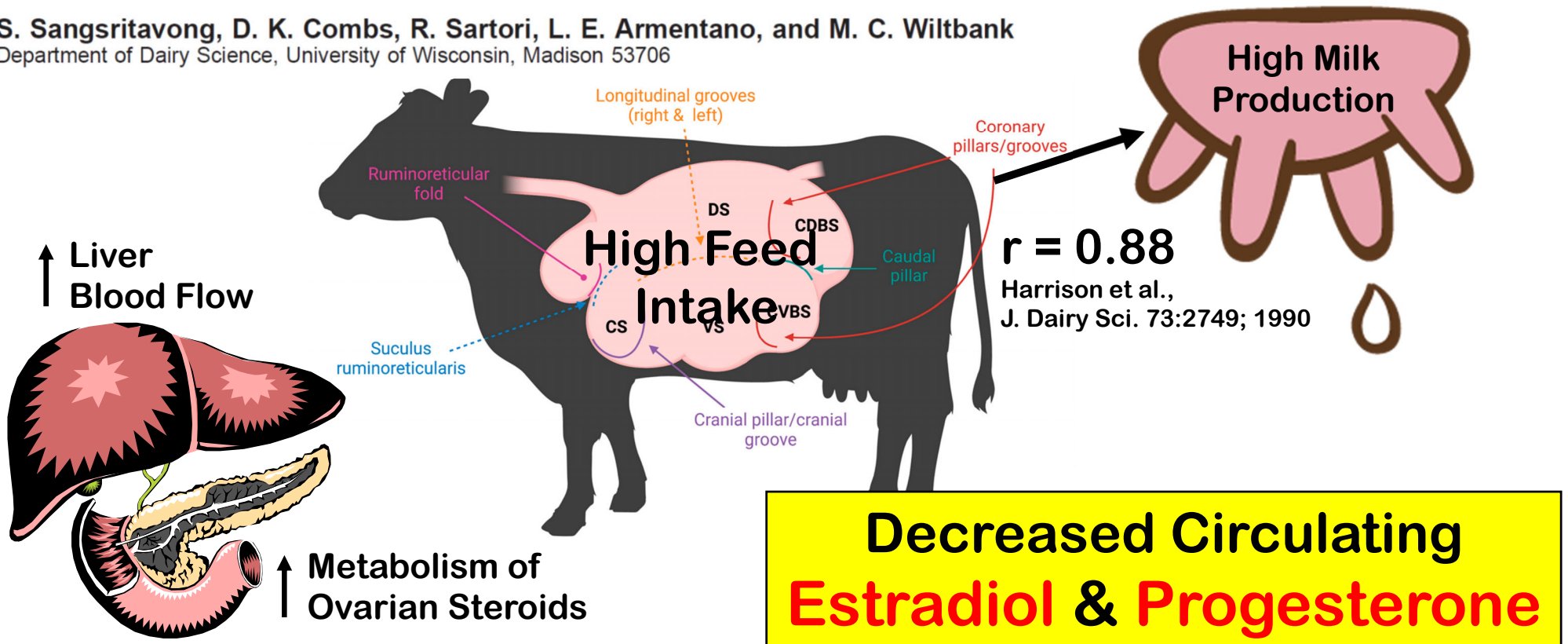
J. Dairy Sci. 85:2831–2842

© American Dairy Science Association, 2002.

High Feed Intake Increases Liver Blood Flow and Metabolism of Progesterone and Estradiol-17 β in Dairy Cattle

S. Sangsritavong, D. K. Combs, R. Sartori, L. E. Armentano, and M. C. Wiltbank

Department of Dairy Science, University of Wisconsin, Madison 53706



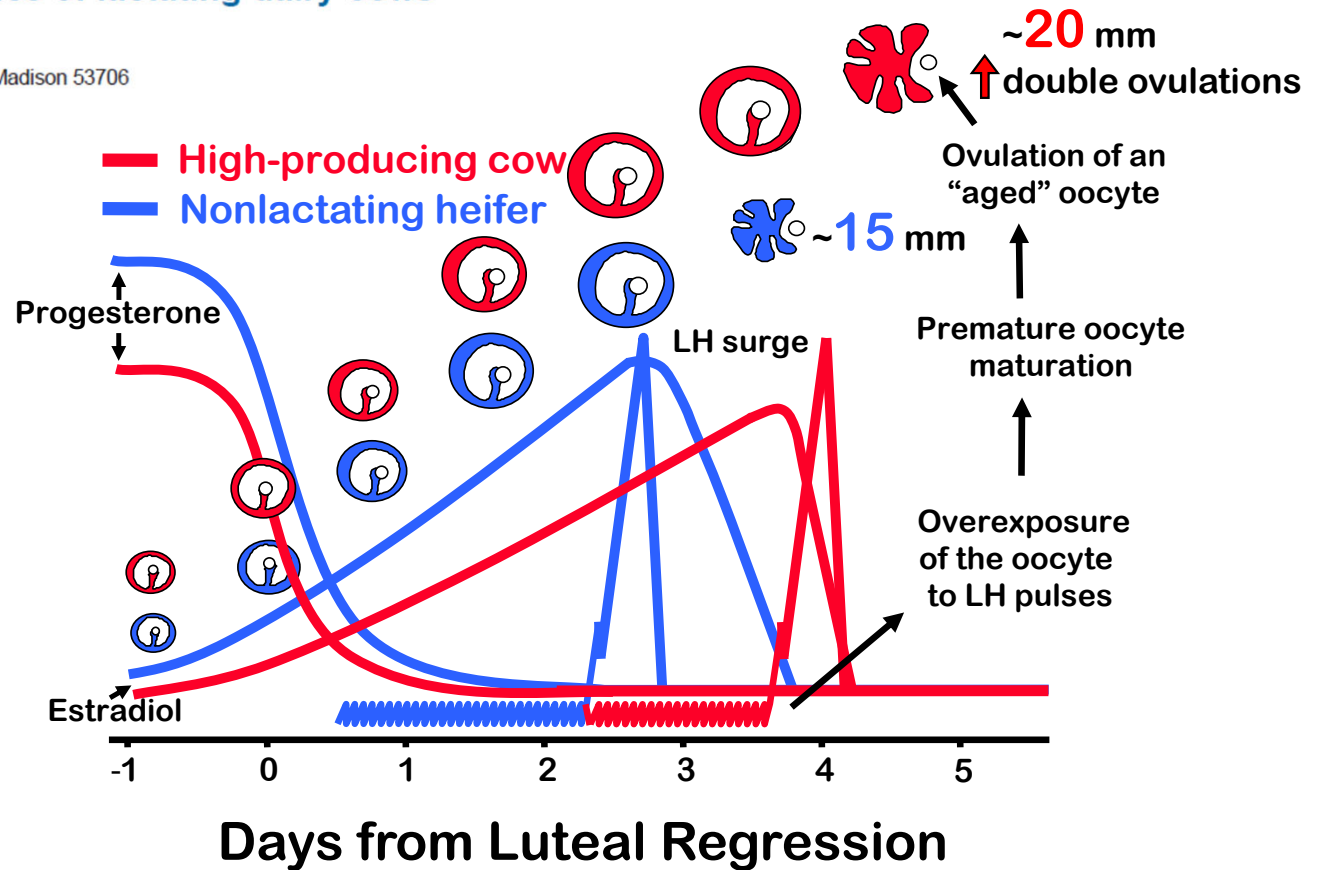


Symposium review: The implications of spontaneous versus synchronized ovulations on the reproductive performance of lactating dairy cows*

P. M. Fricke† and M. C. Wiltbank

Department of Animal and Dairy Sciences, University of Wisconsin-Madison, Madison 53706

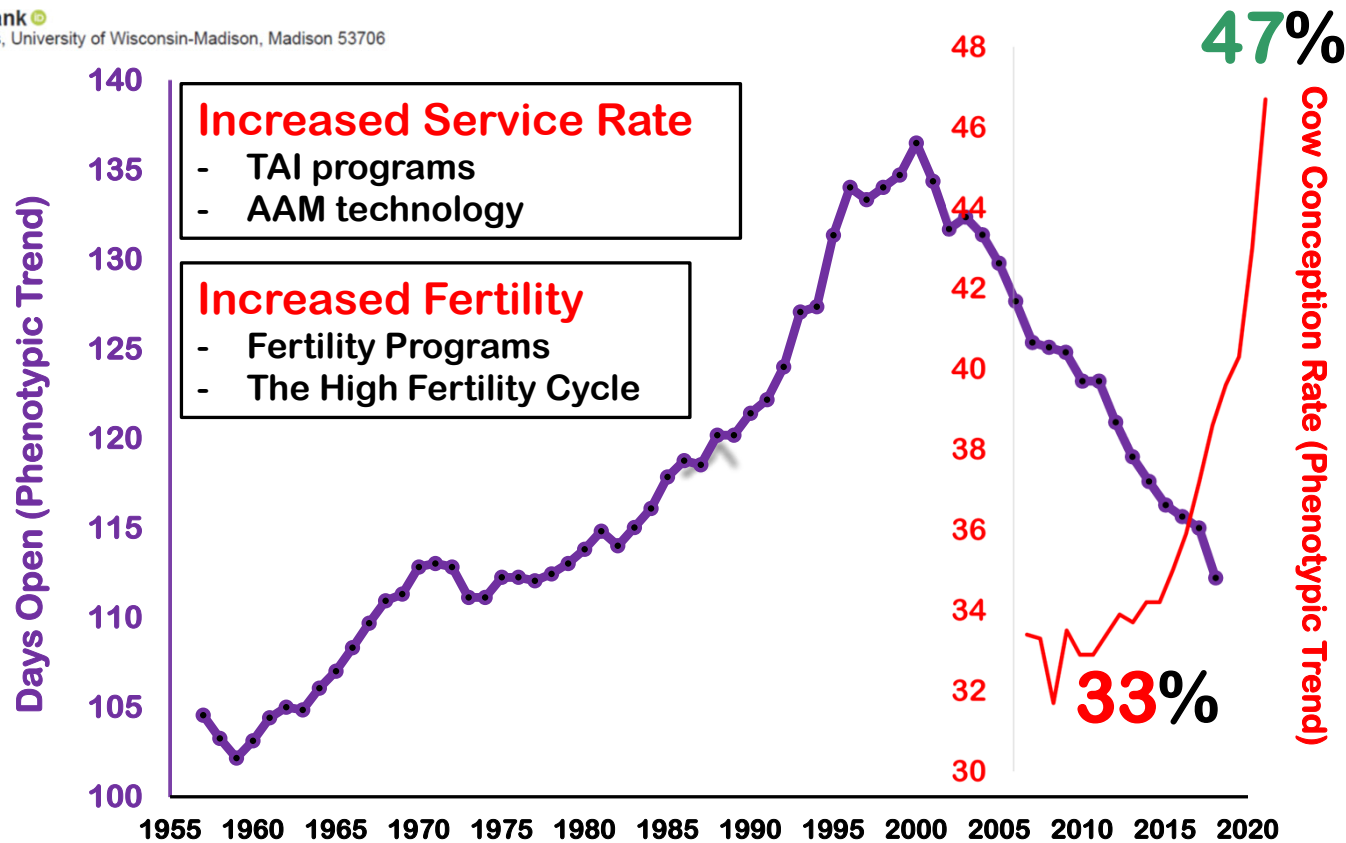
- Comparison of hormonal events during the periovulatory period in nonlactating heifers and high-producing cows.
- Hepatic metabolism of estradiol and progesterone cause endocrine changes that affect physiology and fertility.





Symposium review: The implications of spontaneous versus synchronized ovulations on the reproductive performance of lactating dairy cows*

P. M. Fricke† and M. C. Wiltbank
 Department of Animal and Dairy Sciences, University of Wisconsin-Madison, Madison 53706



% of cows, BCS at calving and 21 DIM

	BCS Change			P-Value
	Lost	Maintained	Gained	BCS
% cows	42 (789/1887)	36 (675/1887)	22 (423/1887)	-
% Primi.	47 (373/789)	53 (356/675)	55 (233/423)	0.02
BCS at calving	2.93±0.01 ^a	2.89±0.02 ^{ab}	2.85±0.02 ^b	0.005
BCS at 21 DIM	2.64±0.01 ^c	2.89±0.02 ^b	3.10±0.02 ^a	<0.001
BCS Δ	-0.29	0.0	+0.25	
ECM (kg/d) ¹	30.9±0.4	31.5±0.4	28.7±0.4	0.3

