Dairy Management

WISCONSIN
UNIVERSITY OF WISCONSIN–MADISON

DEPARTMENT OF DAIRY SCIENCE
University of Wisconsin-Madison

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Fertility associated economic losses of farms

UW-Dairy Management
Decision Support TOOLS

Victor E. Cabrera

4th Health Management & Symposium
25-28 May 2016, Maritim Pine Beach Otel - Antalaya/TURKEY

Implications

- ↑ Reproductive performance
- ↑ **Profitability**

Required:
Economic value quantification

Market conditions:
Change constantly

Farm are different:
Farm specific assessments

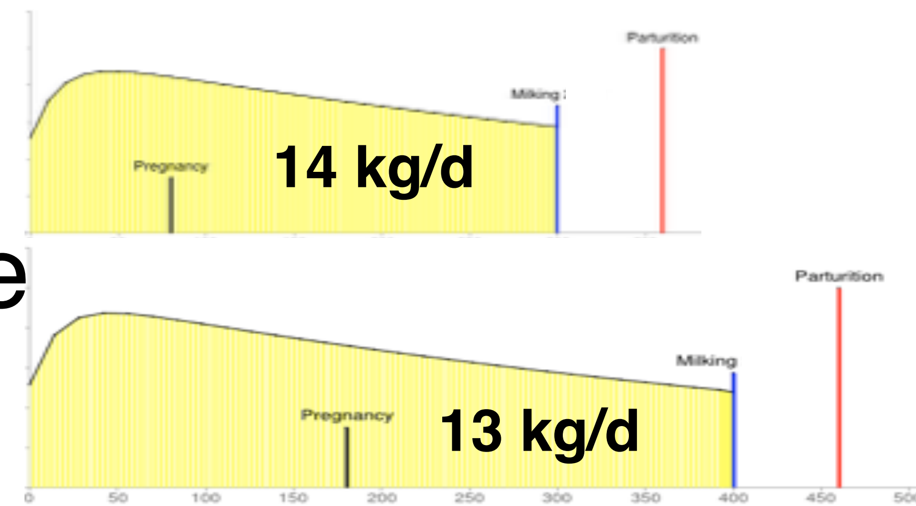
Large economic impact

Economic net return: Strongly associated to reproductive performance

↑ **Reproductive performance:**

Most efficient part of lactation curve

Ferguson and Galligan, 1999



↓ Costs replacement and mortality

Galvao et al., 2013

↑ On-farm replacements

Giordano et al., 2012

↓ Relative reproductive costs

Giordano et al., 2012

21-d Pregnancy Rate: Best single index of reproductive performance (not perfect…)

Ferguson and Galligan, 1999

Measure **Standardize** **Benchmark**

Rate at which eligible cows become pregnant in successive 21-d periods

Integrates many other parameters that indicate reproductive performance

Managers of modern US commercial dairy herds use 21-d PR **adjusted to 50 d VWP**

What happens with the 21-d PR if VWP is arbitrarily changed from 50 d to 70 d?

A. Increases

C. Remains

B. Decreases

D. It depends

Economic impact of reproductive programs: Difficult to assess - integrated

Series of recent simulation studies: Provide interesting clues and further direction

Giordano et al., 2011: Partial budgeting, DSS

Giordano et al., 2012: Daily Markov chains, DSS

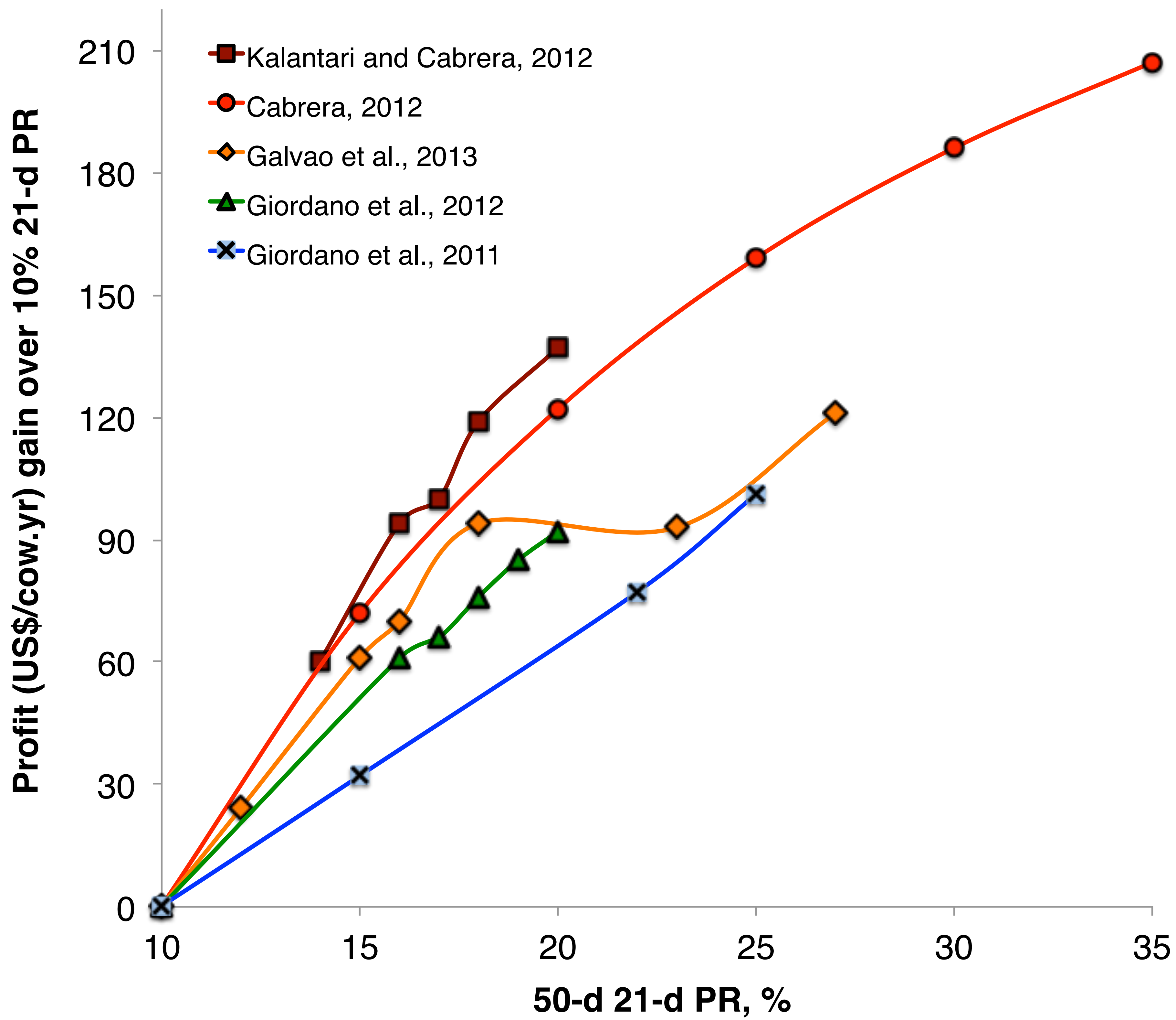
Cabrera, 2012: Markov-Chain, DSS

Kalantari and Cabrera, 2012: Markov-Chain, DSS

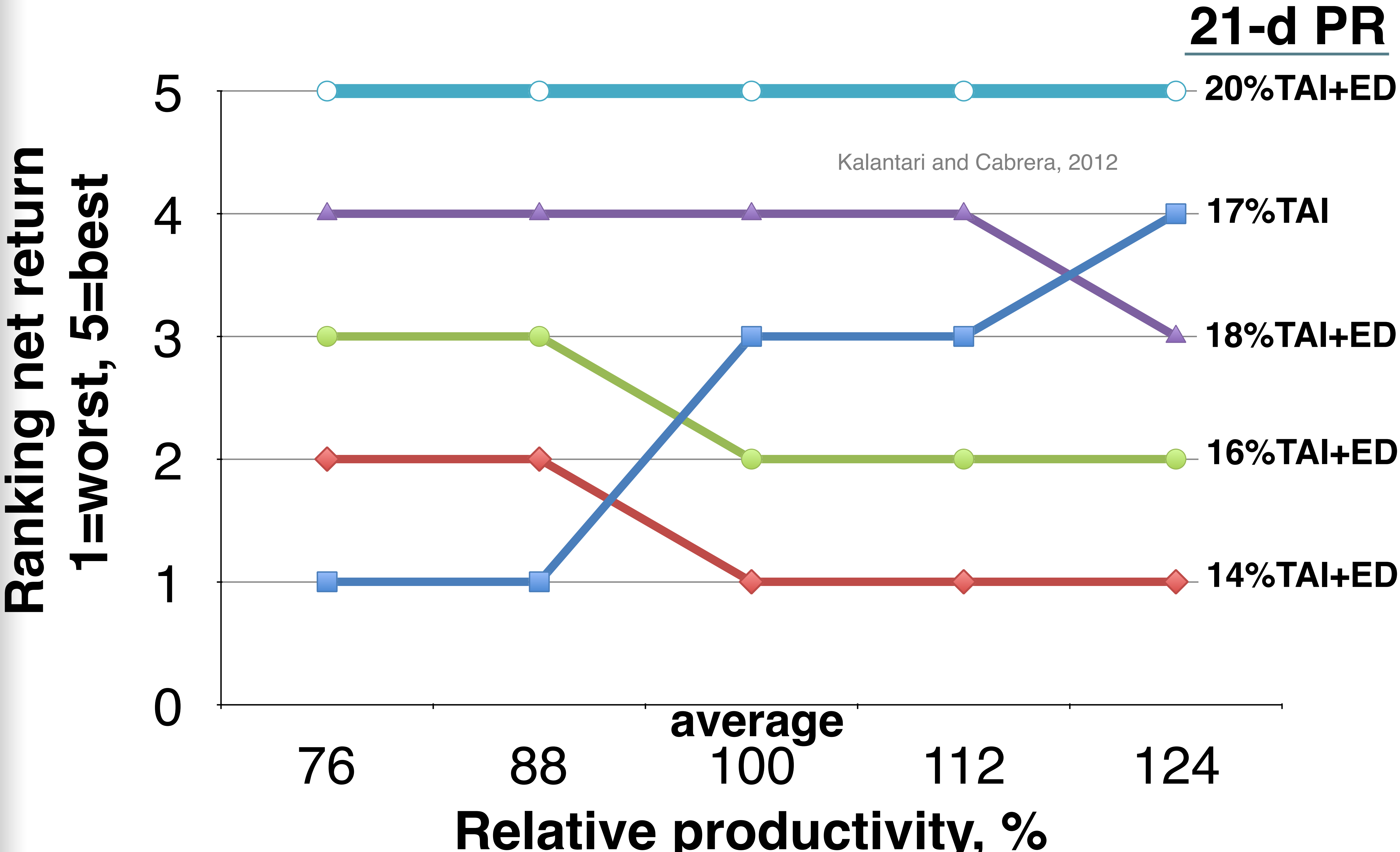
Giordano et al., 2013: Decision theory

Galvao et al., 2013: Monte Carlo

The economic value of improving reproductive performance

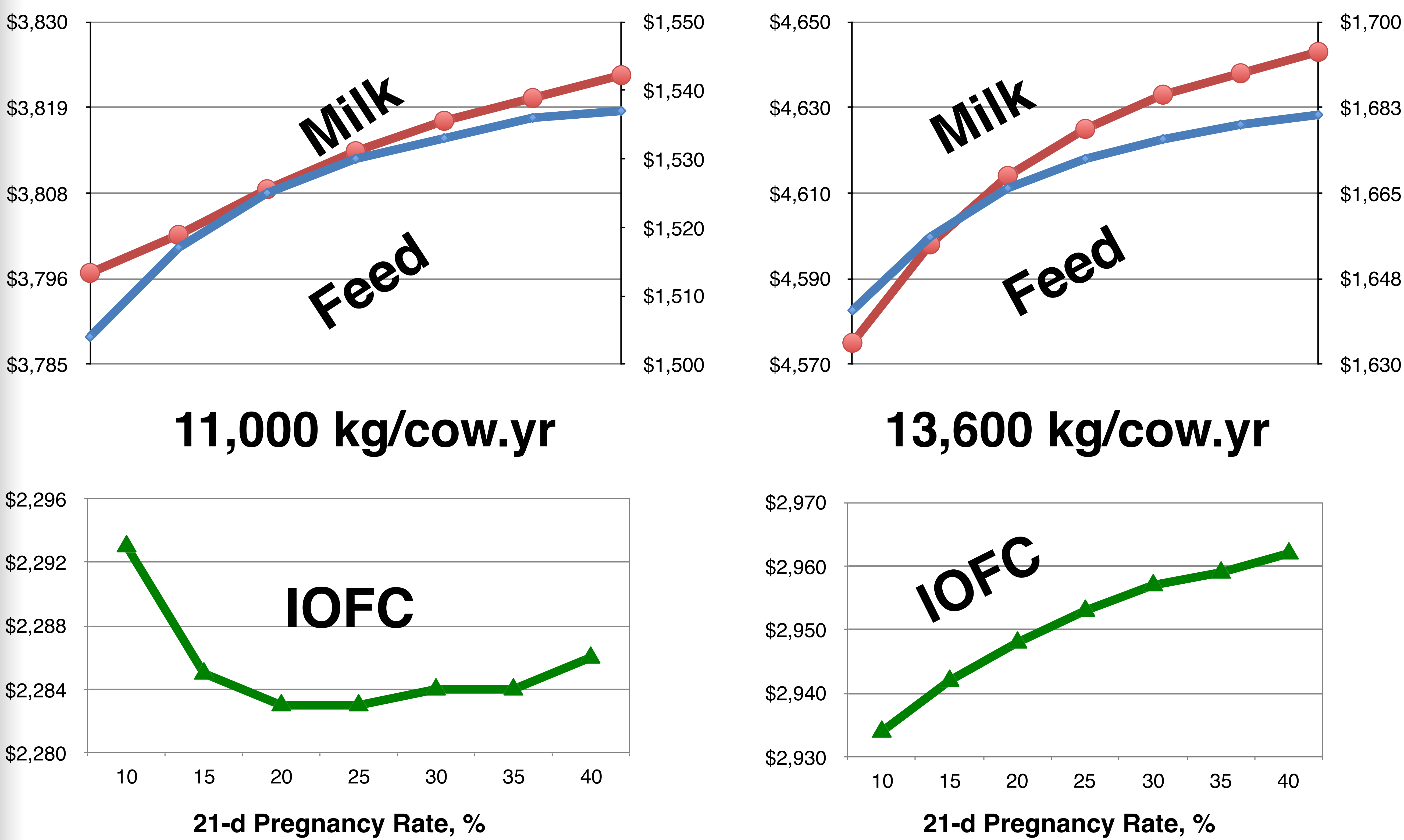


Herd's relative milk productivity



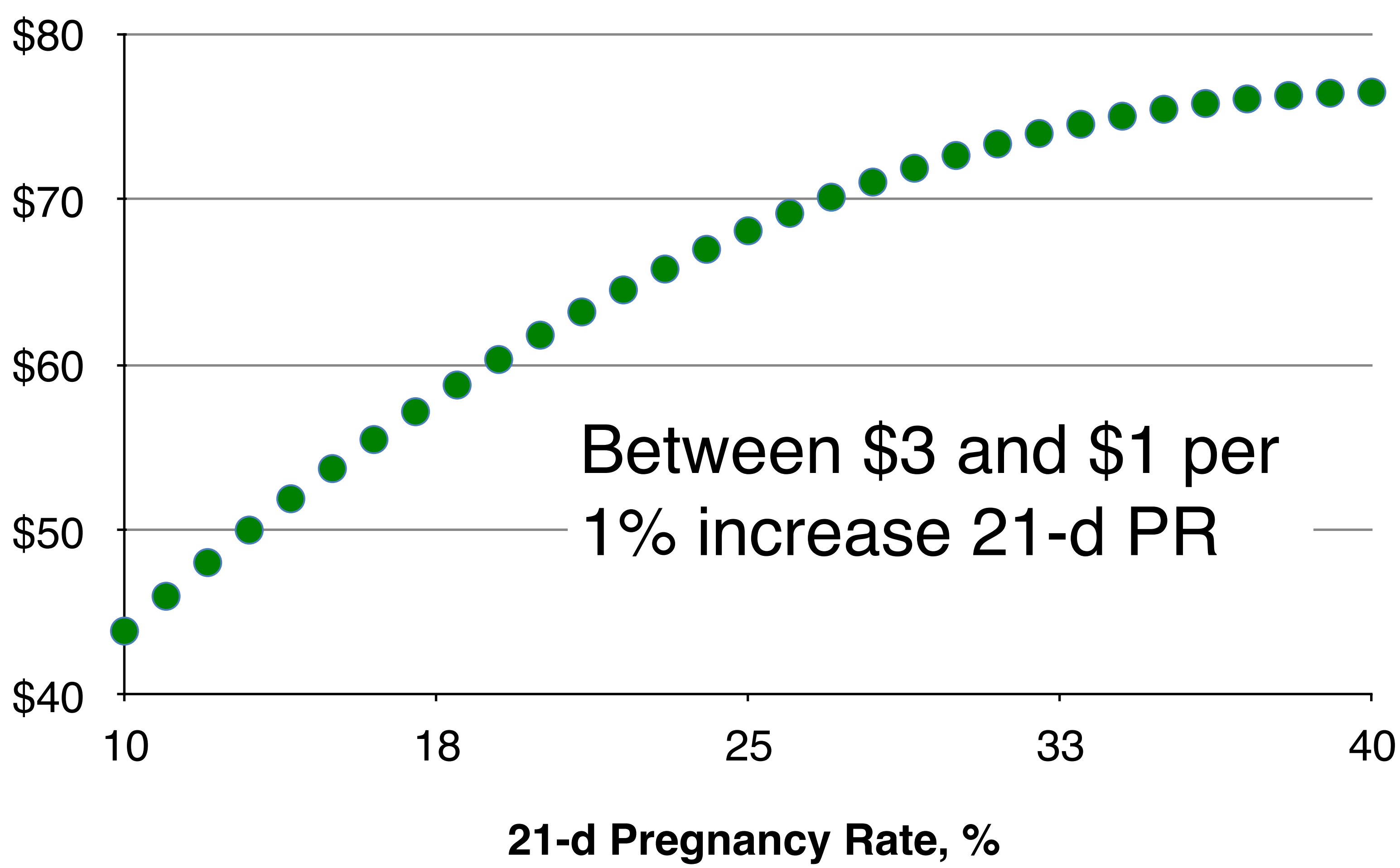
TAI=Timed Artificial Insemination **ED=Estrus Detection**

