



Improving cost-efficiency and profitability

Economic evaluation of reproductive programs

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Rationale

Producers could verify reproductive performance improvements

However, the question remained:

Are they making more money?



Economic impact of reproductive programmes: Difficult to assess

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

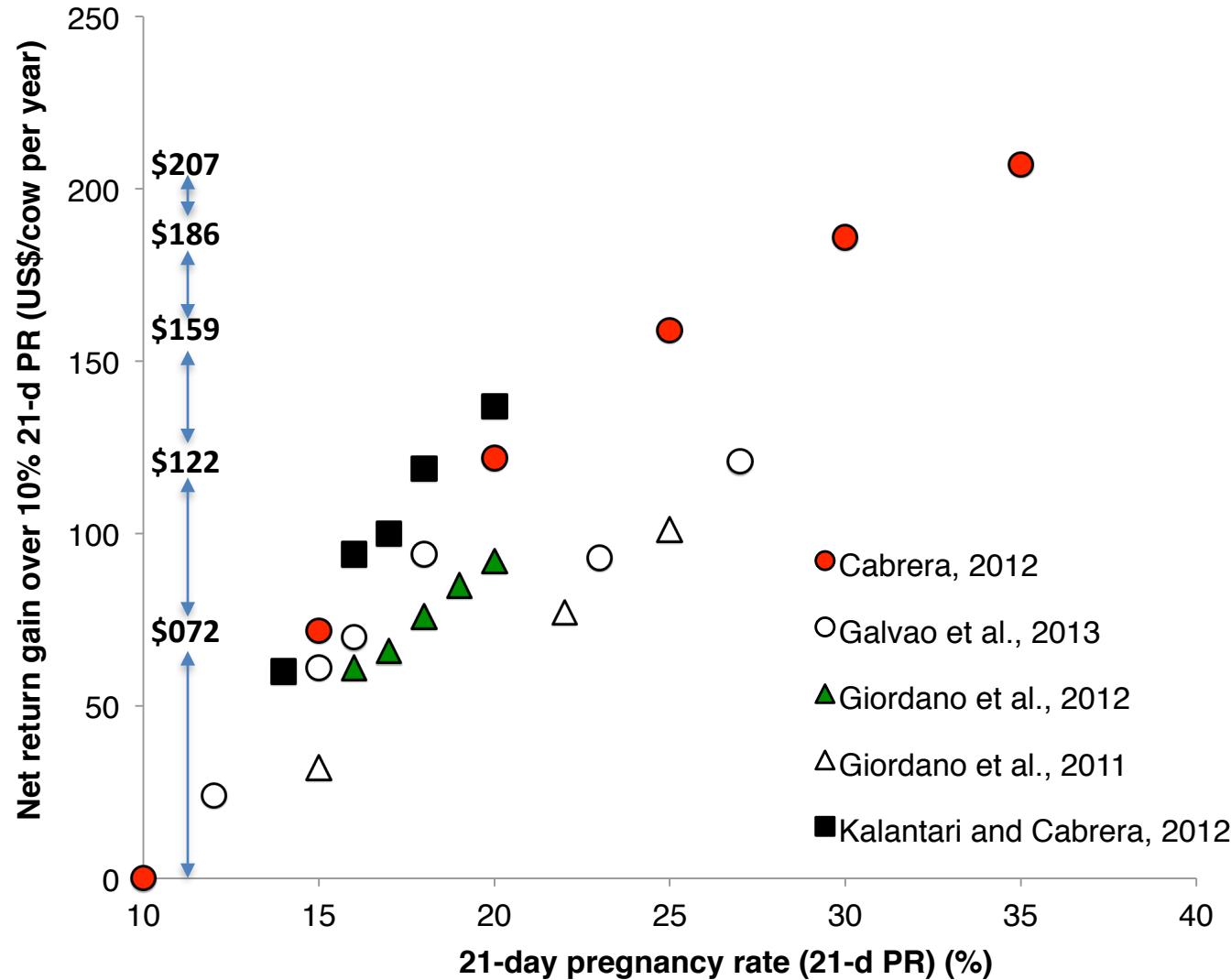
