



# Reproduction management and its economic value

**V.E. Cabrera**

University of Wisconsin-Madison Dairy Science

# Rosy-Lane

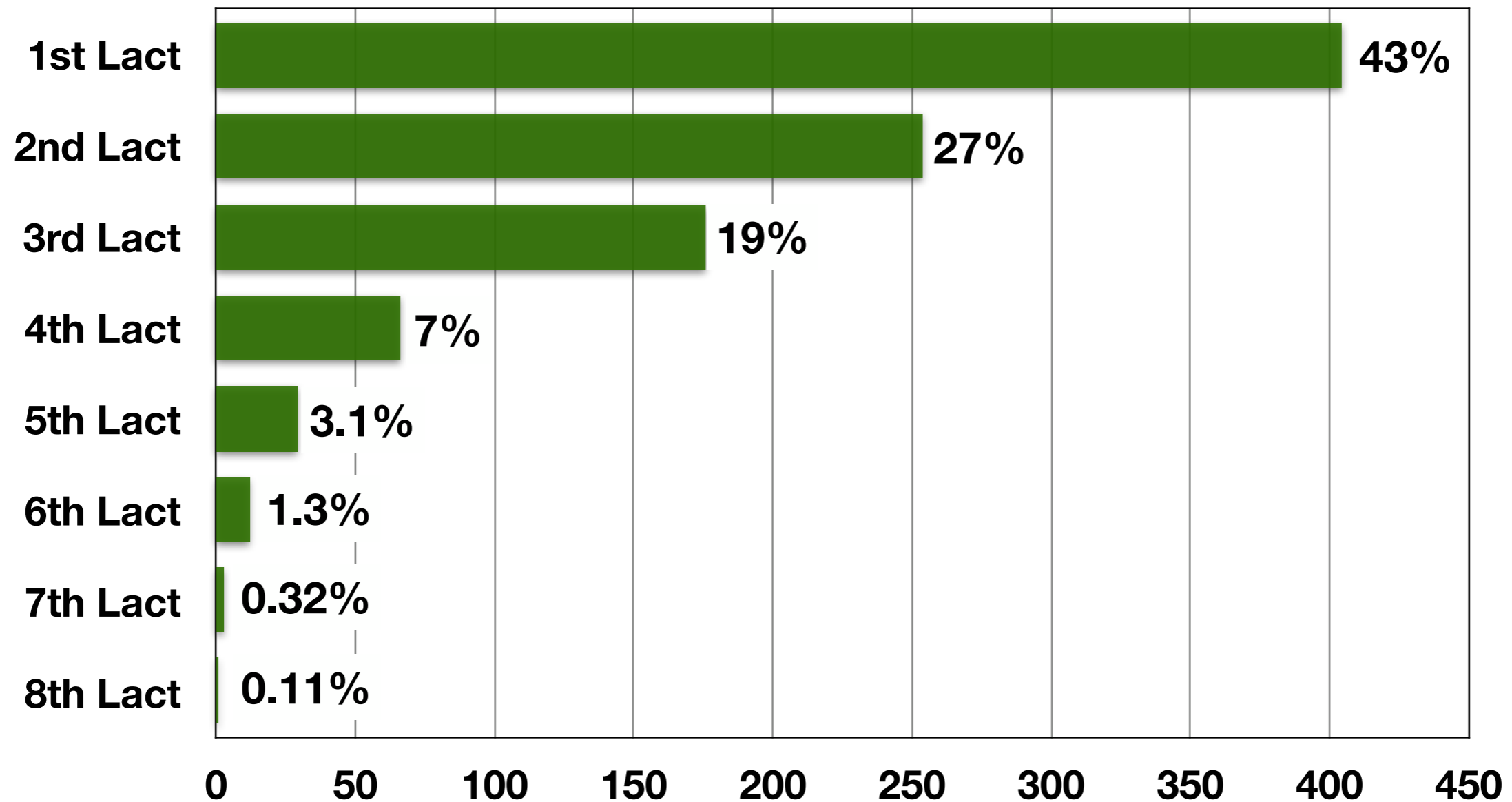


# Rosy-Lane



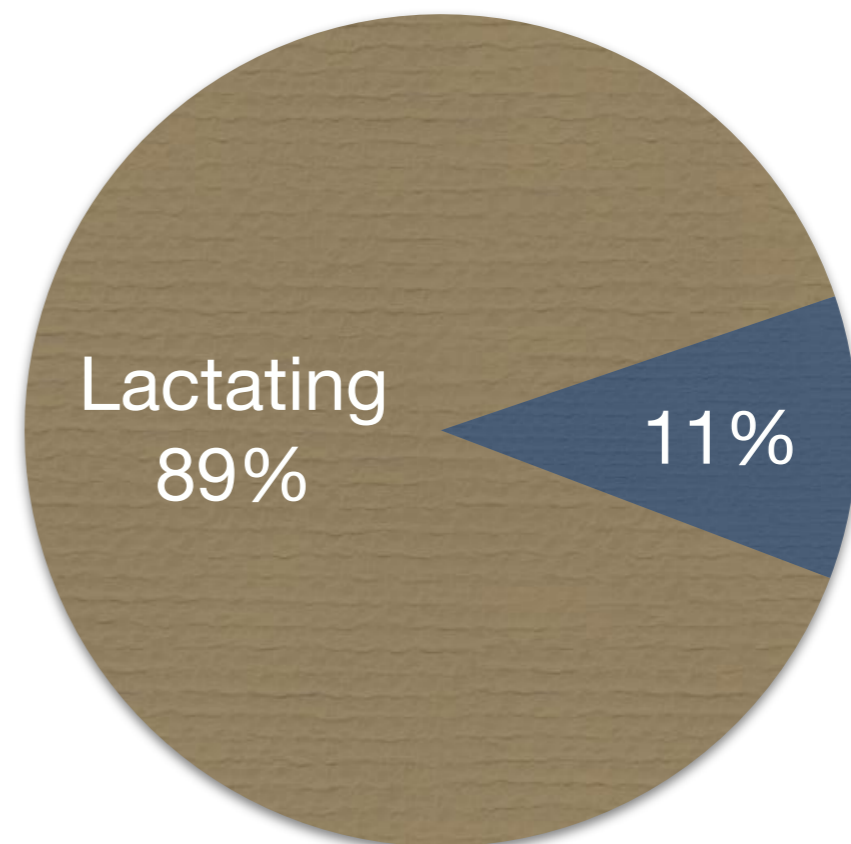
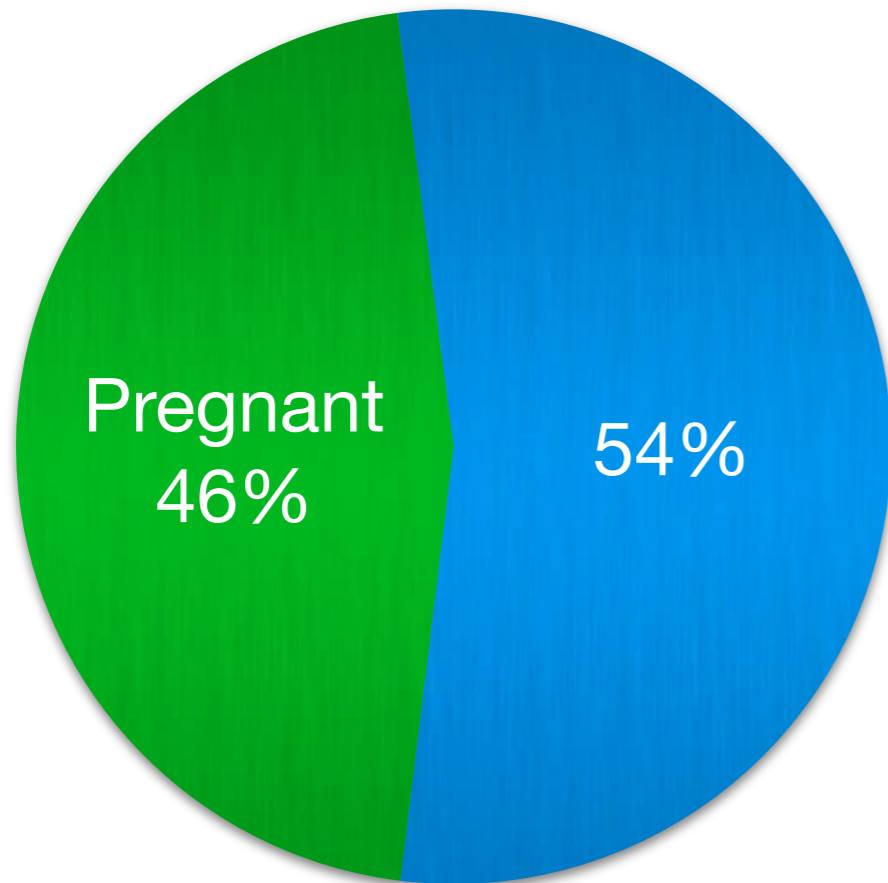
# Cows by lactations

Total number of cows in records: 945



# Cows by status

Total number of cows in records: 945



21-d PR (50 d)

**19%**

# Average BW

## Weighted average

lb		
1st Lact	43%	1,200
2nd Lact	27%	1,400
> 2nd Lact	30%	1,650

lb  
**1,389**

kg  
**631**



# Animal losses

Percentages (%) animals leaving the herd

**Involuntary culling**

Not including reproduction

27.4

**Mortality**

4.1

**Stillbirth**

6.0

**Pregnancy loss**

8.7

# Economic values

Average of a year ending September 2014

Milk price

18.5

\$/cwt

0.41

\$/kg

Feed cost (lactating)

0.132

\$/lb

0.291

\$/kg

Feed cost (dry)