Milk, feed, and IOFC ($/cow.yr)



Cabrera, 2012

Calf sales ($/cow.yr)



Return ($/cow.yr) =

- 0.0352 (21-d PR)^2

+ 2.8476 (21-d PR)

+ 18.93 (R^2=0.996)

⚥Calf value = $100

Cabrera, 2012

Study	⚥Calf value, $	Gain, $/1% 21-d PR
Galvao et al., 2013	*$140*	***$1 to $3***
Giordano et al., 2012	*$90*	***$2 to $1***

Replacement supply

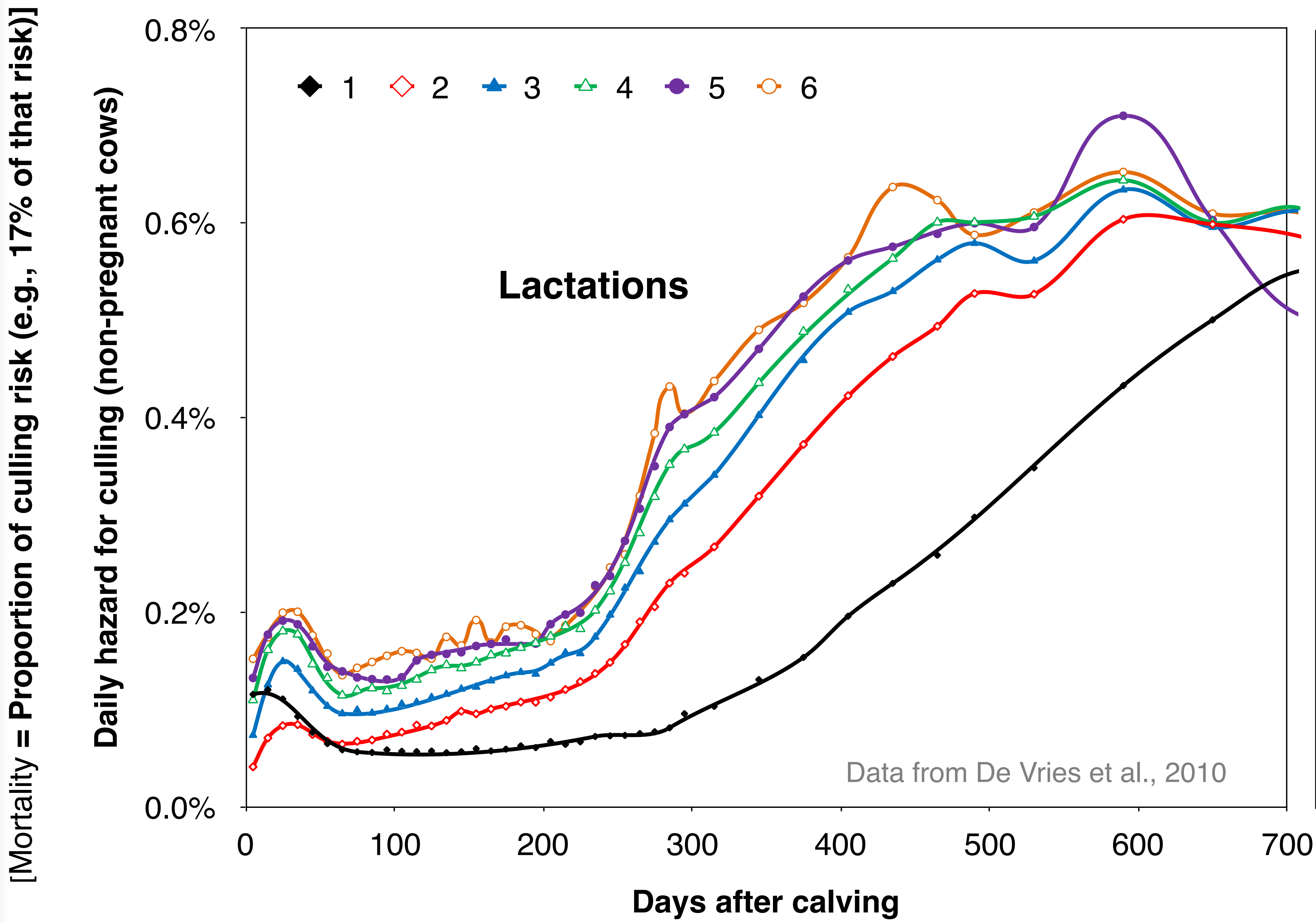
↑21-d PR → ↑Selective culling

Souza et al., 2013

21d-PR, % (reproductive programs)	Replacement balance /1,000 cow Cutoff 300 DIM	NEW cutoff to balance, DIM	Net return change, $/cow.yr
14	*-14*	*310*	*-5*
15	*0*	*300*	*0*
16	*15*	*281*	*+5*
17	*20*	*270*	*+6*
18	*38*	*240*	*+7*
19	*40*	*240*	*+8*
20	*48*	*235*	*+9*

From Giordano et al., 2012

Replacement and mortality costs



Lower Costs
$/cow.yr
↑ 1% 21-d PR

$4 to $1
Cabrera, 2012

$4 to $3
Giordano et al., 2012

$27 to $4
Galvao et al., 2013

Pregnant = **Less risk than non-pregnant (e.g., 75% less risk)**

Reproductive costs

- ↑PR (no investment) → ↓Reproductive costs
- ↑PR may require ↑investments
- Depends on investments vs. ↑PR
- Seems to be inconsistent among studies

$/cow.yr ↑1% 21-d PR

-$4 **+$4**

Galvao et al., 2013
Giordano et al., 2011; 2012

Oestrus detection, synchronisation, or a combination

Most high yielding USA herds use a combination

78% OD & 87% TAI Caraviello et al., 2006

Common reproductive practice:

TAI protocol and perform inseminations at detected oestrous in between Giordano et al., 2012

Recent economic studies:

OD or TAI, but combinations studied

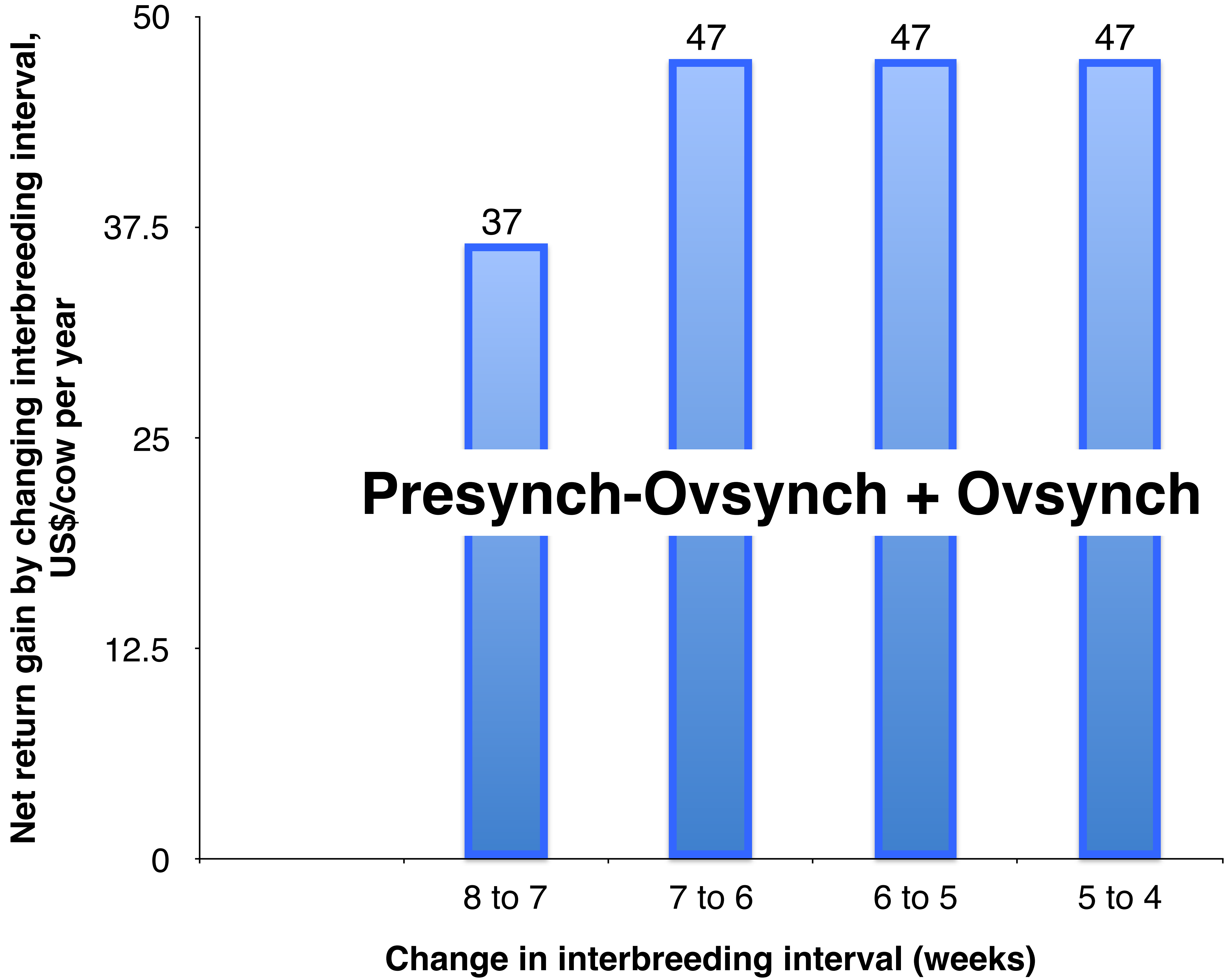
Giordano et al., 2011

Presynch-Ovsynch + Ovsynch with a focus on OD combination Giordano et al., 2012; Galvao et al., 2013

Economic effect of TAI with OD

	Net return gain TAI vs. TAI + OD, $/cow.yr				
	TAI CR, %		*60% OD CR, %*		
Study *Programme*	***First Serv.***	***Later Serv.***	***25***	***30***	***35***
Giordano et al., 2011					
Double Ovsynch + D32 Ovsynch	*45*	*30*		***14***	
Double Ovsynch + Double Ovsynch	*45*	*39*		***-12***	
Giordano et al., 2012					
Presynch-Ovsynch + Ovsynch	*42*	*30*	***-17***	***2***	***19***
Galvao et al., 2013					
Presynch-Ovsynch + Ovsynch	*33*	*25*	***23***	***57***	

Interbreeding interval vs. net return



Adapted from Giordano et al., 2013

Blood or milk-based pregnancy tests

Potentially effective when used earlier than conventional methods – **Shorten IBI**

Earlier pregnancy diagnosis with a **chemical test** could have some important **drawbacks**:

1. **Lower accuracy**
   a. **False negative (issue of sensitivity)**
   b. **False positive (issue of specificity)**
   c. **Questionable diagnoses (inconclusive)**

2. **Larger proportion of early pregnancy losses**

Accuracy of blood chemical test for early pregnancy diagnosis

Compared to conventional ultrasound or palpation

↓ Sensitivity → 2-3% → Re-synch → Preg. loss

↓ Specificity → 2-3% → Longer IBI → Time loss

↓ Conclusive → 3-9% → Re-test/Longer IBI

↑ Preg. Losses → 6-6.6%/week → ↓Specificity

Adapted from Giordano et al., 2013

d31Chemical vs. d39 Palpation

CT31 vs. RP39; 35 vs. 42 d IBI @ 50% OD

= -795

+535 (sensitivity %)

+305 (specificity %)

-305 (pregnancy losses %)

-39 (questionable diagnoses %)

-1.8 (cost of test $)

	Sensitivity %	Specificity %	Pregnancy losses %	Questionable diagnoses %	Test Cost $
Baseline	*98*	*98*	*6.0*	*3.3*	*2.4*
Positive	***≥96***	***≥95***	***≤9.0***	***≤27***	***≤7.5***

d25 Chemical vs. d32 Ultrasound

CT25 vs. TU32; 28 vs. 35 d IBI @ 50% OD

= -638

+450 (sensitivity %)

+253 (specificity %)

-253 (pregnancy losses %)

-34 (questionable diagnoses %)

-1.9 (cost of test $)

	Sensitivity %	Specificity %	Pregnancy losses %	Questionable diagnoses %	Test Cost $
Baseline	*97*	*97*	*6.6*	*8.5*	*2.4*
Positive	***≥95***	***≥94***	***≤10***	***≤34***	***≤7.0***

Why profitability increases as reproductive efficiency improves?