Cabrera, 2012:
Markov-Chain, DSS

Kalantari and Cabrera, 2012:
Markov-Chain, DSS

Giordano et al., 2013:
Decision theory

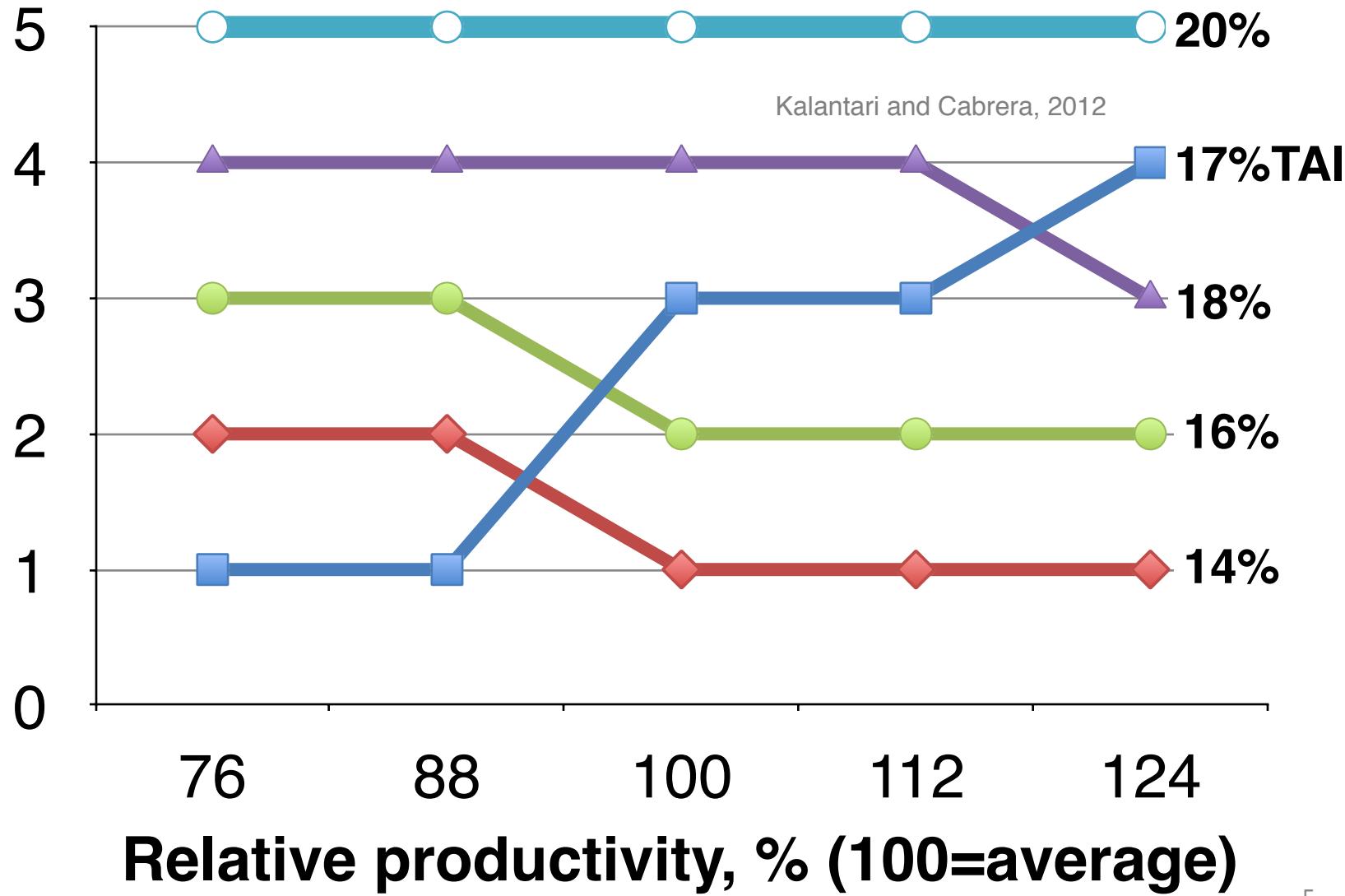
Cabrera, 2014: Review

The economic value of improving reproductive performance



Herd's milk productivity

Ranking net return
1=worst, 5=best



Replacement supply

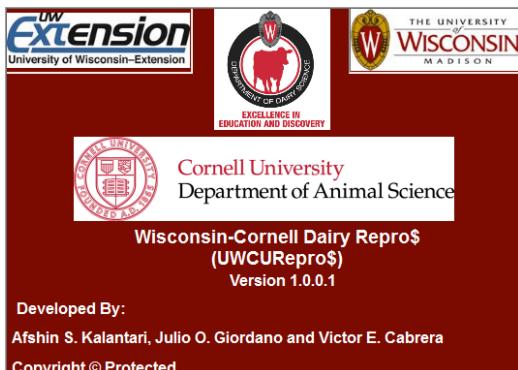
↑21-d PR → ↑Selective culling

