



Improving Reproductive and Economic Performance using Serum and Milk Based Pregnancy Tests

V.E. Cabrera

University of Wisconsin-Madison

Chemical pregnancy tests

Commercial available assays



Blood (serum or plasma)
ELISA for PSP-B



Blood (serum or plasma)
ELISA for PAG



Milk
ELISA for PAG
Blood (serum or plasma)
ELISA for PAG

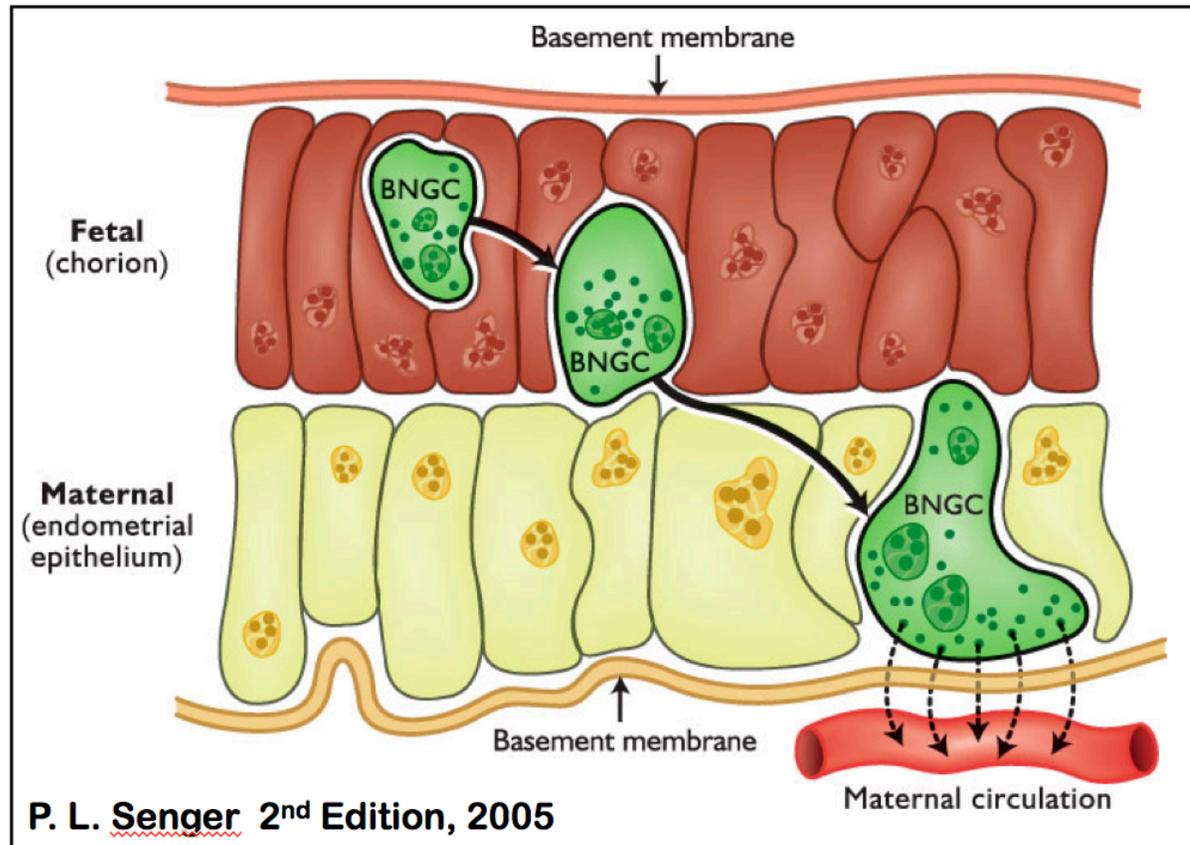
ELISA = Enzyme-Linked Immunosorbent Assay

PSP-B = Pregnancy Specific Protein B (*Sasser et al., 1998*)

PAG = Pregnancy Associated Glycoproteins (*Green et al., 2005*)

Chemical pregnancy tests

How they work?