0.084

\$/lb

0.185

\$/kg

Female calf value

400

\$

Male calf value

300

\$

Heifer replacement

2,150

\$

Salvage value

0.85

\$/lb

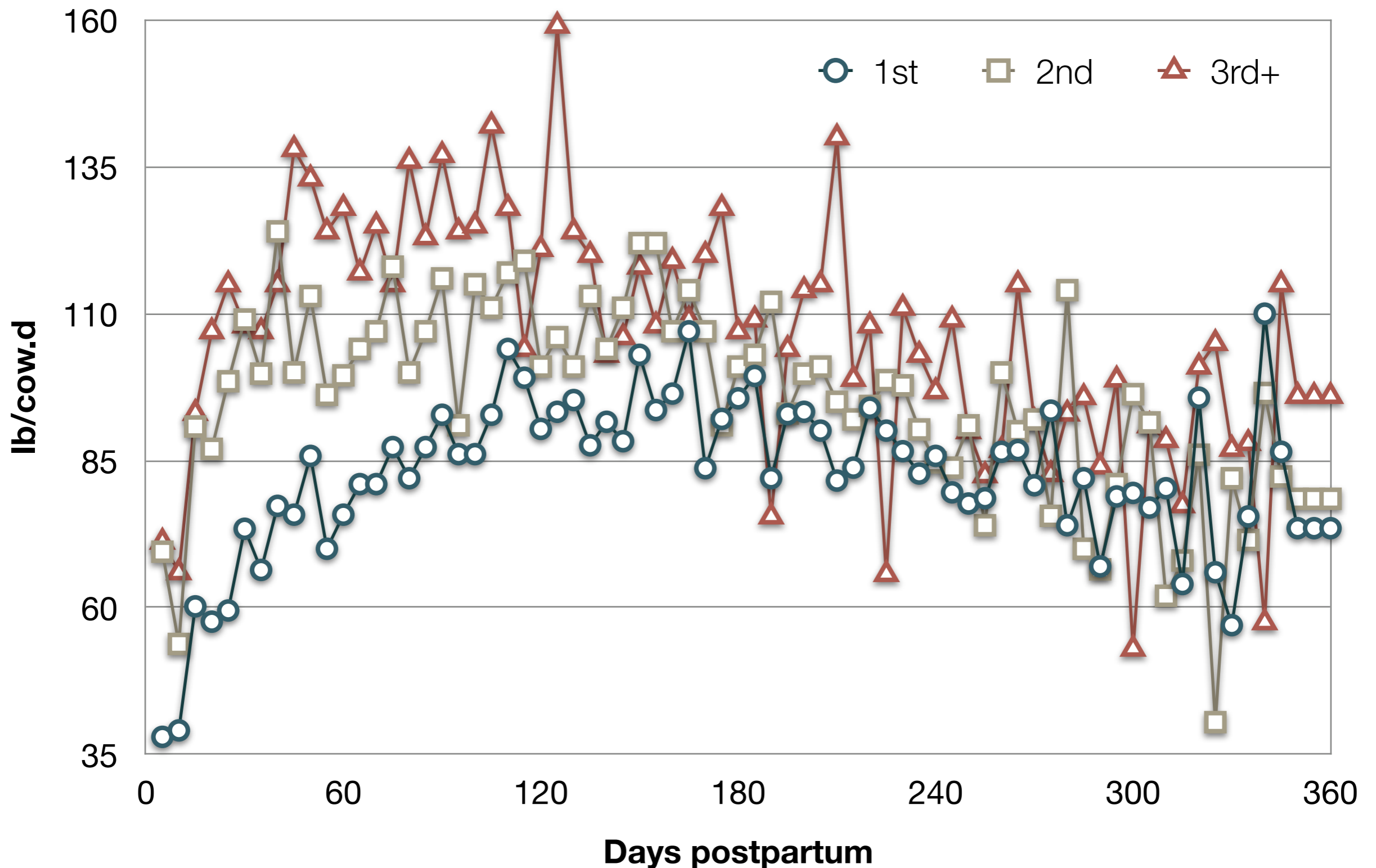
1.87

\$/kg



# Lactation curves

Crucial for reproduction evaluation



# Lactation curves

## Smoothing the curves

There is an app..

### Milk Curve Fitter

Afshin Kalantari and Victor E. Cabrera, UW-Madison Dairy Science

MilkBot Model  Wood's Model Units:  Pounds  Kilograms

[Overview](#) [Curve Fitter](#) [Daily Milk Production](#) [Test Model Parameters](#)

**INPUTS - Edit Values in This Block**

Days Postpartum ⓘ

Total Milk Production from

Days in Milk Starting ⓘ  Days in Milk Ending ⓘ

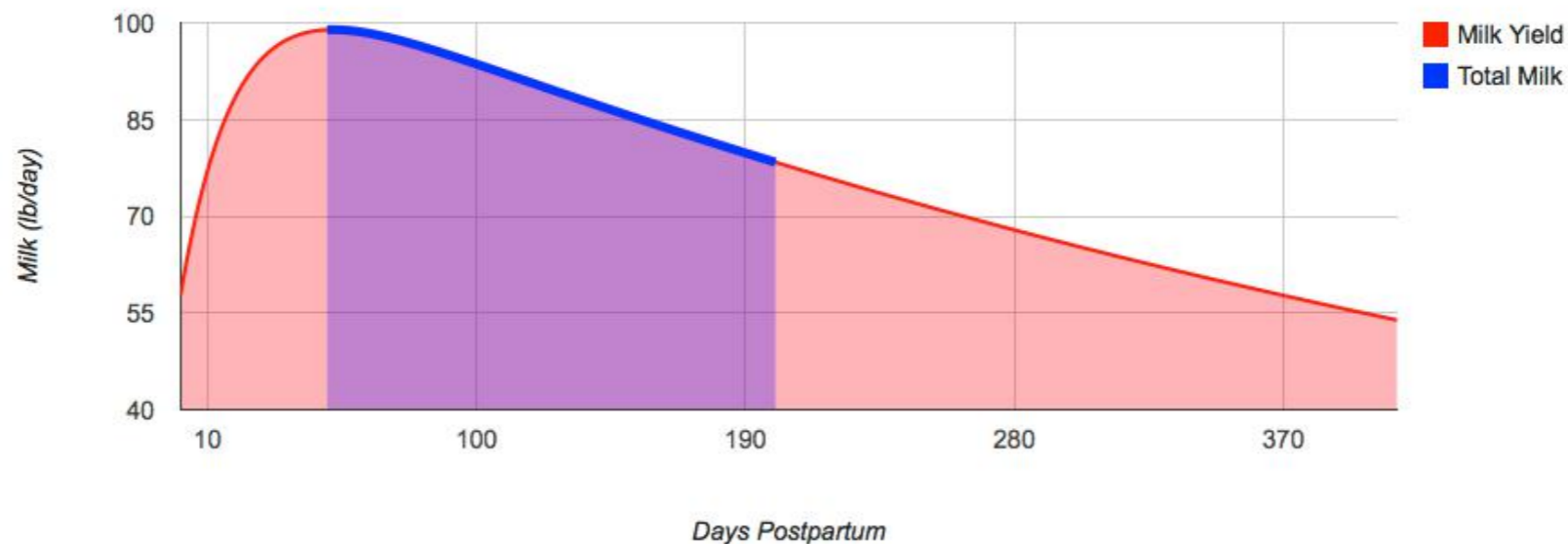
Output based in parameter by default.

**OUTPUTS - Total Milk Production**

Milk from day 50 to 200, lb

Parameter	Value
a	112.3355
b	18.9885
c	0.3467
d	0.0018

[Download Results as Excel Spreadsheet](#)



# Lactation curves

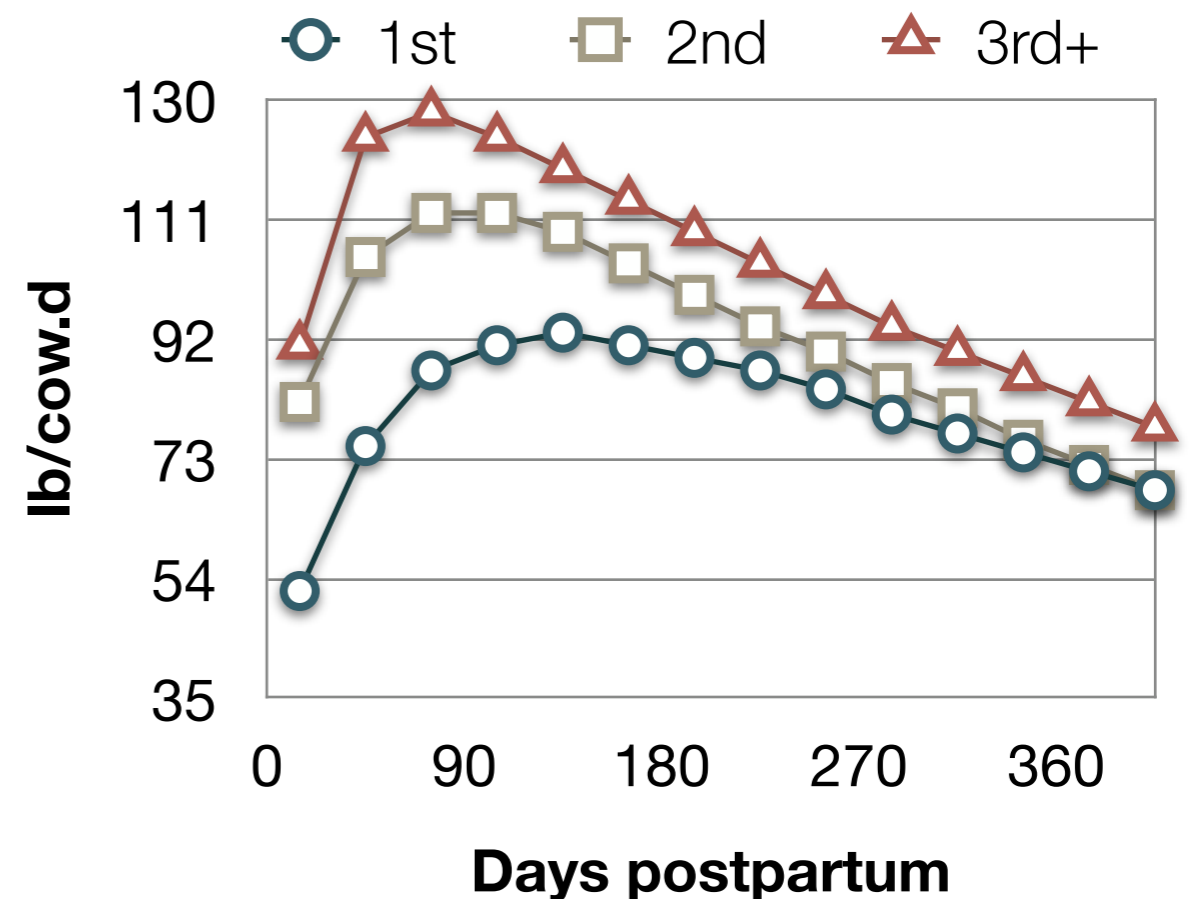
## Smoothing the curves

DIM	1st	2nd	3rd+
15	52	82	91
45	75	105	124
75	87	112	128
105	91	112	124
135	93	109	119
165	91	104	114
195	89	99	109
225	87	94	104
255	84	90	99
285	80	85	94
315	77	81	90
345	74	76	86
375	71	72	82
405	68	68	78

$$M_{DIM} = a \left( 1 - \frac{e^{\left(\frac{c-DIM}{b}\right)}}{2} \right) e^{-d(DIM)}$$

- $M$  = Milk Yield
- $DIM$  = Days in milk
- $a$  = Scale (overall capacity to produce milk)
- $b$  = Ramp (slope of milk production rising after calving)
- $c$  = Offset (starting amount of milk yield)
- $d$  = Decay (rate factor of decline in milk yield after peak)

Fig.1: MilkBot's Model



# Lactation curves

Lactations and optimal pregnancy time

UW-HERD	
1st	167
2nd	46
3rd+	24

## Exploring Pregnancy Timing Impact on Income Over Feed Cost

Victor E. Cabrera, Department of Dairy Science



# The UWCU Repro\$ Tool

Very sophisticated, still highly user-friendly

There is an app...

Herd Description



 **Cornell University**  
Department of Animal Science

**Wisconsin-Cornell Dairy Repro\$ (UWCUREpro\$)**  
Version 1.3.3.0

Developed By:  
Afshin S. Kalantari, Julio O. Giordano and Victor E. Cabrera

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This project was supported by Agriculture and Food Research Initiative Competitive Grant no. 2010-85122-20612 from the USDA National Institute of Food and Agriculture.



This research was also supported by Hatch project to V.E.C. WIS01577.



## Overview

Reproductive performance greatly impacts dairy farm profitability. Optimal reproductive performance improves milk productivity because cows take better advantage of the most productive part of their lactations, decreases replacement costs due to less reproductive failure, increases the number of offspring, and decreases reproductive costs per pregnancy. Normally, farmers and consultants can keep detailed records and compute meticulous reproductive costs. They can also know herd's reproductive performance. However, it is difficult to assess the actual monetary value of alternative reproductive programs. Therefore, in a multi-state collaboration, we have created the Wisconsin-Cornell Repro\$ (UW-CUREpro\$) to assist dairy farm decision-makers perform advanced reproductive analyses by studying the economic value of intended reproductive management strategies. The UW-CUREpro\$ is a complex daily Markov chain model inspired on Giordano et al., 2012 (J. Dairy Science 95:5442) that daily simulates every single cow and her economics, and computes the net return associated to reproductive performance parameters. Luckily, this tool has been designed as a user-friendly decision support tool and users only need to define: 1) productive, reproductive, and economic parameters to represent their own farm particular conditions and 2) potential reproductive strategies to be implemented. The decision support tool takes care of the rest!