¹From calving to 21DIM

P/AI to Double-Ovsynch

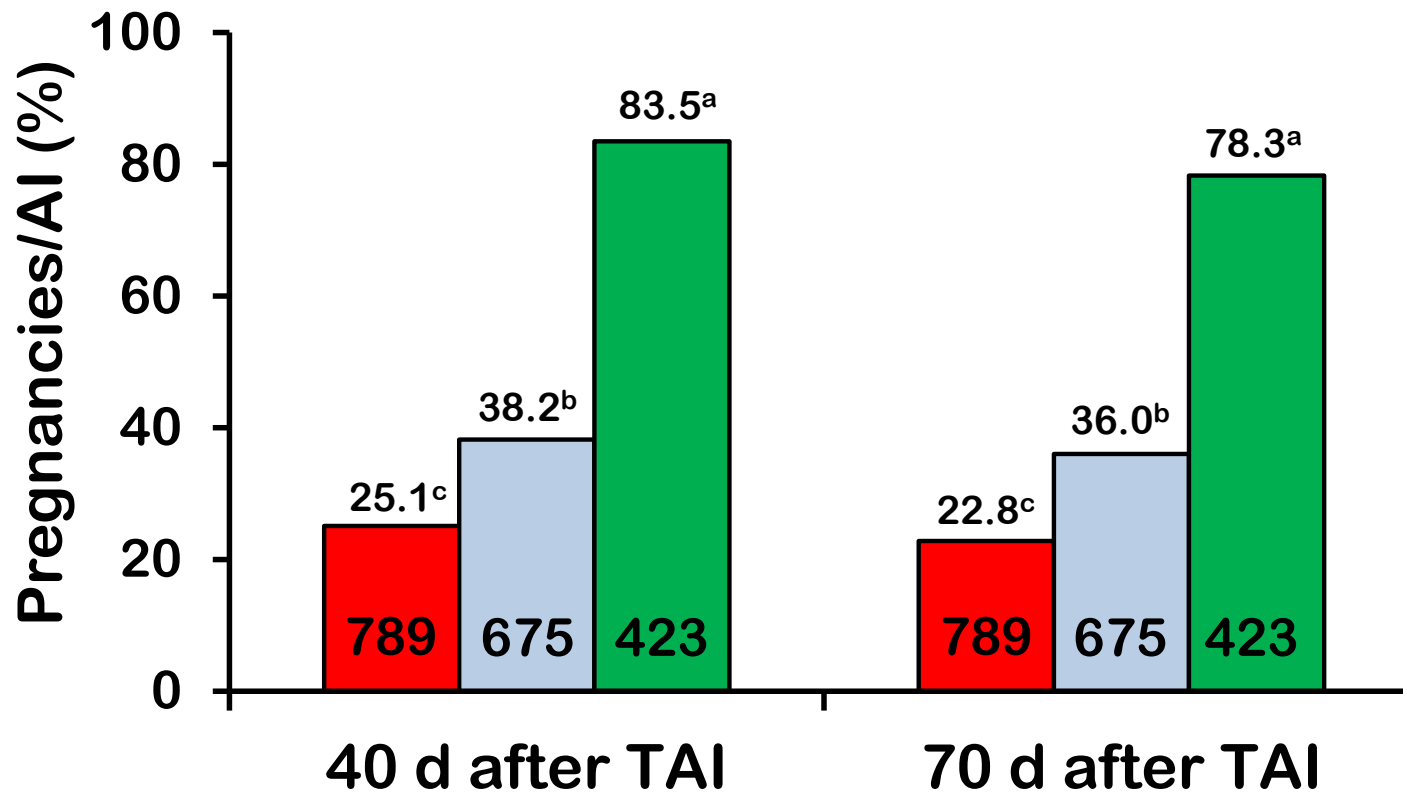
BCS change: $P < 0.001$

Parity: $P < 0.001$

BCS change: $P < 0.001$

Parity: $P < 0.001$

■ Lost ■ Maintained ■ Gained

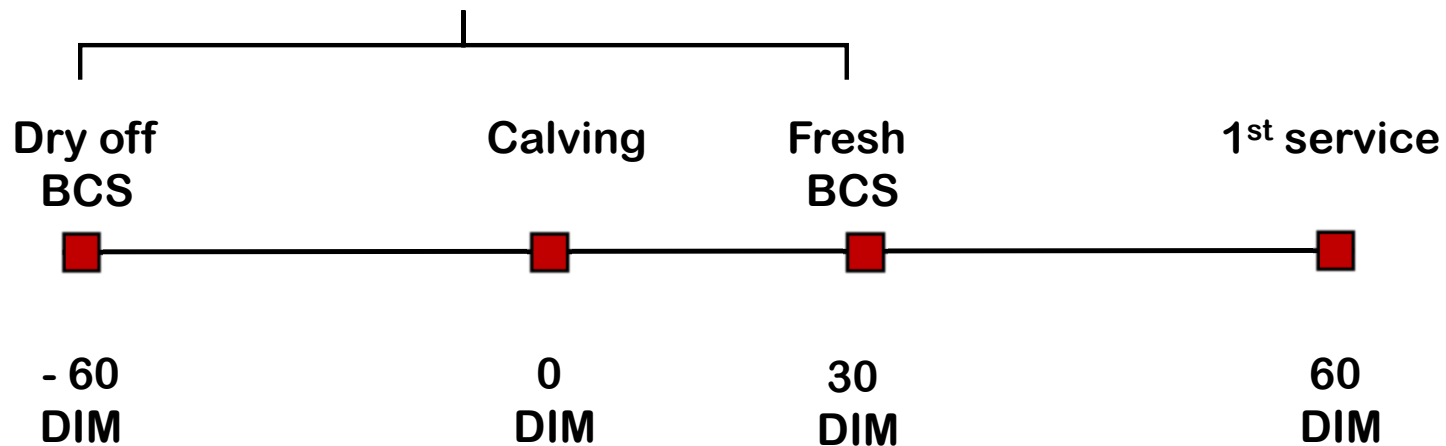


Unpublished Analysis

Megan Lauber, PhD Candidate

7,000-cow dairy in the upper Midwest

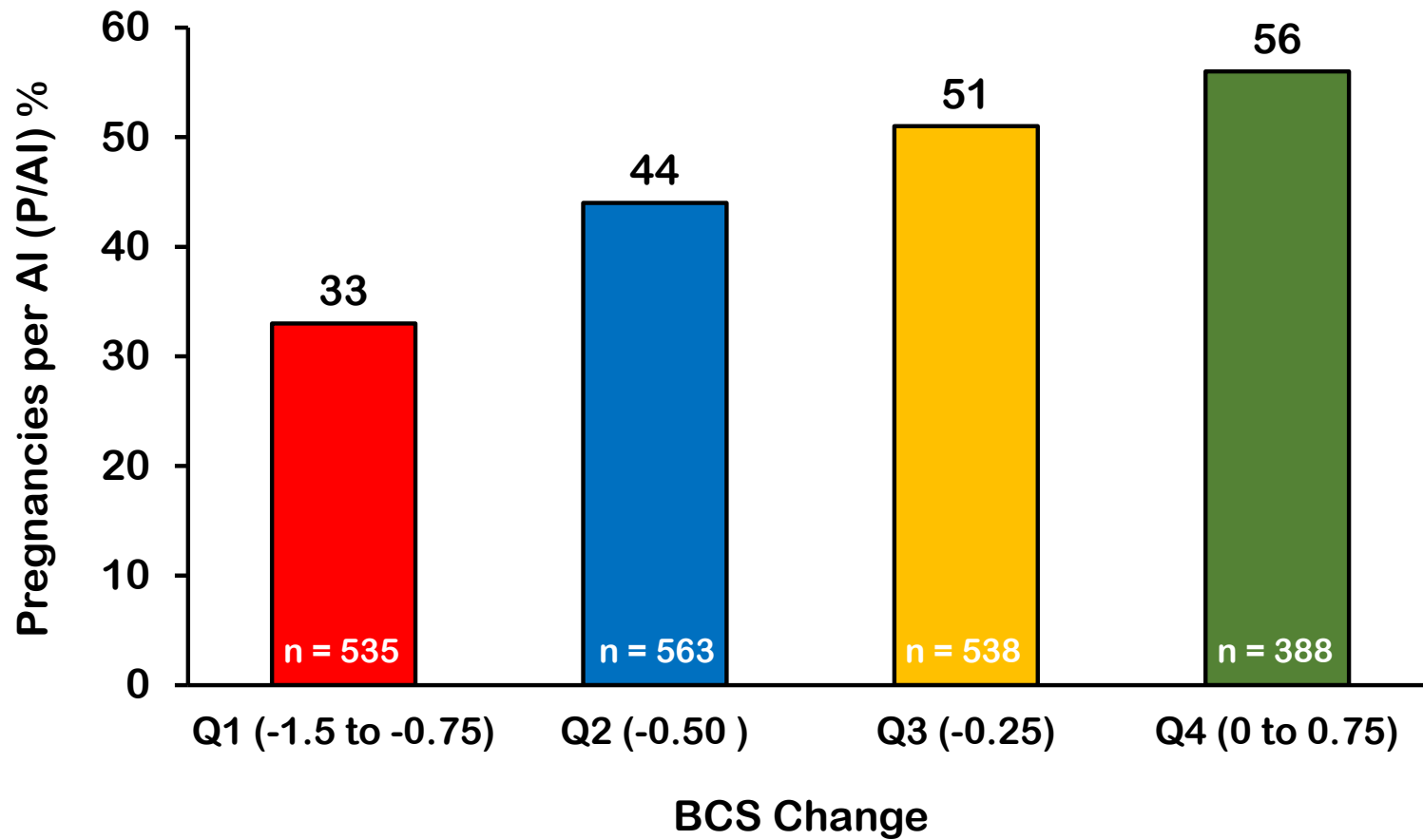
BCS change



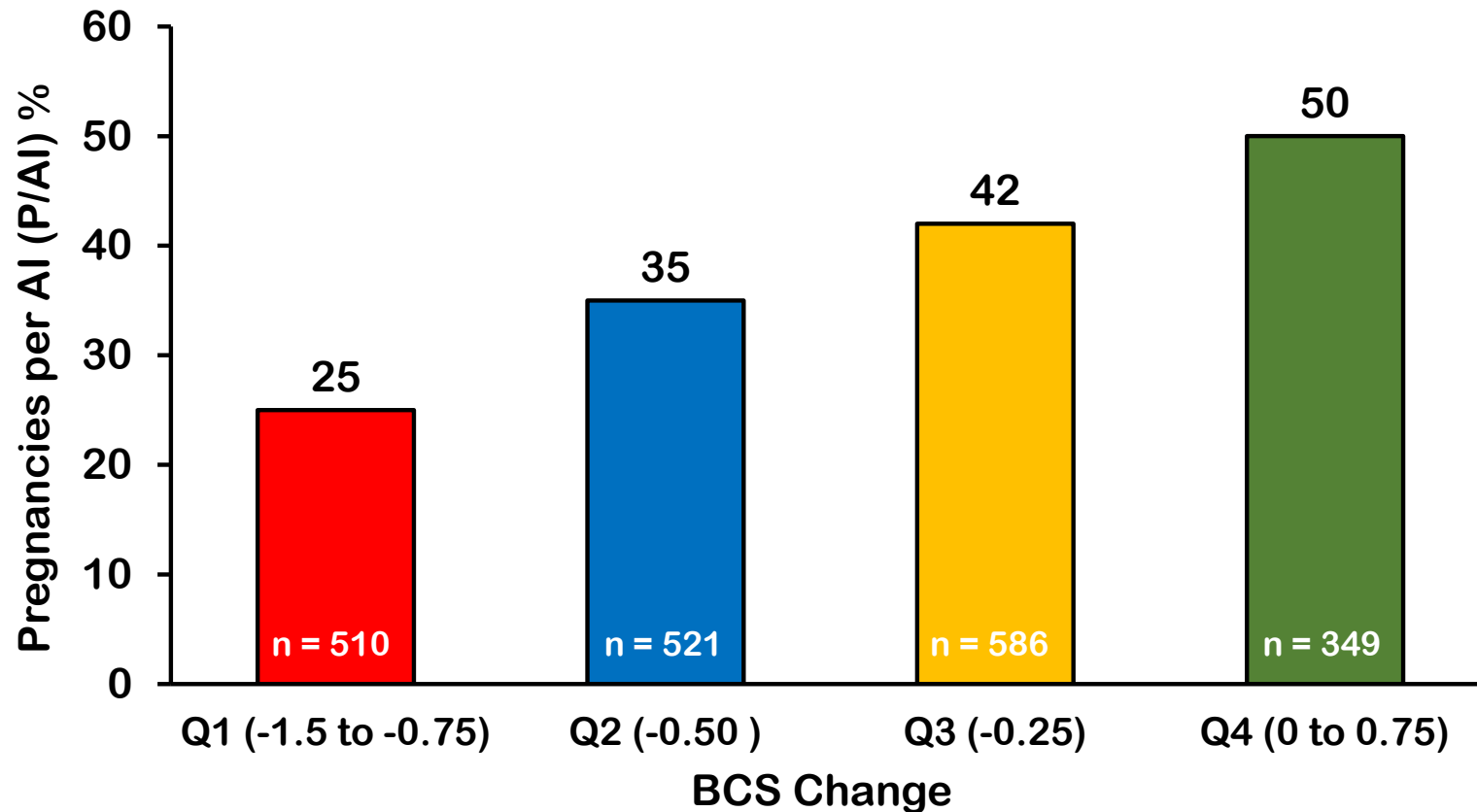
Demographics by BCS change

	BCS Change from Dry off to 30 DIM			
	Q1 n = 608	Q2 n = 672	Q3 n = 650	Q4 n = 449
BCS Change	-1.5 to -0.75	- 0.50	-0.25	0 to 0.75
BCS Change (Mean \pm SEM)	-0.84 \pm 0.01	-0.50 \pm 0	-0.25 \pm 0	0.04 \pm 0.01
Parity (Mean \pm SEM)	3.47 \pm 0.06	3.07 \pm 0.05	2.86 \pm 0.5	2.73 \pm 0.06
Week 8 Milk (lbs)	117	117	113	108
1 st F:P Ratio (Mean \pm SEM)	1.30 \pm 0.02	1.25 \pm 0.01	1.21 \pm 0.01	1.19 \pm 0.01