Courtesy of P. M. Fricke

BNGC = Binucleate giant cell

Pregnancy tests

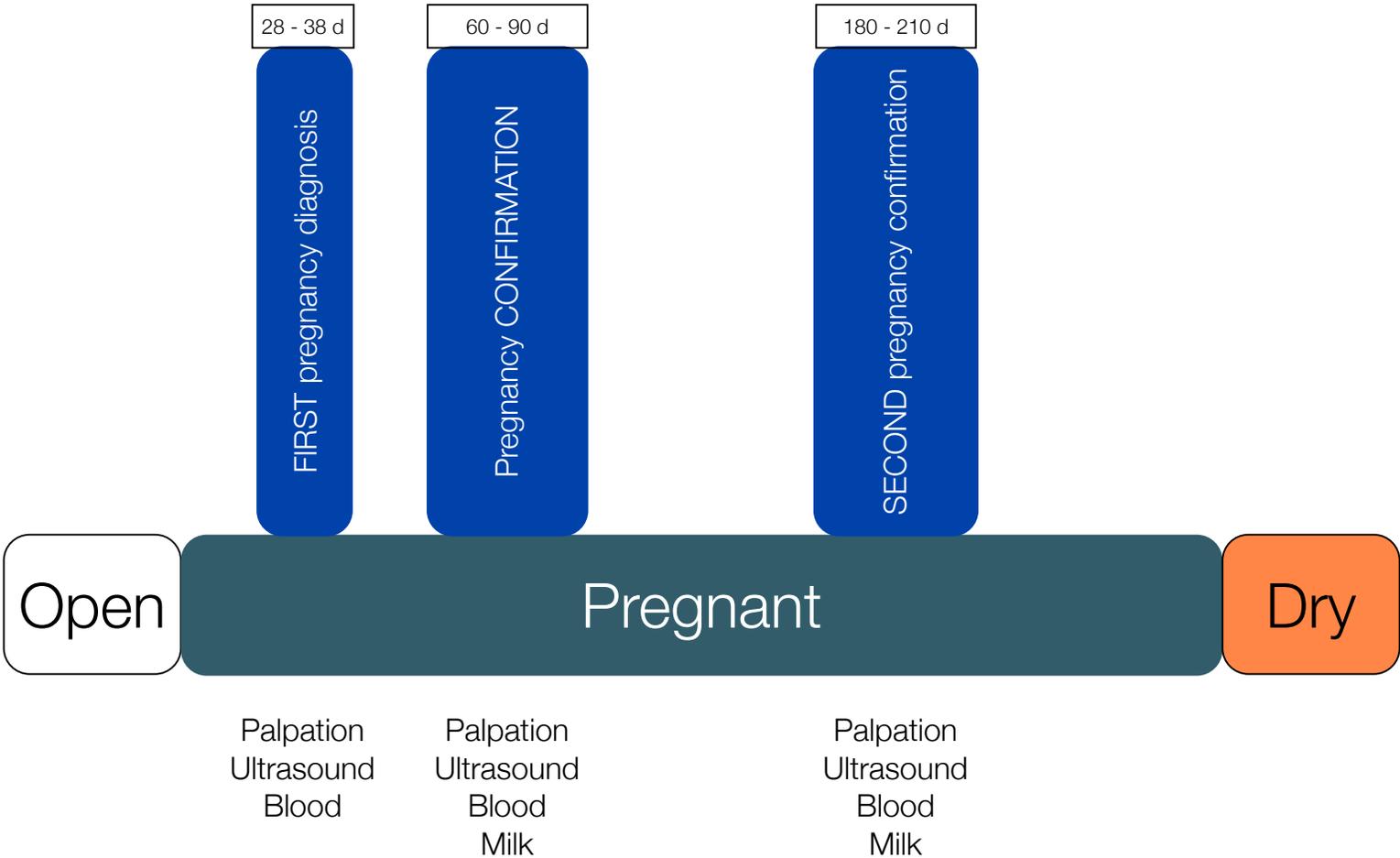
A comparison

	Earliest post breeding d	Gender	Age/Size	Heifers	Less handling	Abortion risks	More available tests
Palpation	32		✓	✓			
Ultrasound	28	✓	✓	✓		✓	
bioPRYN	28			✓		✓	✓
DG29	29			✓		✓	✓
IDDEXX blood	28			✓		✓	✓
IDDEXX milk	35				✓	✓	✓

Chemical tests to be performed at least 60 d after calving

Pregnancy diagnosis

The timeline

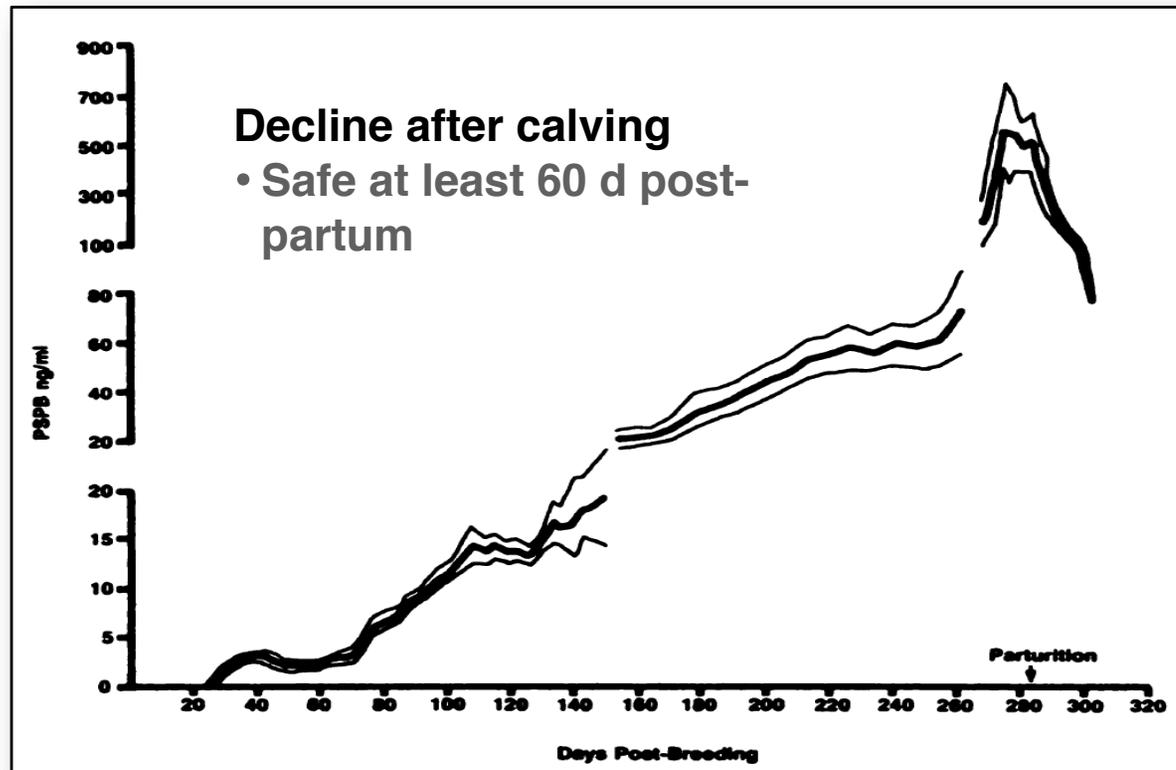


Chemical pregnancy tests facts

Earliest post-calving

Earliest post-calving

- Carryover concentrations
 - PSP-B
 - PAG



Sasser et al., 1986

Chemical pregnancy tests facts

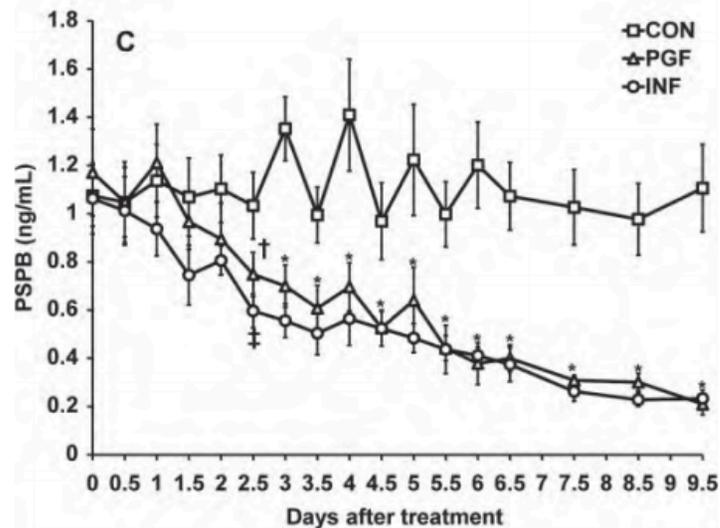
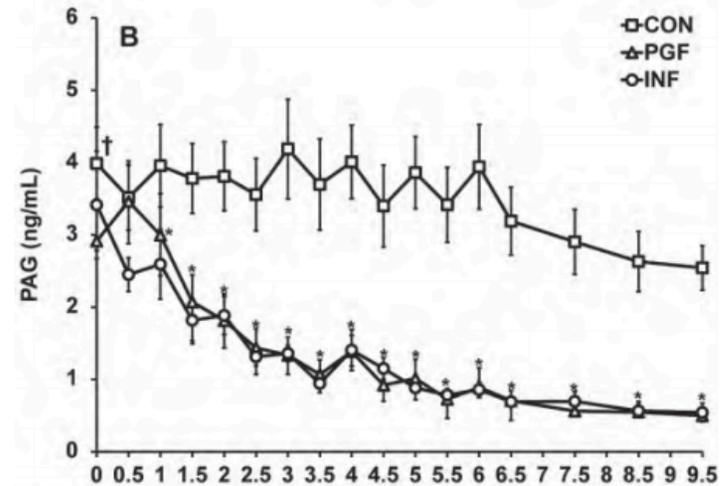
Earliest post-abortion

Earliest post-abortion

- Carryover concentrations
 - PAG
 - PSP-B

Decline below detectable thresholds

- PAG and PSP-B concentrations were similar to non-pregnant cows at 9.5 d after treatment



Giordano et al., 2012

PGF=25 mg of PGF2a (36 h stop heart beat)

INF=Intrauterine infusion of hypertonic saline (0.3 h stop heart beat)

Chemical pregnancy tests facts

Accuracy

Sensitivity: True pregnant

- Actual pregnant cow with positive ELISA

Blood				Milk
27 d PAG	28 d PSP-B	30 d PSP-B	35 d PSP-B	> 60 d PAG
95.4%	93.9%	96.0%	97.2%	99.2
<i>Silva et al., 2007</i>	<i>Romano and Larson, 2010</i>			<i>LeBlanc, 2013</i>

Sensitivity: False non-pregnant

- Induced abortion!