[UWCU-DairyRepro\\$-Instructions.pdf](#)

Check for Updates

DairyMGT.info



J. Dairy Sci. 95:5442–5460  
<http://dx.doi.org/10.3168/jds.2011-4972>  
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**A daily herd Markov-chain model to study the reproductive and economic impact of reproductive programs combining timed artificial insemination and estrus detection**

J. O. Giordano,<sup>1</sup> A. S. Kalantari, P. M. Fricke, M. C. Wiltbank, and V. E. Cabrera<sup>2</sup>  
Department of Dairy Science, University of Wisconsin-Madison 53706

# Herd and economic parameters

## UWCU Repro\$

### Herd Parameters

Herd Size (#)

Average Body Weight (lb)

Involuntary Culling (%/yr)

Mortality Rate (%/yr)

Stillbirth (%)

### Lactation Curves (lb/cow/test)

Own Farm Lactations (Enter/Edit NUMBERS Below) ▼

DIM	Parity 1	Parity 2	Parity ≥3
15	52	82	91
45	75	105	124
75	87	112	128
105	91	112	124
135	93	109	119
165	91	104	114
195	89	99	109
225	87	94	104
255	84	90	99
285	80	85	94
315	77	81	90
345	74	76	86
375	71	72	82
405	68	68	78

### Economic Parameters

Milk Price (\$/cwt)

Cost Feed Lactating (\$/lb DM)

Dry Period Fixed Cost (\$/lb DM)

Female Calf value(\$)

Male Calf value (\$)

Heifer Replacement Value(\$)

Salvage Value (\$/lb)

[Next](#)

# Reproductive program

Timed Artificial Insemination program

1<sup>st</sup> TAI service postpartum

**Double Ovsynch**

2<sup>nd</sup>+ TAI services

**Double Ovsynch**

Weekday first injection

**Friday**

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					<b>GnRH</b>	
					<b>PGF</b>	
	<b>GnRH</b>					
	<b>GnRH</b>					
	<b>PGF</b>		<b>GnRH</b>	<b>TAI</b>		

# Reproductive program

## Description of program

Voluntary waiting period 1<sup>st</sup> lact, d

40

Voluntary waiting period 2<sup>nd</sup>+ lact, d

40

Estrous duration, d

22

Maximum DIM breeding 1<sup>st</sup> lact, d

338

Maximum DIM breeding 2<sup>nd</sup> lact, d

276

Maximum DIM breeding 3<sup>rd</sup>+ lact, d

236



# Reproductive program

## Description of program

lb

kg

Do-not-breed minimum milk/d

80

36

DIM first TAI injection, d

36

Resynch before pre check

NO

Interbreeding interval TAI, d

70

# Reproductive program

## Description of program

Heat bred before 1<sup>st</sup> TAI service, %  
AFI detect

72

CR before 1<sup>st</sup> TAI service, %

37

CR 1<sup>st</sup> TAI service

25

Heat bred after 1<sup>st</sup> TAI service, %  
AFI detect

85

CR after 1<sup>st</sup> TAI services, %

29

CR 2<sup>nd</sup>+ TAI services

33

# Reproductive program

## Pregnancy diagnosis

Days in gestation 1<sup>st</sup> preg check, d

34

Days in gestation 2<sup>nd</sup> preg check, d

90

Days in gestation 3<sup>rd</sup> preg check, d

180

# Reproductive program

Cost of semen, insemination, & pre check

Semen cost, \$/dose

15

Labor insemination, \$/AI

2.5

Ultrasound, \$/hr

30

Time used in preg check, hr/d

3

Number of cows checked, #/d

60

# Reproductive program

Synchronization labor and hormones

Labor for injections, \$/hr

20

GnRH, \$/dose

2.4

PGF, \$/dose

2.08

# Reproductive program

Activity monitors for heat detection (avg)

System cost, \$

40,000

Monitors, #

990

Cost per monitor, \$

65

Maintenance cost, \$/yr

5,200

Life expectancy, yr

7

Salvage value, \$

0

# Reproductive program

Labor for TAI injections

	Mon	Wed	Fri
Laborers, #	1	1	1
Injections, hr/d	1	1	2
Number cows, #	90	70	130
TAI breedings	Thu		

# **Repro Performance**



# Reproductive program

## UWCU Repro\$

**Reproductive Programs**

**Current**

First AI postpartum

Second and sub. AI

Resynch before preg check

**Programs Description**

VWP (d)

Estrous Cycle Duration (d)

Maximum DIM for Breeding

Do-not-Breed Minimum Milk (lb/d)

DIM first injection for first AI sync program (d)

Weekday first injection

Interbreeding interval for TAI services (d)

Heat bred before first TAI service (%)

CR heat bred before first TAI service (%)

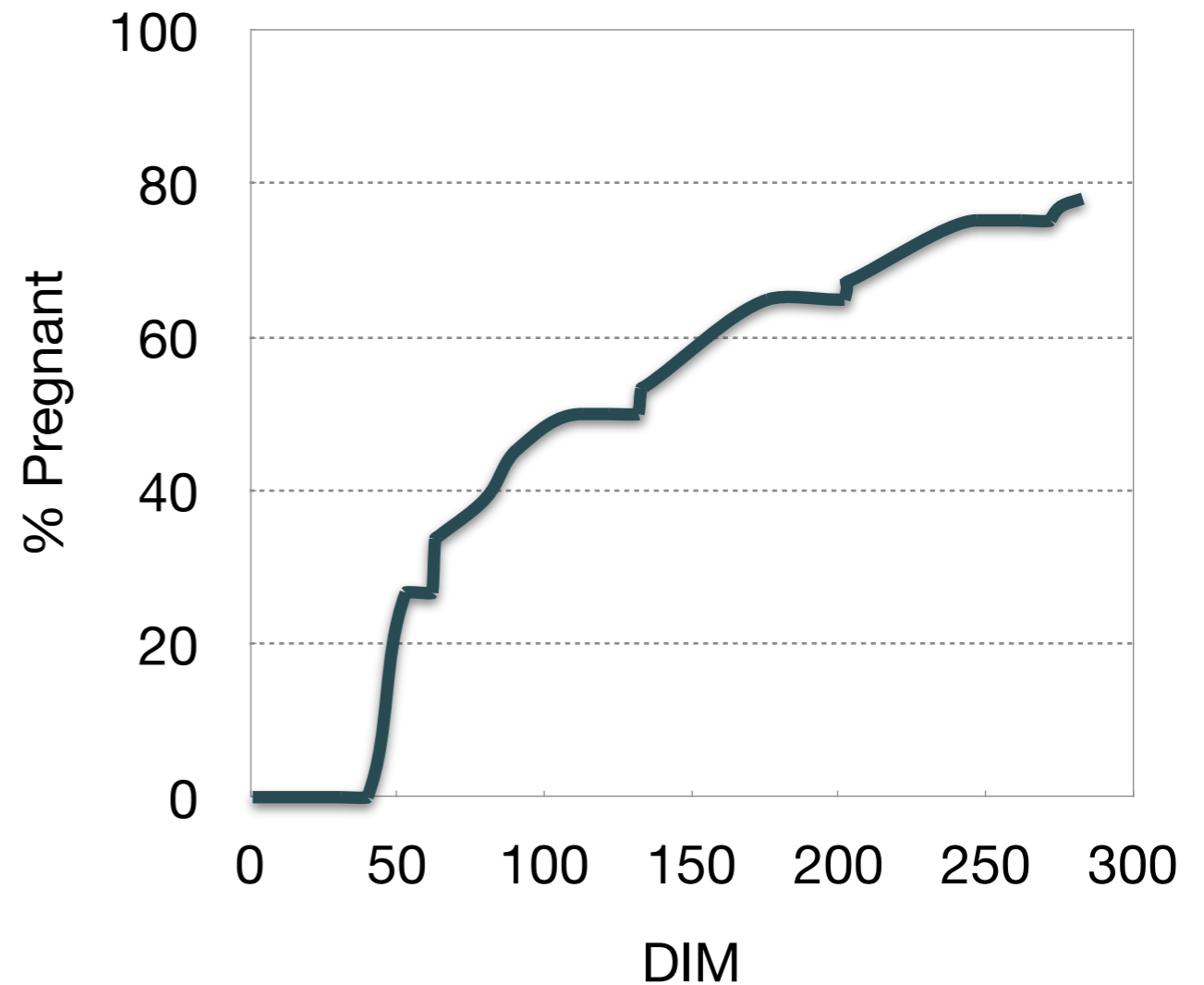
CR first TAI service (%)

Heat bred after first TAI service (%)

CR heat bred after first TAI service (%)

CR second and subsequent TAI services (%)

Pregnancy Loss (%)



21-d PR (40 d)