A. +Milk

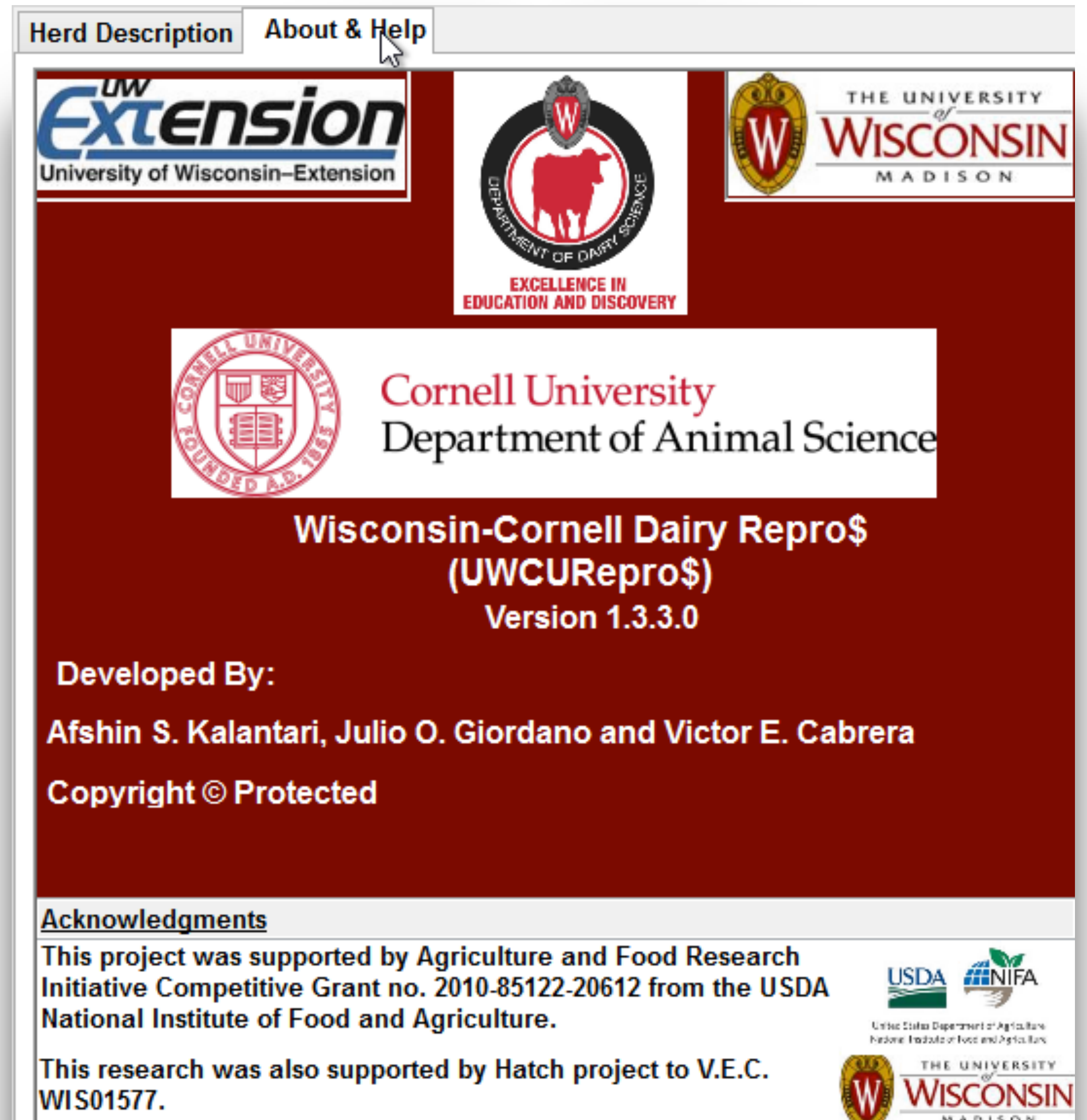
B. -Culling

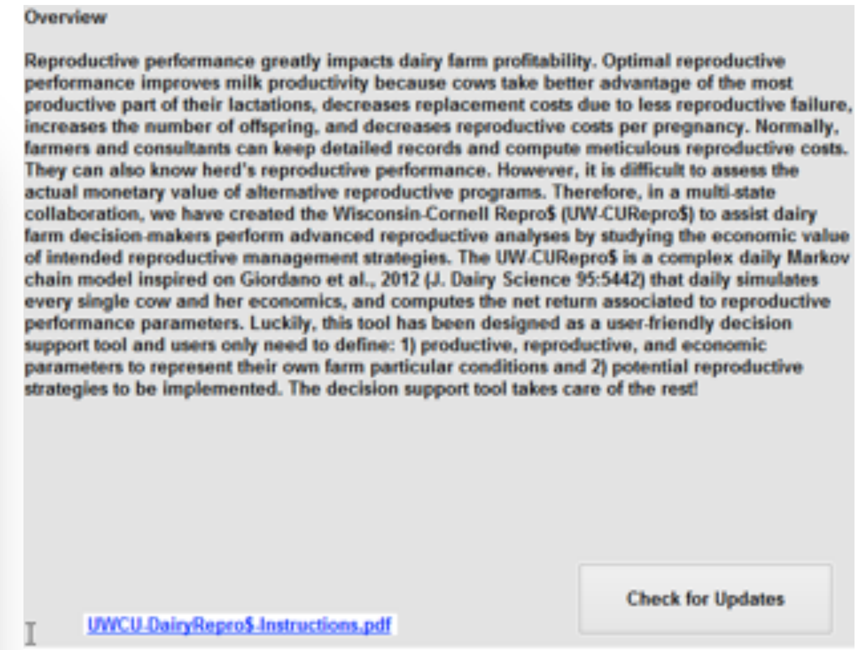
C. +Replacement

D. All the above

The UWCU Repro$ Tool

Very sophisticated, still highly user-friendly





DairyMGT.info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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

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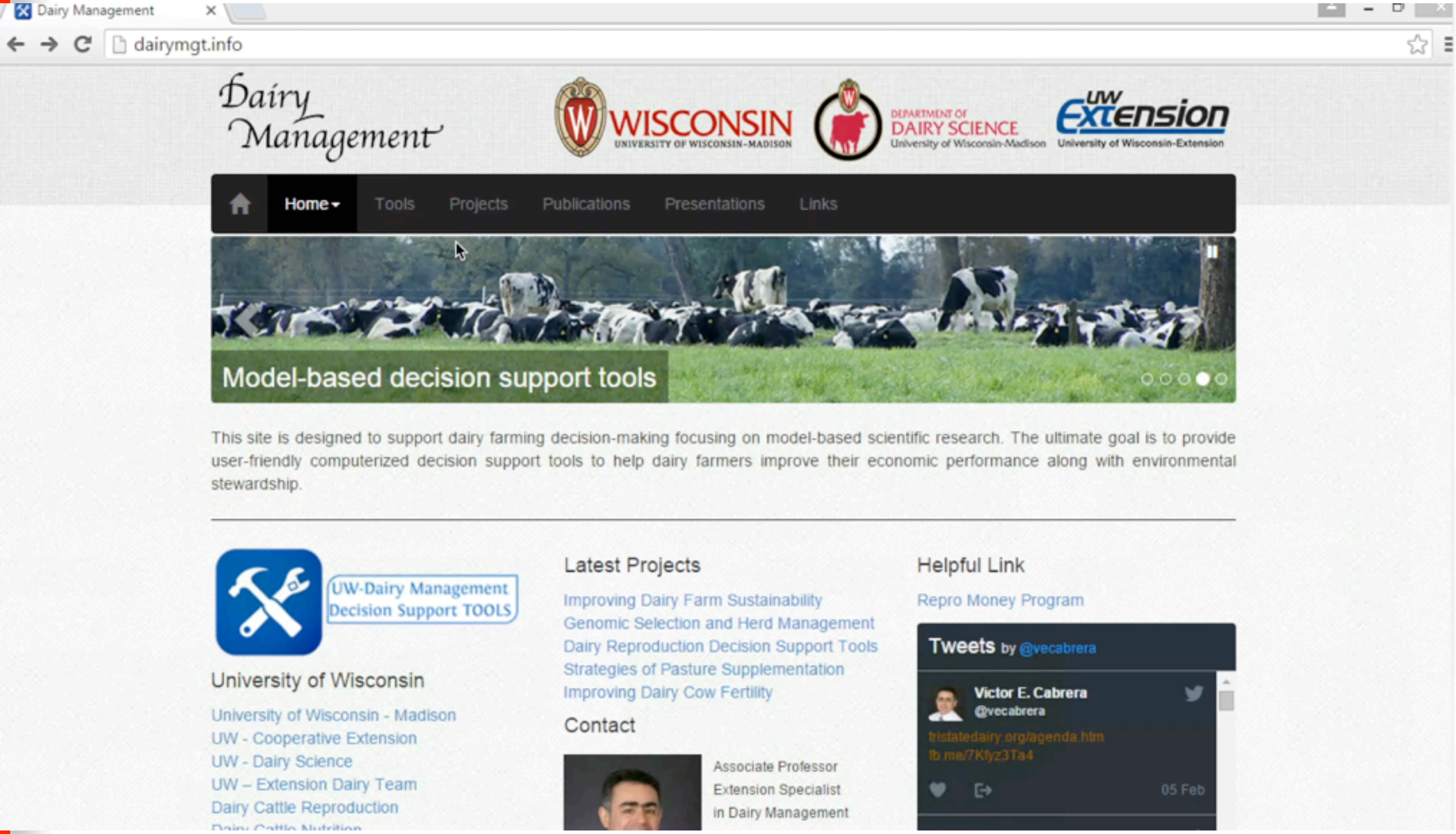
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Tweets by @vecabrera
Victor E. Cabrera
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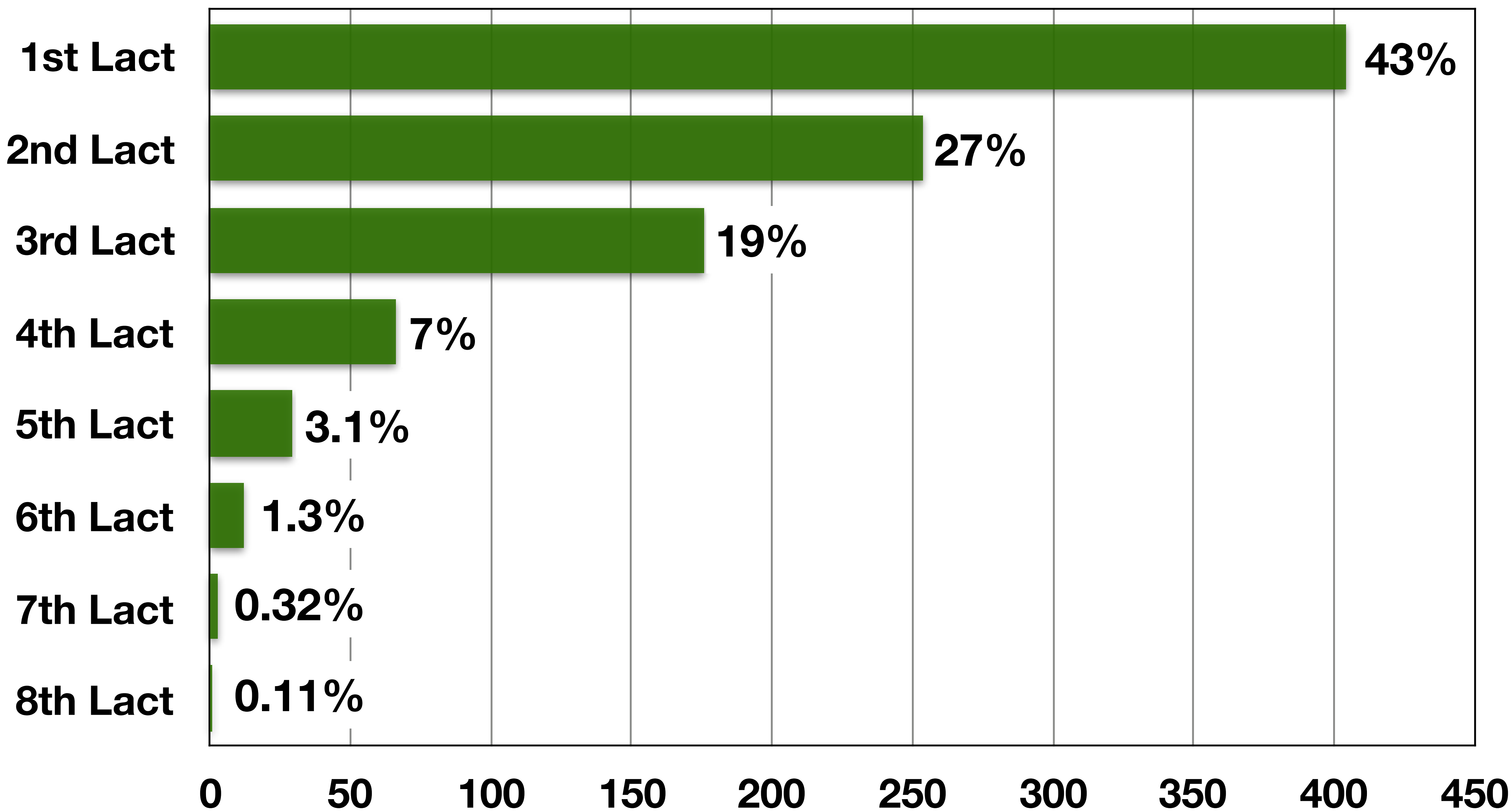
Video demo

Wisconsin Dairy Farm (Dec 2014)

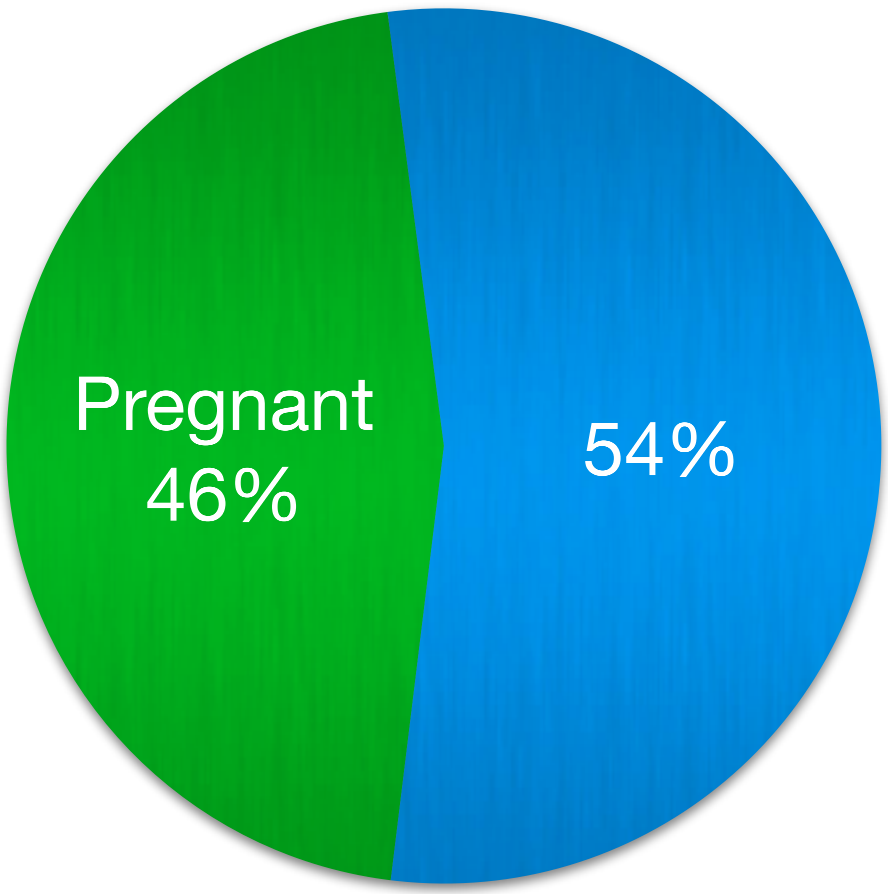
Cows by lactations

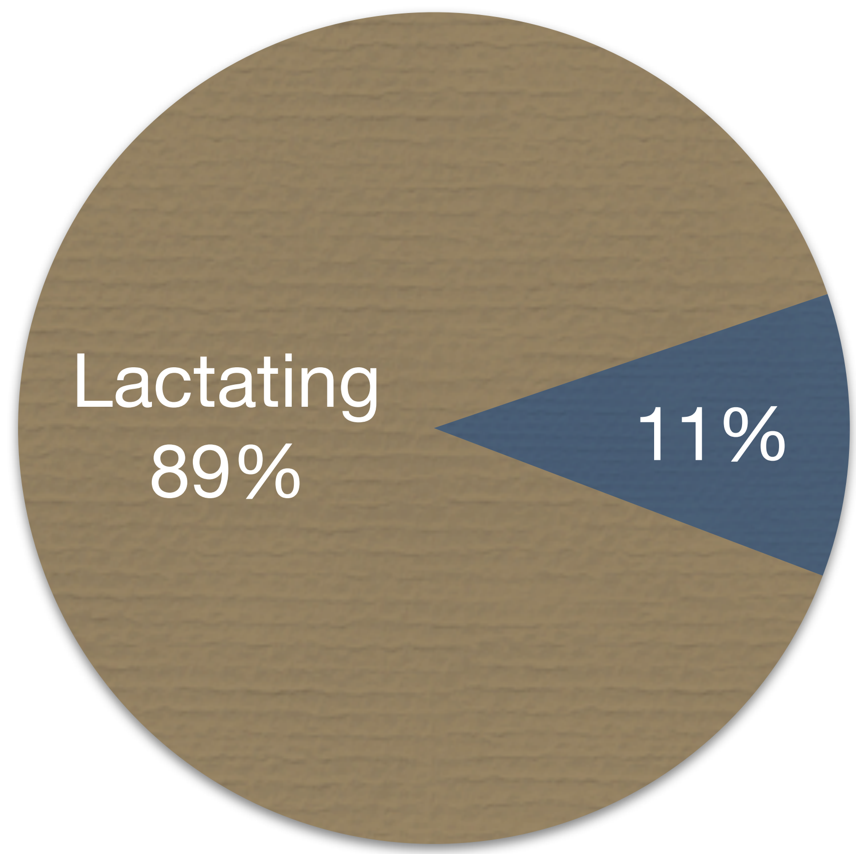
Total number of cows in records: 945



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	kg
1,389	**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