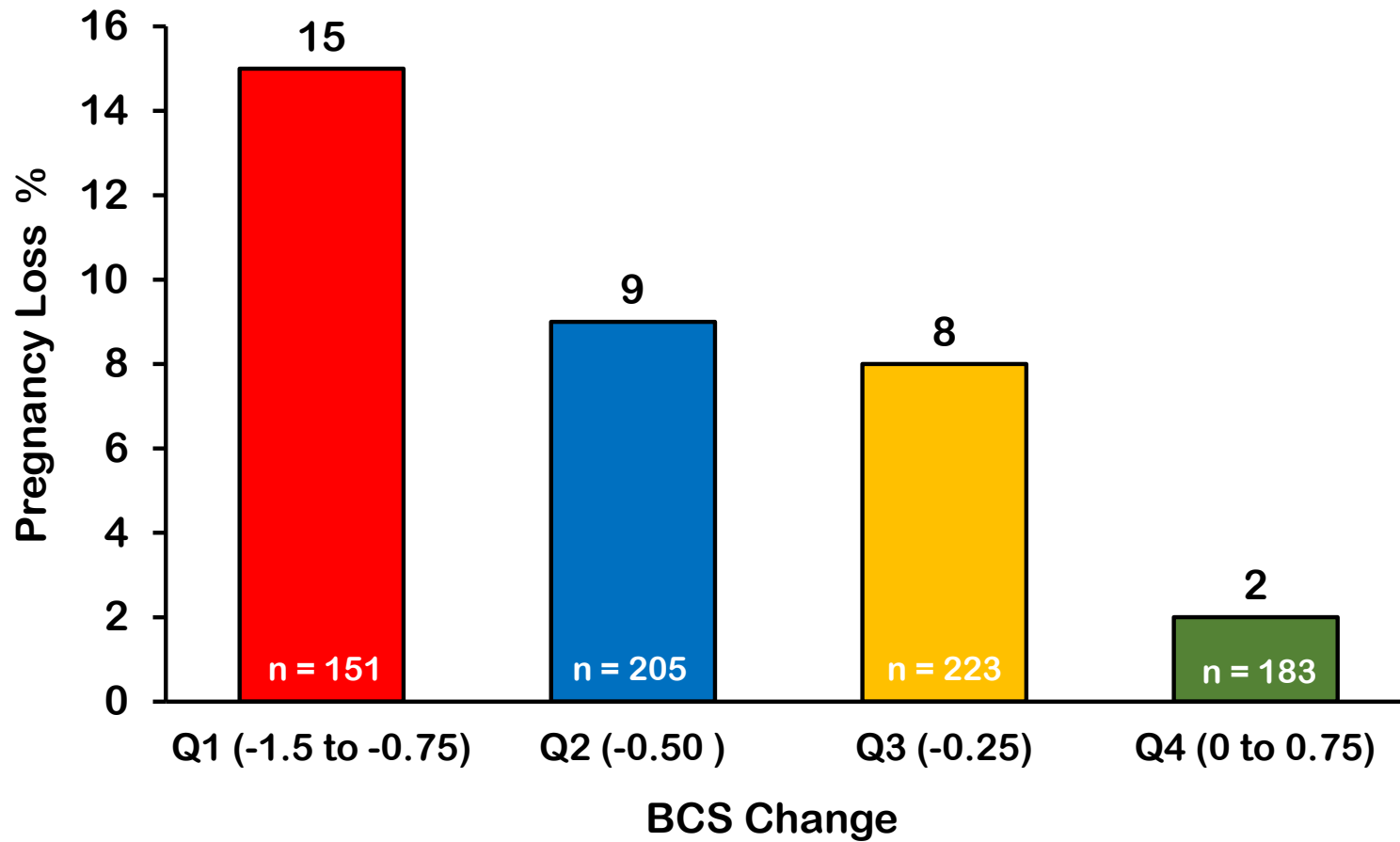
Pregnancy outcomes, d 32



Pregnancy outcomes, d 60



Pregnancy Loss, d 32-60

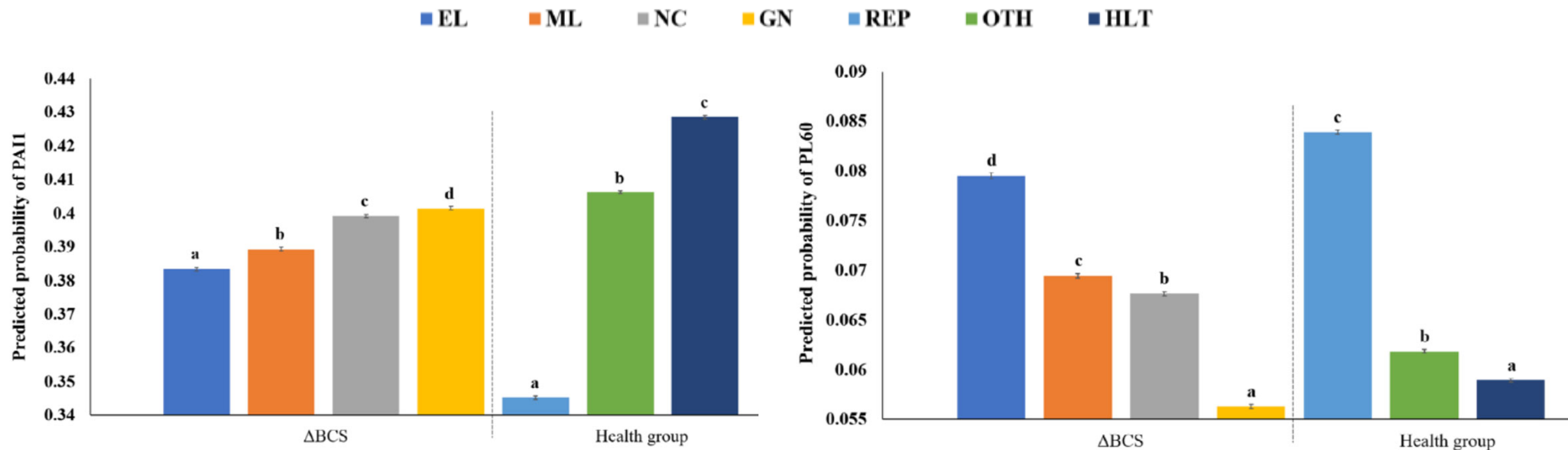




Effect of body condition change and health status during early lactation on performance and survival of Holstein cows

D. Manríquez,¹ W. W. Thatcher,² J. E. P. Santos,² R. C. Chebel,³ K. N. Galvão,³ G. M. Schuenemann,⁴ R. C. Bicalho,⁵ R. O. Gilbert,⁶ S. Rodriguez-Zas,⁷ C. M. Seabury,⁸ G. J. M. Rosa,⁹ and P. Pinedo^{1*}

A retrospective cohort study used information from 11,733 Holstein cows to assess the effect of Δ BCS and health status during the first 40 DIM. breeding management included combinations of timed AI and heat detection.



Case Study Extreme Example

A nutritionist called me about a 450-cow dairy with severe repro problems

- **21-d Pregnancy Rate: 8%**
 - <20% = poor
 - 21% to 25% = OK with room for improvement
 - 26% to 30% = excellent
 - >30% = outstanding
- **21-d Service Rate: 33%**
 - Goal: >60%
- **Conception Rate: 39% overall**
 - No sexed semen used in lactating cows
 - CR is difficult to benchmark; many factors are involved
 - Goal: 45% to 55%

Far-Off Dry Cows



Early Lactation Cows



Question:

How can we get cows to gain or maintain BCS after calving?



ELSEVIER

Contents lists available at ScienceDirect

Theriogenology

journal homepage: www.theriojournal.com



Association of changes among body condition score during the transition period with NEFA and BHBA concentrations, milk production, fertility, and health of Holstein cows



R.V. Barletta ^{a,*}, M. Maturana Filho ^b, P.D. Carvalho ^a, T.A. Del Valle ^b, A.S. Netto ^b, F.P. Rennó ^b, R.D. Mingoti ^b, J.R. Gandra ^d, G.B. Mourão ^c, P.M. Fricke ^a, R. Sartori ^c, E.H. Madureira ^b, M.C. Wiltbank ^a

^a Department of Dairy Science, University of Wisconsin-Madison, Madison, 53706, USA

^b Department of Animal Nutrition and Production, University of São Paulo, Pirassununga, 13635-900, Brazil

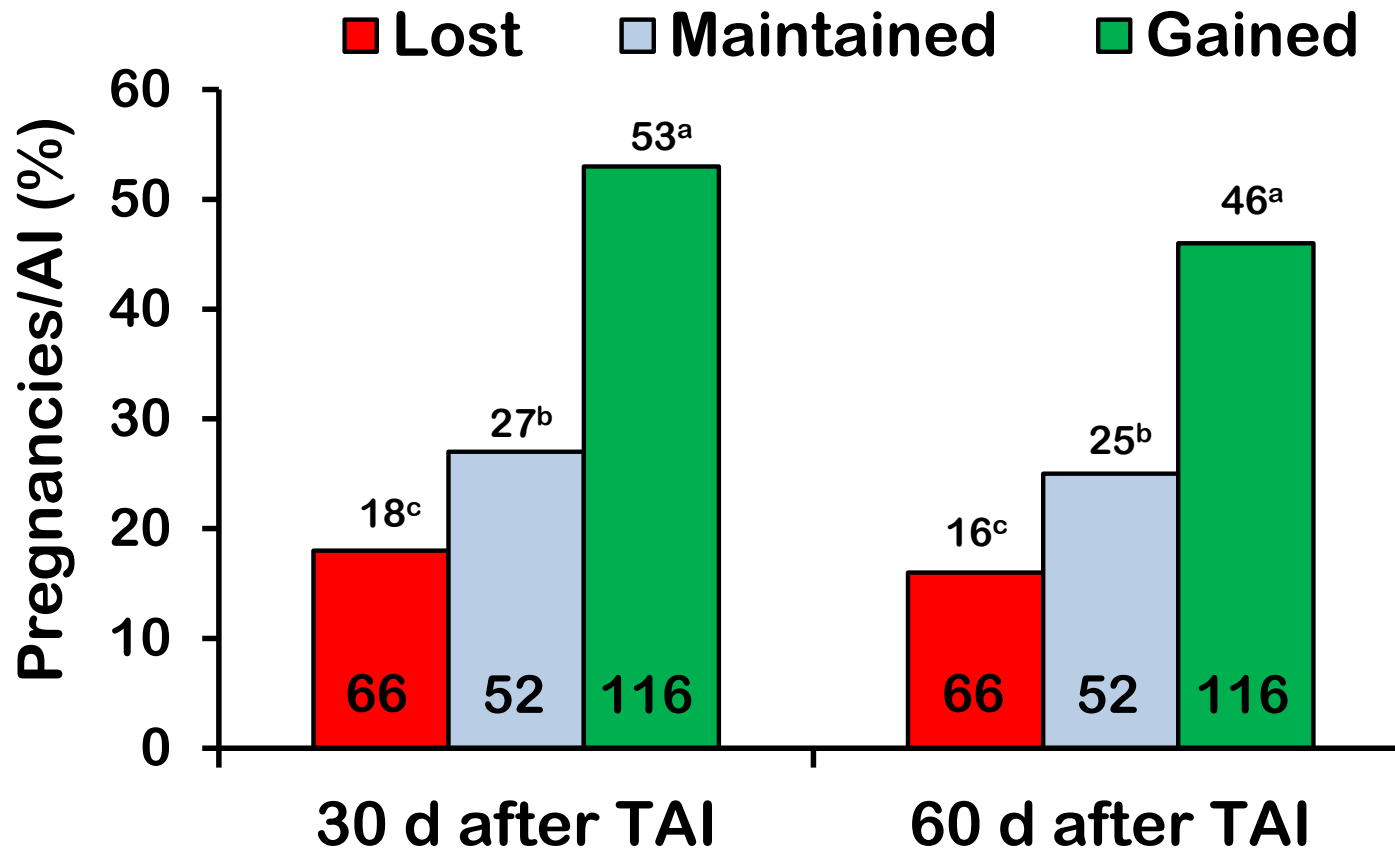
^c Department of Animal Science, University of São Paulo, Escola Superior de Agricultura Luiz de Queiroz, Piracicaba, 13418-900, Brazil

^d College of Agricultural Science, Federal University of Dourados, Dourados, 79804-970, Brazil

BCS change from 21 days before calving to 21 days after calving

P/AI to TAI after a fertility program

Barletta et al., 2017; Theriogenology 104:30-36



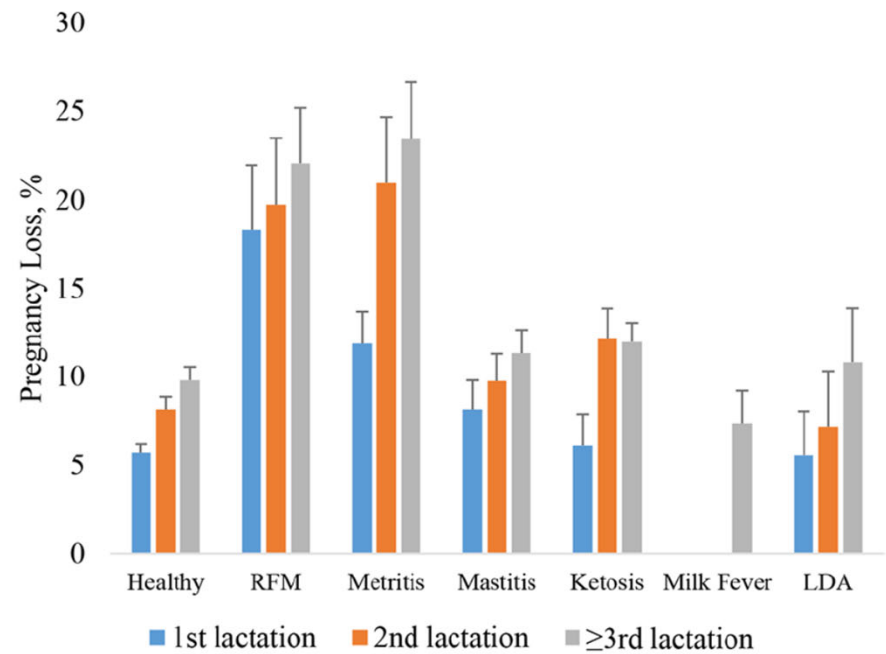
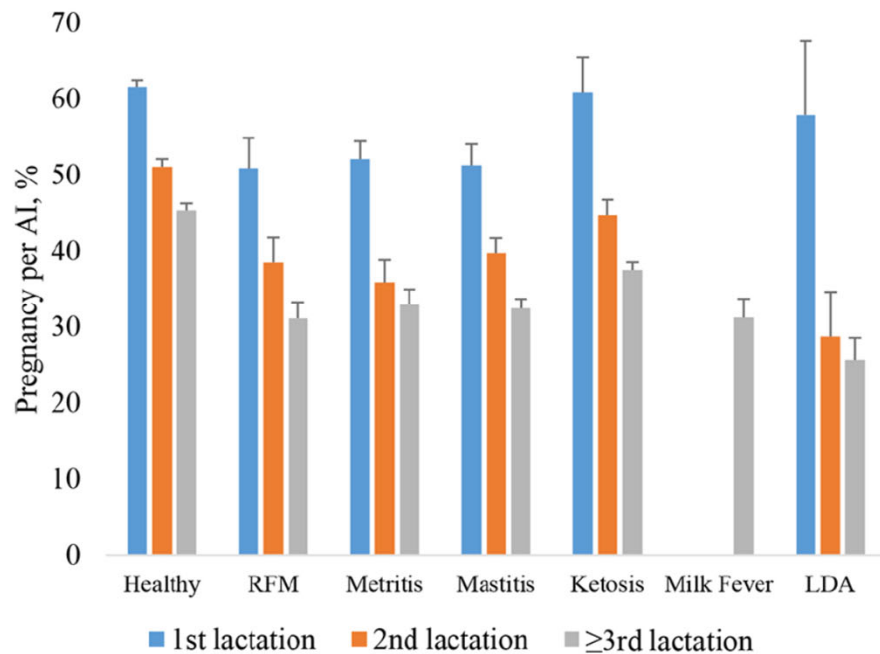
Effect of BCS Change on Health Events

Barletta et al., 2017; Theriogenology 104:30-36.