18%

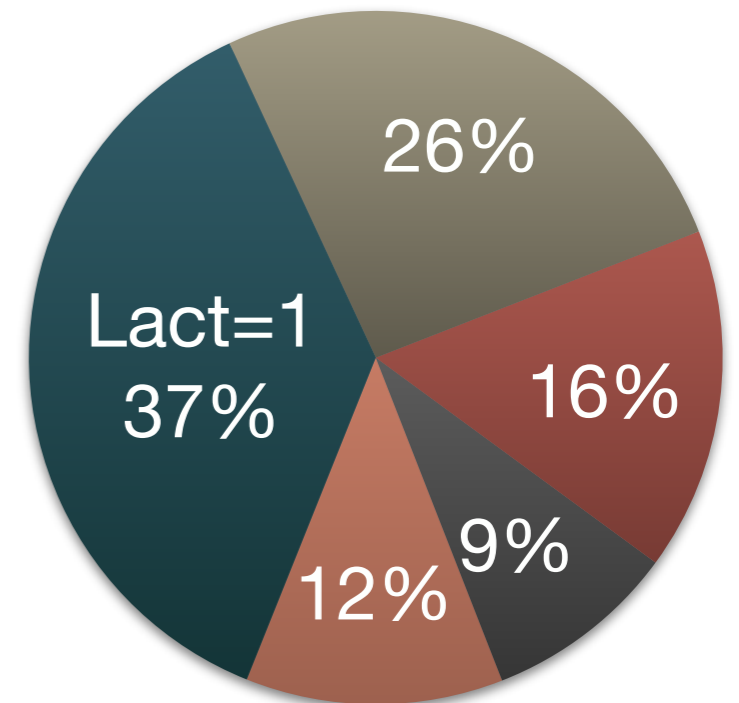
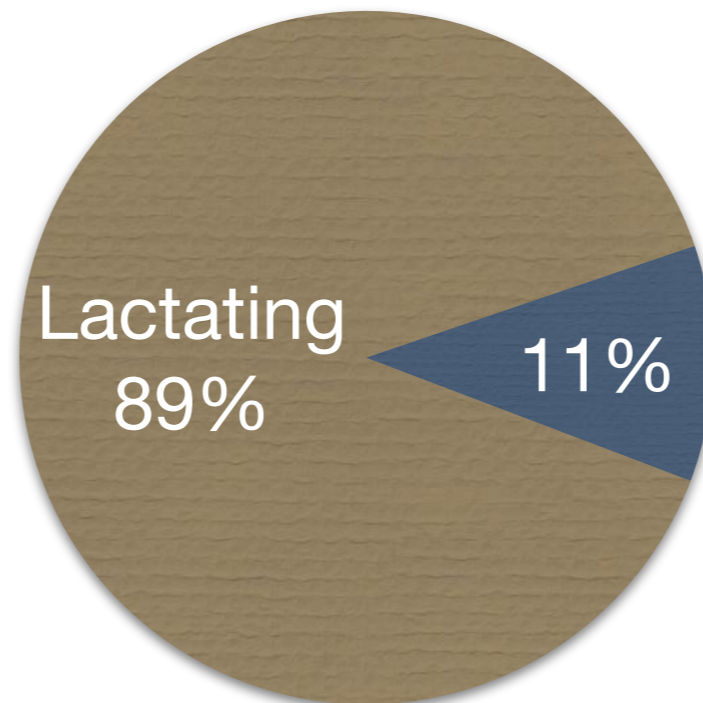
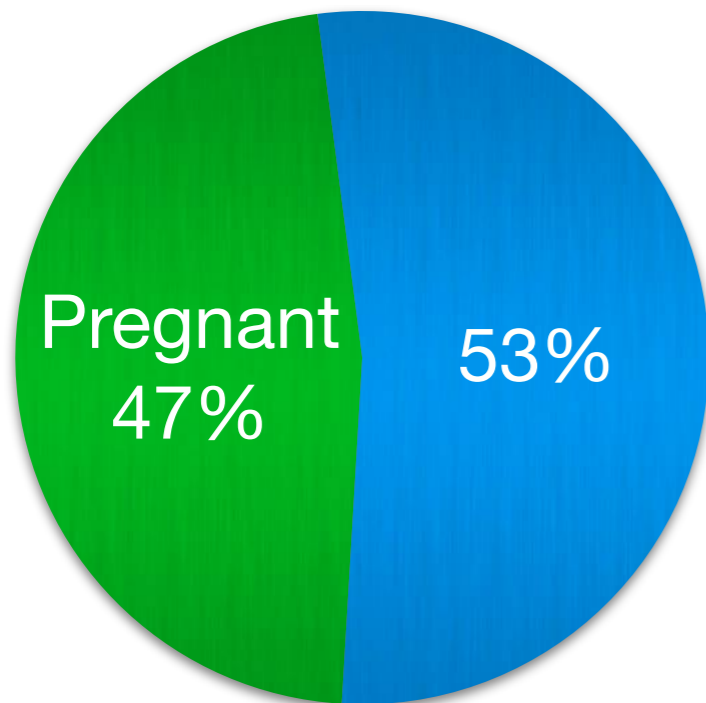
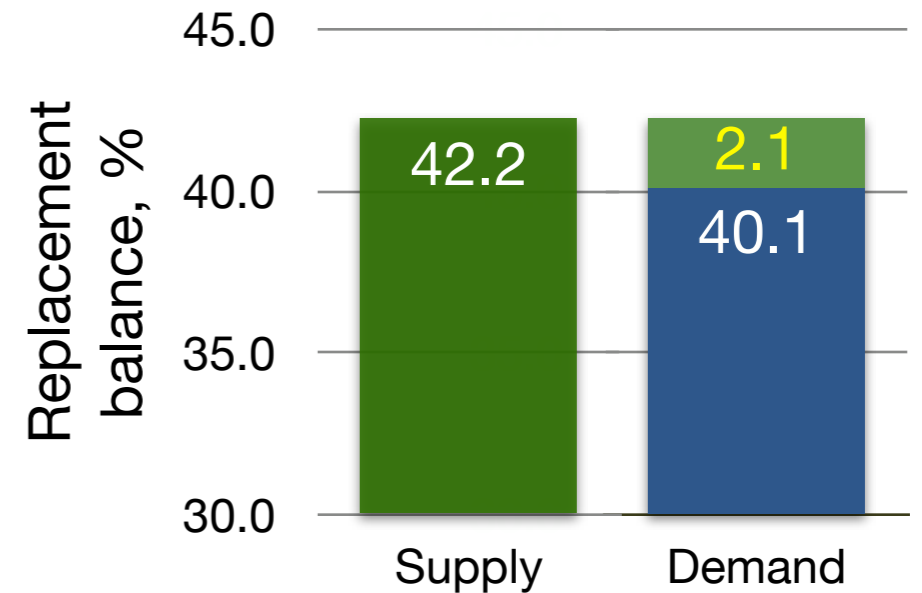
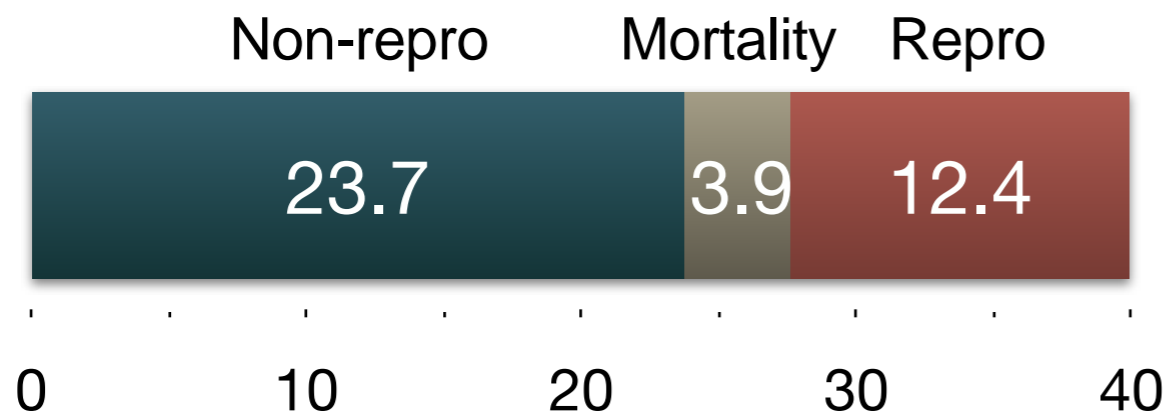
21-d PR (50 d)

19%

# Reproductive program

## UWCU Repro\$

### Cows leaving the herd, %



# Reproductive program

UWCU Repro\$

**\$/cow.yr**

Income over feed costs

**\$3,095.2**

Replacement costs

**\$242.6**

Reproductive costs

**\$64.2**

Calf revenue

**\$152.7**

Cow net value

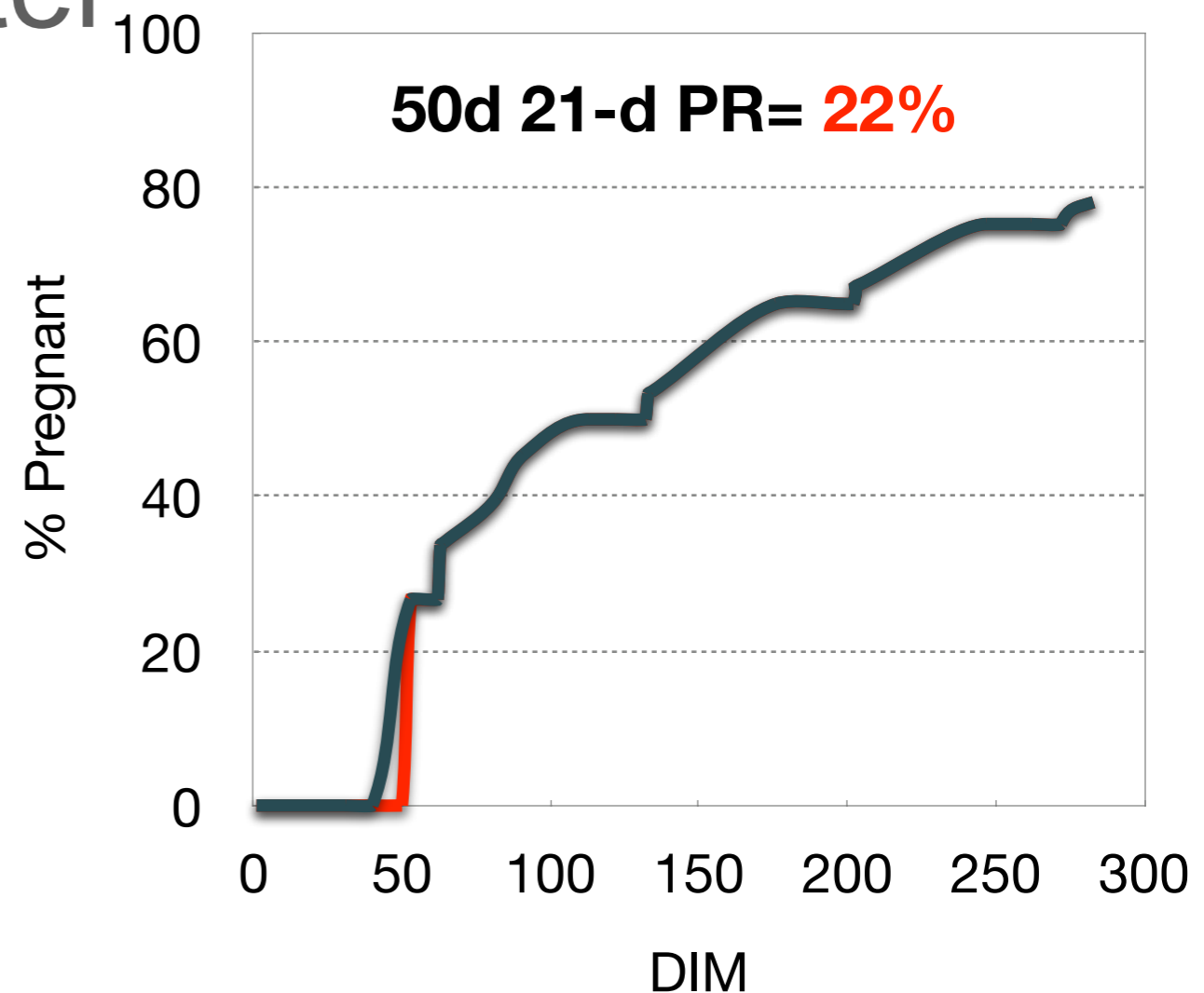
**\$2,941.1**

# **Management strategies**

# Delay waiting period to 50 d

Start heat breeding later

Cull, %	Current	Change
No Repro	23.7	0.0
Mortality	3.9	0.0
Repro	12.4	0.0
Total	40.0	0.0



Heifer, %	Current	Change
Supply	42.2	0.1
Demand	40.1	0.0
Balance	2.1	0.1

Herd, %	Current	Change
Pregnant	47	1.0
Lactating	89	0.0
1 <sup>st</sup> Lact.	37	0.0