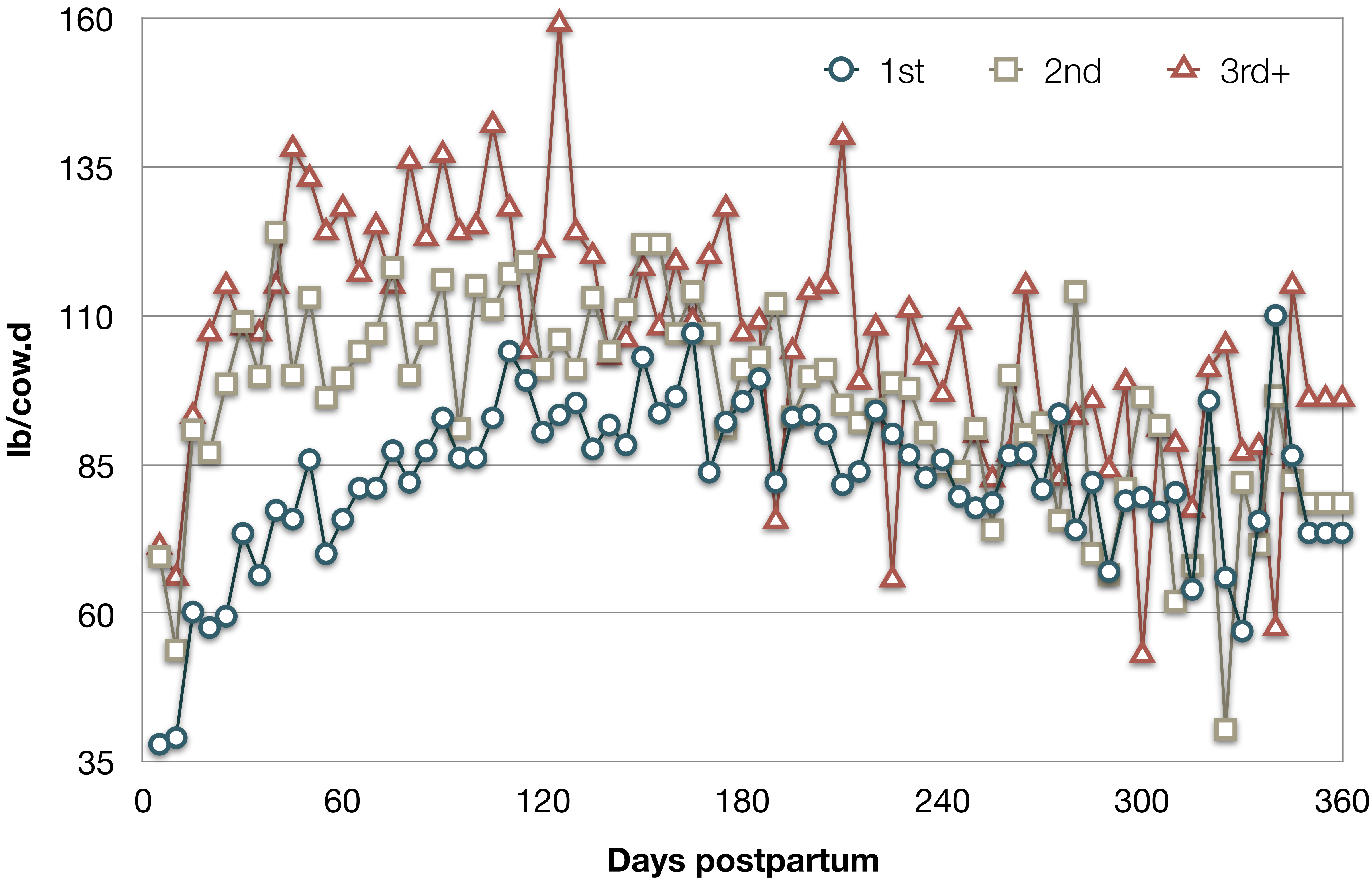
Economic values

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

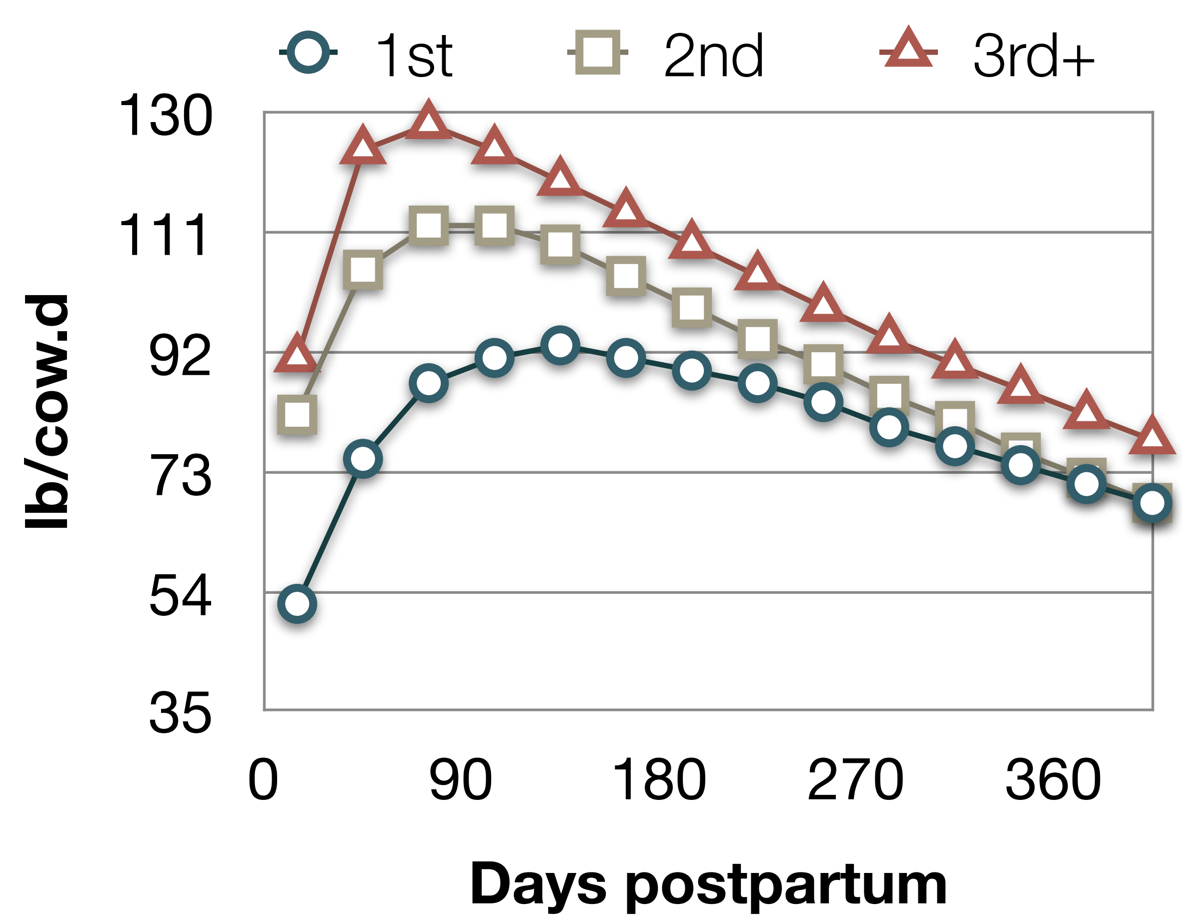
DIM	1st	2nd	3rd+
15	52	82	91
45	75	105	124
75	87	112	128
105	91	112	124
135	93	109	119
165	91	104	114
195	89	99	109
225	87	94	104
255	84	90	99
285	80	85	94
315	77	81	90
345	74	76	86
375	71	72	82
405	68	68	78

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

$M =$ 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

Tool: Milk curve fitter



Herd and economic parameters

UWCU Repro$

Herd Parameters

Herd Size (#)	945
Average Body Weight (lb)	1,389
Involuntary Culling (%/yr)	27.4
Mortality Rate (%/yr)	4.1
Stillbirth (%)	6.0

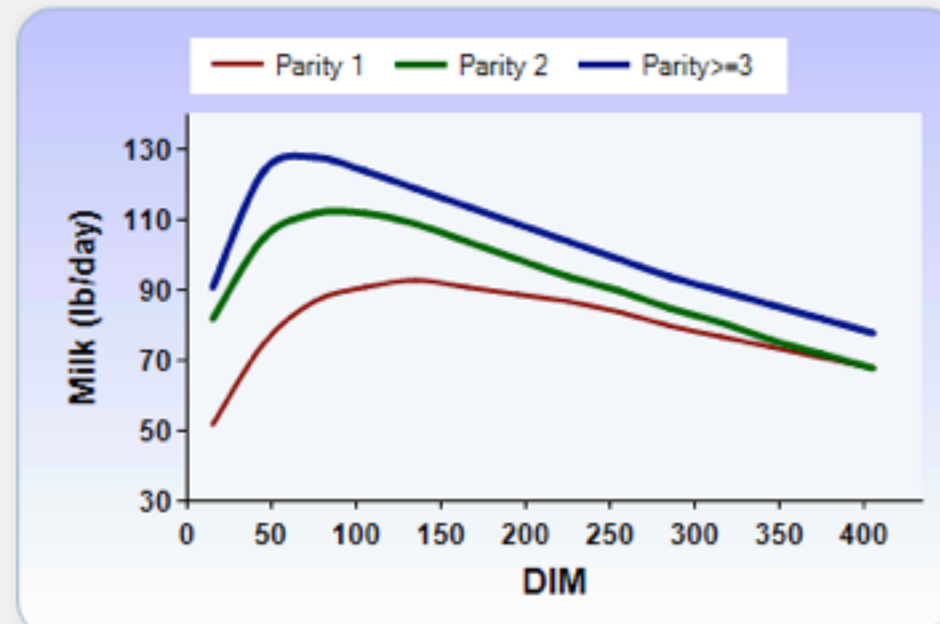
Economic Parameters

Milk Price ($/cwt)	18.50
Cost Feed Lactating ($/lb DM)	0.13
Dry Period Fixed Cost ($/lb DM)	0.08
Female Calf value($)	400
Male Calf value ($)	300
Heifer Replacement Value($)	2,150
Salvage Value ($/lb)	0.850

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



Next

Reproductive program

Description of program

Voluntary waiting period 1st lact, d	40
Voluntary waiting period 2nd+ lact, d	40
Estrous duration, d	22
Maximum DIM breeding 1st lact, d	338
Maximum DIM breeding 2nd lact, d	276
Maximum DIM breeding 3rd+ 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 preg check	**NO**	
Interbreeding interval TAI, d	**70**	

Reproductive program

Description of program

Heat bred before 1st TAI service, % AFI detect	72
CR before 1st TAI service, %	37
CR 1st TAI service	25
Heat bred after 1st TAI service, % AFI detect	85
CR after 1st HD services, %	29
CR 2nd+ TAI services	33

Reproductive program

Pregnancy diagnosis

Days in gestation 1st preg check, d	34
Days in gestation 2nd preg check, d	90
Days in gestation 3rd 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

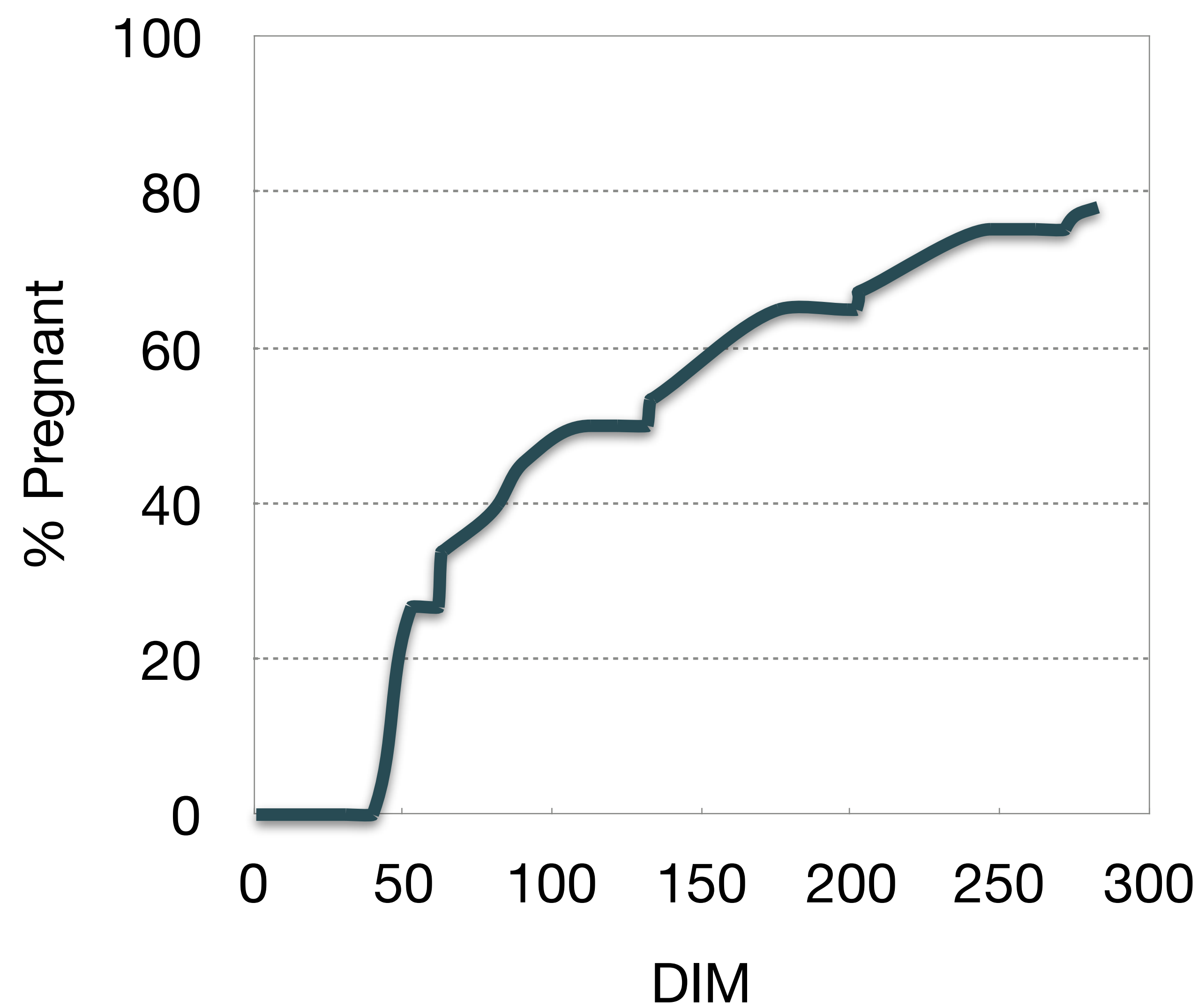
Current

[redacted]

Resynch before preg check	NO

Programs Description

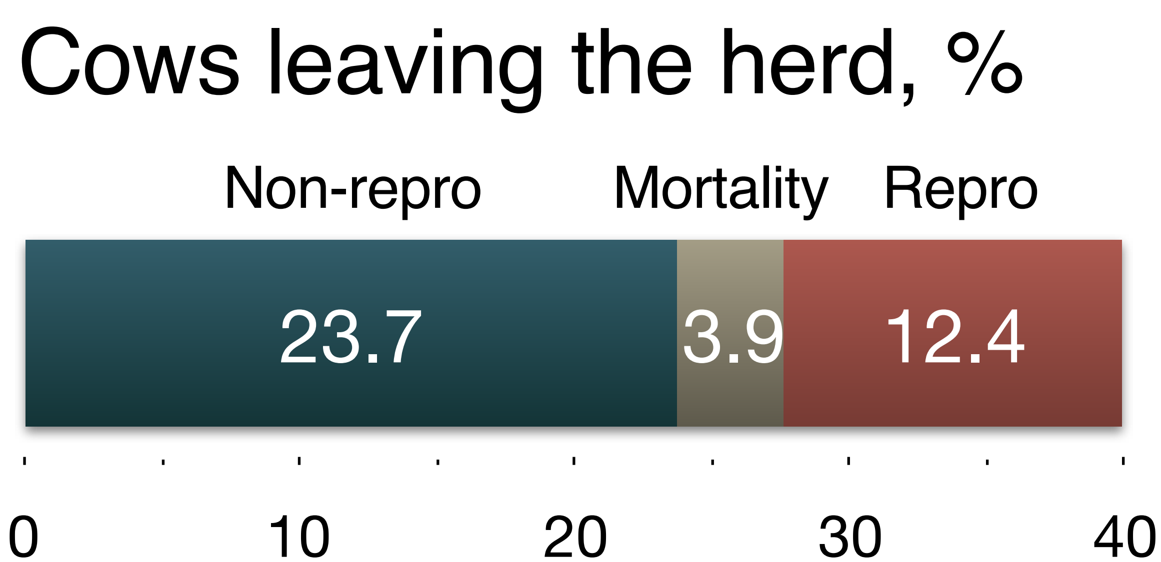
VWP (d)	40
Estrous Cycle Duration (d)	22
Maximum DIM for Breeding	283
Do-not-Breed Minimum Milk (lb/d)	80
DIM first injection for first AI sync program (d)	36
Weekday first injection	Friday
Interbreeding interval for TAI services (d)	70
Heat bred before first TAI service (%)	72
CR heat bred before first TAI service (%)	37
CR first TAI service (%)	25
Heat bred after first TAI service (%)	85
CR heat bred after first TAI service (%)	29
CR second and subsequent TAI services (%)	33
Pregnancy Loss (%)	8.7