Chemical pregnancy tests facts

Accuracy

Specificity: True non-pregnant

- Actual non-pregnant cow with negative ELISA

Blood				Milk
27 d PAG	28 d PSP-B	30 d PSP-B	35 PSP-B	> 60 d PAG
94.2%	95.5%	93.9%	93.6%	95.5%
<i>Silva et al., 2007</i>	<i>Romano and Larson, 2010</i>			<i>LeBlanc, 2013</i>

Specificity: False pregnant

- Lost time to re-enrollment

Chemical pregnancy tests facts

Accuracy

Questionable diagnosis

- Not conclusive answer

Blood		Milk
Lower	Higher	> 60 d PAG
3.3%	8.5%	3.8%
<i>Giordano et al., 2013</i>		<i>LeBlanc, 2013</i>

Questionable diagnosis

- Re-check required
- Lost time to re-enrollment

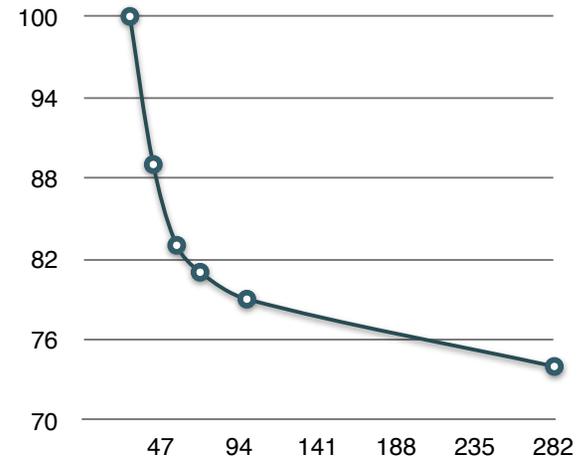
Chemical pregnancy tests facts

Early embryonic loss

Pregnancy loss

- More in early stages

24-28 d	28-42 d	42-56d	56-70 d
-Pregnancy losses per day-			
0.9%	0.78%	0.42%	0.14%
<i>Giordano et al., 2013</i>	<i>Vasconcelos et al., 1997</i>		



Vasconcelos et al., 1997

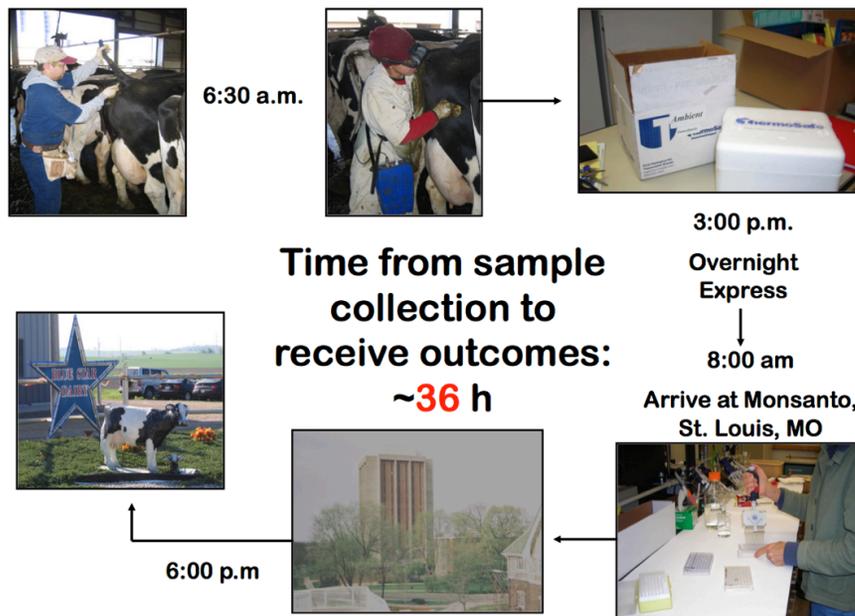
Pregnancy loss

- Similar to lower specificity
- Appear as false pregnant
- Lost time to re-enrollment

Chemical pregnancy tests facts

Lab test time cycle

Blood PAG tests (Silva et al., 2007)



Courtesy of P. M. Fricke

Blood PAG tests (Giordano et al., 2013)

- Assumed 4 effective days from sample collection to next reproductive action

Milk PAG AgSource Easy Preg-Check

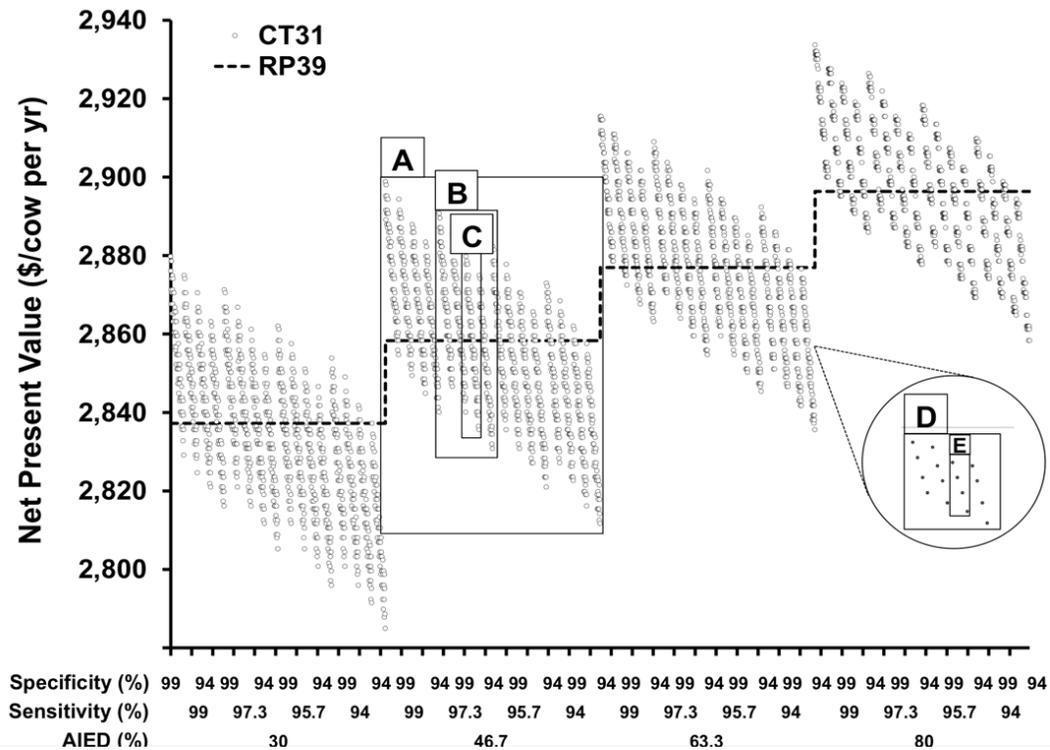
- Results within 2 d from sample arrival at laboratory