Event	Lost	Maintained	Gained
	50% (116/234)	22% (52/234)	28% (66/234)
Metritis	23%	21%	20%
Mastitis	29% ^b	17% ^{a,b}	17% ^a
Ketosis	27%	19%	15%
Pneumonia	15%	12%	9%
>1 Event	63% ^b	46% ^a	39% ^a

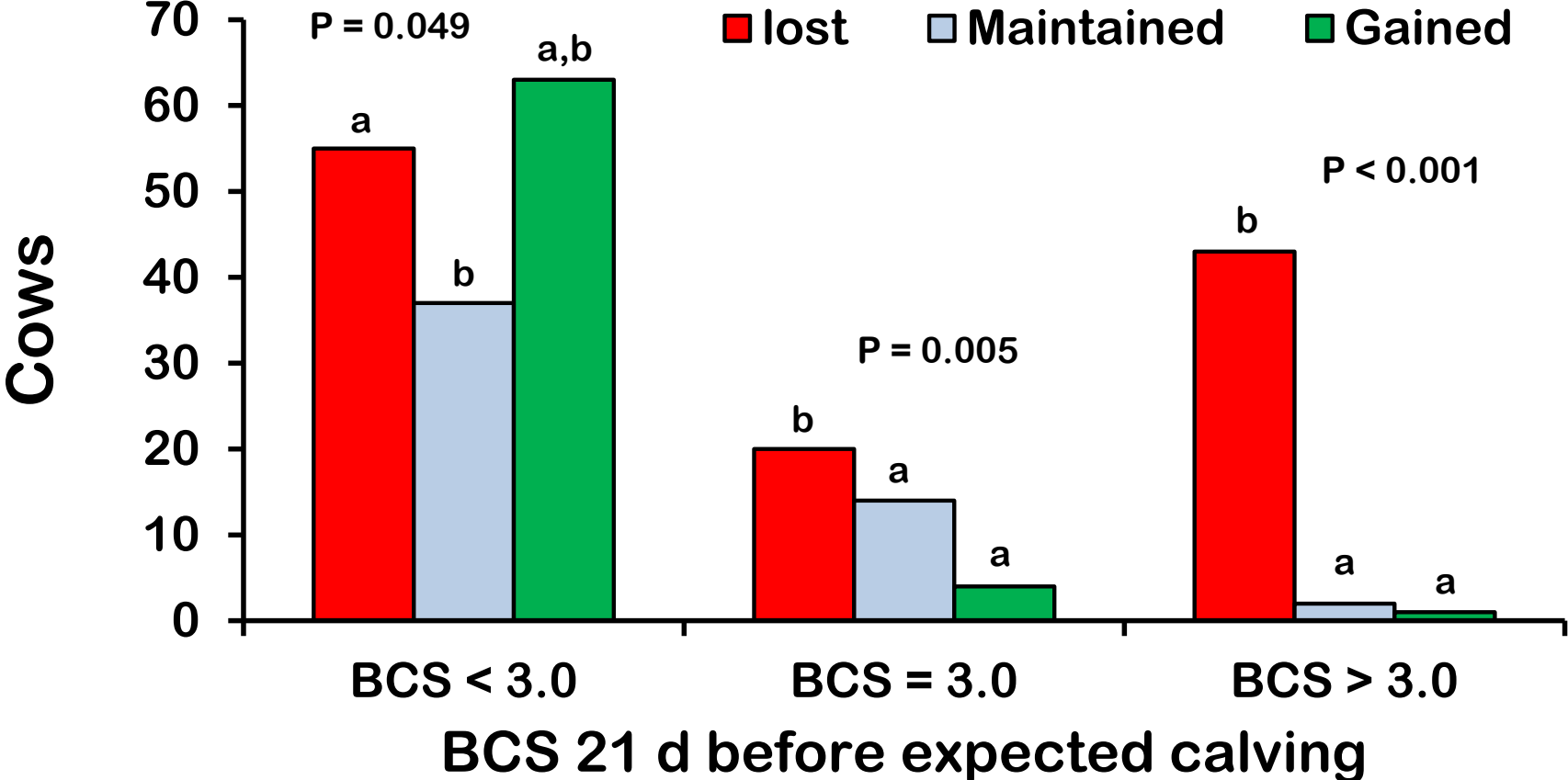
Association of transition cow health with pregnancy per artificial insemination and pregnancy loss in Holstein cows submitted to a Double-Ovsynch protocol for first service

R. Frenkel,¹ P. M. Fricke,² A. M. L. Madureira,³ W. Heuwieser,¹ and S. Borchardt^{1*}



Overall, 50% of cows lost BCS from 21 d before to 21 days after calving

Barletta et al., 2017; Theriogenology 104:30-36



Question:

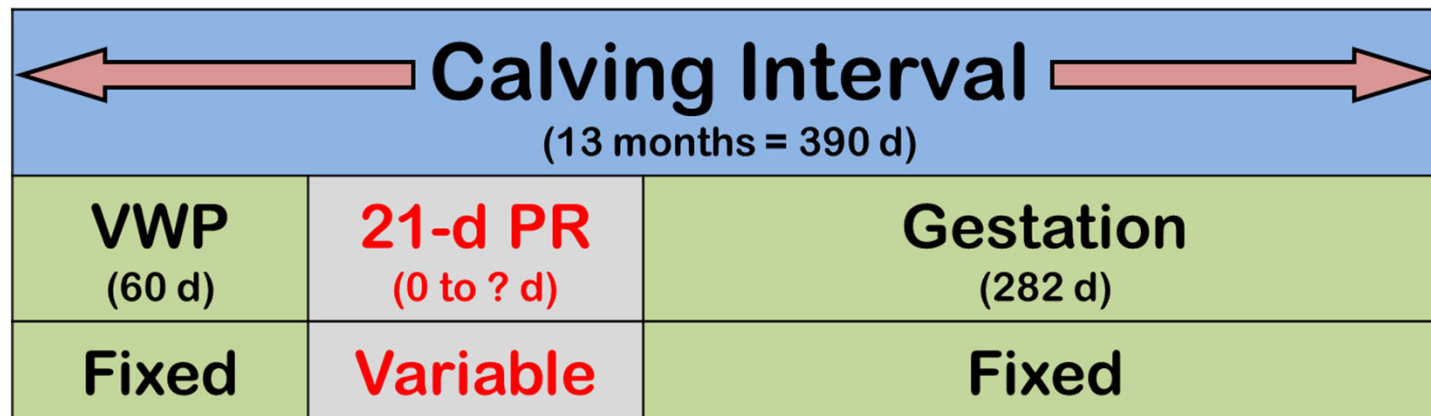
How can we get cows to gain or maintain BCS after calving?

Answer:

Avoid calving over-conditioned cows!

Question:

How can we avoid calving over-conditioned cows?

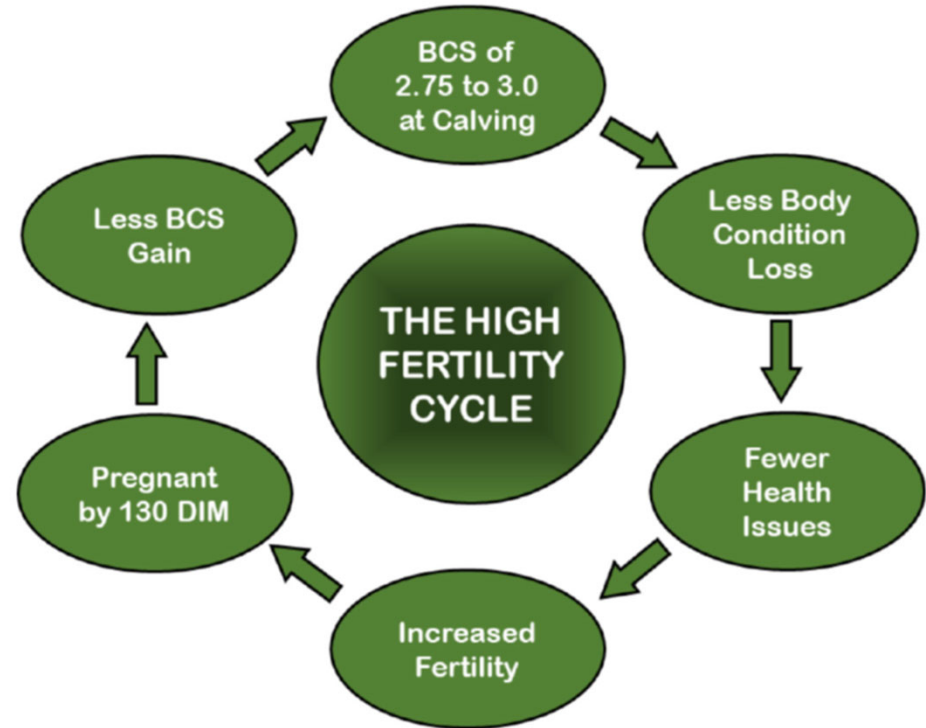




J. Dairy Sci. 102:5577–5587
<https://doi.org/10.3168/jds.2018-15828>
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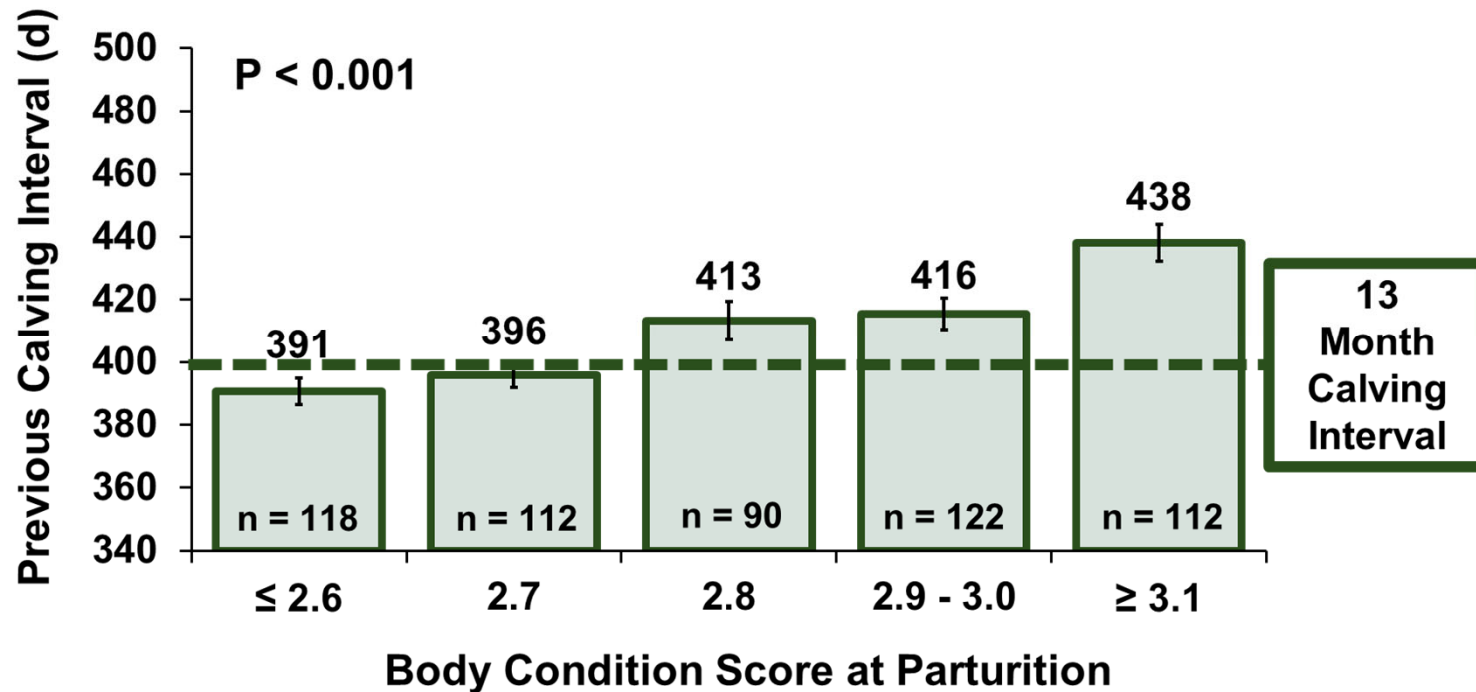
The high-fertility cycle: How timely pregnancies in one lactation may lead to less body condition loss, fewer health issues, greater fertility, and reduced early pregnancy losses in the next lactation

E. L. Middleton, T. Minela, and J. R. Pursley*
Department of Animal Science, Michigan State University, East Lansing 48824



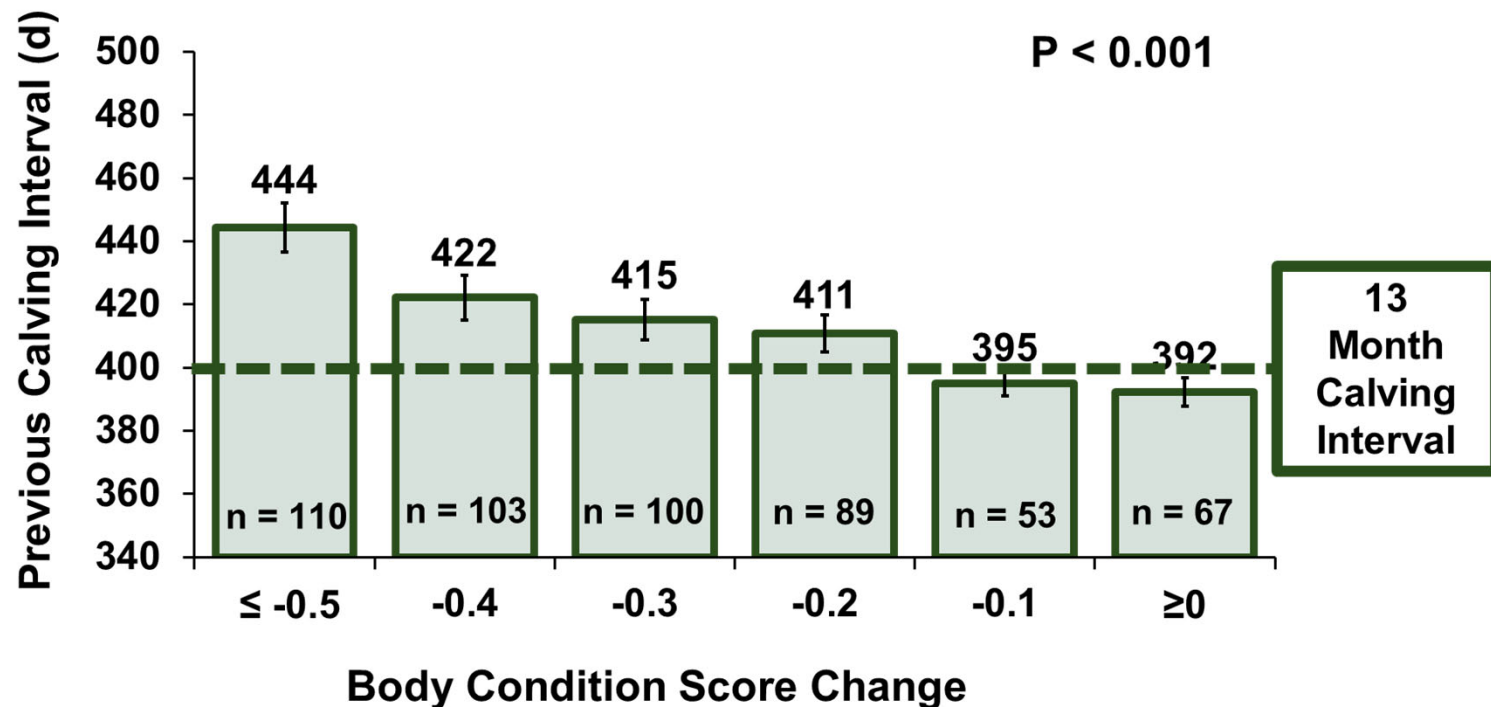
Effect of previous calving interval on BCS at calving