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

Reproductive costs

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



The UWCURepro\$ Tool could be used for farm-specific assessments

e.g., ↑ \$1 hormones → ↓ \$3.28/cow.yr

Oestrus detection, synchronization, 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

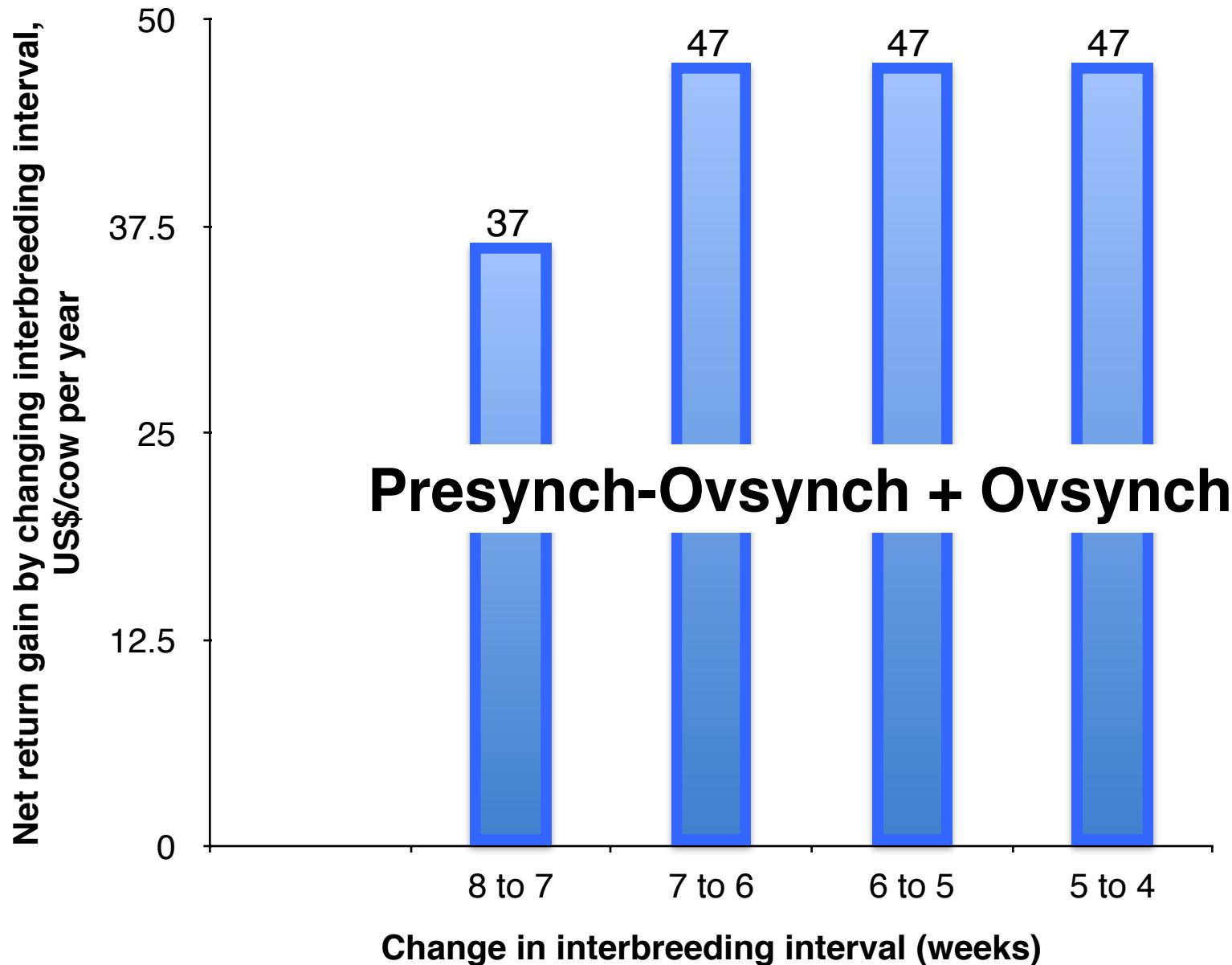
Presynch-Ovsynch + Ovsynch with a focus on OD combination