J. Dairy Sci. 96:949–961
<http://dx.doi.org/10.3168/jds.2012-5704>
 © American Dairy Science Association®, 2013.

Economics of resynchronization strategies including chemical tests to identify nonpregnant cows

J. O. Giordano, P. M. Fricke, and V. E. Cabrera¹
 Department of Dairy Science, University of Wisconsin, Madison 53706



UW-DairyRepro\$Plus

A decision support tool



UW-DairyRepro\$ Plus
Victor E. Cabrera & Julio O. Giordano
Department of Dairy Science



UW Extension
University of Wisconsin-Extension

Farm Name: _____ Location: _____

1. Herd Parameters

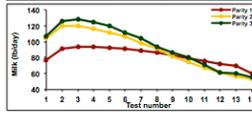
Lactating Cows, #	300
Parity 1	175
Parity 2	125
Parity 3	200
Body Weight, lb/cow	
Parity 1	1,350
Parity 2	1,400
Parity 3	1,450
Involuntary Culling, %/yr	20.0%
Mortality, %/yr	8.0%
Stillbirth, %/yr	8.0%

2. Economic Parameters

Milk Price, \$/cwt	15.00
Cost Feed Lactating, \$/lb DM	0.10
Dry Period Fixed Cost, \$/d	2.20
Female Calf Value, \$	125
Male Calf Value, \$	50
Heifer Replacement Value, \$	1,250
Cow Salvage Value, \$	650
Labor Cost for Injection, \$/hr	15.00
Heat Detection Cost, \$/hr	15.00
AI Cost, \$/cow	15.00
Interest Rate, %/yr	5.0%

3. Lactation Curves (lb/cow/yr)

Test	Parity 1	Parity 2	Parity 3
1	77	105	107
2	91	120	128
3	94	120	128
4	94	116	125
5	93	112	120
6	91	107	112
7	89	98	104
8	87	91	94
9	83	82	86
10	79	75	81
11	75	68	71
12	72	61	61
13	70	57	60
14	60	53	55



4. Reproductive Program

	Current	Start day	Alternative	Start day
1 st Service postpartum	Ovsynch	1	Presynch-Ovsynch-12	1
2 nd and subsequent services	Ovsynch	1	Ovsynch	1
Resynch before preg check	NO		YES	

5. Do you know total breeding costs (semen, hormones, and pregnancy diagnosis)?
If "Yes" check box:

6. Reproductive Program Parameters

	Current	Alternative
Voluntary Waiting Period, d	60	72
Estrus Cycle Duration, d	22	330
Maximum DIM for Breeding, d	60	72
DIM to 1 st TAI, d	49	35
Interbreeding Interval, d	0%	0%
Heat Bred Before 1 st TAI, %	0%	0%
CR Heat Bred Before 1 st TAI, %	0%	0%
Heat Bred After 1 st TAI, %	0%	0%
CR Heat Bred After 1 st TAI, %	0%	0%
CR 1 st Service TAI, %	33%	42%
CR 2 nd + Services TAI, %	30%	30%
Cost of 1 st Service TAI, \$		
Cost of 2 nd + Services TAI, \$		
Cost of Heat Breeding, \$		
Cost resynch before preg check, \$		
Calving Interval, d	13.7	
Dry Period, d	60	

7. Heat Detection Labor Cost

	Current	Alternative
Laborers herd	1	2.5
herd	2.5	2.5

8. Activity Monitors for Heat Detection

	Current	Alternative
System Cost, \$	7,000	0
Number of monitors	250	0
Cost per monitor, \$	100	0
Maintenance, \$/yr	250	0
Life expectancy, yr	10	0
Salvage value, %	25%	0%

9. Pregnancy Diagnosis Cost

	Current	Alternative
Palpation, \$/hr	105	
Ultrasound, \$/hr		135
Blood Test, \$/cow		

10. Labor Required for Injections and Labor Required for Pregnancy Diagnosis

		Mon	Tue	Wed	Thu	Fri	Sat	Sun
Current	Injections herd	2	1	1				
	# Cows	50	30					
Alternative	Injections herd	2	2	1				
	# Cows	75	60					
Pregnancy Diagnosis	herd	1						
	# Cows	30						

11. Hormones Cost

	Vial, \$	# Doses
GnRH	20	10
PGF	25	10
PGI		
PGI Inset		
tCG		

Parity Group to ANALYZE:



UW-DairyRepro\$ Plus
Victor E. Cabrera & Julio O. Giordano
Department of Dairy Science



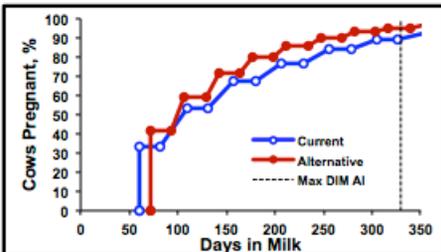
UW Extension
University of Wisconsin-Extension

Reproductive Programs Summary

	Current	Alternative
1 st Service Postpartum	Ovsynch	Presynch-Ovsynch-12
2 nd and Following Services	Ovsynch	Ovsynch
Voluntary Waiting Period, d	60	72
Maximum DIM for Breeding, d	60	72
DIM 1st TAI, d	49	35
Interbreeding Interval, d	0%	0%
Heat Bred Before 1 st TAI, %	0%	0%
CR Heat Bred Before 1 st TAI, %	0%	0%
Heat Bred After 1 st TAI, %	0%	0%
CR Heat Bred After 1 st TAI, %	0%	0%
CR 1 st Service TAI, %	33%	42%
CR 2 nd + Services TAI, %	30%	30%
Cost 1 st Service Breeding, \$	26.7	34.5
Cost Resynch Breedings, \$	26.7	28.5
Cost Heat Breedings, \$	18.5	19.5
Pregnancy Diagnosis Method	Palpation	Ultrasound
Pregnancy Diagnosis Cost, \$	3.5	4.5

Activity Monitors for Heat Detection

System + monitors cost, \$	32000	0
Salvage value, \$	8000	0
Value after depreciation, \$	24000	0
Total cost per d of period, \$/d	6.58	0.00
Maintenance, \$/d	0.68	0.00
Cost Per Cow/d, \$	0.017	0.000