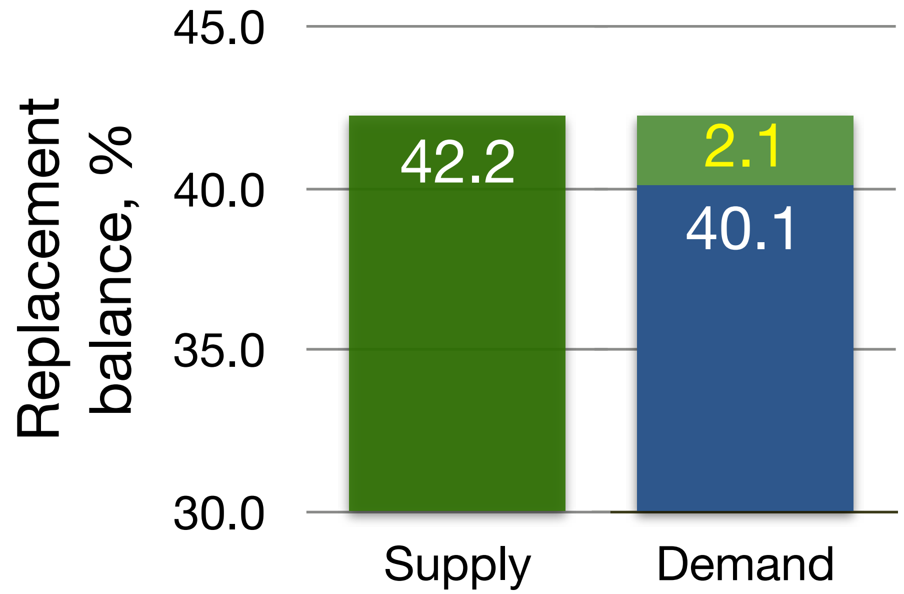


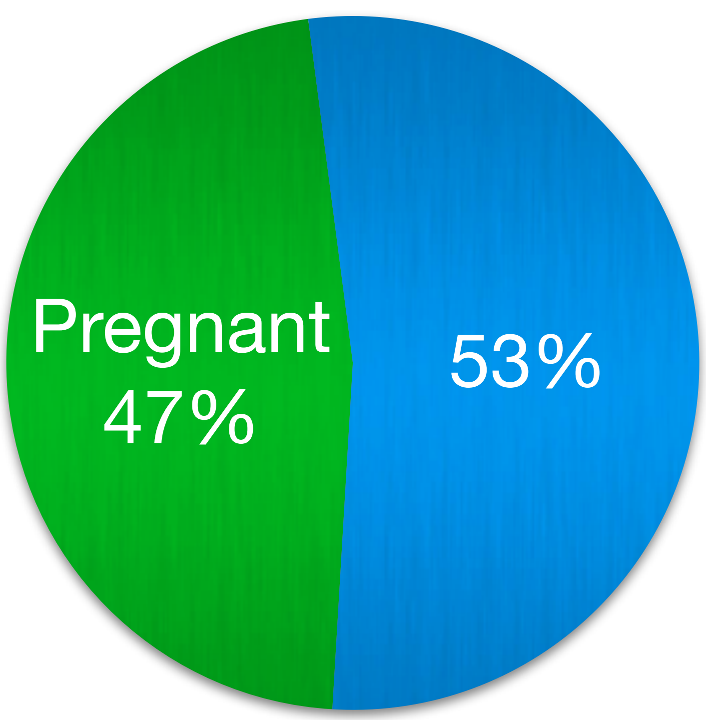
21-d PR (40 d)	**18%**
21-d PR (50 d)	**19%**

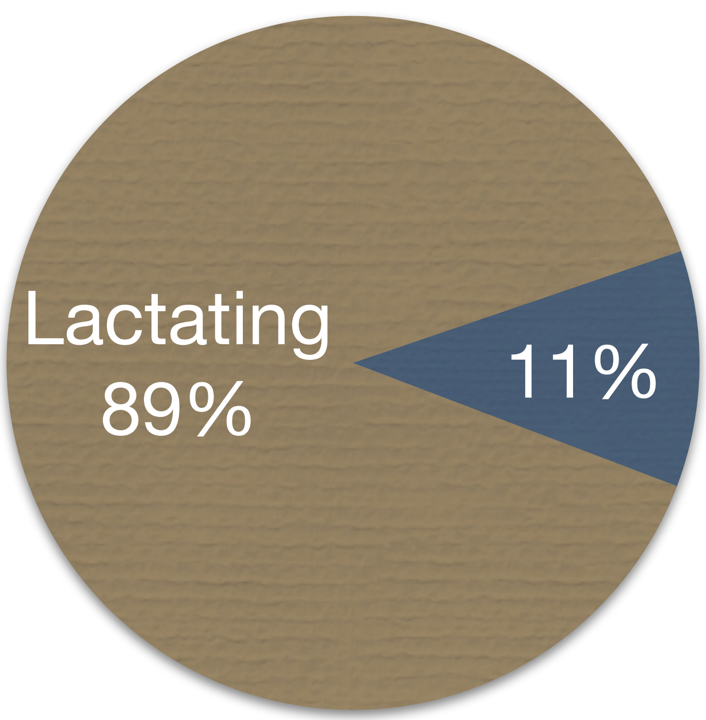
Reproductive program

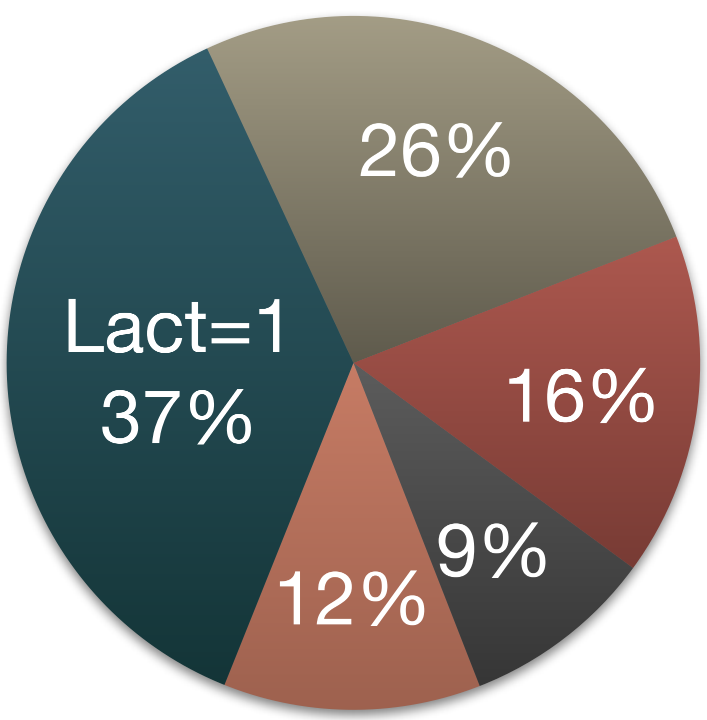
UWCU Repro$











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

What reproductive parameter is <u>more critical</u> to be improved in Wisconsin farm?

A. ED

C. ED CR

B. TAI CR

D. Abortion

Management strategy
(In place July 2, 2015)

Reproductive program

Timed Artificial Insemination program

1st TAI service postpartum	**Double Ovsynch**
2nd+ TAI services	**Ovsynch**
Weekday first injection	**Friday**

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1 GnRH	
					7 PGF	
	10 GnRH					
	17 GnRH					
	24 PGF		26 GnRH	27 TAI		

Reproductive program

Description of program

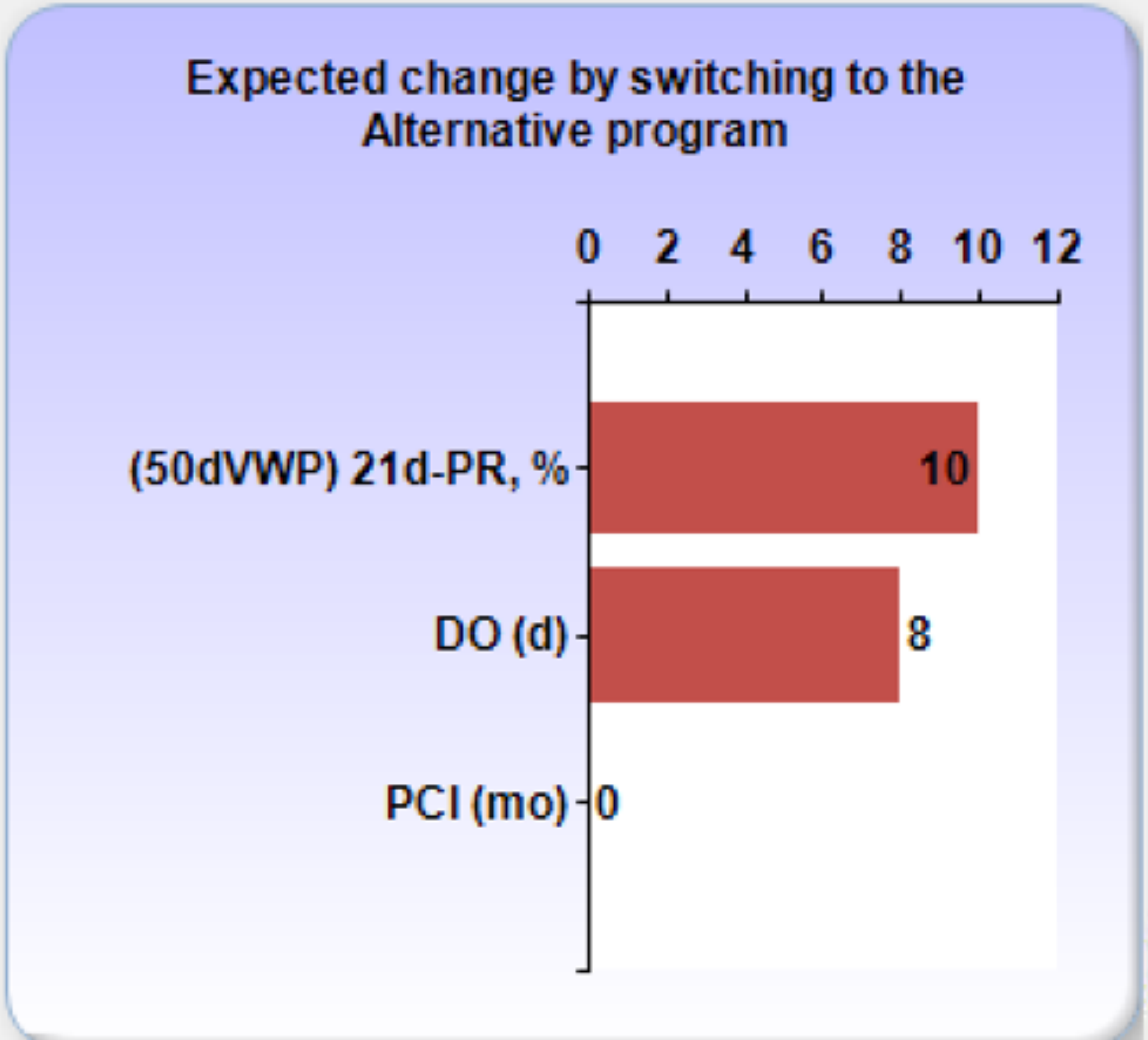
	lb	kg
Do-not-breed minimum milk/d	80	36
DIM first TAI injection, d	36	
Resynch before preg check	YES	
Interbreeding interval TAI, d	70	

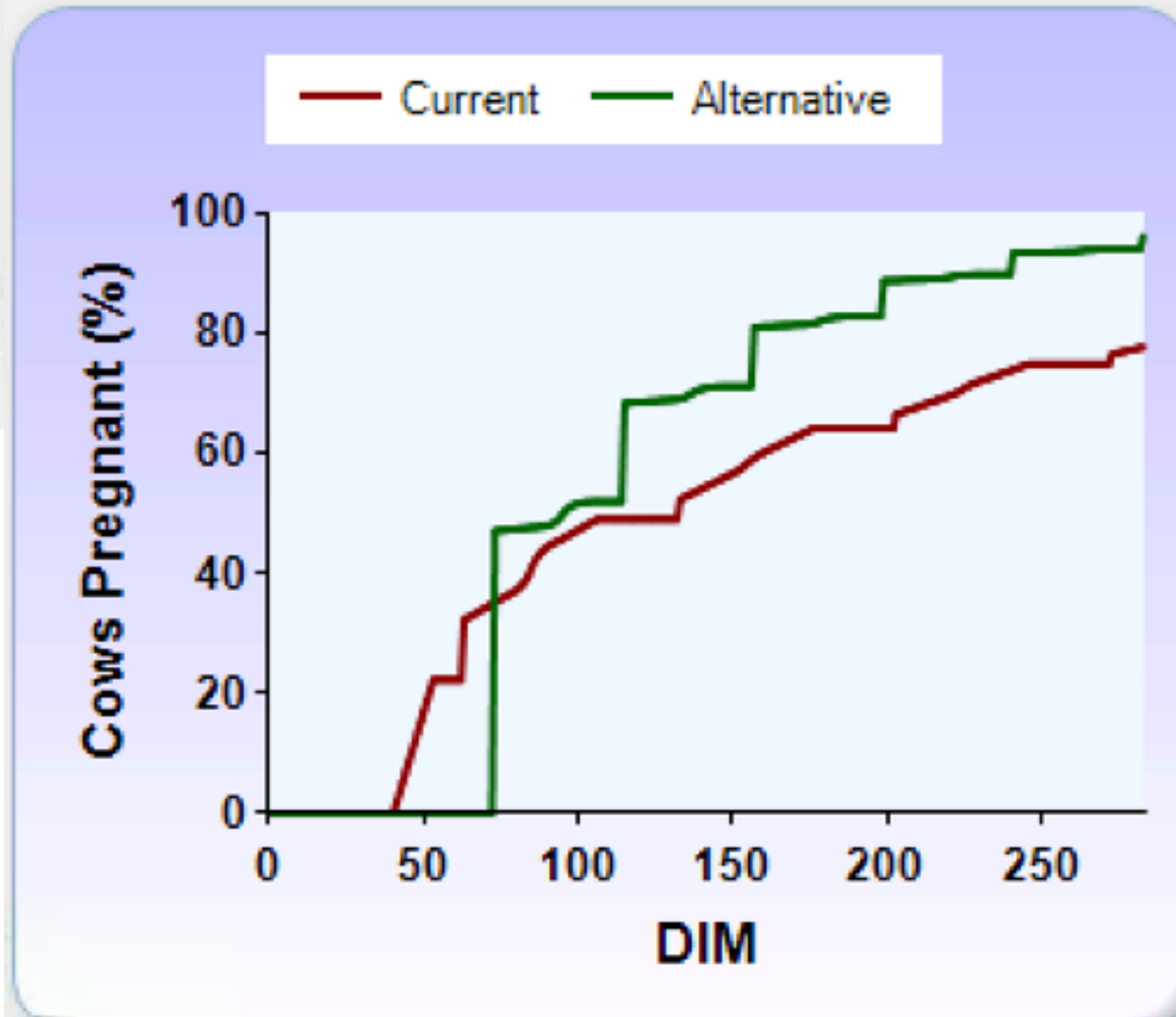
Reproductive program

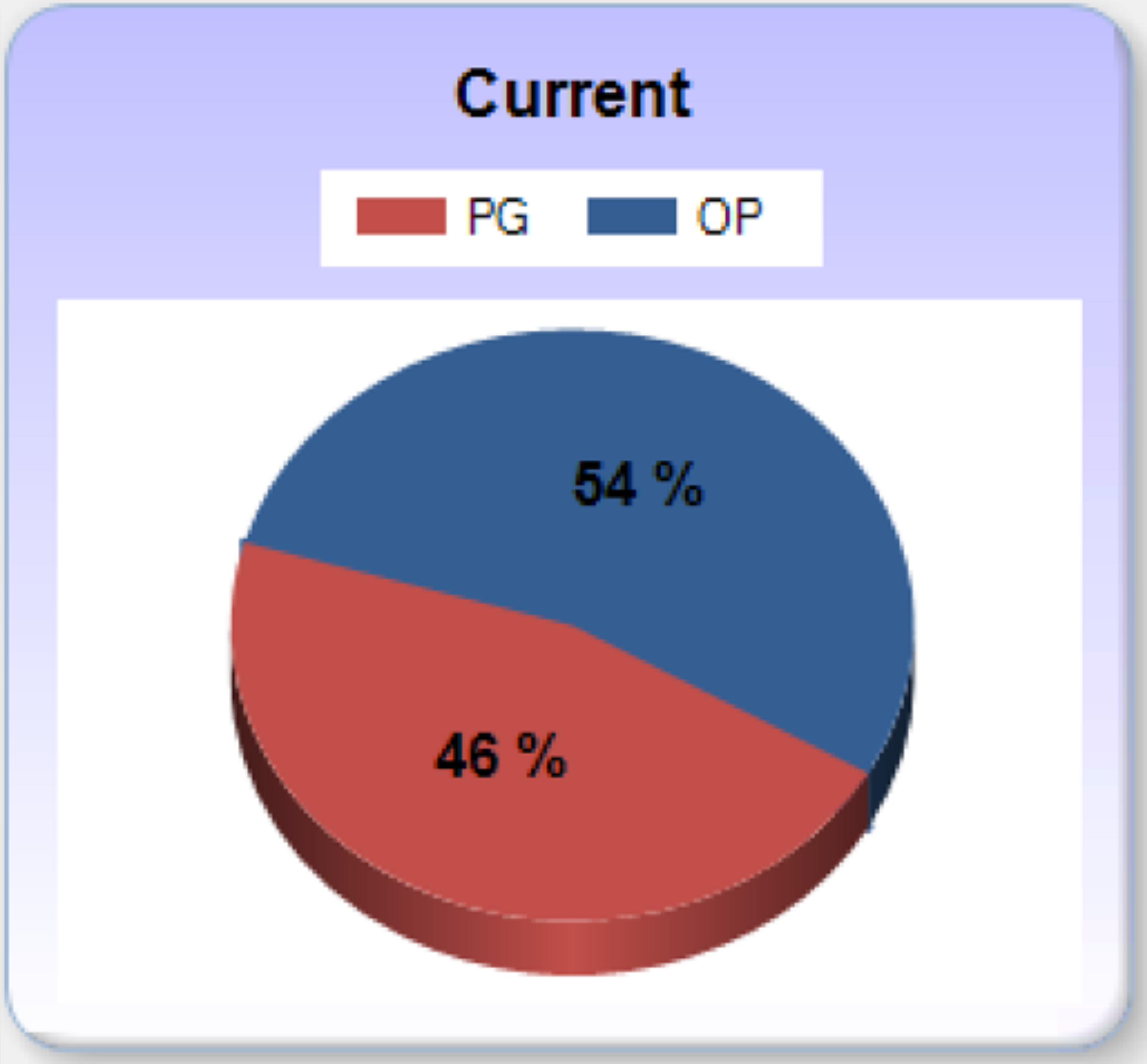
Description of program

Heat bred before 1st TAI service, % AFI detect	0
CR before 1st TAI service, %	0
CR 1st TAI service	47
Heat bred after 1st TAI service, % AFI detect	23
CR after 1st HD services, %	40
CR 2nd+ TAI services	40