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



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

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

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

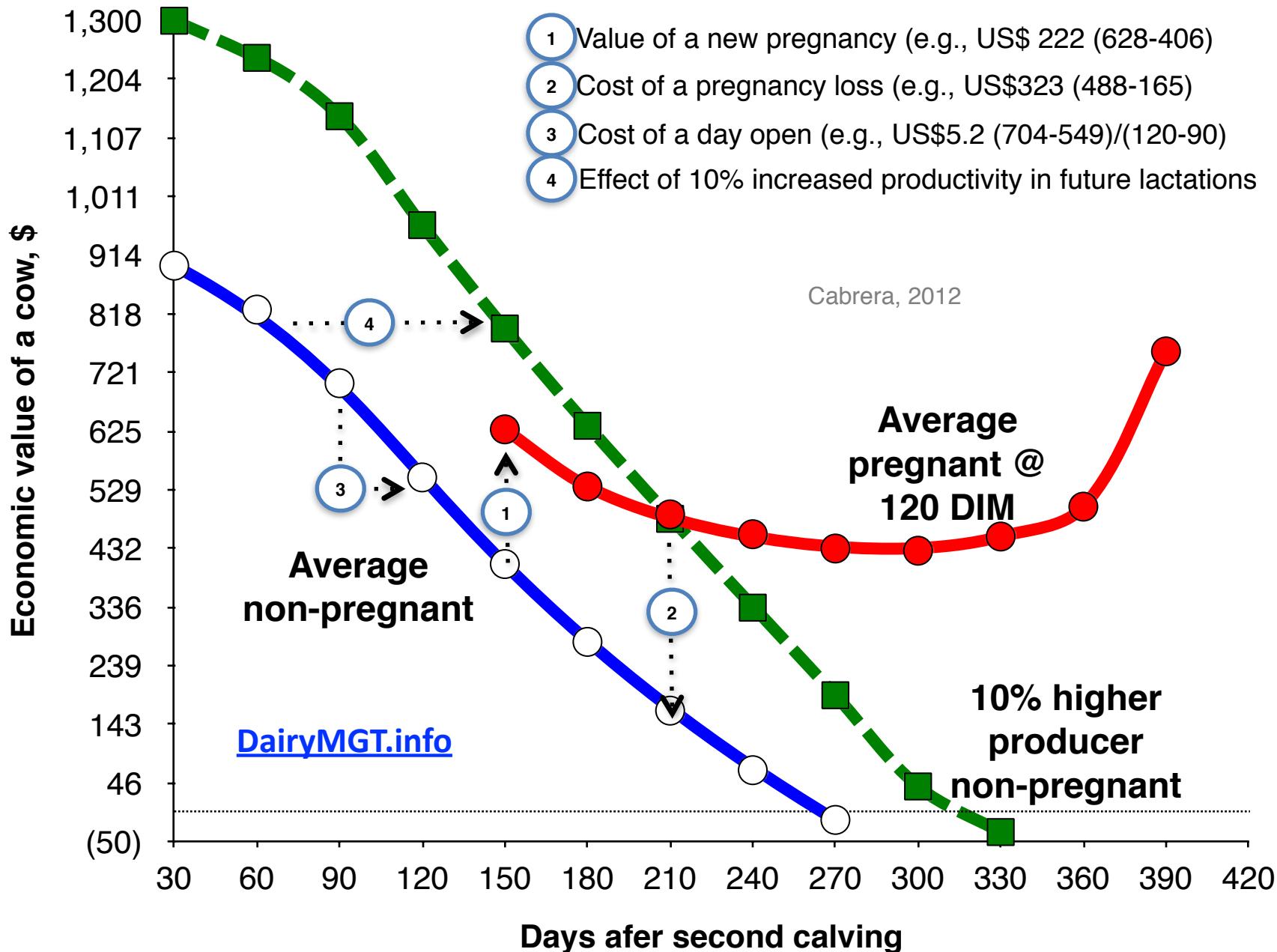
Associated economic values could be used to enhance the value of reproductive programs. E.g.,