Cows Pregnant, % vs Days in Milk

Expected change by switching to the ALTERNATIVE program

21d-PR, %	8
21d-SR, %	18
Avg. CR, %	5
DO, d	-7
PCI, mo	-0.7

Net Present Value (\$/cow/day)

Current	\$6.14
Alternative	\$6.38

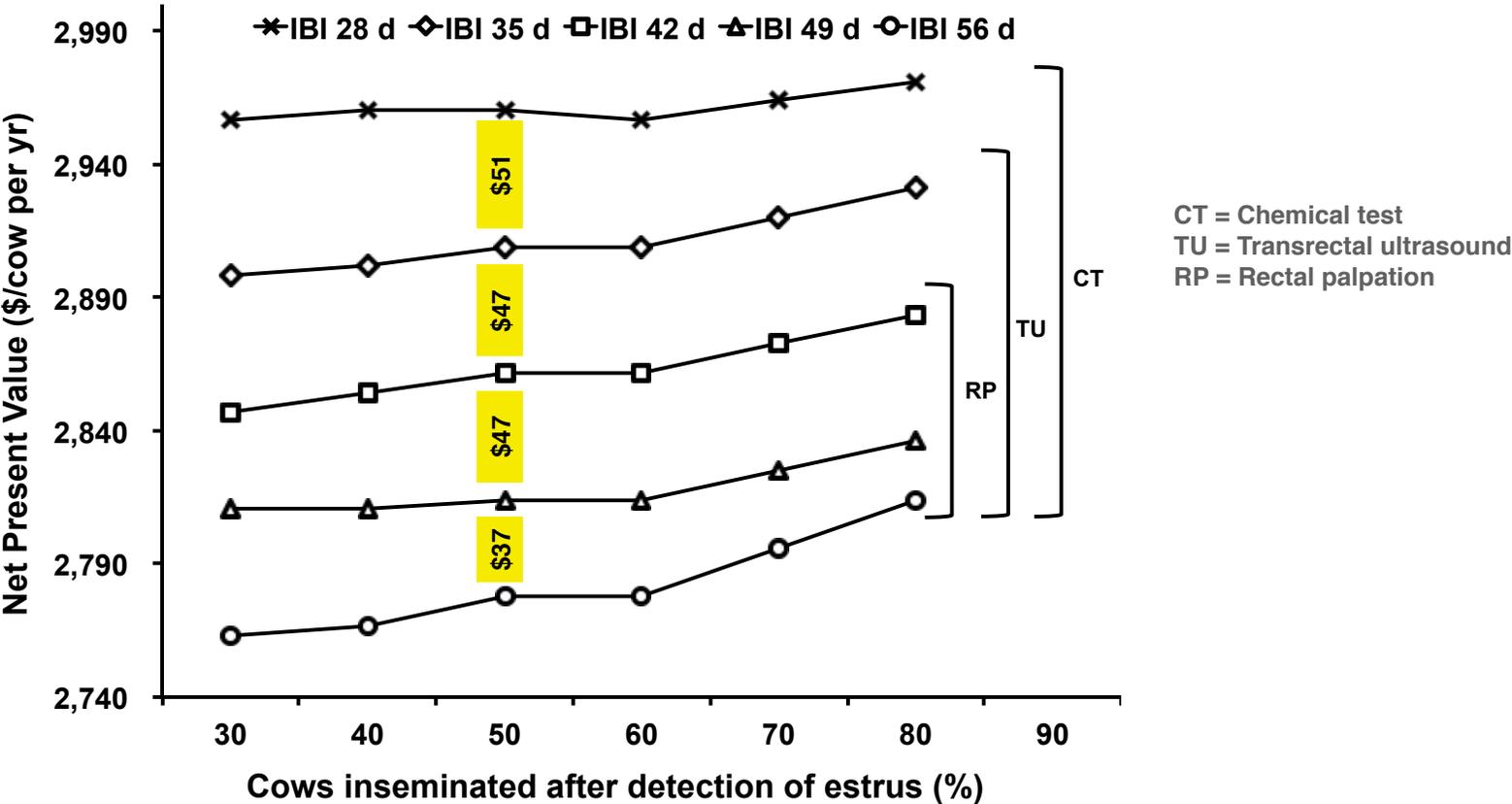
Profit (\$/herd/year) made by switching to the ALTERNATIVE program

↓

\$42,537

Experiment 1

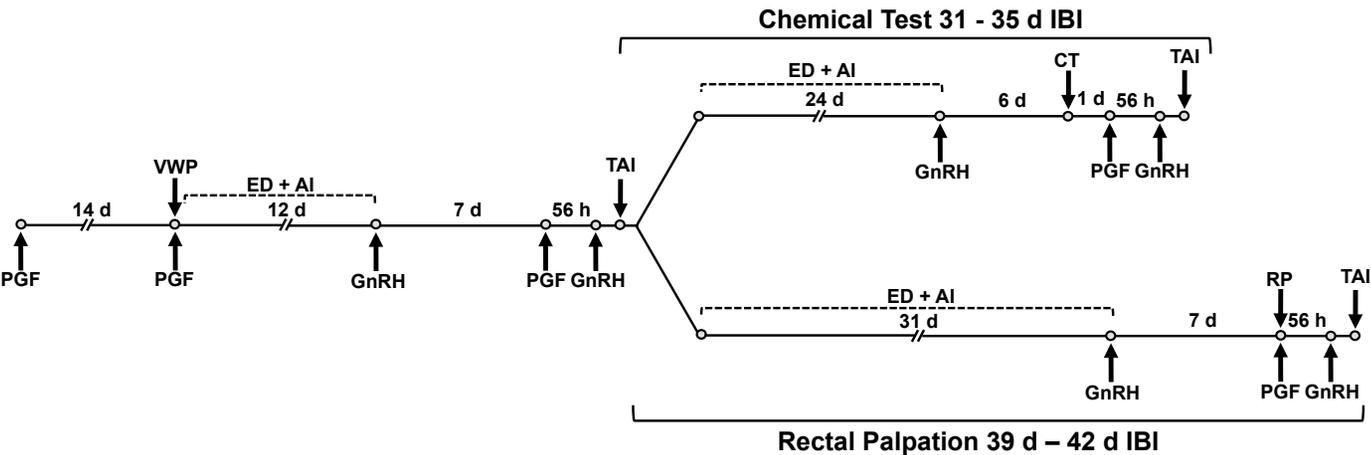
Effect of shorter interbreeding intervals (IBI)