Reproductive Performance

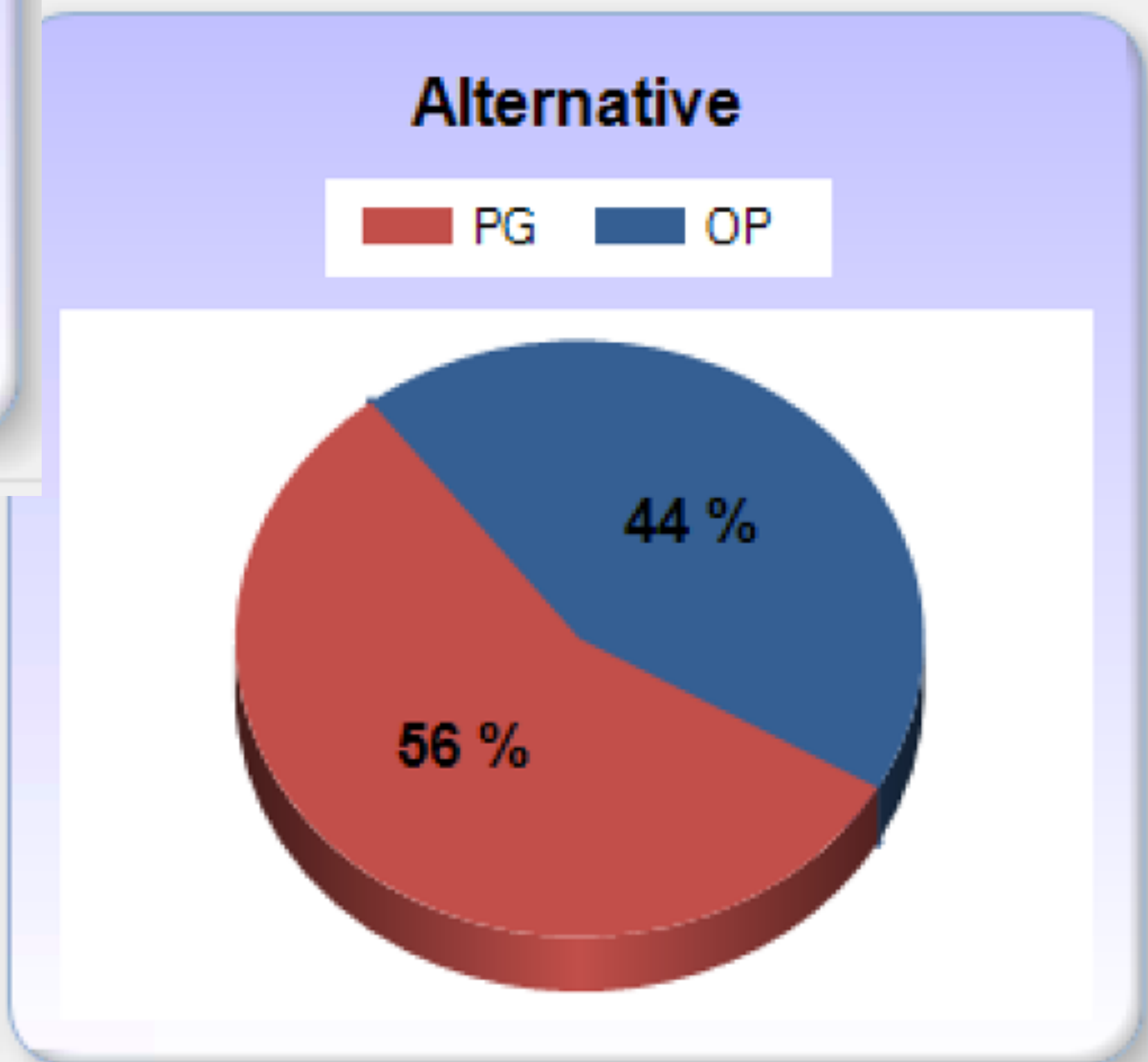




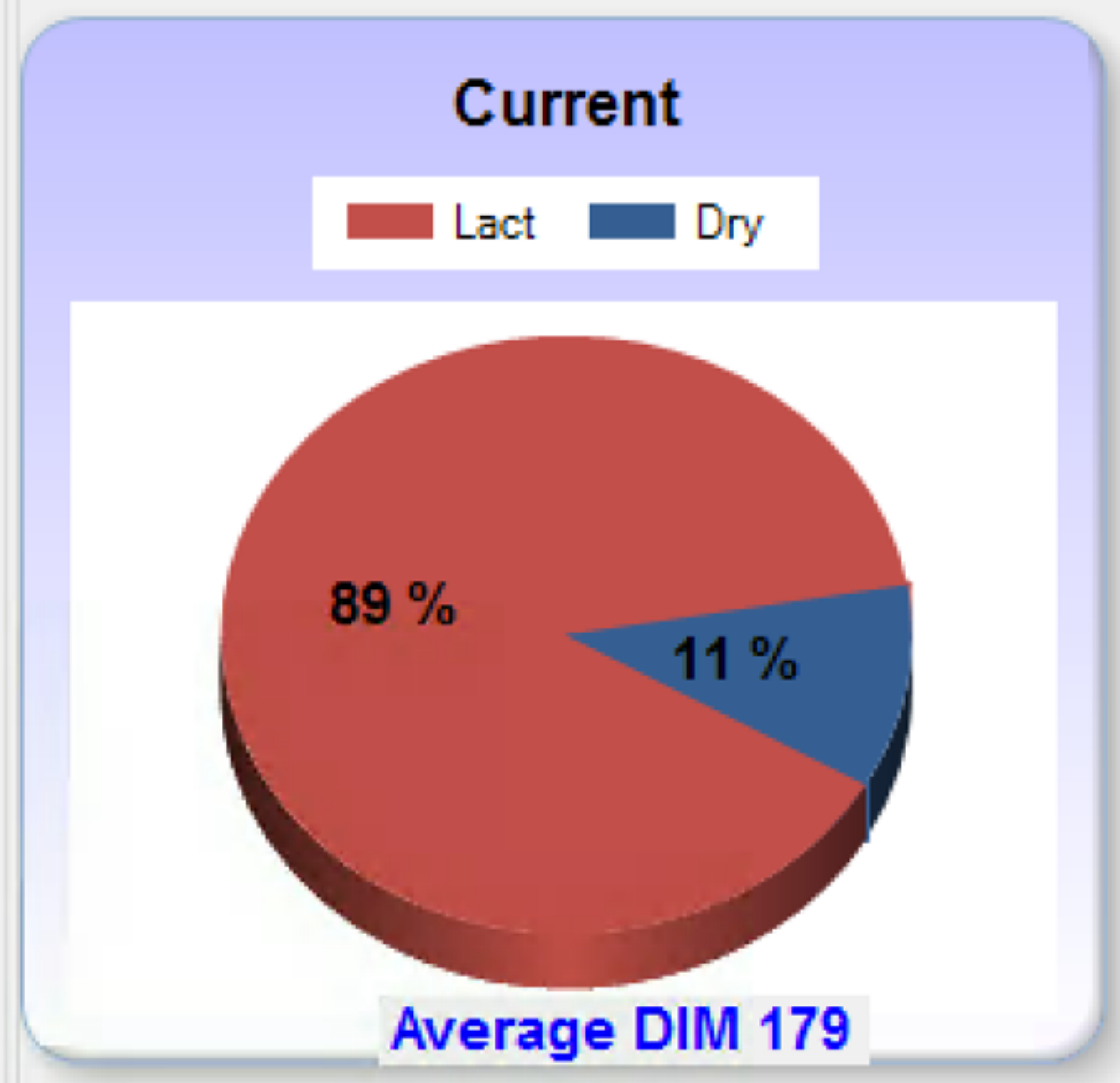


Herd Structure: Pregnant and open cows

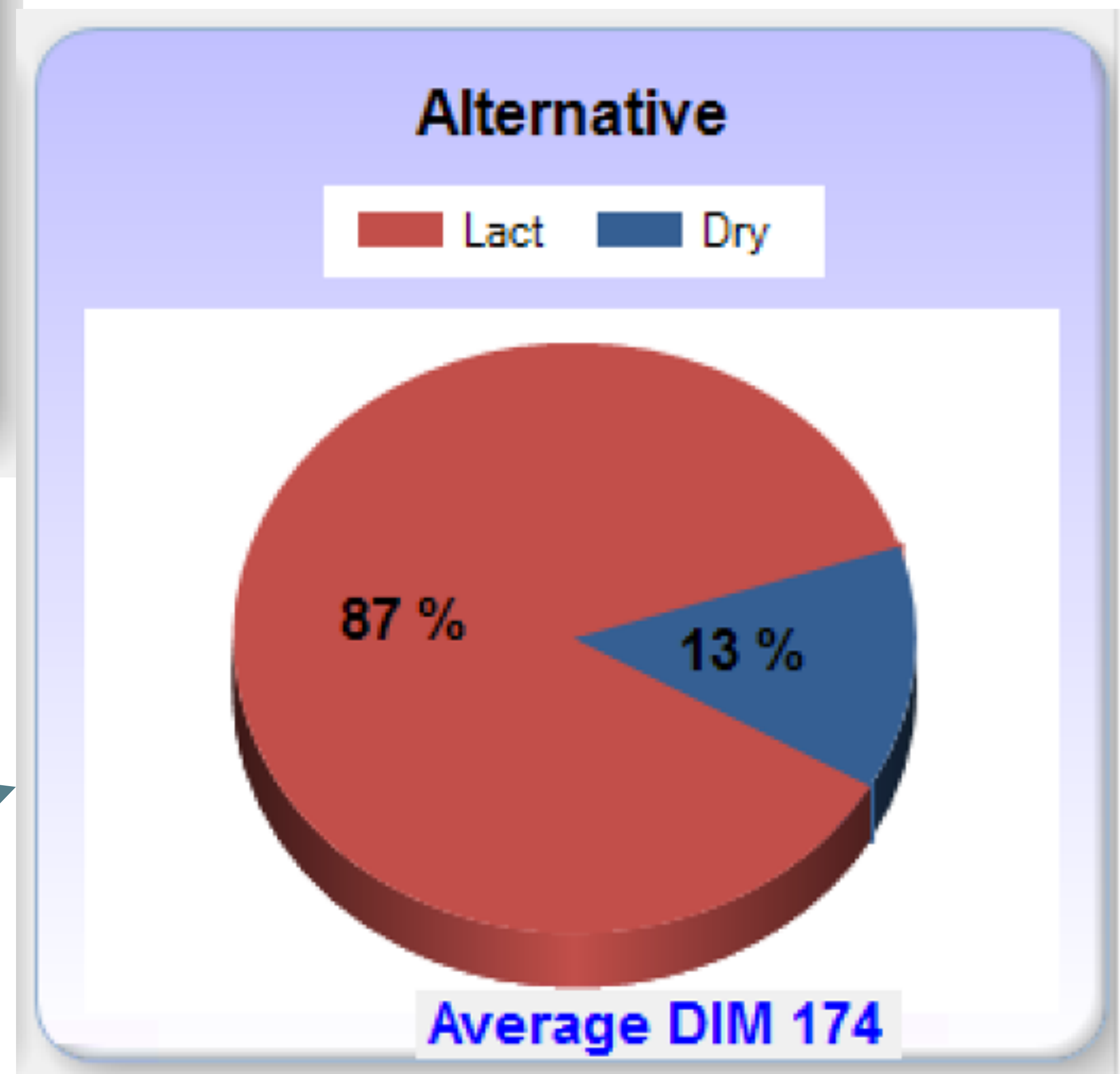
10% more pregnant cows



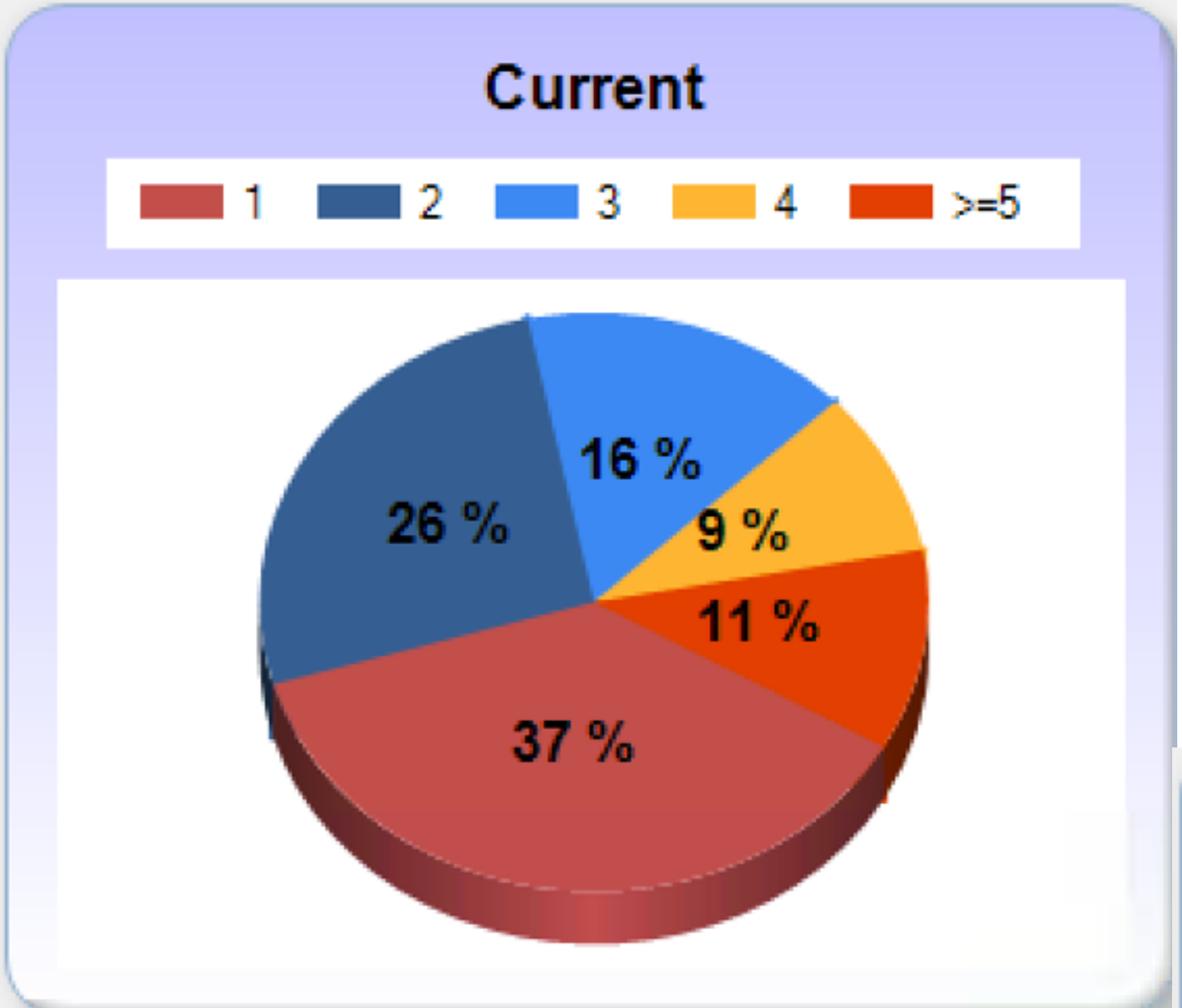
Herd Structure: Lactating and Dry cows

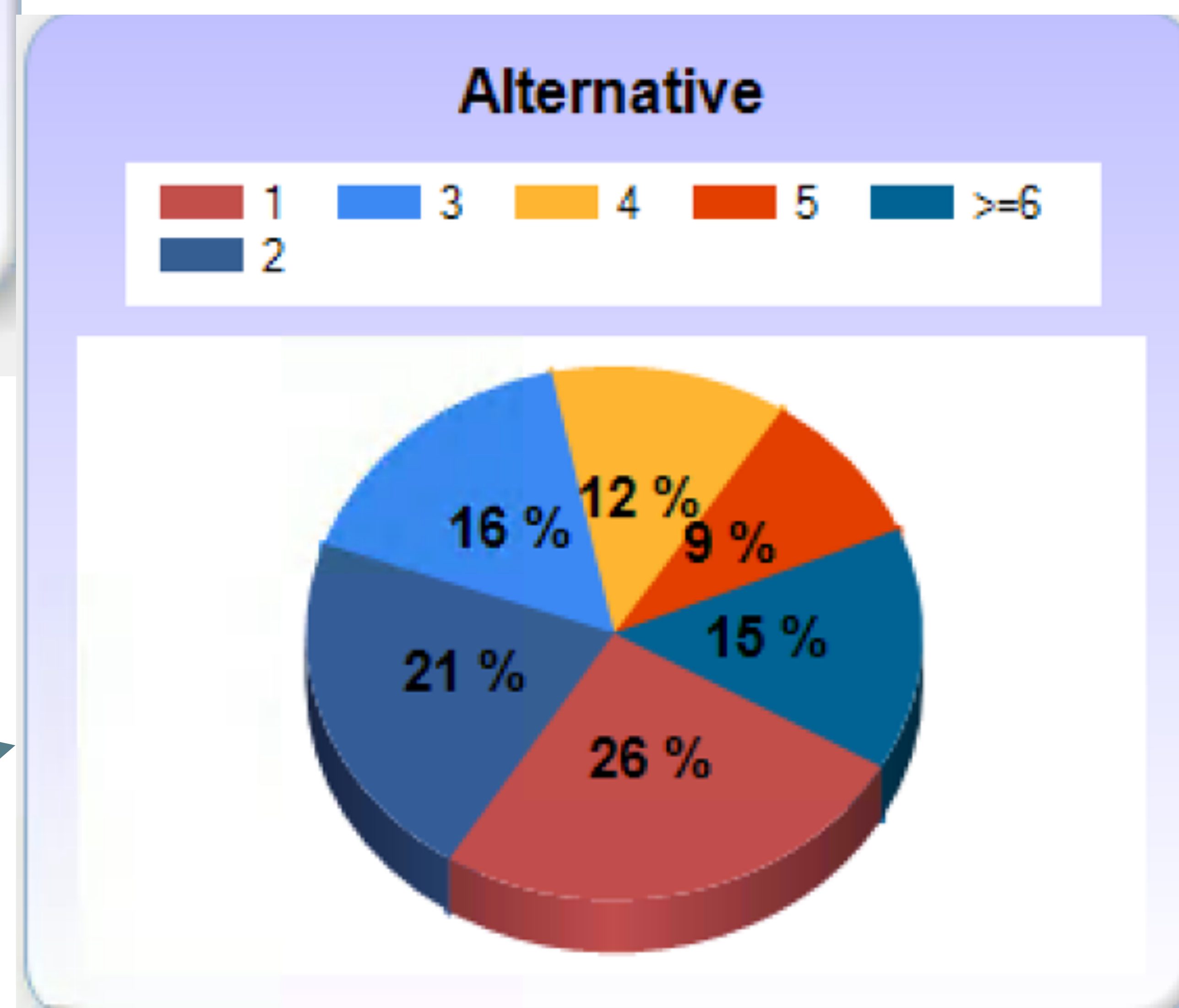


2% less lactating cows



Herd Structure: Lactations





11% less
1st lactation cows

Cows Leaving the Herd

Item	Current	Alternative	Diff
Total Culling (%)	40.3	25.9	-14.4
Non-Reproductive Culling (%)	23.8	18.8	-5
Mortality (%)	3.9	2.9	-1
Reproductive Culling (%)	12.6	4.1	-8.5

⇩ **5.0% Non-reproductive culling**

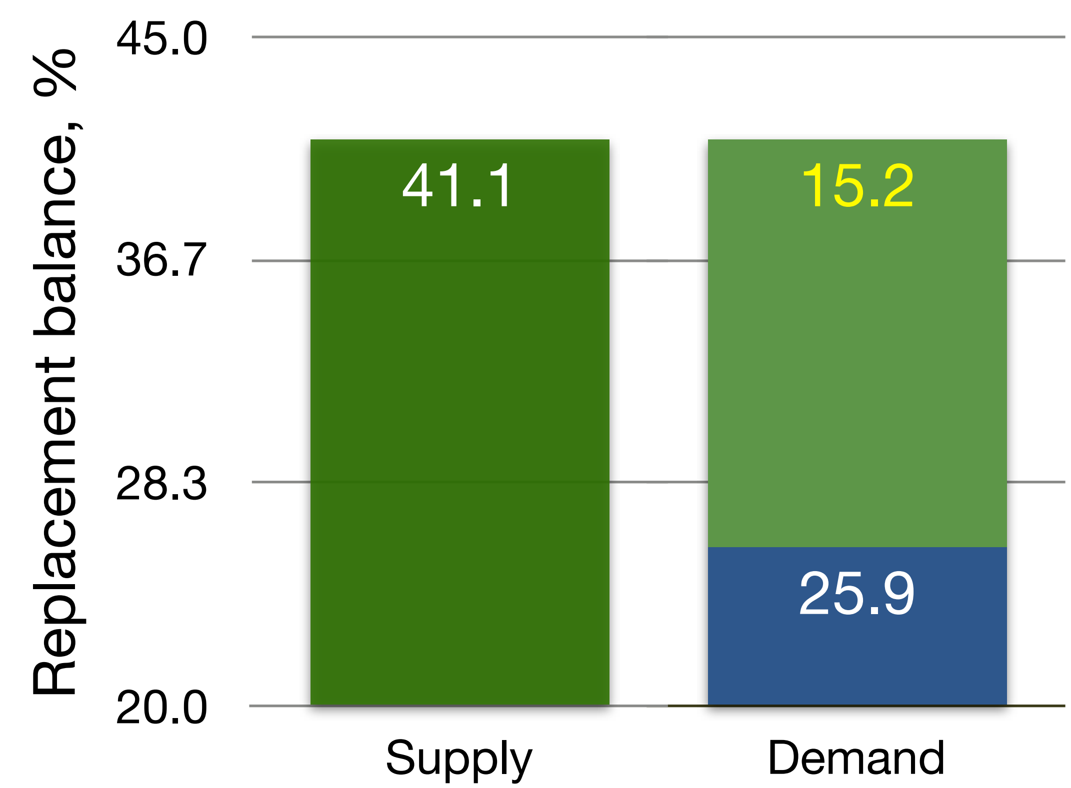
⇩ **1.0% Mortality**

⇩ **8.5% Reproductive culling**

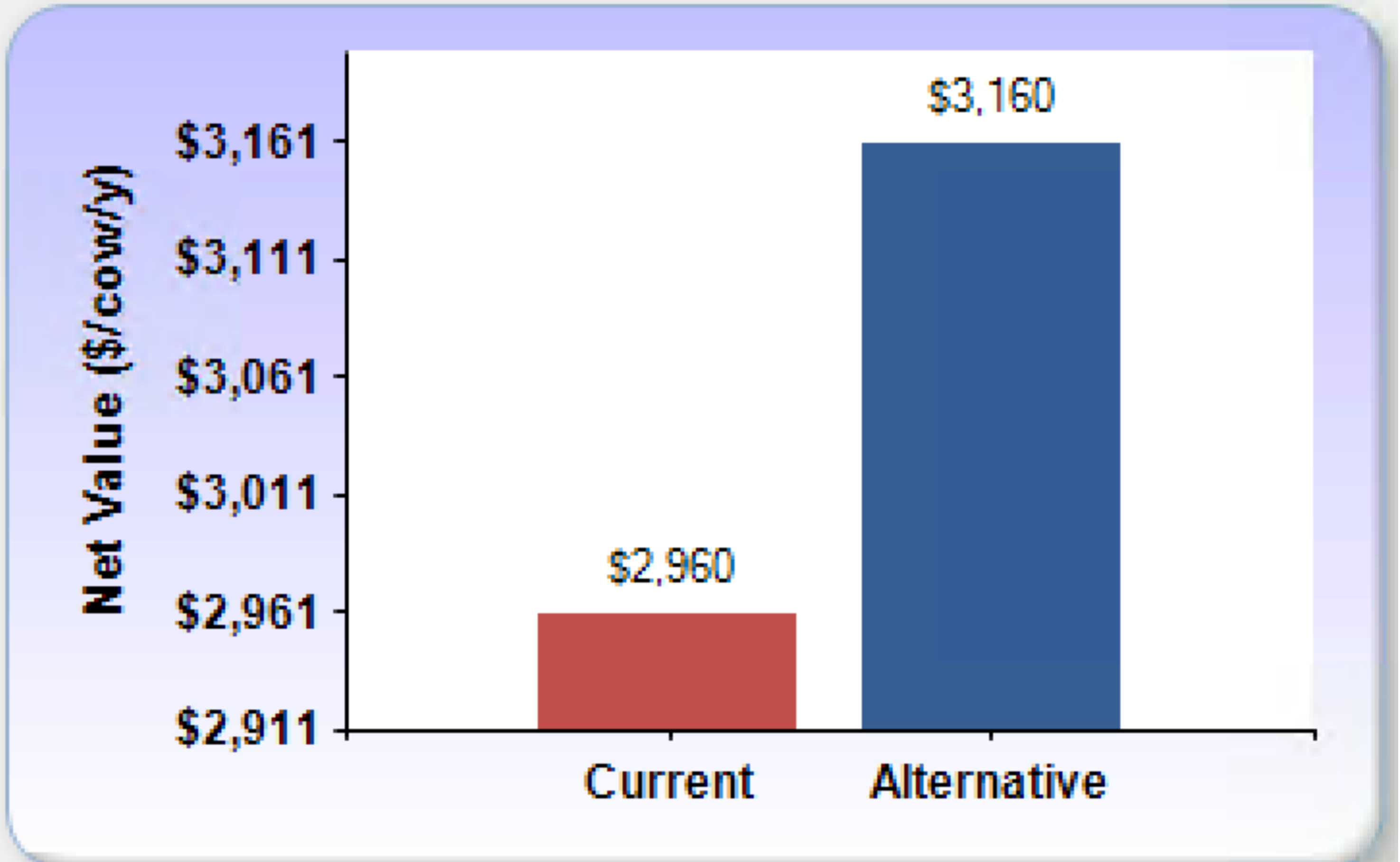
Heifer Supply and Demand

Item	Current	Alternative
Heifer Supply (% of herd/year)	42.1	41.1
Heifer Demand (% of herd/ye...	40.4	25.9
Heifer Balance (% of herd/year)	1.7	15.2

⇧ **13.5% EXTRA heifer available**



Economic Results