Middleton et al., 2019; J. Dairy Sci. 102:5577-5587



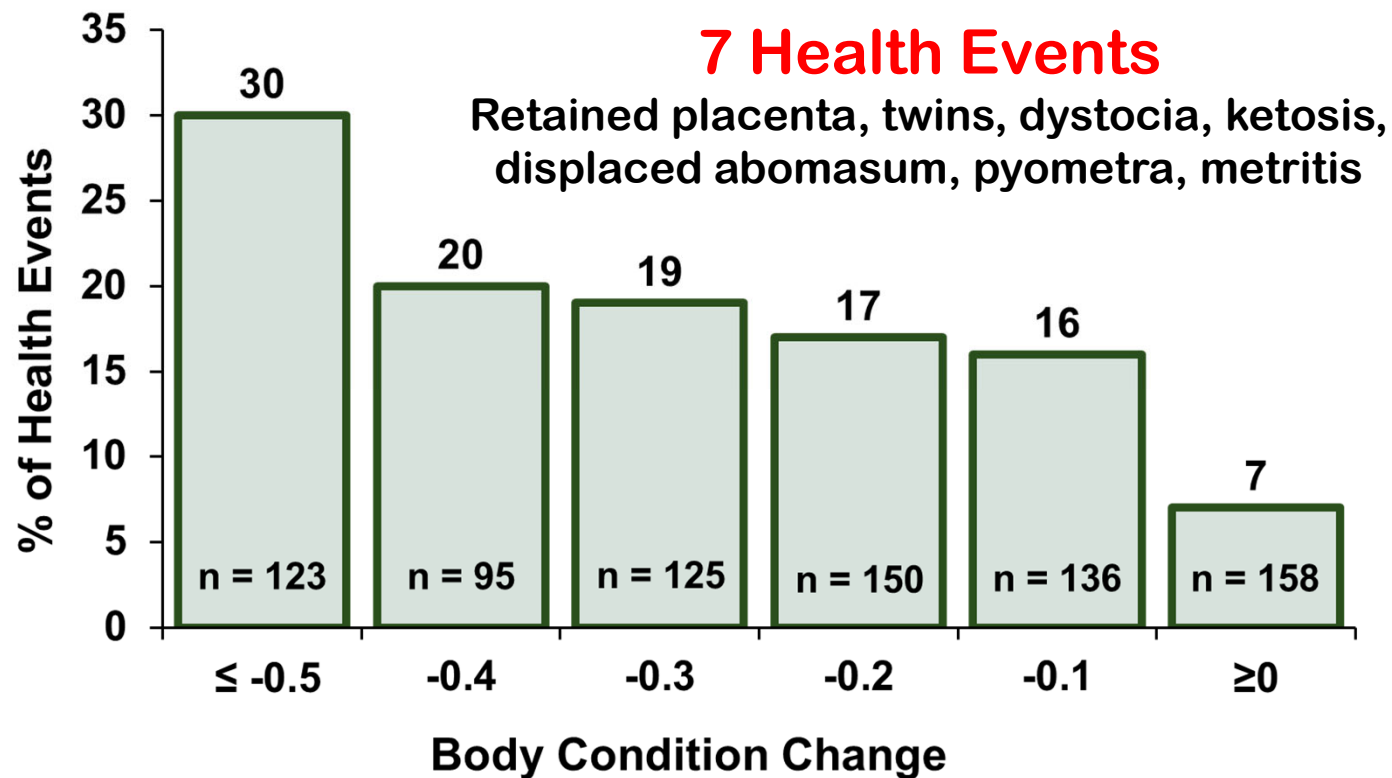
Effect of previous calving interval on BCS change calving to 30 DIM

Middleton et al., 2019; J. Dairy Sci. 102:5577-5587



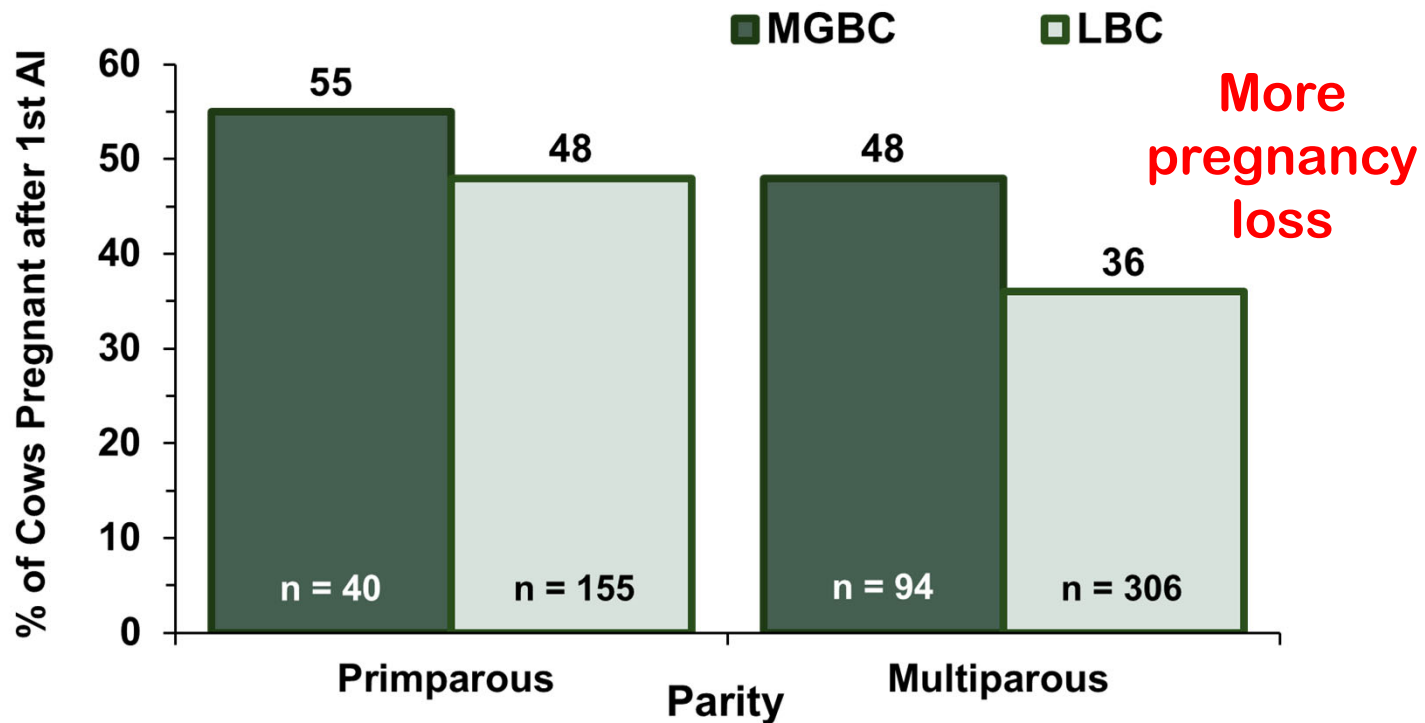
Effect of BCS change on health events

Middleton et al., 2019; J. Dairy Sci. 102:5577-5587



Effect of BCS change after calving on fertility to first TAI

Middleton et al., 2019; J. Dairy Sci. 102:5577-5587





J. Dairy Sci. 107:2524–2542
<https://doi.org/10.3168/jds.2023-23892>

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Effect of postpartum body condition score change on the pregnancy outcomes of lactating Jersey cows inseminated at first service with sexed Jersey or conventional beef semen after a synchronized estrus versus a synchronized ovulation

M. R. Lauber  and P. M. Fricke* 

Department of Animal and Dairy Sciences, University of Wisconsin–Madison, Madison, WI 53706



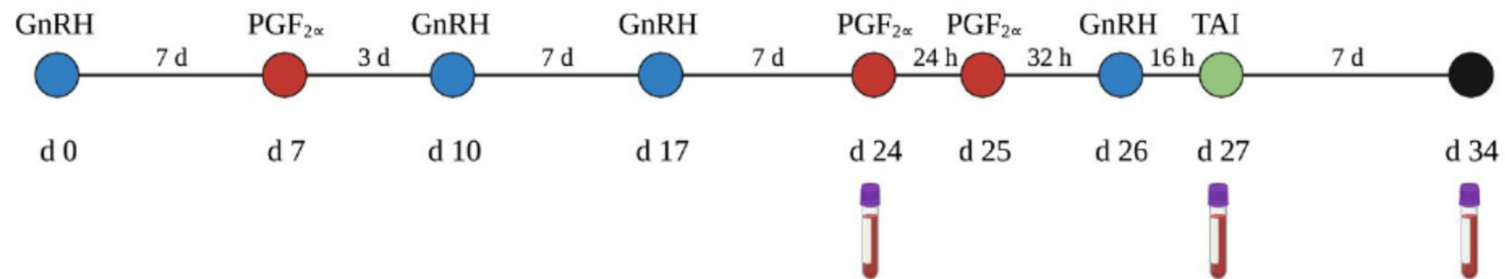
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University of Wisconsin–Madison



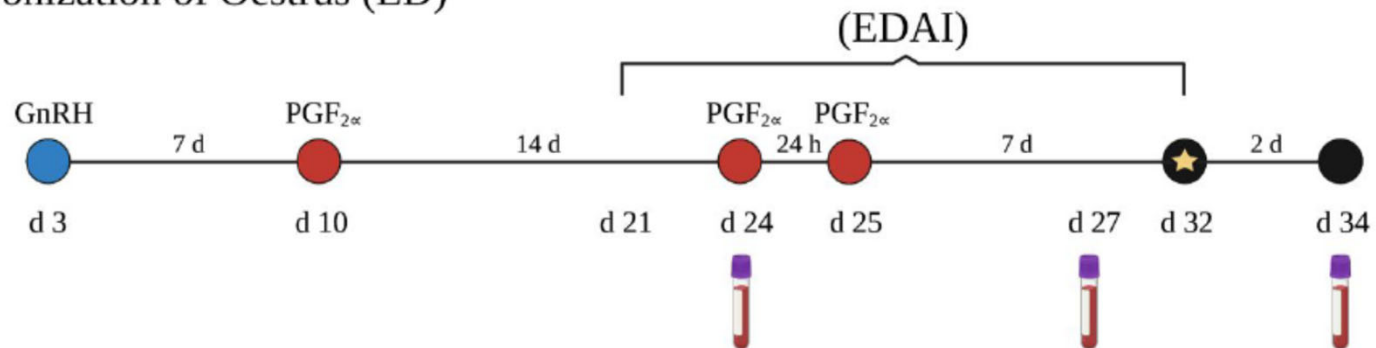
Experimental Design

Sexed and Conventional Beef Semen

Double Ovsynch (DO)



Synchronization of Oestrus (ED)



Enrollment

336 primiparous and 950 multiparous Jersey cows

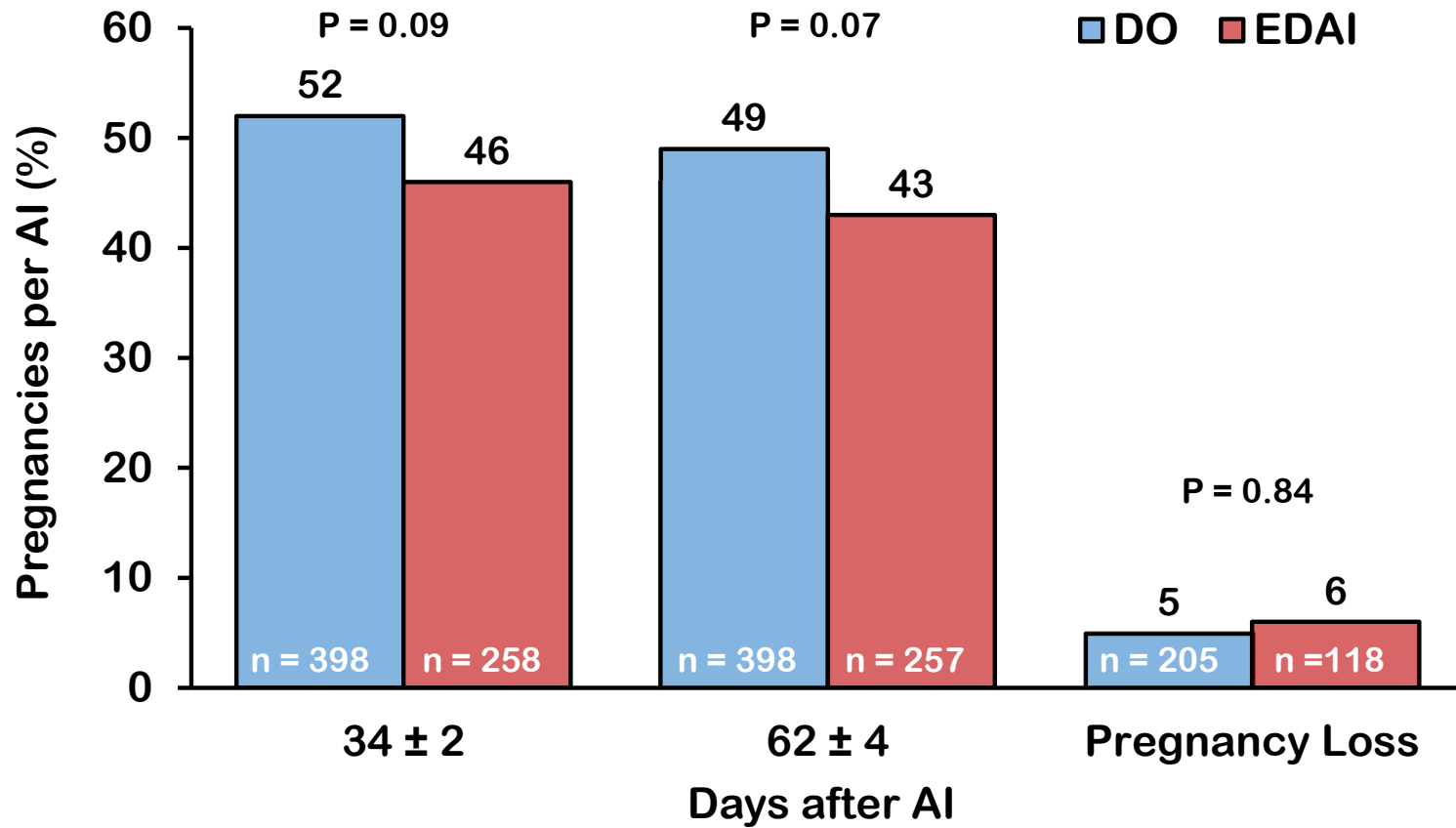
Semen	Treatment		Total
	DO	EDAI	
Beef	317	227	544
Sexed	398	344	742
Total	715	571	1,286



The decision to inseminate cows with sexed vs. beef semen was made by the farm. Mated cows were then randomized to treatment *within* each semen type.