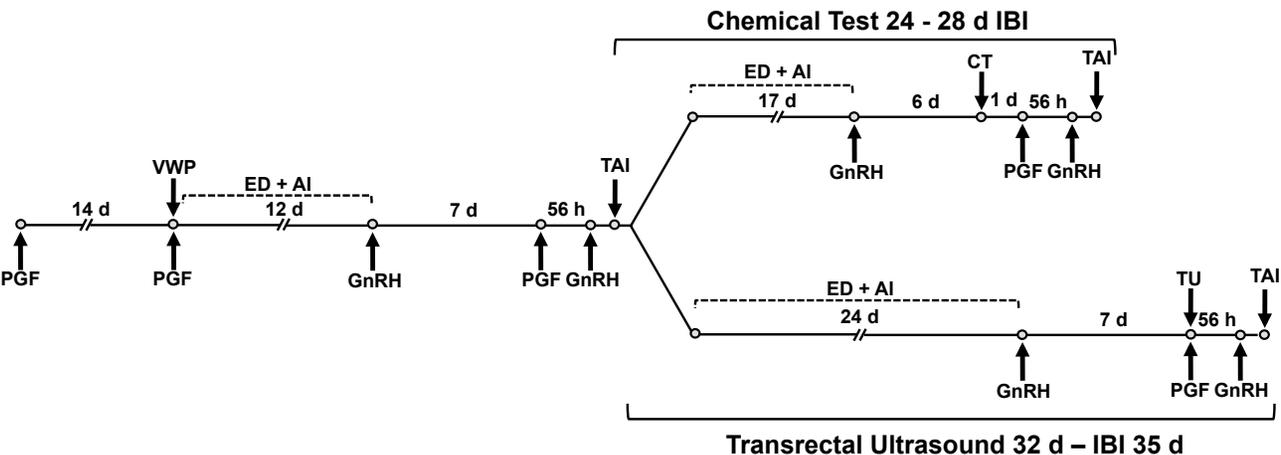
Experiment 2

Economic impact of using chemical tests for early pregnancy diagnosis

A

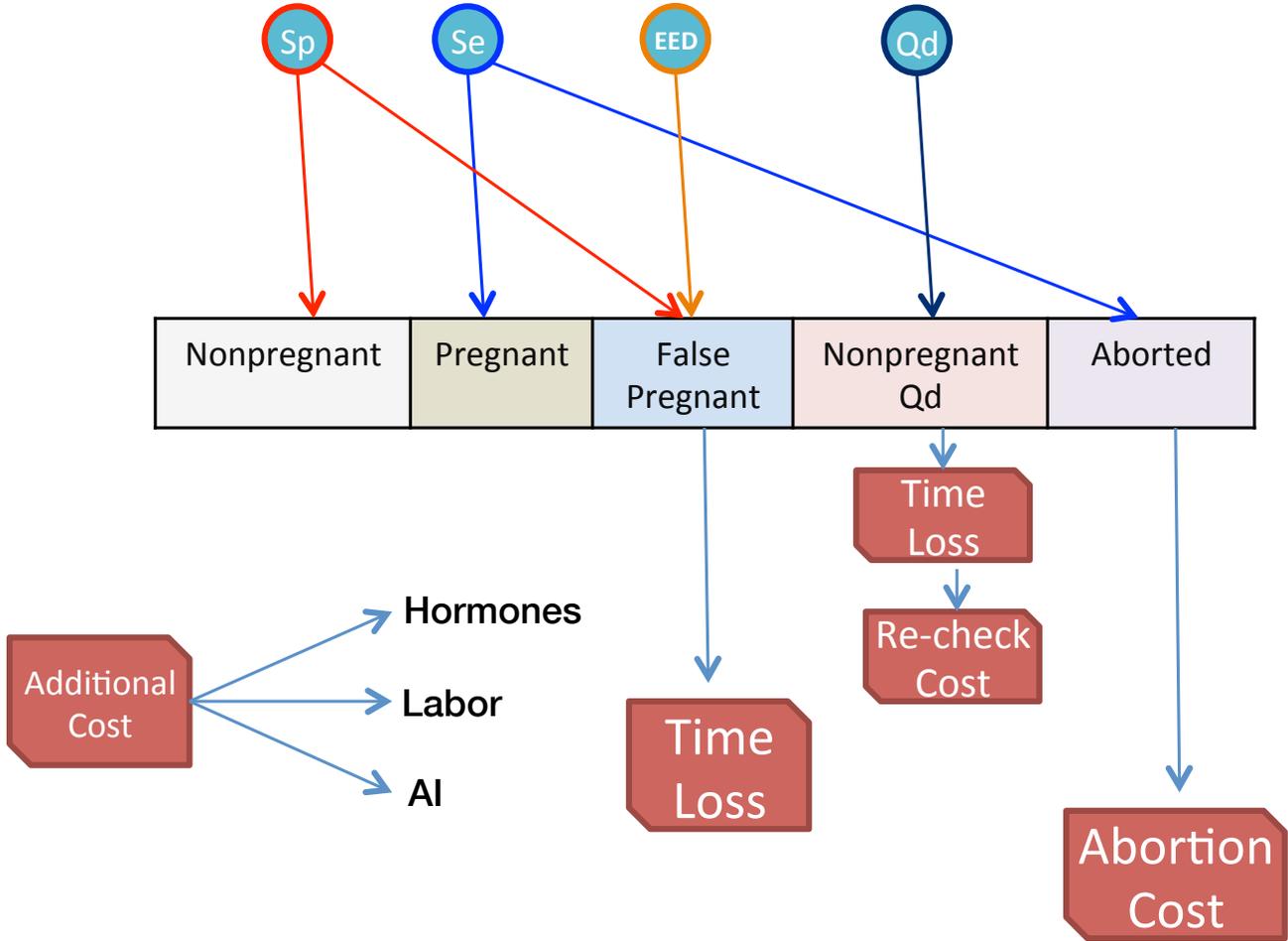


B



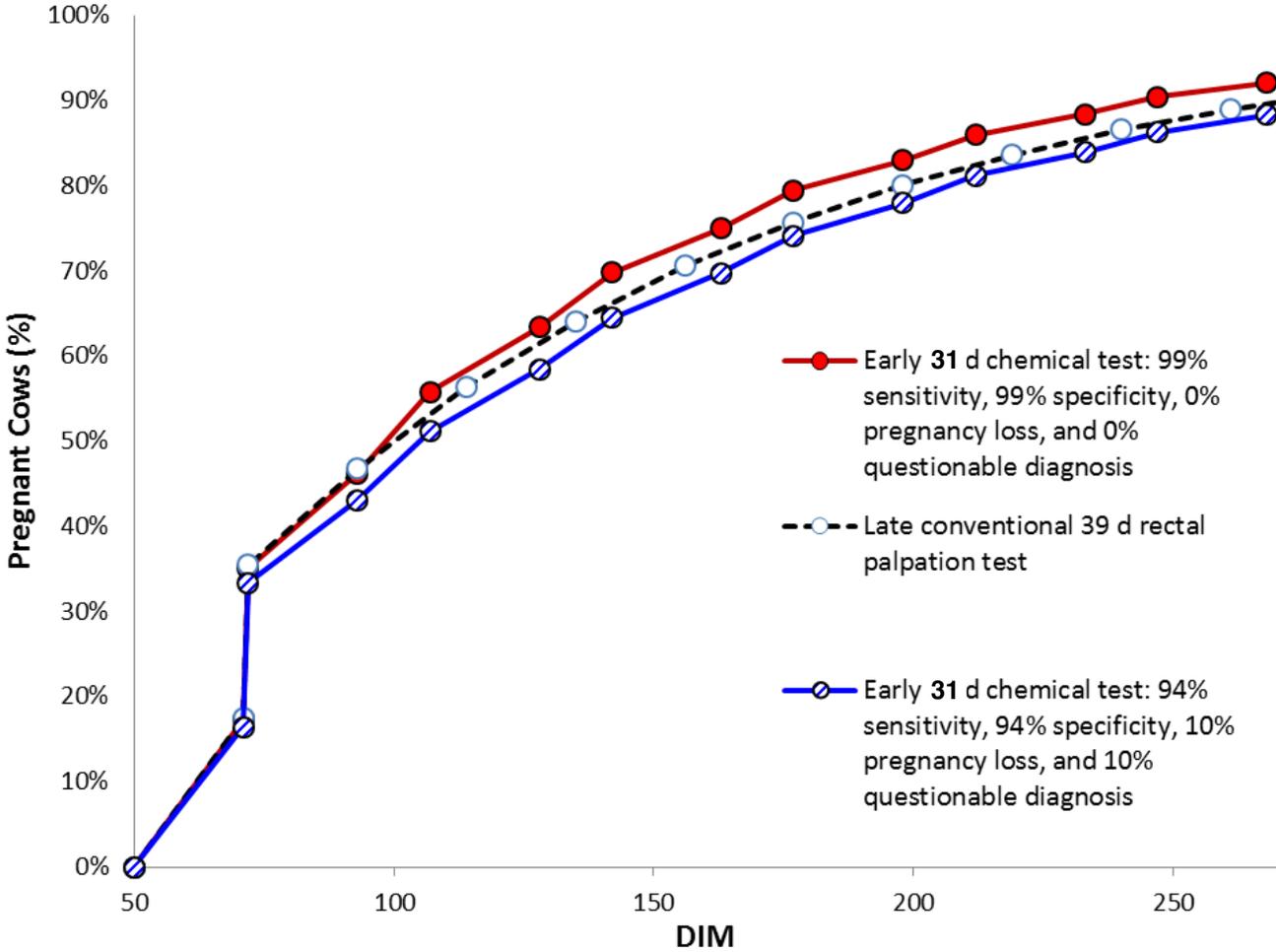
Experiment 2

Design



Experiment 2

Reproductive performance



Experiment 2

Economic performance, value of chemical test (CT)

			\$ per 1% or \$0.1	
	Base	Range	CT31 vs RP39	CT24 vs TU32
% Sensitivity	98/97	94-99	+5.3	+4.5
% Specificity	98/97	94-99	+3.1	+2.5
% Pregnancy loss	6/6.6	0-10	-3.1	-2.5
% Questionable	3.3/8.5	0-10	-0.4	-0.3
% Estrous detection	50	30-80	0.097	-0.220
\$ CT cost	2.4	0.5-5	-0.0175	-0.0192

Experiment 2

Economic performance, breakeven of chemical test (CT)

	Break even	
	CT31 vs RP39	CT24 vs TU32
% Sensitivity	96.4	94.9
% Specificity	95.1	93.2
% Pregnancy loss	8.9	10.5

Economic value of a dairy cow

A decision support tool



The Economic Value of a Dairy Cow

Victor E. Cabrera, Department of Dairy Science



Overview | **Single Cow Analysis** | Herd Analysis

INPUTS - Edit Values in This Block

Evaluated Cow Variables

Current Lactation	3
Current Months after Calving	5