# Delay waiting period to 50 d

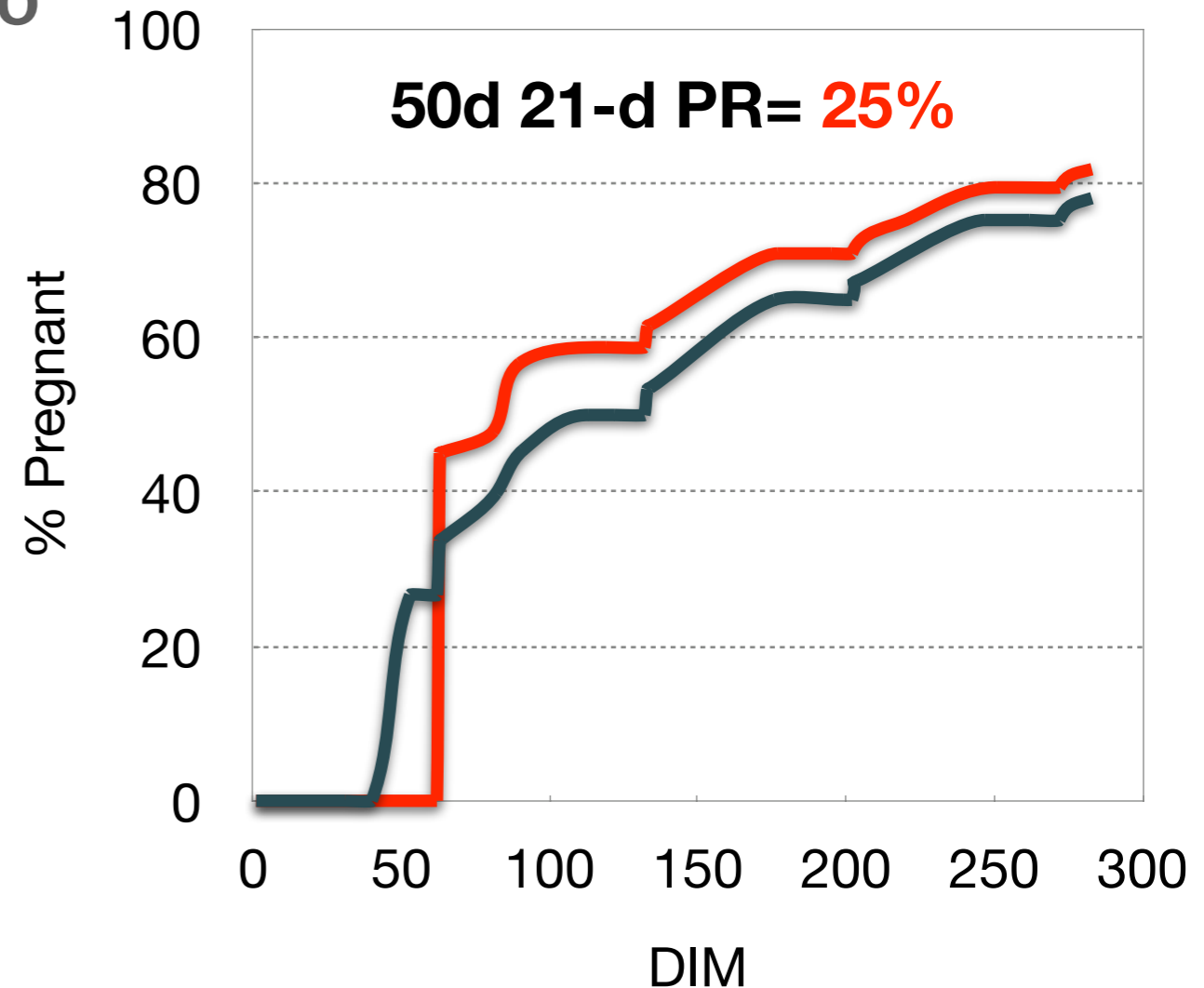
Start heat breeding later

<b>\$/cow.yr</b>	<b>Current</b>	<b>Change</b>
<b>Income over feed costs</b>	\$3,095.2	<b>\$0.2</b>
<b>Replacement costs</b>	<b>\$242.6</b>	<b>\$0.1</b>
<b>Reproductive costs</b>	<b>\$64.2</b>	<b>\$1.0</b>
<b>Calf revenue</b>	\$152.7	<b>\$0.2</b>
<b>Cow net value</b>	\$2,941.1	<b>\$1.5</b>
<b>Herd net value (945 cows)</b>	<b>\$1,417.5</b>	<b>\$/herd.yr</b>

# Delay waiting period to 63 d (TAI)

CR DO 1<sup>st</sup> serv. = 45%

Cull, %	Current	Change
No Repro	23.7	0.8
Mortality	3.9	0.2
Repro	12.4	1.8
Total	40.0	2.8



Heifer, %	Current	Change
Supply	42.2	0.2
Demand	40.1	2.8
Balance	2.1	3.0

Herd, %	Current	Change
Pregnant	47	2.0
Lactating	89	1.0
1 <sup>st</sup> Lact.	37	2.0

# Delay waiting period to 63 d (TAI)

CR DO 1<sup>st</sup> serv. = 45%

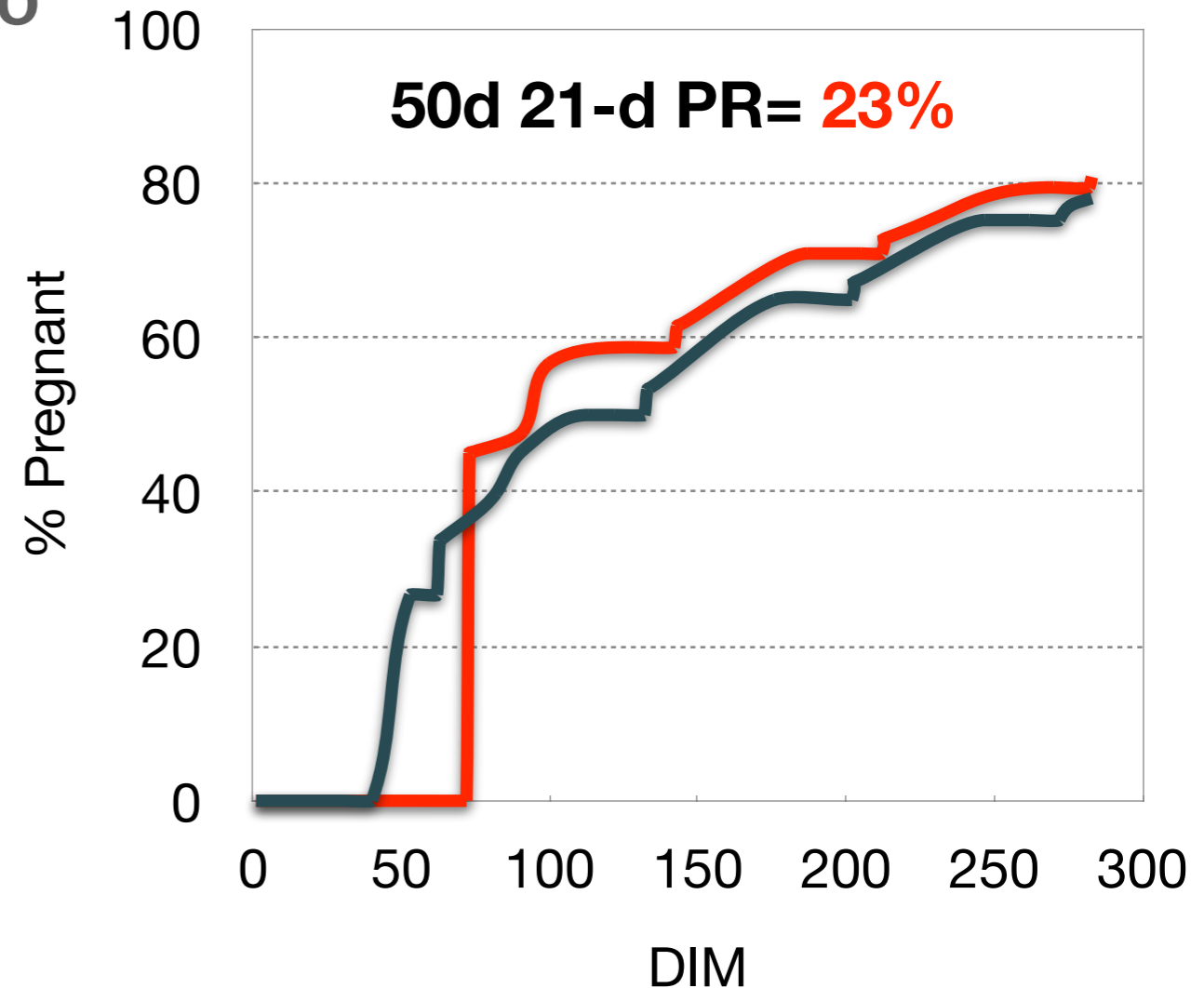
<b>\$/cow.yr</b>	<b>Current</b>	<b>Change</b>
<b>Income over feed costs</b>	\$3,095.2	<b>\$16.7</b>
<b>Replacement costs</b>	<b>\$242.6</b>	<b>\$8.7</b>
<b>Reproductive costs</b>	<b>\$64.2</b>	<b>\$5.1</b>
<b>Calf revenue</b>	\$152.7	<b>\$12.2</b>
<b>Cow net value</b>	\$2,941.1	<b>\$32.5</b>
<b>Herd net value (945 cows)</b>	<b>\$30,712.5</b>	<b>\$/herd.yr</b>



# Delay waiting period to 73 d (TAI)

CR DO 1<sup>st</sup> serv. = 45%

Cull, %	Current	Change
No Repro	23.7	0.6
Mortality	3.9	0.1
Repro	12.4	1.3
Total	40.0	2.0



Heifer, %	Current	Change
Supply	42.2	0.2
Demand	40.1	2.1
Balance	2.1	1.9

Herd, %	Current	Change
Pregnant	47	1.0
Lactating	89	0.0
1 <sup>st</sup> Lact.	37	2.0