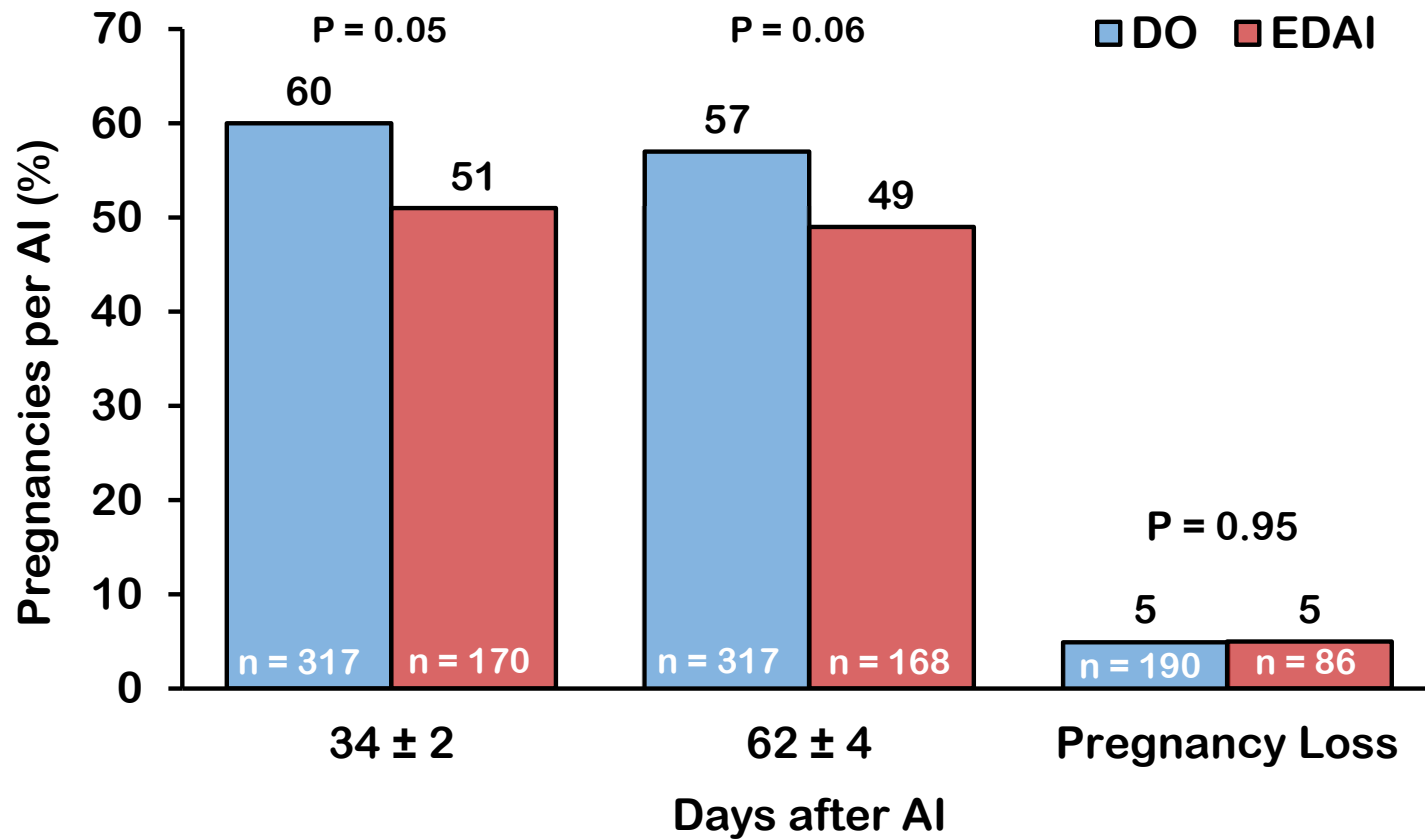
Effect of Treatment on P/AI

Sexed Semen

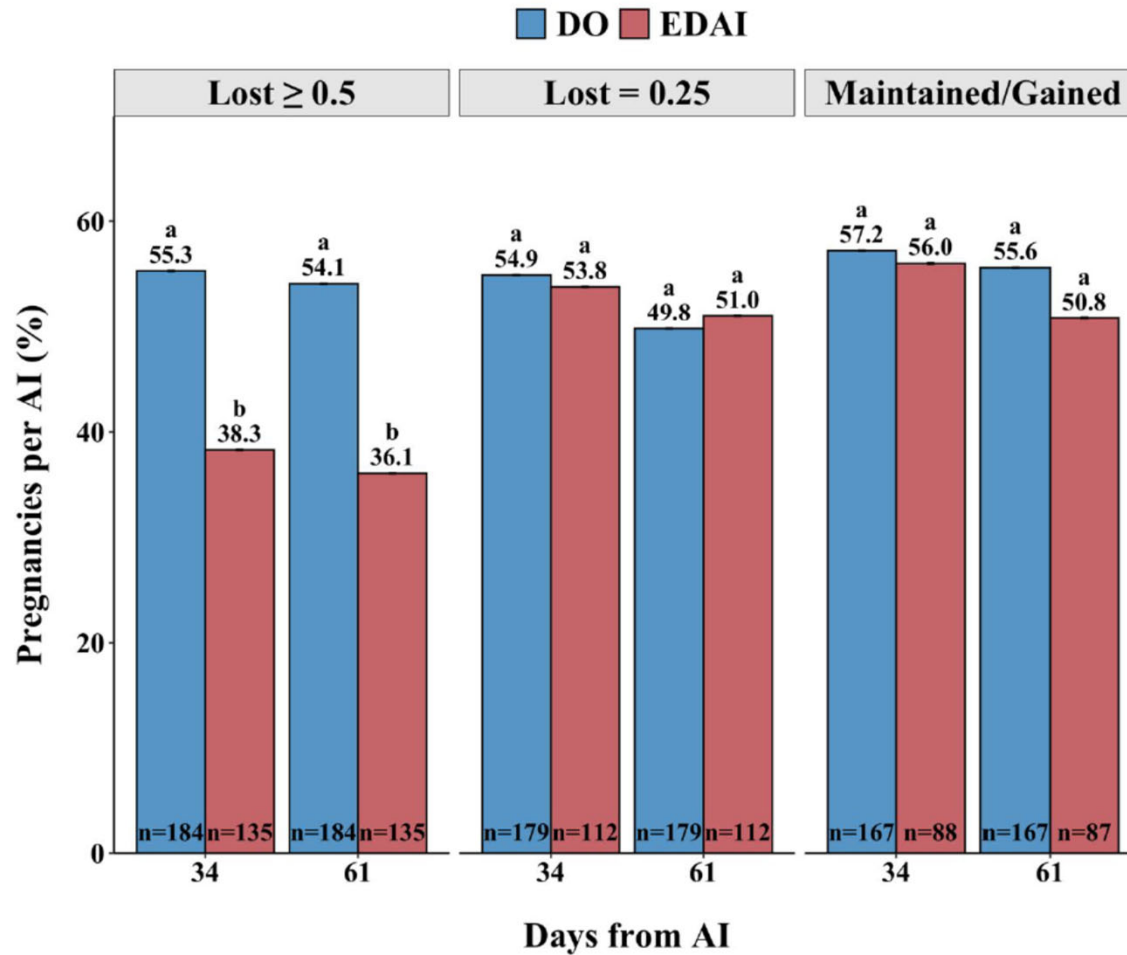


Effect of Treatment on P/AI

Beef Semen

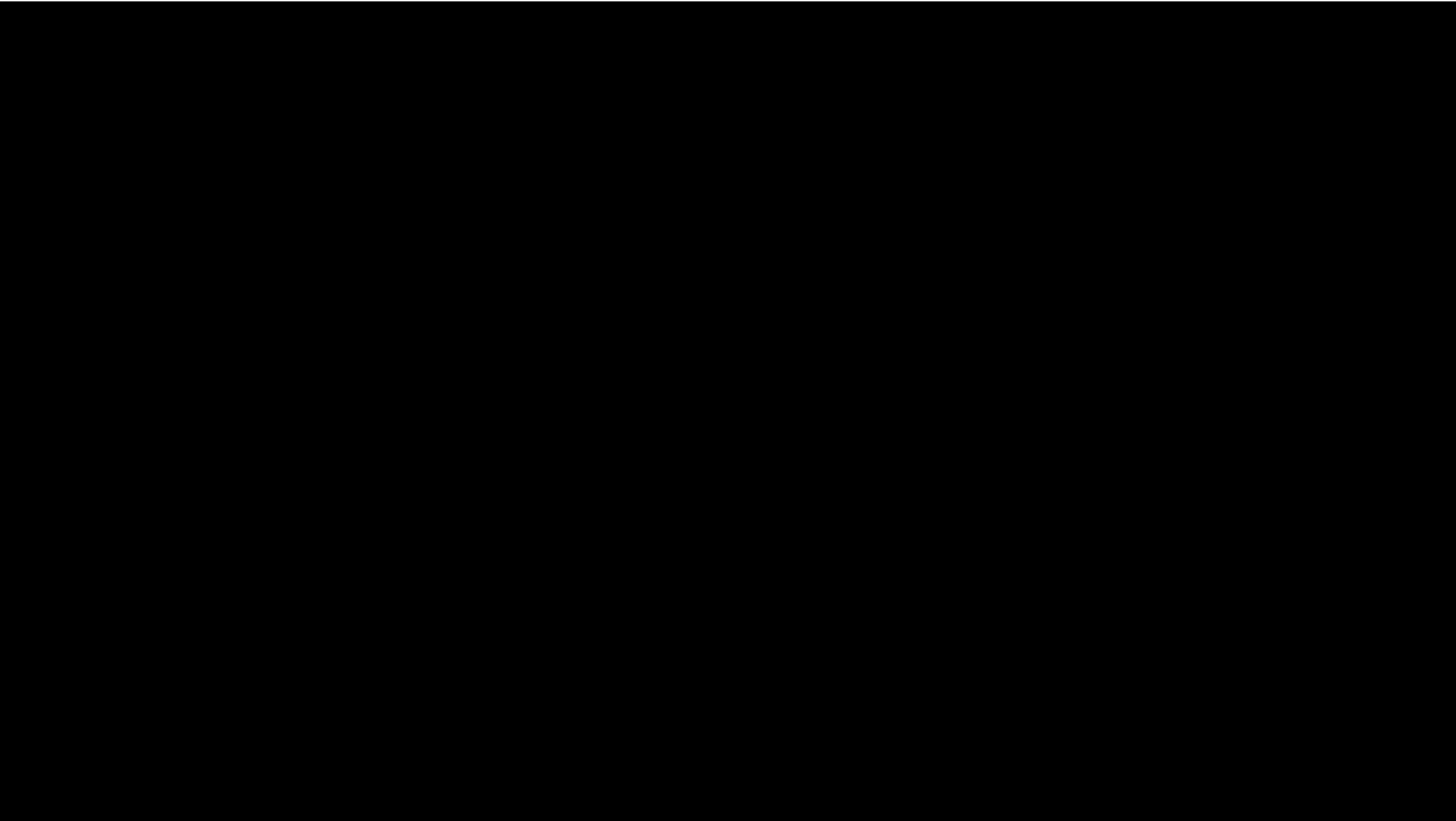


Effect of postpartum BCS change on P/AI



Take-Home Messages

- 1. Body condition score change during the periparturient period has a profound effect on reproductive performance**
- 2. Get your herds into the High Fertility Cycle!**
 - Implement a reproductive management strategy that gets cows pregnant quickly after the end of the voluntary waiting period
 - Culling strategies
 - Grouping strategies