Current Months in Pregnancy	1
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, lb/cow per year	24,000
21-d Pregnancy Rate, %	18
Reproduction Cost, \$/cow per month	20
Last Month After Calving to Breed a Cow	10
Do-not-Breed Cow Minimum Milk, lb/day	50
Pregnancy Loss after 35 Days Pregnant, %	22.6
Average Cow Body Weight, lb	1306

Herd Economic Variables

Replacement Cost, \$/cow	1300
Salvage Value, \$/lb live weight	0.38
Calf Value, \$/calf	100
Milk Price, \$/cwt	16
Milk Butterfat, %	3.5
Feed Cost Lactating Cows, \$/lb dry matter	0.1
Feed Cost Dry Cows, \$/lb dry matter	0.08
Interest Rate, %/year	6

Analyze

OUTPUTS - Interactive Results

Value of the Cow, \$ 628

Compared Against a Replacement, \$

Milk Sales, \$	148
Feed Cost, \$	-157
Calf Value, \$	26
Non-reproductive Cull, \$	-126
Mortality Cost, \$	-24
Reproductive Cull, \$	12
Reproduction Costs, \$	45
Replacement Transaction, \$	704

Herd Structure at Steady State

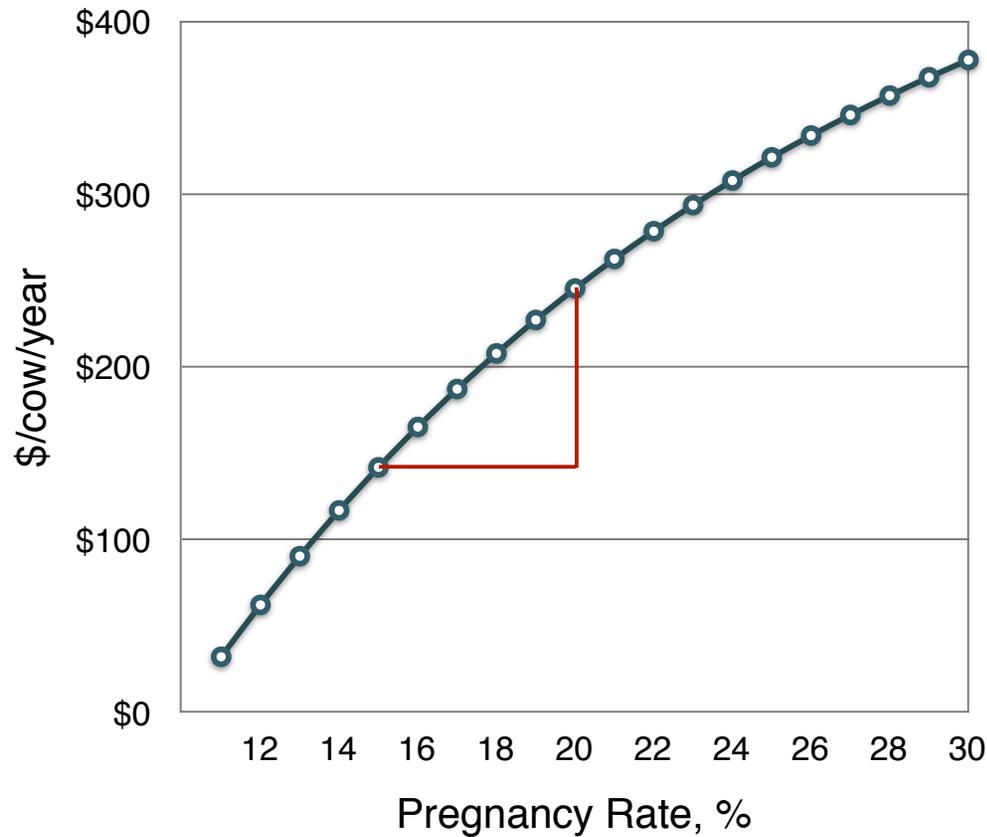
Days in milk	224
Days to Conception	122
Percent of Pregnant	52
Reproductive Culling, %	8
Mortality, %	3
1st Lactation, %	43
2nd Lactation, %	27
> 3rd Lactation, %	30