The value of a new pregnancy

The cost of a pregnancy loss

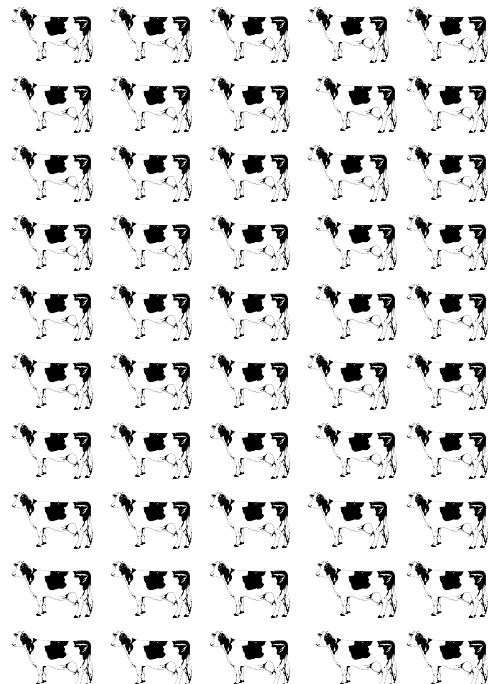
The cost of an additional day open

The value of a cow

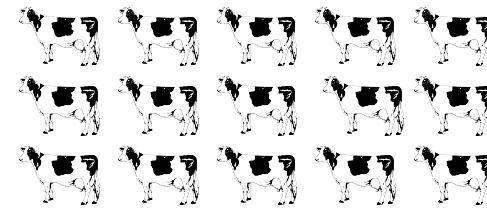


Lift chart analysis and cost-sensitive

Breed only the most fertile cows?