Re-think BCS targets

2001 BCS Recommendations:

Calving: **3.25** to **3.75**

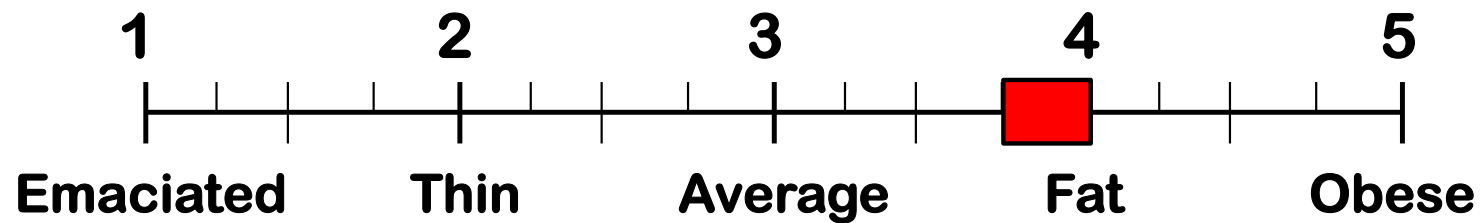
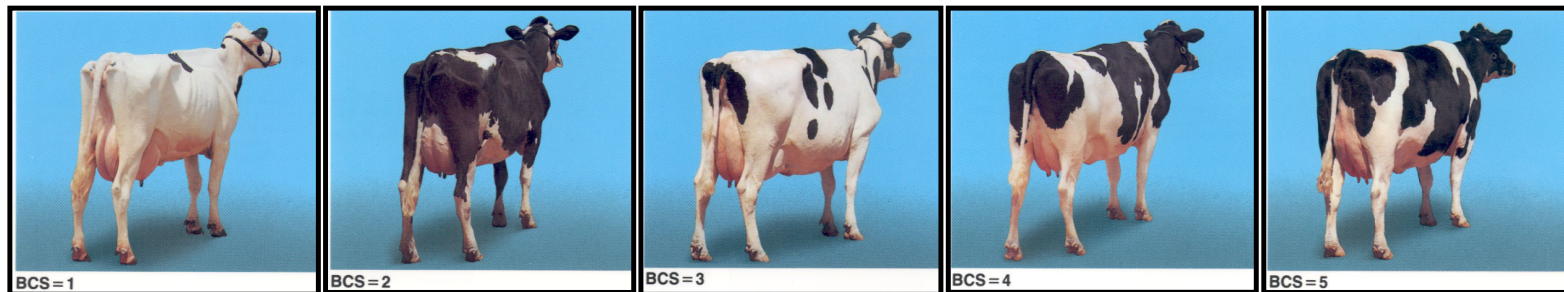
Early: 2.50 to 3.25

Mid: 2.75 to 3.25

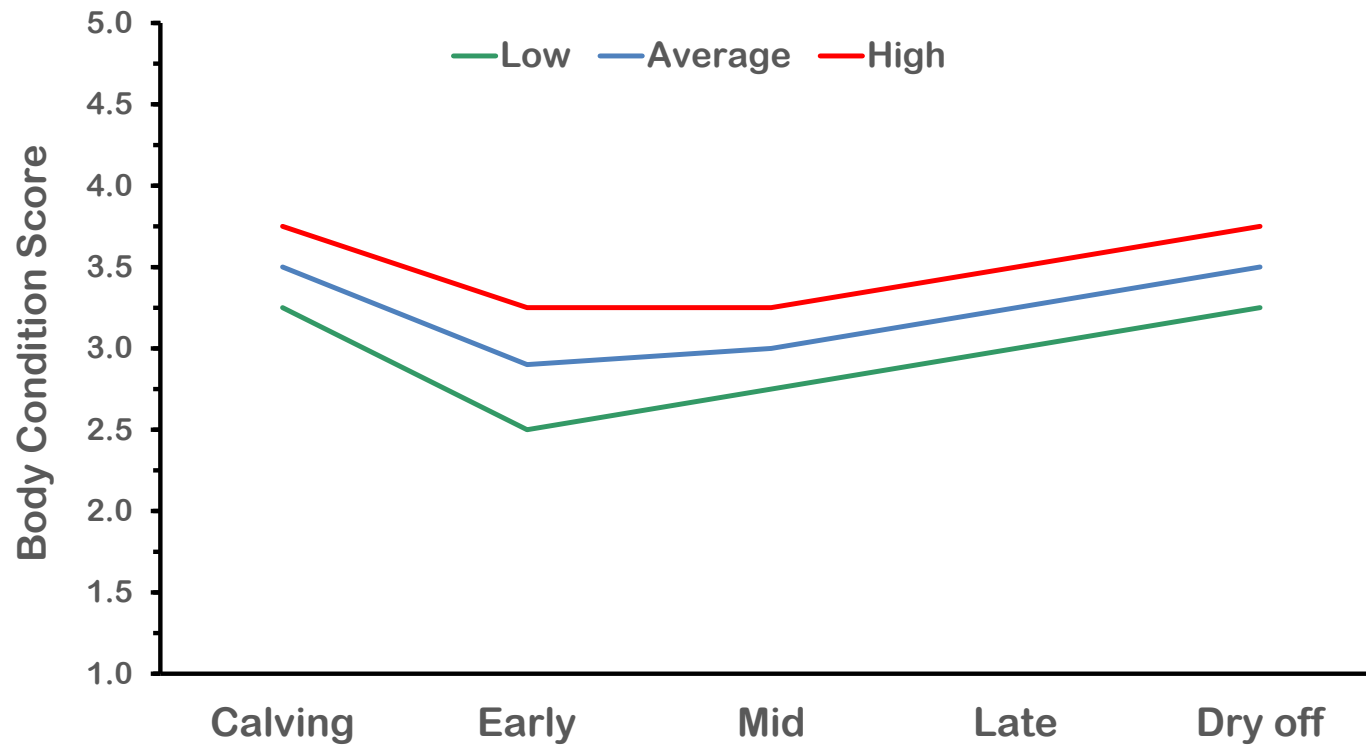
Late: 3.00 to 3.50

Dry Off: **3.25** to **3.75**

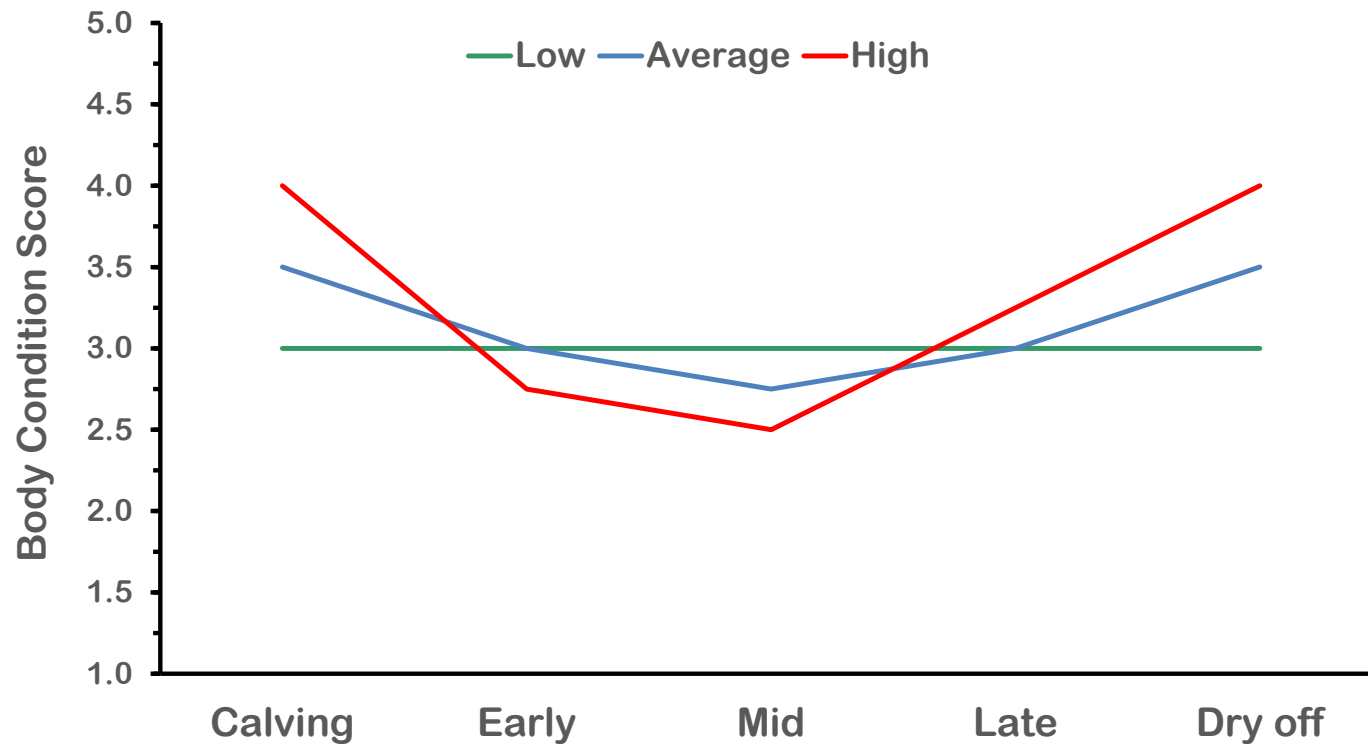
Too High!



BCS Change – Old Paradigm



BCS Change – New Paradigm





J. Dairy Sci. TBC

<https://doi.org/10.3168/jds.2024-25387>

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Michigan dairy farm that used an automated milking system

Associations of Body Condition Score, Body Condition Score Change, and Hyperketonemia with Mastitis, Reproduction, and Milk Production

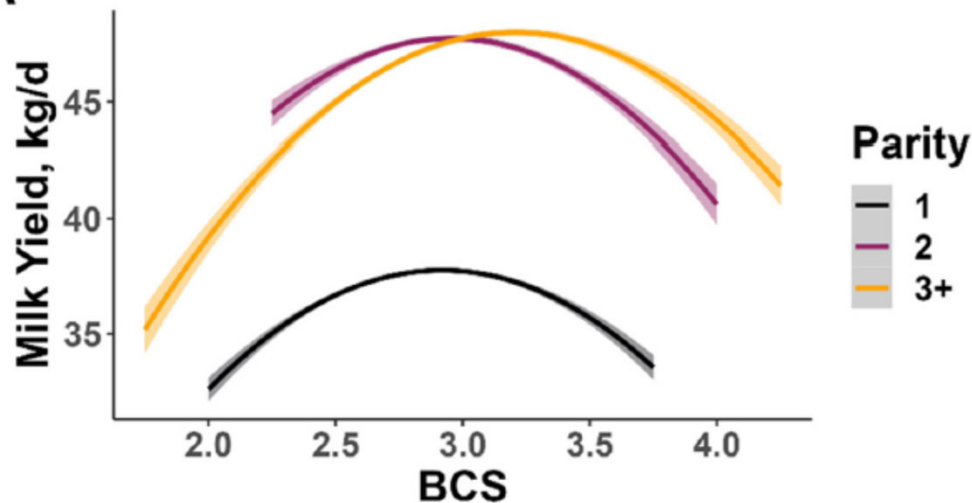
K. C. Krogstad^{1,2*} and B. J. Bradford¹

¹Department of Animal Science, Michigan State University, East Lansing, MI 48824

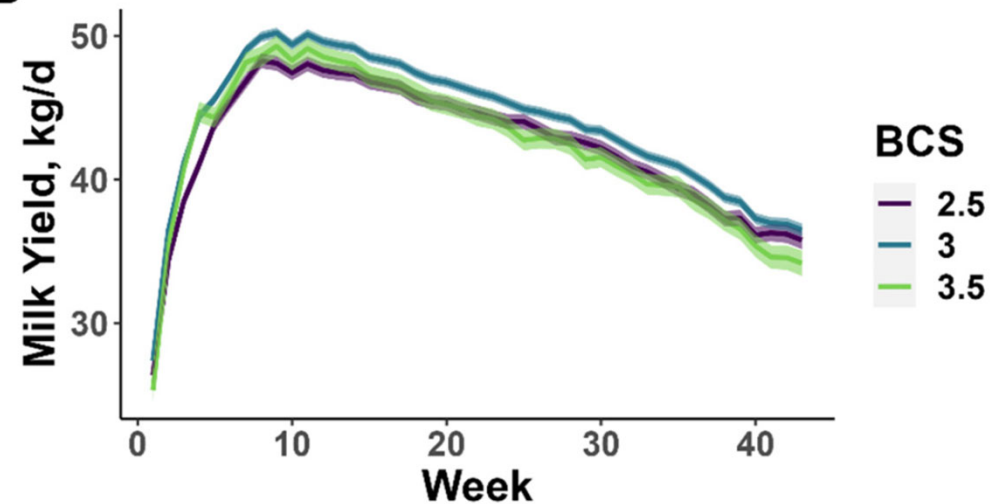
²Department of Animal Science, The Ohio State University, Wooster, OH 44691

Associations of postpartum BCS observed between 14 and 21 DIM with milk yield.

A



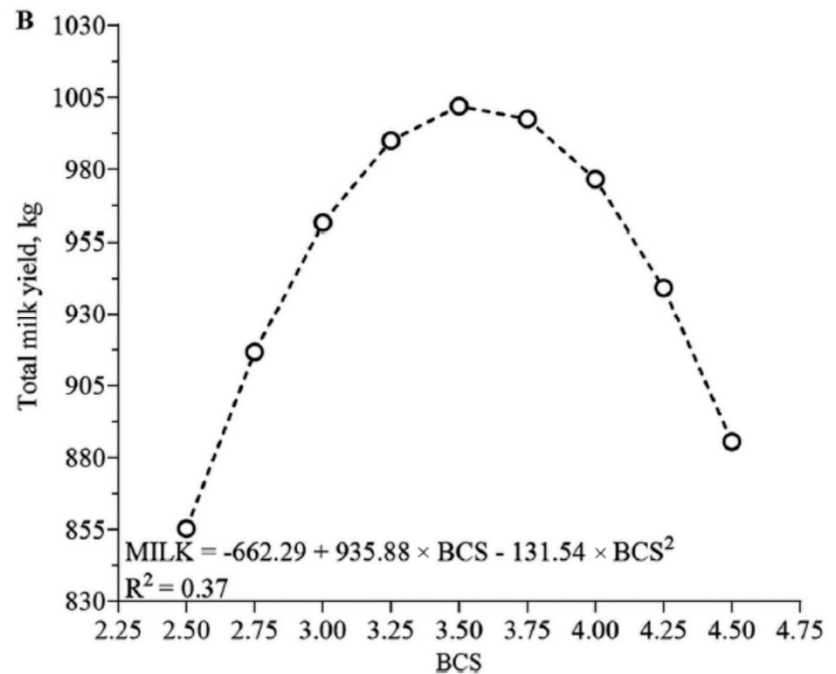
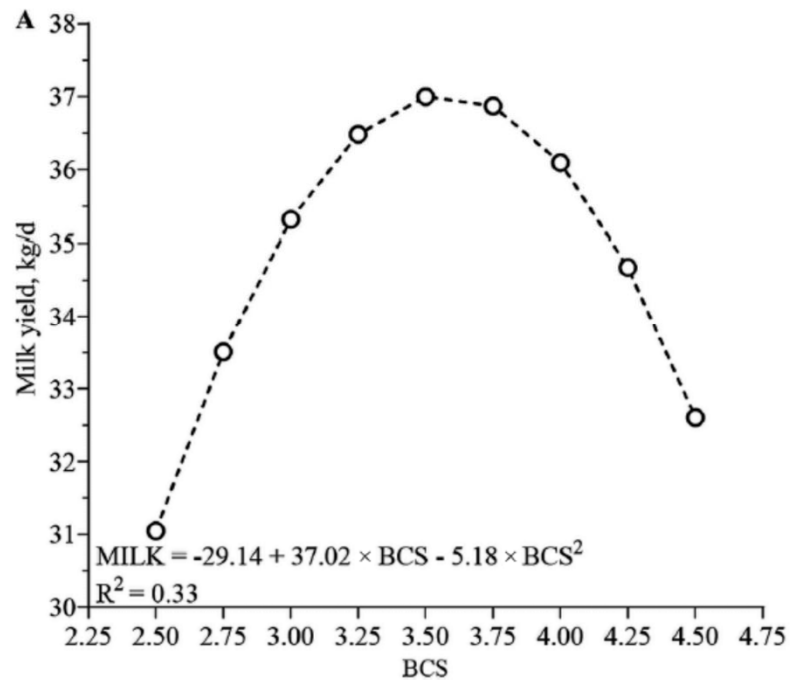
B