# Delay waiting period to 73 d (TAI)

CR DO 1<sup>st</sup> serv. = 45%

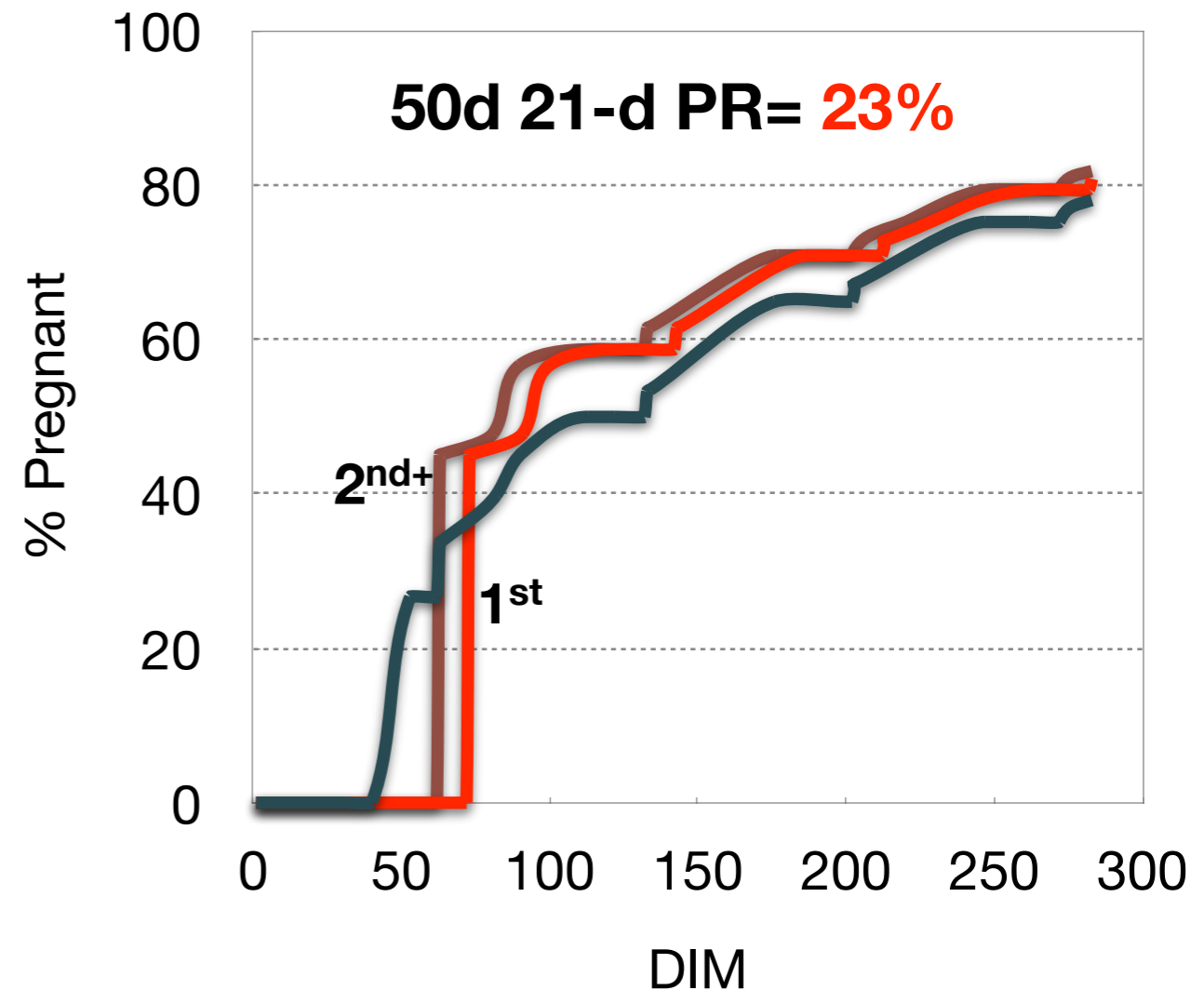
<b>\$/cow.yr</b>	<b>Current</b>	<b>Change</b>
<b>Income over feed costs</b>	\$3,095.2	<b>\$11.0</b>
<b>Replacement costs</b>	<b>\$242.6</b>	<b>\$6.2</b>
<b>Reproductive costs</b>	<b>\$64.2</b>	<b>\$4.5</b>
<b>Calf revenue</b>	\$152.7	<b>\$5.3</b>
<b>Cow net value</b>	\$2,941.1	<b>\$18.0</b>
<b>Herd net value (945 cows)</b>	<b>\$17,010.0</b>	<b>\$/herd.yr</b>

# Delay by lactation (TAI CR = 45%)

1<sup>st</sup> Lact TAI = 73 d

Later Lact TAI = 63 d

Cull, %	Current	Change
No Repro	23.7	0.9
Mortality	3.9	0.1
Repro	12.4	1.3
Total	40.0	2.3



Heifer, %	Current	Change
Supply	42.2	0.1
Demand	40.1	2.4
Balance	2.1	2.5

Herd, %	Current	Change
Pregnant	47	2.0
Lactating	89	1.0
1 <sup>st</sup> Lact.	37	2.0

# Delay by lactation (TAI CR = 45%)

1<sup>st</sup> Lact TAI = 73 d

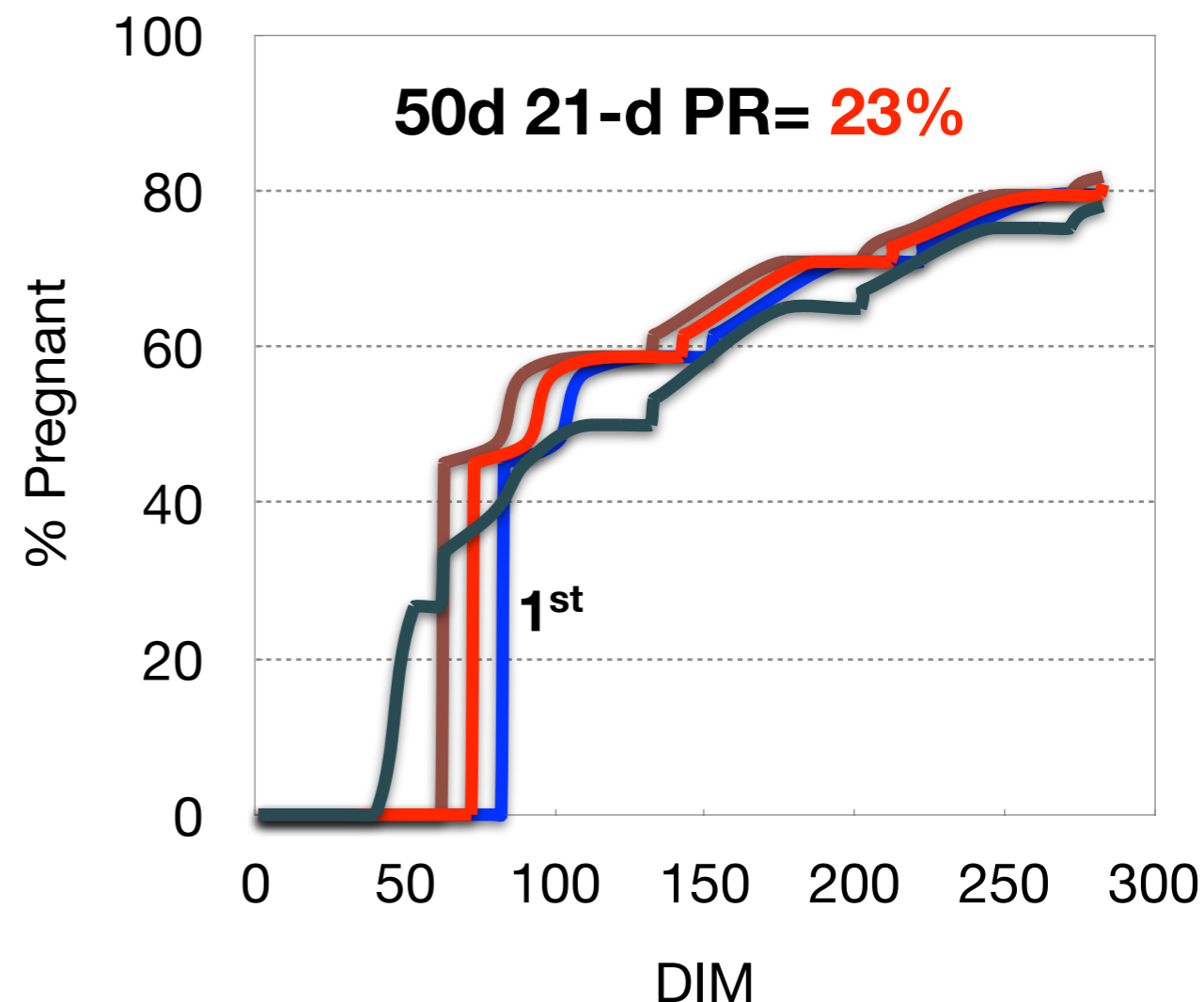
Later Lact TAI = 63 d

<b>\$/cow.yr</b>	<b>Current</b>	<b>Change</b>
<b>Income over feed costs</b>	\$3,095.2	<b>\$14.8</b>
<b>Replacement costs</b>	<b>\$242.6</b>	<b>\$9.3</b>
<b>Reproductive costs</b>	<b>\$64.2</b>	<b>\$5.3</b>
<b>Calf revenue</b>	\$152.7	<b>\$9.9</b>
<b>Cow net value</b>	\$2,941.1	<b>\$28.7</b>
<b>Herd net value (945 cows)</b>	<b>\$27,074.3</b>	<b>\$/herd.yr</b>

# Delay by lactation (TAI CR = 45%)

83, 73, and 63 d for  
1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup>+ lact.

Cull, %	Current	Change
No Repro	23.7	0.9
Mortality	3.9	0.1
Repro	12.4	0.7
Total	40.0	1.7



Heifer, %	Current	Change
Supply	42.2	0.2
Demand	40.1	1.8
Balance	2.1	1.6

Herd, %	Current	Change
Pregnant	47	1.0
Lactating	89	0.0
1 <sup>st</sup> Lact.	37	1.0

# Delay by lactation (TAI CR = 45%)

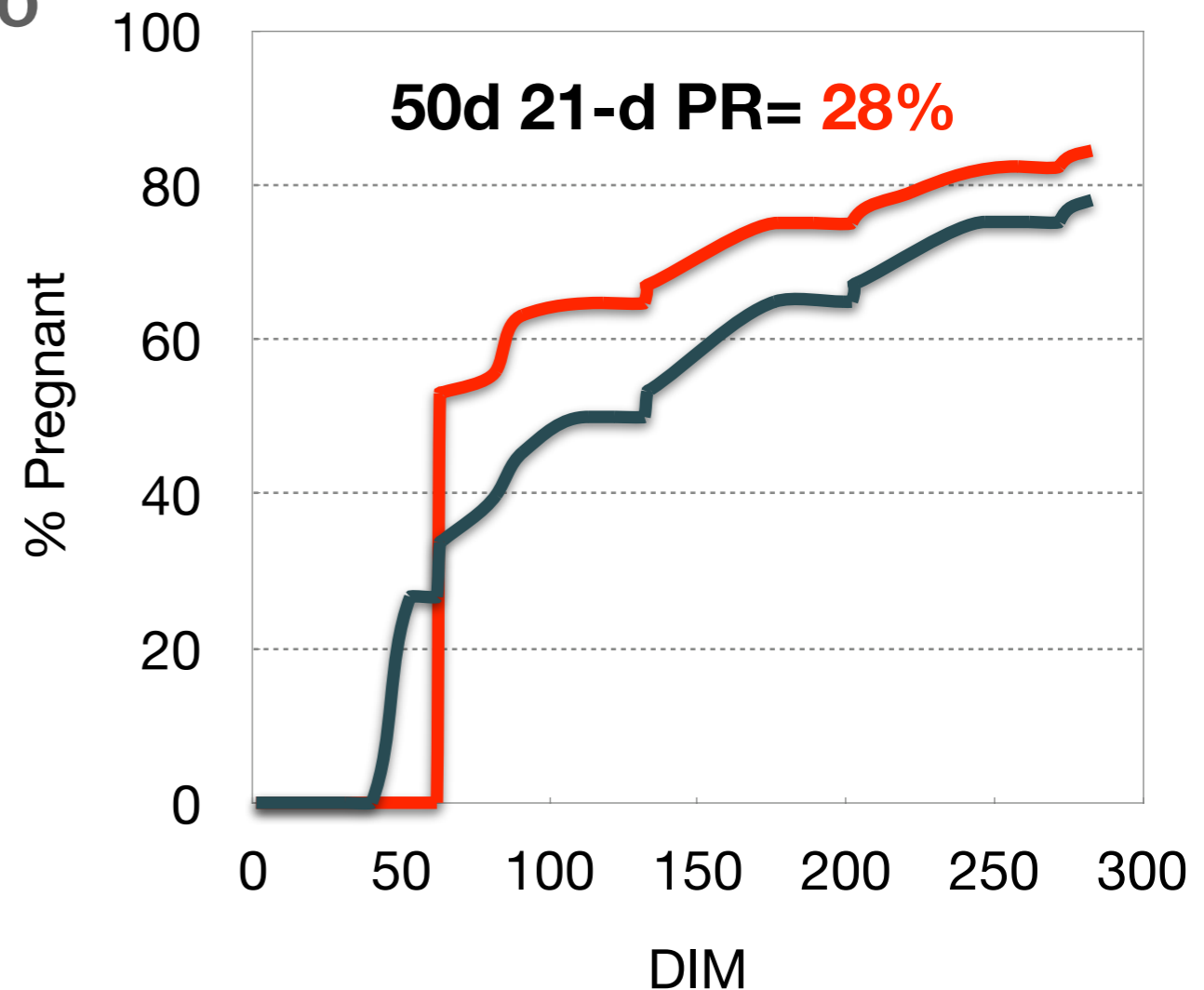
83, 73, and 63 d for  
1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup>+ lact.