Profit made by switching to the Alternative program

$/herd/year	$188,000
$/cow/year	$200.0

Contribution to Net Value

Item	Current	Alternative	Diff
Total Net Value ($/cow/y)	2,960.0	3,160.0	200.0
IOFC ($/cow/y)	3,132.6	3,202.8	70.2
Replacement Cost ($/cow/y)	-243.4	-192.4	51.0
Reproductive Cost ($/cow/y)	-79.6	-46.0	33.6
Calf Value ($/cow/y)	150.4	195.6	45.2

What was the <u>single largest</u> economic parameter improved?

A. IOFC

B. Replacement cost

C. Reproductive cost

D. Calf value

Conclusions

Decision support available

- UW-CU Repro$ Tool
- Open and free

Analysis are farm and market specific

- Farm and market data are required
- Minimum proficiency in dairy reproduction

Case study in Wisconsin

- Improving efficiency of TAI programs and limiting the use of ED to only remaining cows improved substantially the herd reproductive efficiency (~**10% 21-d PR**) and the herd net return (~**$200/cow per yr**)

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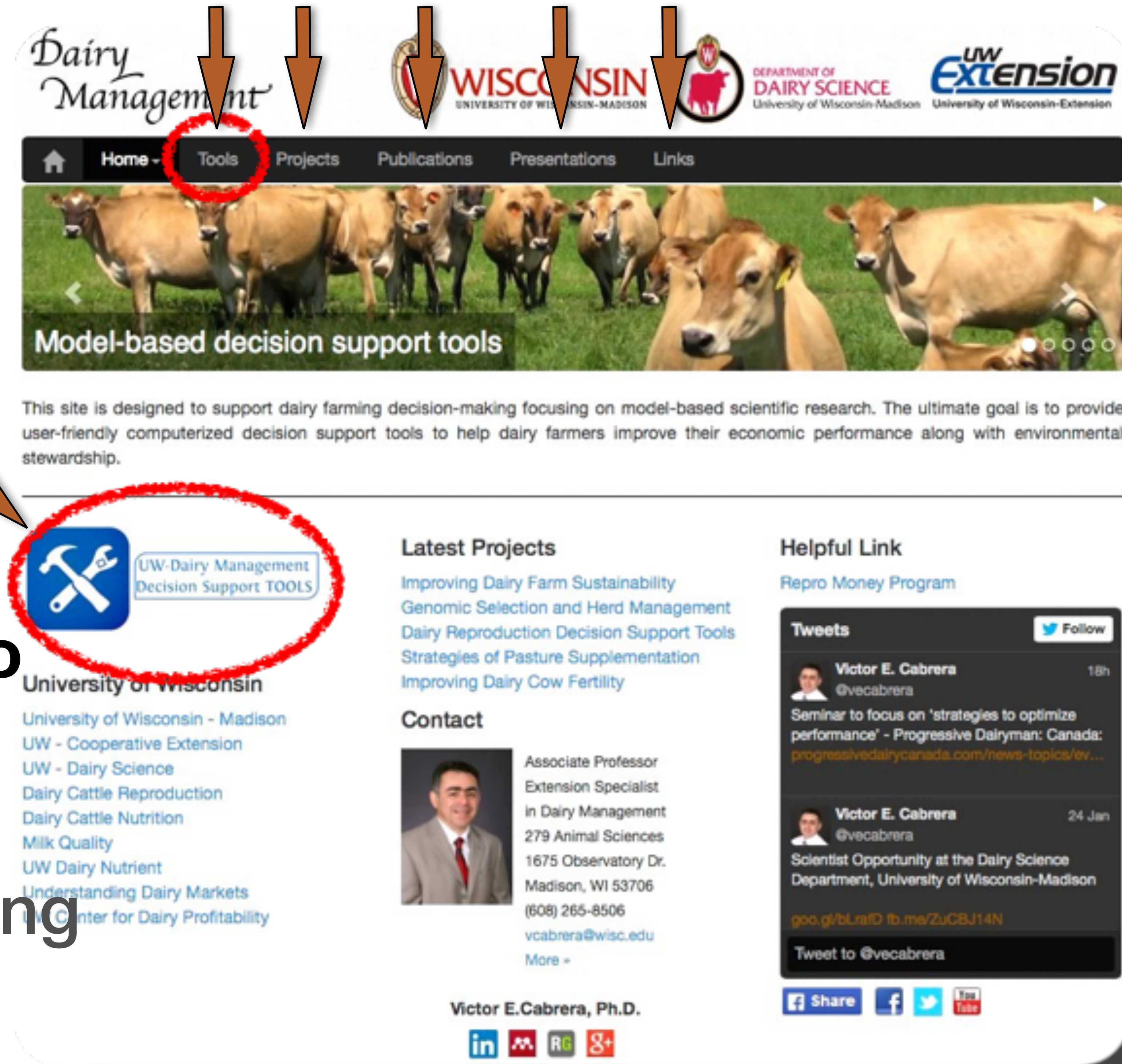
The largest selection of dairy farm decision support tools