Breed all
30% CR

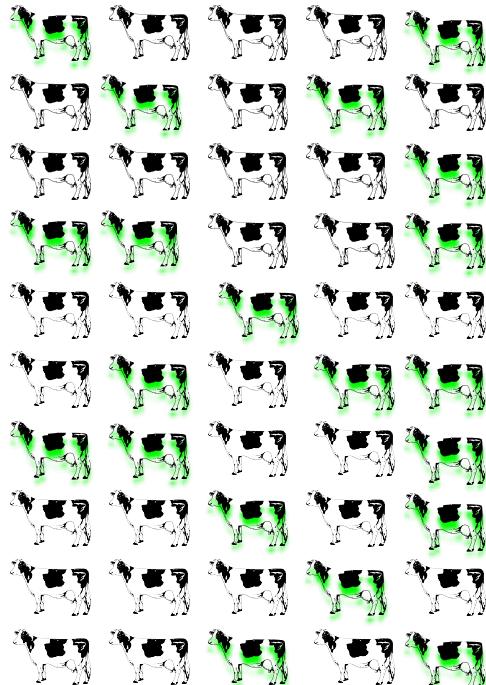


15 pregnant

50 elegible

Lift chart analysis and cost-sensitive

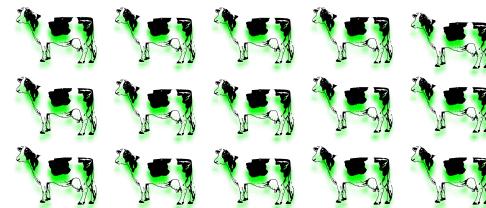
Breed only the most fertile cows?