<b>\$/cow.yr</b>	<b>Current</b>	<b>Change</b>
<b>Income over feed costs</b>	\$3,095.2	<b>\$10.5</b>
<b>Replacement costs</b>	<b>\$242.6</b>	<b>\$8.8</b>
<b>Reproductive costs</b>	<b>\$64.2</b>	<b>\$5.0</b>
<b>Calf revenue</b>	\$152.7	<b>\$5.5</b>
<b>Cow net value</b>	\$2,941.1	<b>\$19.8</b>
<b>Herd net value (945 cows)</b>	<b>\$18,711.0</b>	<b>\$/herd.yr</b>

# Delay waiting period to 63 d (TAI)

CR DO 1<sup>st</sup> serv. = 53%

Cull, %	Current	Change
No Repro	23.7	1.5
Mortality	3.9	0.3
Repro	12.4	3.4
Total	40.0	5.2



Heifer, %	Current	Change
Supply	42.2	0.5
Demand	40.1	5.2
Balance	2.1	5.7

Herd, %	Current	Change
Pregnant	47	5.0
Lactating	89	1.0
1 <sup>st</sup> Lact.	37	5.0

# Delay waiting period to 63 d (TAI)

CR DO 1<sup>st</sup> serv. = 53%

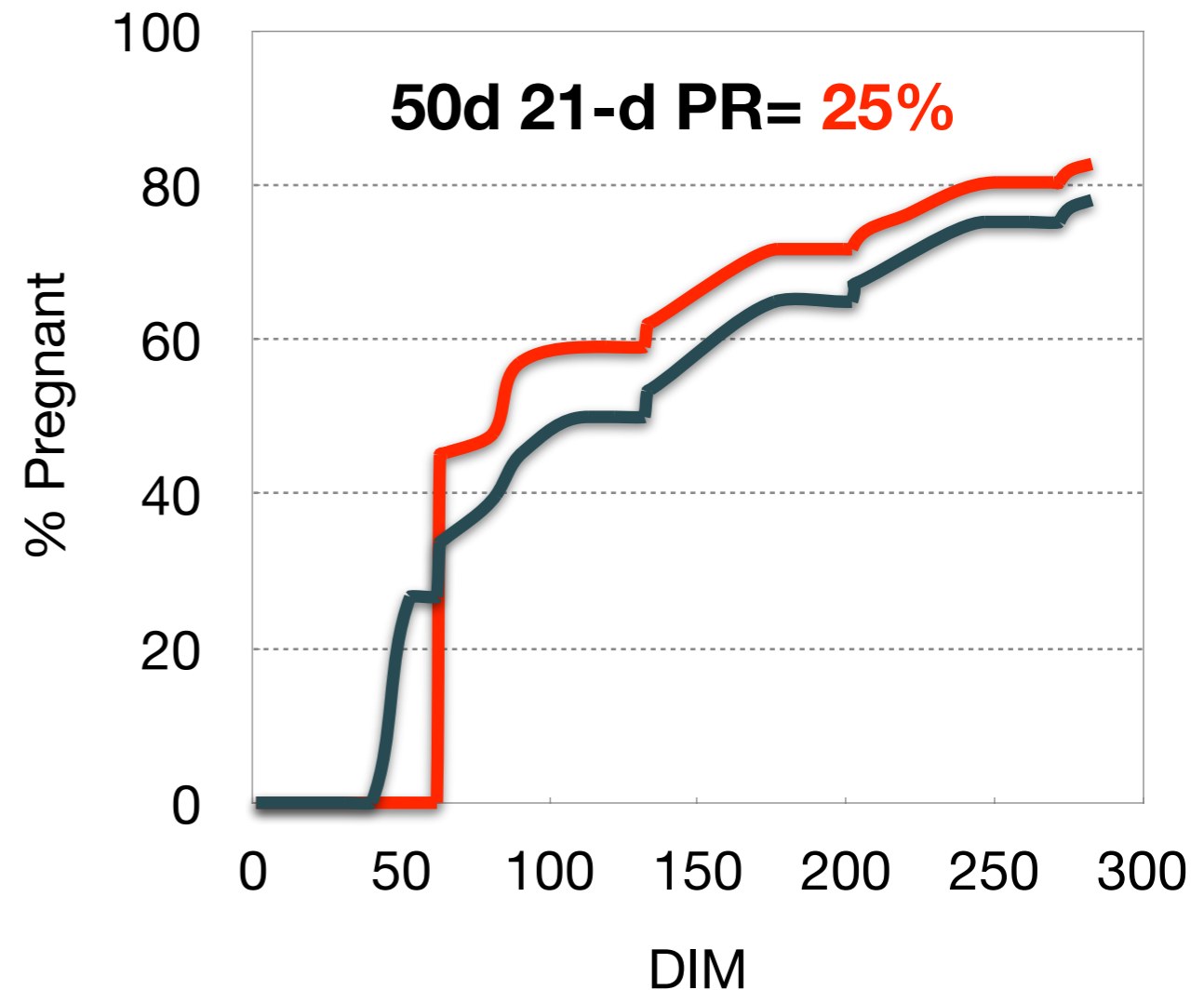
<b>\$/cow.yr</b>	<b>Current</b>	<b>Change</b>
<b>Income over feed costs</b>	\$3,095.2	<b>\$32.4</b>
<b>Replacement costs</b>	<b>\$242.6</b>	<b>\$16.4</b>
<b>Reproductive costs</b>	<b>\$64.2</b>	<b>\$1.0</b>
<b>Calf revenue</b>	\$152.7	<b>\$22.7</b>
<b>Cow net value</b>	\$2,941.1	<b>\$70.5</b>
<b>Herd net value (945 cows)</b>	<b>\$66,622.5</b>	<b>\$/herd.yr</b>



# Delay waiting period to 63 d (TAI)

1<sup>st</sup> TAI 45%, HD 30%,  
2<sup>nd</sup>+TAI CR 35%

Cull, %	Current	Change
No Repro	23.7	1.0
Mortality	3.9	0.2
Repro	12.4	2.2
Total	40.0	3.4



Heifer, %	Current	Change
Supply	42.2	0.2
Demand	40.1	3.5
Balance	2.1	3.7

Herd, %	Current	Change
Pregnant	47	3.0
Lactating	89	1.0
1 <sup>st</sup> Lact.	37	3.0

# Delay waiting period to 63 d (TAI)

1<sup>st</sup> TAI 45%, HD 30%,

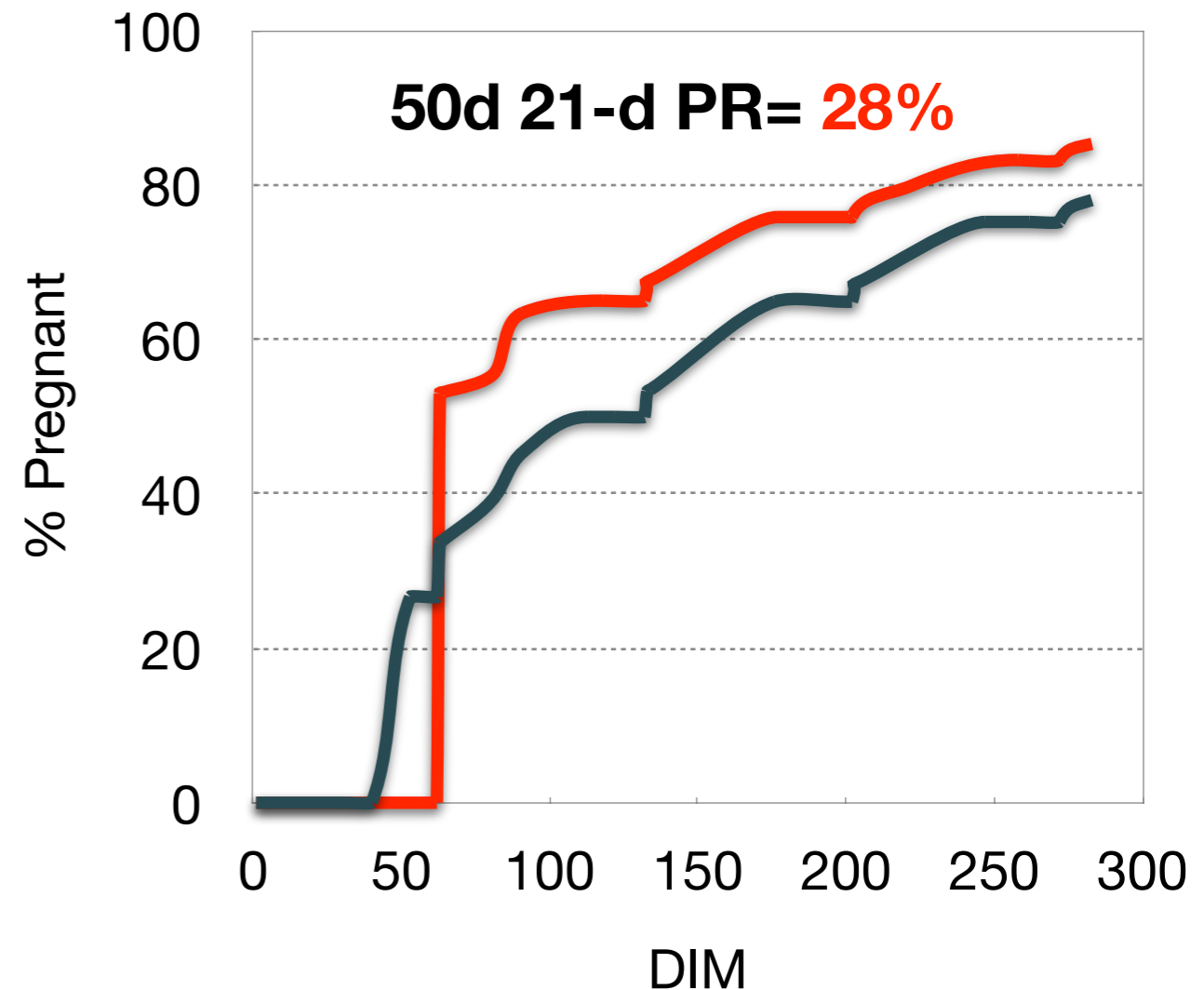
2<sup>nd</sup>+TAI CR 35%

<b>\$/cow.yr</b>	<b>Current</b>	<b>Change</b>
<b>Income over feed costs</b>	\$3,095.2	<b>\$18.8</b>
<b>Replacement costs</b>	<b>\$242.6</b>	<b>\$11.1</b>
<b>Reproductive costs</b>	<b>\$64.2</b>	<b>\$3.0</b>
<b>Calf revenue</b>	\$152.7	<b>\$18.0</b>
<b>Cow net value</b>	\$2,941.1	<b>\$44.9</b>
<b>Herd net value (945 cows)</b>	<b>\$42,430.5</b>	<b>\$/herd.yr</b>

# Delay waiting period to 63 d (TAI)

1<sup>st</sup> TAI 53%, HD 30%,  
2<sup>nd</sup>+TAI CR 35%

Cull, %	Current	Change
No Repro	23.7	1.8
Mortality	3.9	0.3
Repro	12.4	3.7
Total	40.0	5.8