Association between prepartum body condition score and prepartum and postpartum dry matter intake and energy balance in multiparous Holstein cows

S. Casaro,¹ J. Pérez-Báez,² R. S. Bisinotto,¹ R. C. Chebel,¹ J. G. Prim,¹ T. D. Gonzalez,¹ G. Carvalho Gomes,¹ S. Tao,³ I. M. Toledo,⁴ B. C. do Amaral,⁴ J. M. Bollati,⁴ M. G. Zenobi,⁴ N. Martinez,⁴ G. E. Dahl,⁴ J. E. P. Santos,^{4,5} and K. N. Galvão^{1,5*}





Automated body condition scoring of dairy cows using 3-dimensional feature extraction from multiple body regions

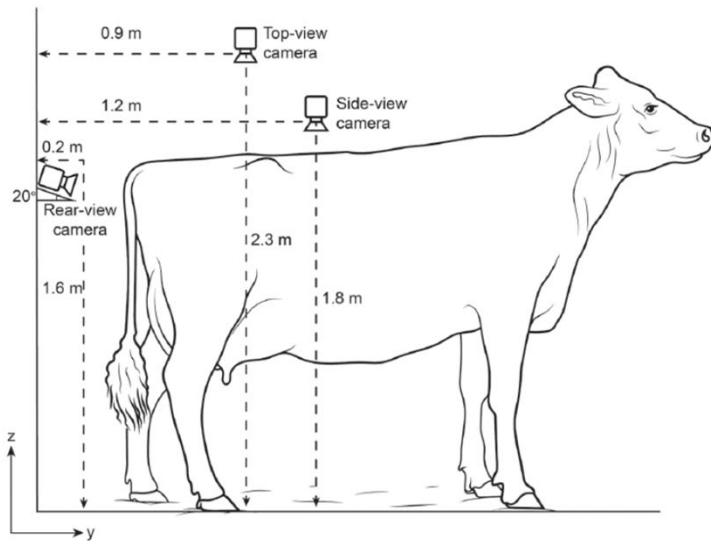
X. Song,^{1,2*} E. A. M. Bokkers,³ S. van Mourik,¹ P. W. G. Groot Koerkamp,¹ and P. P. J. van der Tol^{1,2}

¹Farm Technology Group, Wageningen University & Research, PO Box 16, Wageningen, 6700 AA, the Netherlands

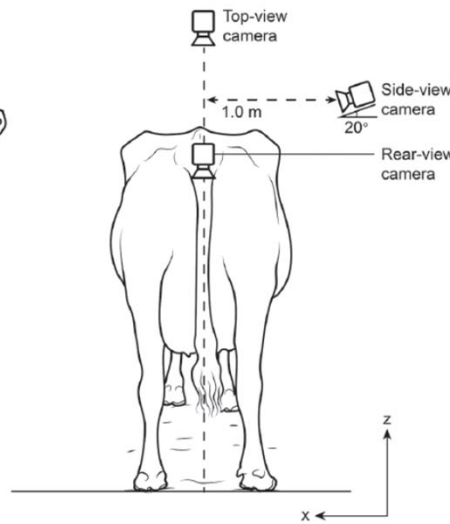
²Sensors and Data Analysis Department, Lely Innovation, Cornelis van der Lelylaan 1, Maassluis, 3147 PB, the Netherlands

³Animal Production Systems Group, Wageningen University & Research, PO Box 338, Wageningen, 6700 AH, the Netherlands

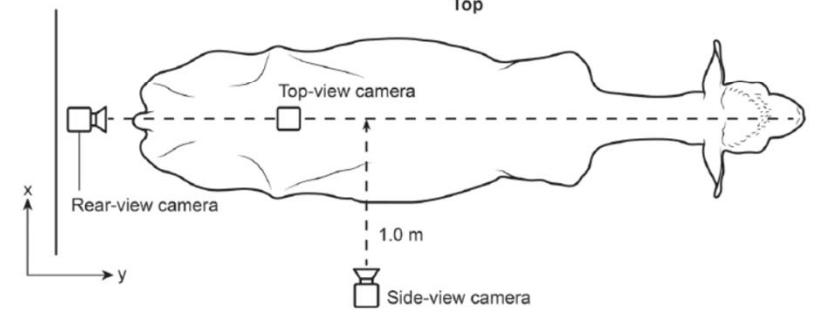
Side



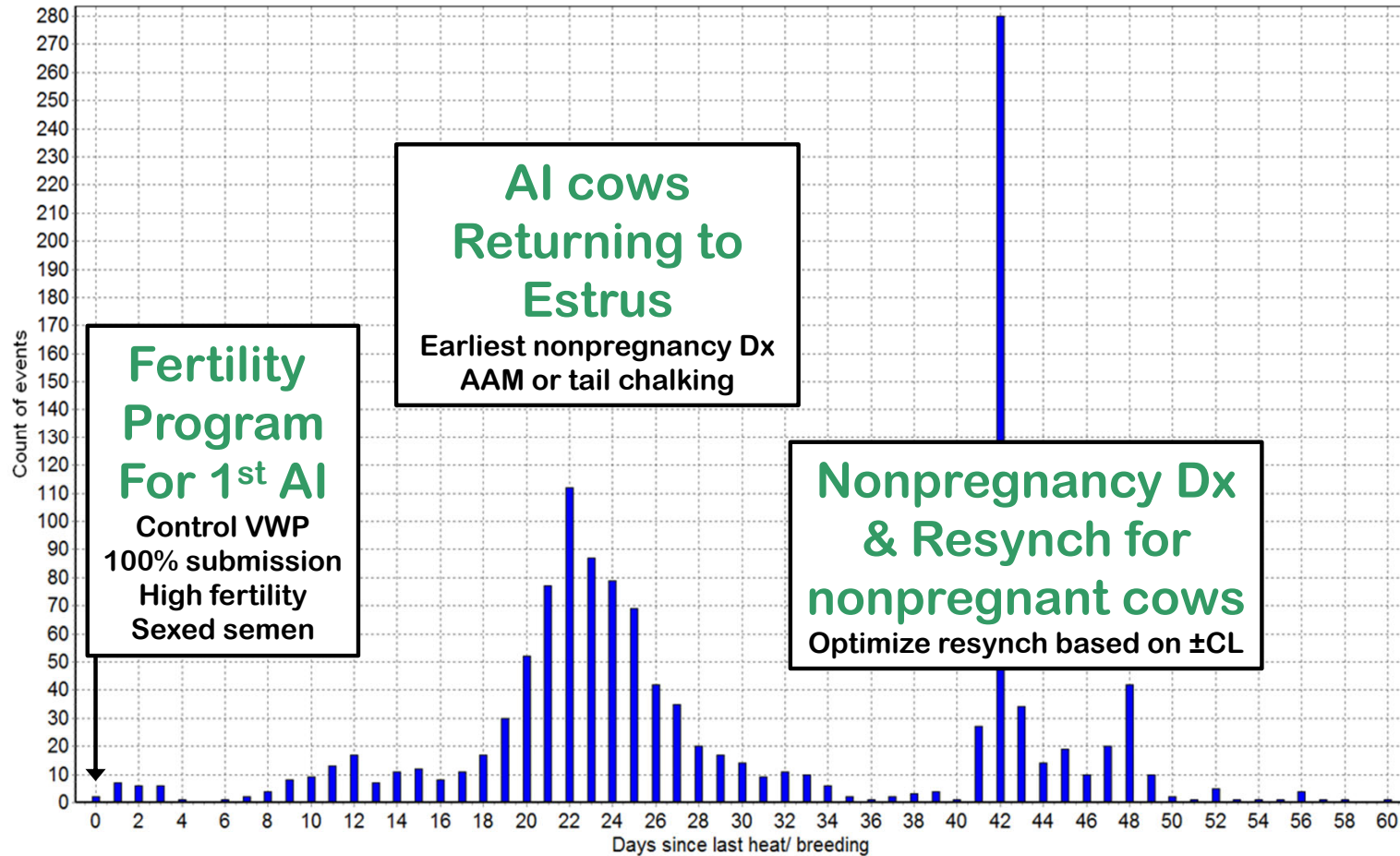
Rear



Top



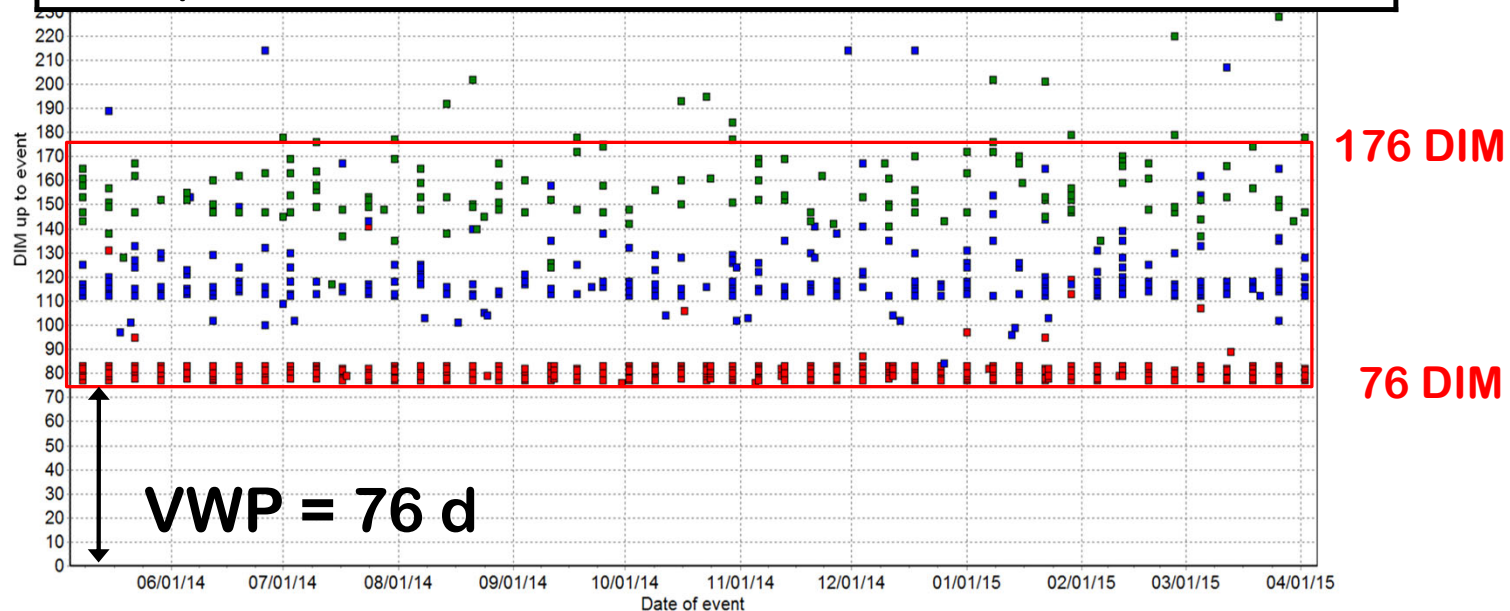
Aggressive Reproductive Management



TAI for First Three Inseminations

Parity	21-d Preg Rate	Service Rate	P/AI
All cows	31%	66%	50%
Primiparous	41%	70%	61%
Multiparous	29%	65%	47%

BRED_1
BRED_2
BRED_3



176 DIM

76 DIM

BREDSUM By Times Bred

January 2019 to January 2020

	95% CI	%Conc	#Preg	#Open	Other	Abort	Total	%Tot	SPC
=====	=====	=====	=====	=====	=====	=====	=====	=====	=====
1	46-55	50	269	266	5	35	540	49	2.0
2	47-58	53	153	137	4	13	294	27	1.9
3	42-58	50	75	75	1	6	151	14	2.0
4	34-57	46	31	37	1	2	69	6	2.2
5	21-54	36	10	18	0	1	28	3	2.8
6	-	62	10	6	0	0	16	1	1.6
7	-	50	1	1	0	0	2	0	2.0
8	-	100	1	0	0	0	1	0	1.0
TOTALS	47-53	50	550	540	11	57	1101	100	2.0

90%
pregnant
after 3 AI

BREDSUM By Times Bred

April 2004 to April 2005

	95% CI	%Conc	#Preg	#Open	Other	Abort	Total	%Tot	SPC
1	38-50	44	121	154	14	16	289	36	2.3
2	25-39	31	49	107	8	5	164	20	3.2
3	21-38	29	30	74	3	4	107	13	3.5
4	16-34	24	18	58	3	5	79	10	4.2
5	18-42	28	15	38	2	3	55	7	3.5
6	6-27	13	5	34	1	0	40	5	7.8
7	14-44	27	8	22	0	1	30	4	3.8
8	-	33	6	12	2	1	20	2	3.0
OTHERS	-	31	5	11	3	0	19	2	3.2
TOTALS	30-37	34	257	510	36	35	803	100	3.0

91%
pregnant
after 6 AI

Feeding through the lactation cycle

Mike VandeHaar, MSU