Large information

- Projects
- Publications
- Presentations
- Links



Heart of DairyMGT.info

Tools

to Support

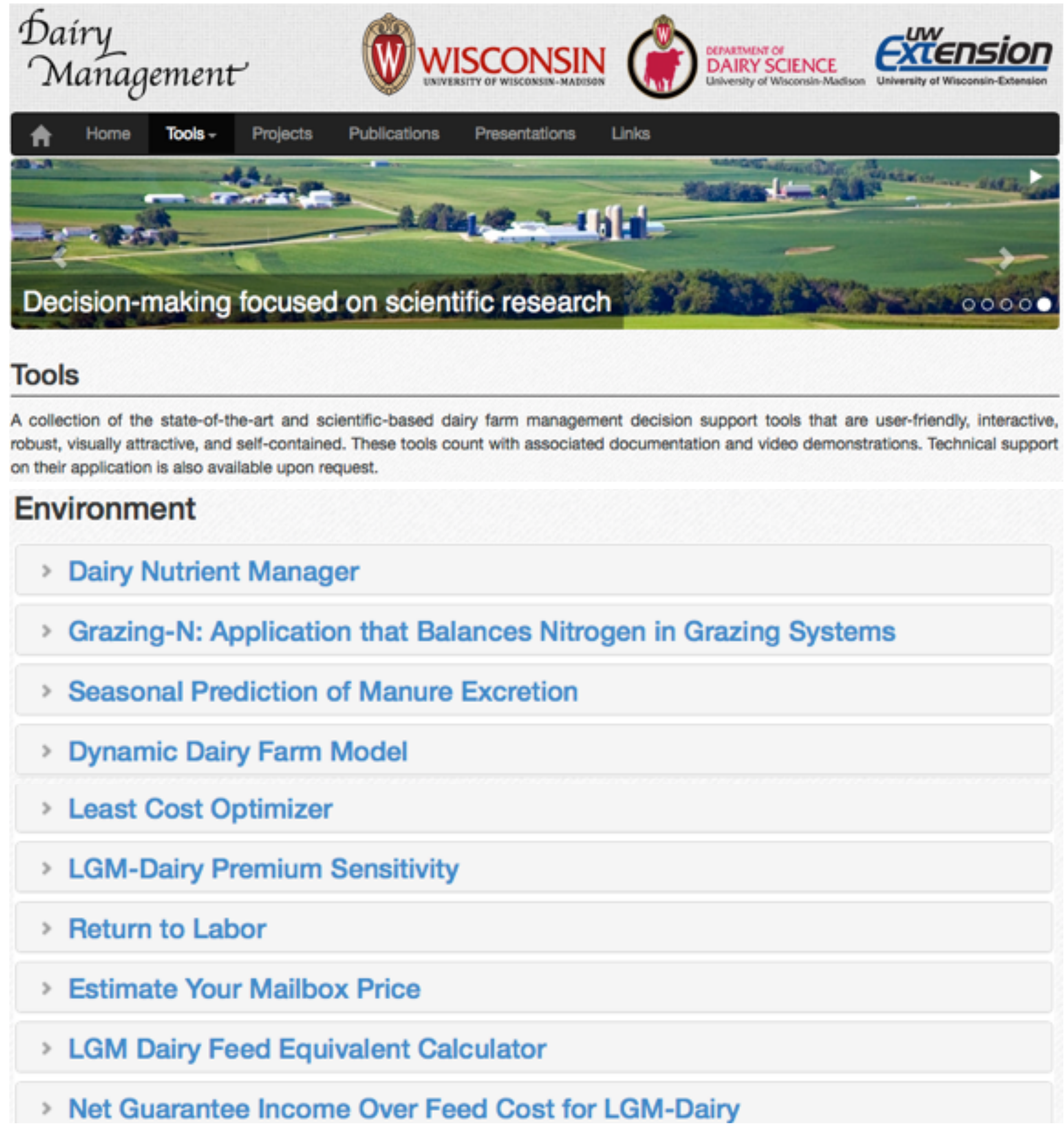
Decision-Making

DairyMGT.info: Tools

>40 Decision Support Tools

Many areas of dairy farm management

- Feed
- Replacements
- Reproduction
- Production
- Replacement
- Environment
- Finances
- Genetics
- Health
- …



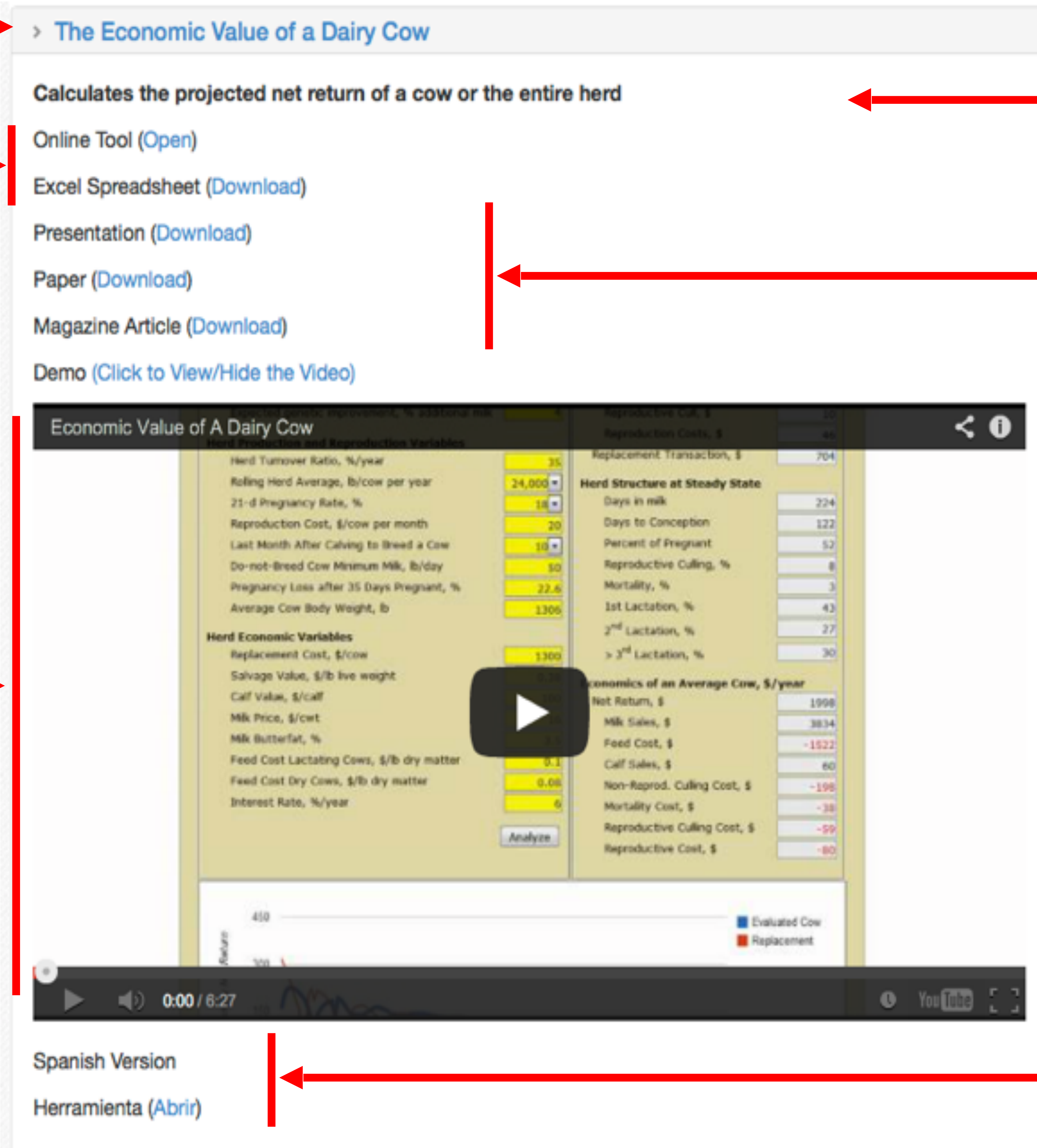
Anatomy of tools

How to explore and use them

Title

Link to the tool

Video Demo



Brief description

Supporting Documents

Other languages

The value of a cow and reproduction

Important relationship for decision-making

Opportunities for cow-level reproductive management. E.g.,

High value cow → **more inseminations**
Low value cow → **lower quality semen**

Associated economic values could be used to enhance the value of reproductive programs. E.g.,

The value of a new pregnancy
The cost of a pregnancy loss
The cost of an additional day open

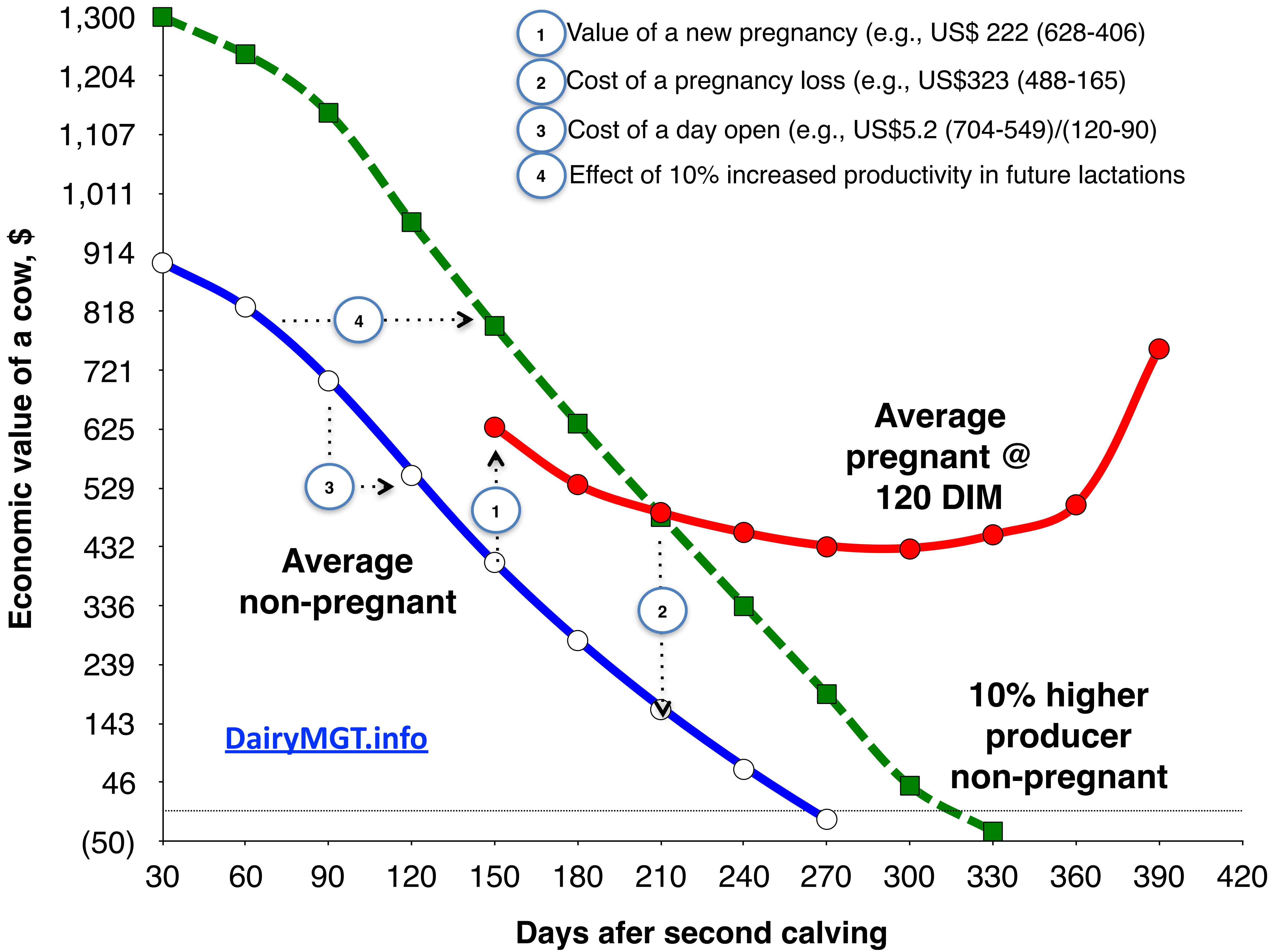
The value of a cow

Long-term expected net return of a cow compared with that of an imminent replacement

Critical factors

- **Cow's productivity level in relation to herd mates**
- **Replacement's genetic improvement in relation to herd mates**
- **Cow's current conditions**
  - **Lactation**
  - **Days after calving**
  - **Pregnancy status**

The value of a cow



The Economic Value of a Dairy Cow

INPUTS - Edit Values in This Block	
Evaluated Cow Variables	
Current Lactation	2
Current Months after Calving	8
Current Months in Pregnancy	6
Expected Milk Production Rest of Lactation, %	100
Expected Milk Production Next Lactations, %	100
Replacement Cow Variable	
Expected genetic improvement, % additional milk	0
Herd Production and Reproduction Variables	
Herd Turnover Ratio, %/year	35
Rolling Herd Average, kg/cow per year	10890
21-d Pregnancy Rate, %	18
Reproduction Cost, $/cow per month	20.00
Last Month After Calving to Breed a Cow	10
Do-not-Breed Cow Minimum Milk, kg/day	22.68
Pregnancy Loss after 35 Days Pregnant, %	22.6
Average Cow Body Weight, kg	592.39
Herd Economic Variables	
Replacement Cost, $/cow	1300.00
Salvage Value, $/kg live weight	0.84
Calf Value, $/calf	100.00
Milk Price, $/kg	0.35
Milk Butterfat, %	3.5
Feed Cost Lactating Cows, $/kg dry matter	0.22
Feed Cost Dry Cows, $/kg dry matter	0.18
Interest Rate, %/year	6

OUTPUTS - Interactive Results	
Value of the Cow, $	507
Compared Against a Replacement, $	
Milk Sales, $	-67
Feed Cost, $	-111
Calf Value, $	71
Non-reproductive Cull, $	-111
Mortality Cost, $	-21
Reproductive Cull, $	21
Reproduction Costs, $	20
Replacement Transaction, $	704
Herd Structure at Steady State	
Days in milk	224
Days to Conception	122
Percent of Pregnant	52
Reproductive Culling, %	8

Changes to $71 if **aborted**
So, a loss of **$436**

The tool Economic Value of a Dairy Cow can be used to calculate the cost of a pregnancy loss, value of a new pregnancy, or cost per day open

http://DairyMGT.info/Tools

How the value of a cow can be used for reproductive decision-making?

A. Breeding opportunities

B. Semen quality selection

C. Calculate the cost of a pregnancy loss

D. All the above

The value of using sexed semen

Producers using it in heifers

Important considerations

- Ratio of females increases greatly
  - E.g., 47% (conventional) to 89% (sexed)
- Conception rate decreases
  - ~ 20% (DeJarnette et al, 2009)
- Sexed semen has a premium cost
  - Double or triple conventional
- Less proportion of male calves reduces the cost of dystocia

Economic considerations of sexed semen

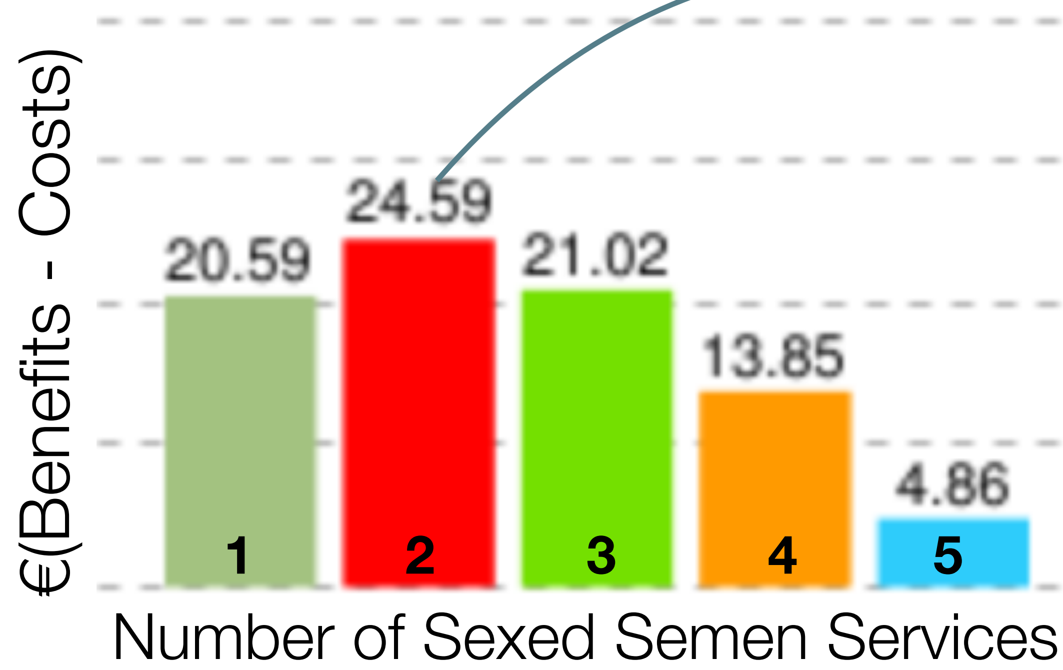
Economic gains of using sexed semen

- More production of more valuable female calves
- Reduced cost of treatment of dystocia

Economic costs of using sexed semen

- More breedings to same level of pregnancy
- Longer raising time for heifers becoming pregnant later
- More culling for reproductive failure
- Extra cost of sexed semen

An example of sexed semen analysis



Best economic value of using sexed semen occurs when it is used in 1st and 2nd heifer breedings

Expected Females (%)

Conventional	47
Sexed	89
Sexed Semen (% of Conventional CR)	80
Conventional Semen Average CR (%)	60

Semen Cost (&)

Conventional	15
Sexed	25
Female Calf ($)	250
Male Calf ($)	50
Raising Cost ($/d)	2
Salvage Value ($/cwt)	81.26
Dystocia Cost($/heifer)	50
20-mo Pregnant Heifer($)	1000

http://DairyMGT.info/Tools

When sexed semen use makes sense economically?

A. Always

B. When the sexed semen cost is low

C. When the CR is high

D. When benefits less costs are positive

Thanks

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Dairy Management

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