50 elegible

20 more fertile

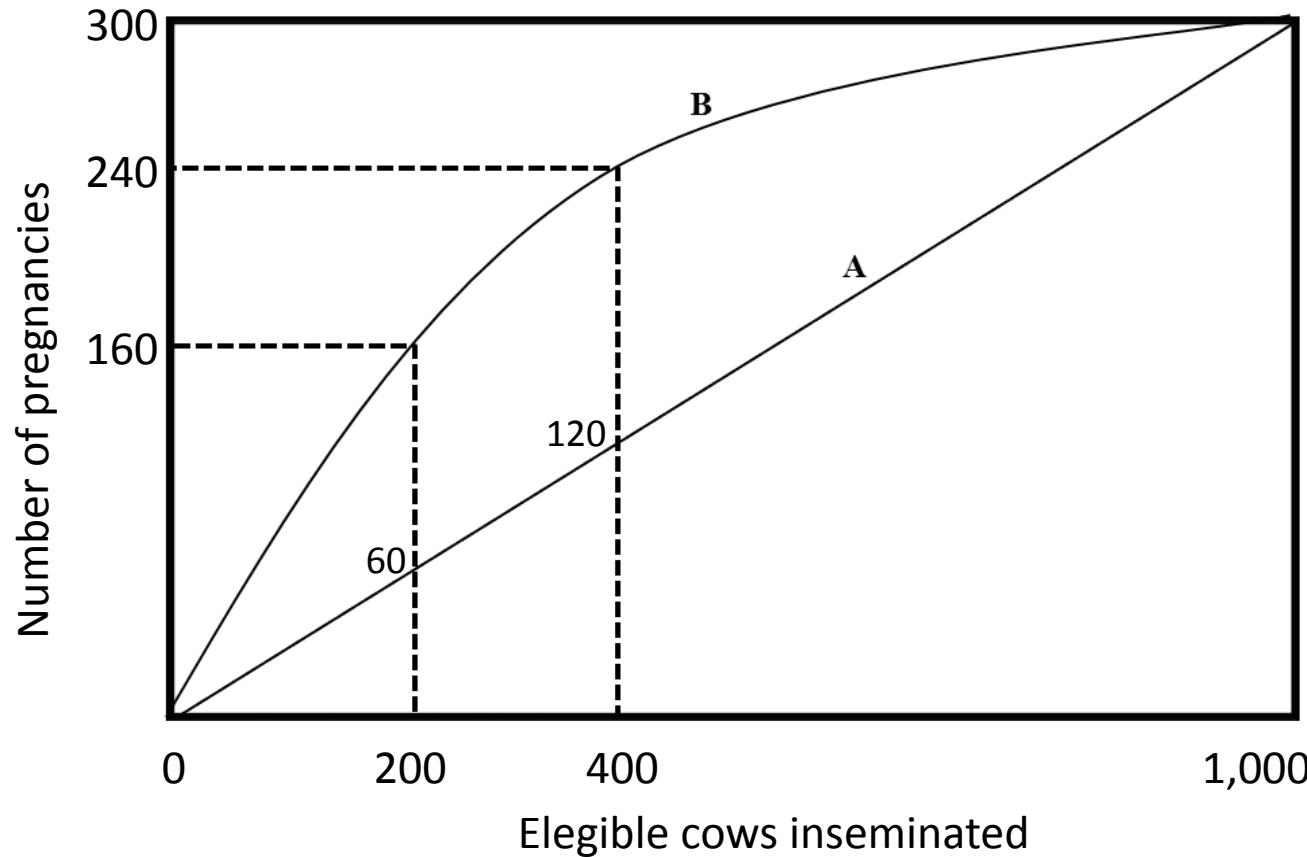
Breed 20 more fertile
75% CR



15 pregnant

Lift chart analysis and cost-sensitive

Breed only the most fertile cows?



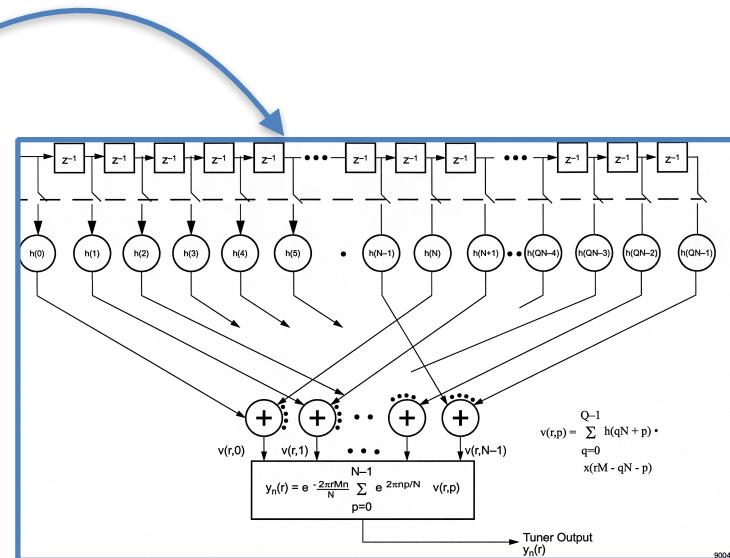
A= Inseminate all elegible (or random) = 30% CR