Economics of an Average Cow, \$/year

Net Return, \$	1998
Milk Sales, \$	3834
Feed Cost, \$	-1522
Calf Sales, \$	60
Non-Reprod. Culling Cost, \$	-198
Mortality Cost, \$	-38
Reproductive Culling Cost, \$	-59
Reproductive Cost, \$	-80

Value of improved reproductive performance

Law of diminishing returns



How much is the gain

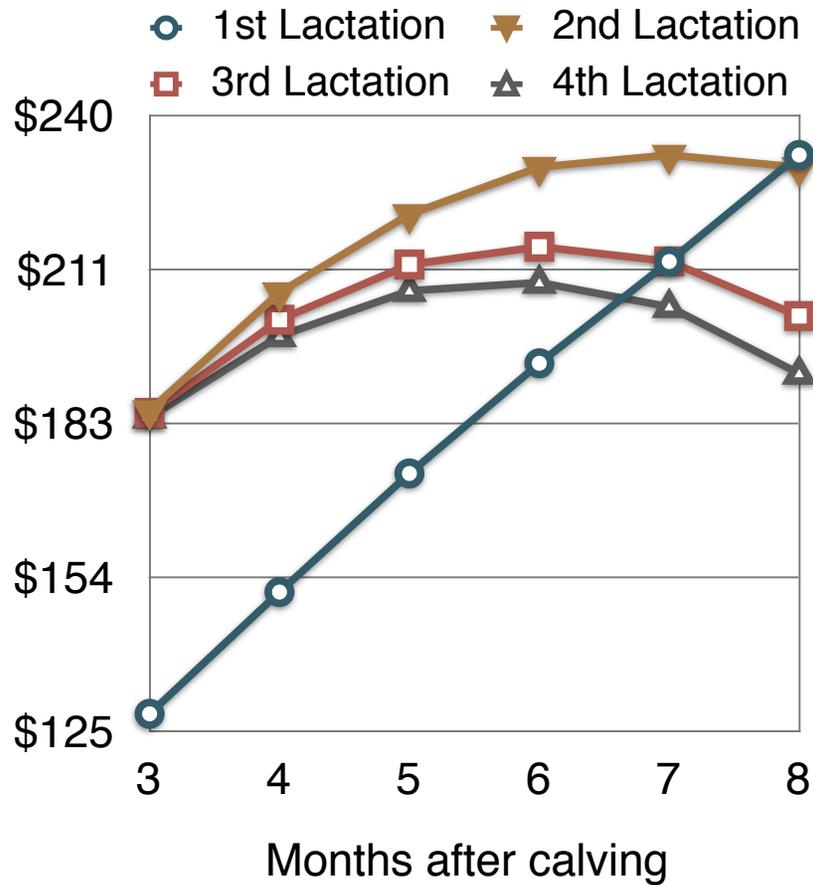
- Between \$32 and \$11 per cow per year

Net profit when increasing preg. rate from 15 to 20%

- \$103 per cow per year

Value of a new pregnancy

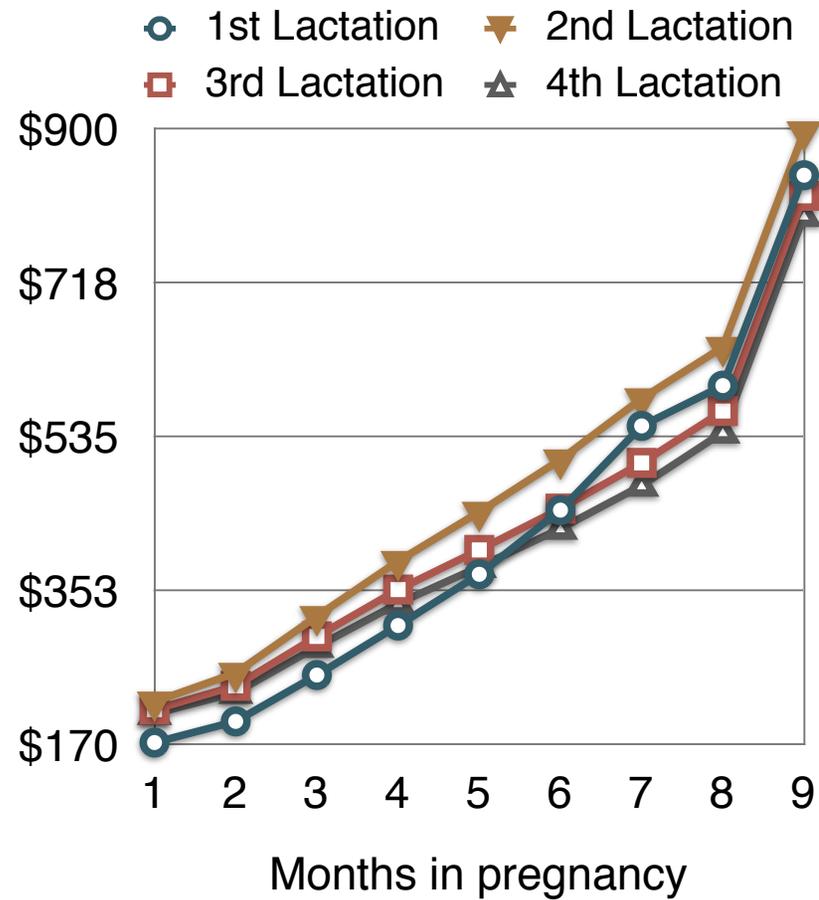
Important to have cows pregnant



Cabrera, 2012

Cost of a pregnancy loss

Detect aborted cows as early as possible



Cabrera, 2012

Cost of a day open (\$/d)

Critical to have pregnant cows and detect non-pregnant cows as early as possible

	Lactation			
MIM	1	2	3	4
1	-0.58	2.41	2.01	1.75
2	1.30	4.03	4.17	3.96
3	2.88	5.16	5.55	5.41
4	3.07	4.75	5.12	5.00
5	3.08	4.27	4.53	4.40
6	3.02	3.77	3.92	3.80
7	2.94	3.26	3.28	3.17
8	2.92	2.73	2.60	2.49
9	2.98	2.19	1.86	1.74
10	3.14	1.63	1.05	0.91

Cabrera, 2012

Acknowledgement

Project support

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



United States Department of Agriculture
National Institute of Food and Agriculture



Thanks

© 2011 Wisconsin Milk Marketing Board, Inc.