Heifer, %	Current	Change
Supply	42.2	0.5
Demand	40.1	5.9
Balance	2.1	6.4

Herd, %	Current	Change
Pregnant	47	5.0
Lactating	89	1.0
1 <sup>st</sup> Lact.	37	5.0

# Delay waiting period to 63 d (TAI)

1<sup>st</sup> TAI 53%, HD 30%,

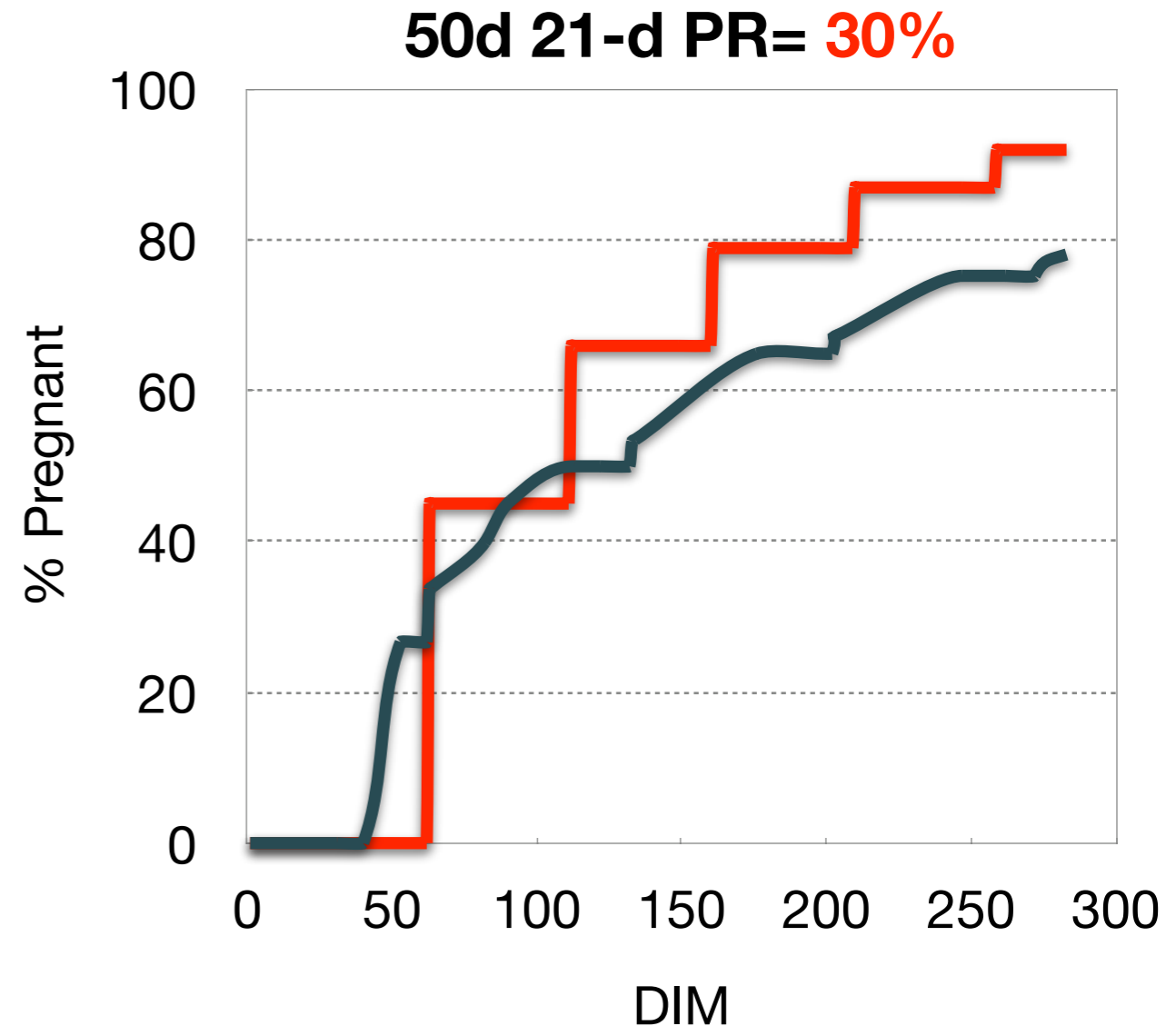
2<sup>nd</sup>+TAI CR 35%

<b>\$/cow.yr</b>	<b>Current</b>	<b>Change</b>
<b>Income over feed costs</b>	\$3,095.2	<b>\$34.3</b>
<b>Replacement costs</b>	<b>\$242.6</b>	<b>\$19.0</b>
<b>Reproductive costs</b>	<b>\$64.2</b>	<b>\$0.8</b>
<b>Calf revenue</b>	\$152.7	<b>\$39.0</b>
<b>Cow net value</b>	\$2,941.1	<b>\$91.5</b>
<b>Herd net value (945 cows)</b>	<b>\$86,467.5</b>	<b>\$/herd.yr</b>

# Only Double OvSynch

1<sup>st</sup> TAI 45%,  
2<sup>nd</sup>+ TAI 38%

Cull, %	Current	Change
No Repro	23.7	3.5
Mortality	3.9	0.7
Repro	12.4	6.9
<b>Total</b>	<b>40.0</b>	<b>11.1</b>



Heifer, %	Current	Change
Supply	42.2	0.8
Demand	40.1	11.1
Balance	2.1	10.3

Herd, %	Current	Change
Pregnant	47	7.0
Lactating	89	2.0
1 <sup>st</sup> Lact.	37	9.0

# Only Double OvSynch

1<sup>st</sup> TAI 45%,

2<sup>nd</sup>+ TAI 38%

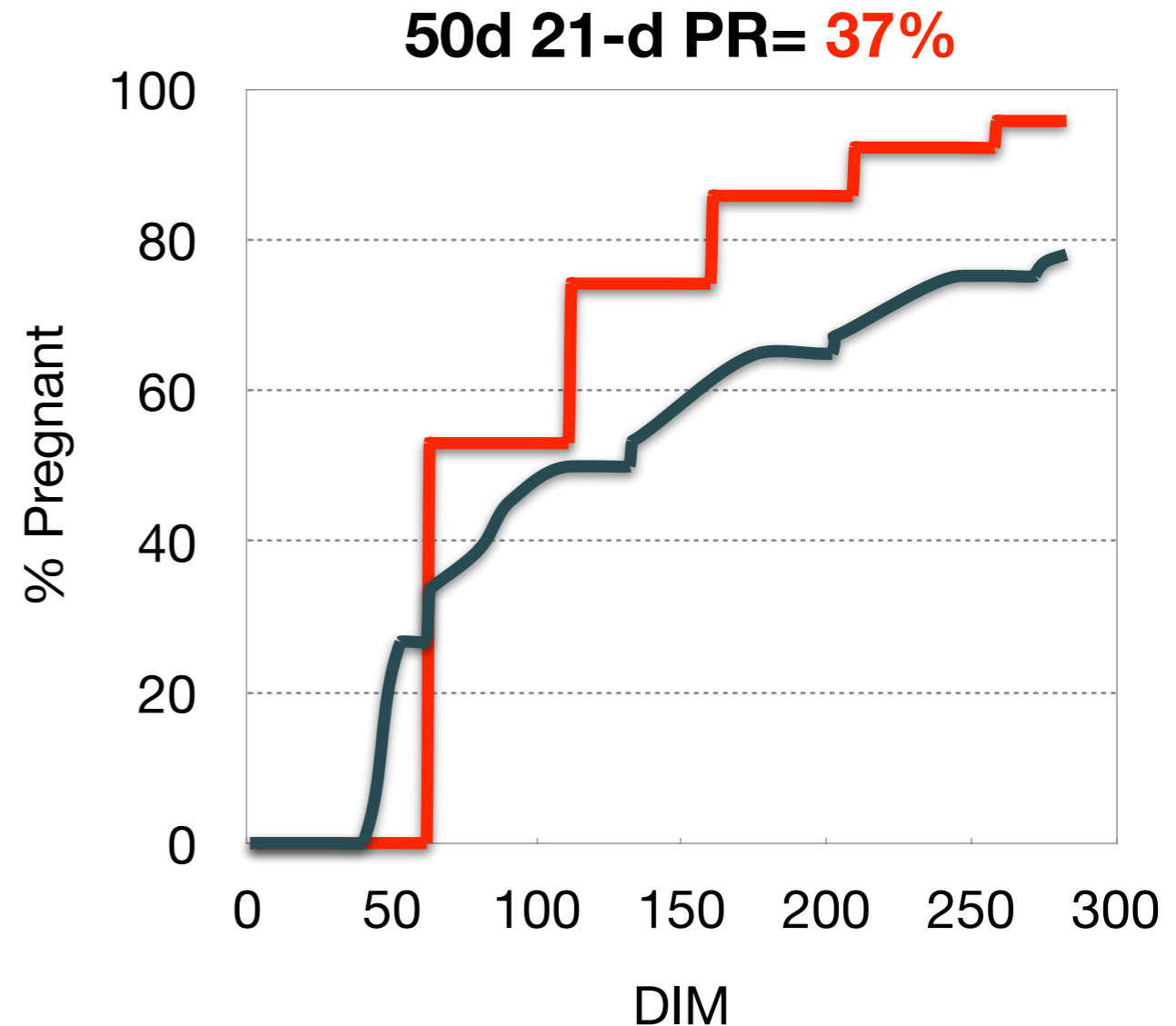
<b>\$/cow.yr</b>	<b>Current</b>	<b>Change</b>
<b>Income over feed costs</b>	\$3,095.2	<b>\$53.1</b>
<b>Replacement costs</b>	<b>\$242.6</b>	<b>\$36.5</b>
<b>Reproductive costs</b>	<b>\$64.2</b>	<b>\$9.8</b>
<b>Calf revenue</b>	\$152.7	<b>\$34.4</b>
<b>Cow net value</b>	\$2,941.1	<b>\$114.2</b>

<b>Herd net value (945 cows)</b>	<b>\$107,919.0</b>	<b>\$/herd.yr</b>
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# Only Double OvSynch

1<sup>st</sup> TAI 53%,  
2<sup>nd</sup>+ TAI 45%

Cull, %	Current	Change
No Repro	23.7	5.0
Mortality	3.9	1.0
Repro	12.4	7.9
Total	40.0	13.9



Heifer, %	Current	Change
Supply	42.2	0.4
Demand	40.1	14.0
Balance	2.1	14.4

Herd, %	Current	Change
Pregnant	47	11.0
Lactating	89	3.0
1 <sup>st</sup> Lact.	37	12.0

# Only Double OvSynch

1<sup>st</sup> TAI 53%,

2<sup>nd</sup>+ TAI 45%

<b>\$/cow.yr</b>	<b>Current</b>	<b>Change</b>
<b>Income over feed costs</b>	\$3,095.2	<b>\$76.1</b>
<b>Replacement costs</b>	<b>\$242.6</b>	<b>\$52.0</b>
<b>Reproductive costs</b>	<b>\$64.2</b>	<b>\$5.8</b>
<b>Calf revenue</b>	\$152.7	<b>\$49.8</b>
<b>Cow net value</b>	\$2,941.1	<b>\$172.1</b>

<b>Herd net value (945 cows)</b>	<b>\$162,634.5</b>	<b>\$/herd.yr</b>
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## Helping dairy farms improve economic performance

This site is designed to support dairy farming decision-making focusing on model-based scientific research. The ultimate goal is to provide user-friendly computerized decision support tools to help dairy farmers improve their economic performance along with environmental stewardship.



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