B= CR depends on selection of more fertile elegible cows

Identify more fertile cows

Machine learning: Prediction of insemination outcome

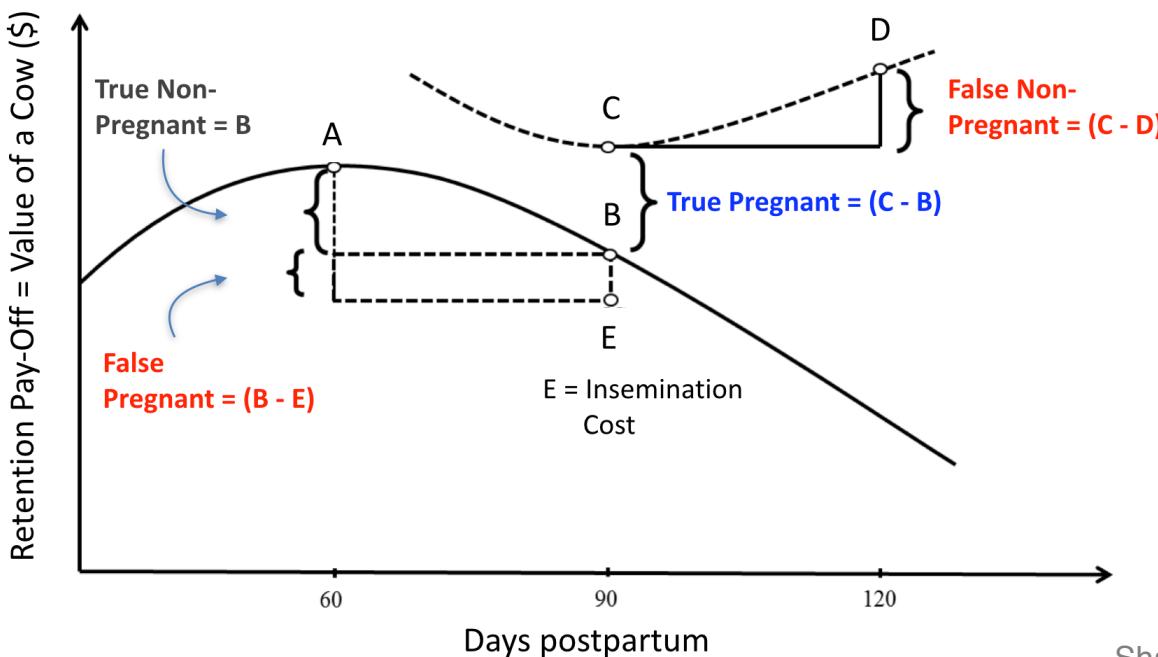
Herd-yr-mo
Herd CR
Stage
DIM
Program
Age calving
Milk
Distocia
Ketosis
Lameness
Fat-protein
etc.
etc.
etc.



Prediction is not infallible

There is a level of errors

		Predicted Outcome	
		Pregnant	Non-Pregnant
Actual Outcome	Pregnant	True Pregnant +(PregValue)	False Non-Pregnant -(PregValueDiff.)
	Non-Pregnant	False Pregnant -(InseminationCost)	True Non-Pregnant +(0)



Lift Chart and Cost-Sensitive

60 to 90 DIM			90 to 120 DIM			120 - 150 DIM			
Milk Production			Milk Production			Milk Production			
Low	Med.	High	Low	Med.	High	Low	Med.	High	
Elegible Population (n)	13,745	11,015	5,239	6,109	5,271	2,372	4,576	4,188	2,291
Prediction accuracy	0.68	0.58	0.72	0.74	0.72	0.74	0.75	0.76	0.80
CR all elegible	0.44	0.44	0.44	0.37	0.36	0.34	0.33	0.32	0.34
CR Selected	0.49	0.45	0.51	0.43	0.41	0.41	0.36	0.36	0.35
LIFT Factor	1.11	1.02	1.15	1.15	1.13	1.20	1.09	1.13	1.04
Accuracy of prediction	0.56	0.46	0.57	0.50	0.49	0.52	0.42	0.45	0.46
% Elegible population	85.5	97.2	84.5	83.6	85.3	79.0	89.9	85.6	87.0
% Target population	95.7	99.0	97.2	96.1	96.7	95.0	97.8	96.9	90.3
Gain, \$/elegible cow	1.10	0.44	1.96	1.19	1.50	2.18	1.10	1.49	1.21

Optimization to maximize the profit of the reproductive management program

Lift Chart and Cost-Sensitive

Elegible Population for training (n)	14,000
Prediction accuracy	0.80
CR all elegible population	0.43
CR Selected subpopulation	0.66
LIFT Factor	1.55
Elegible population for validation (n)	3,197
Accuracy of prediction	0.76
% Elegible population	59.0
% Target population	92.0
Gain, \$/elegible cow	5.21



Optimization to maximize the profit in a **herd with outstanding recording of health and fertility data**



Decision-making focused on scientific research



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.



UW-Dairy Management
Decision Support TOOLS

University of Wisconsin

University of Wisconsin - Madison
UW - Cooperative Extension
UW - Dairy Science
Dairy Cattle Reproduction
Dairy Cattle Nutrition
Milk Quality
UW Dairy Nutrient
Understanding Dairy Markets
UW Center for Dairy Profitability

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