Economic aspects of dairy fertility in the USA

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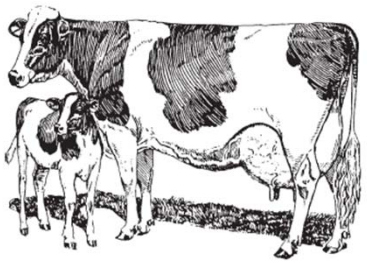
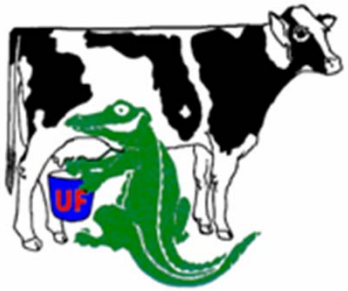
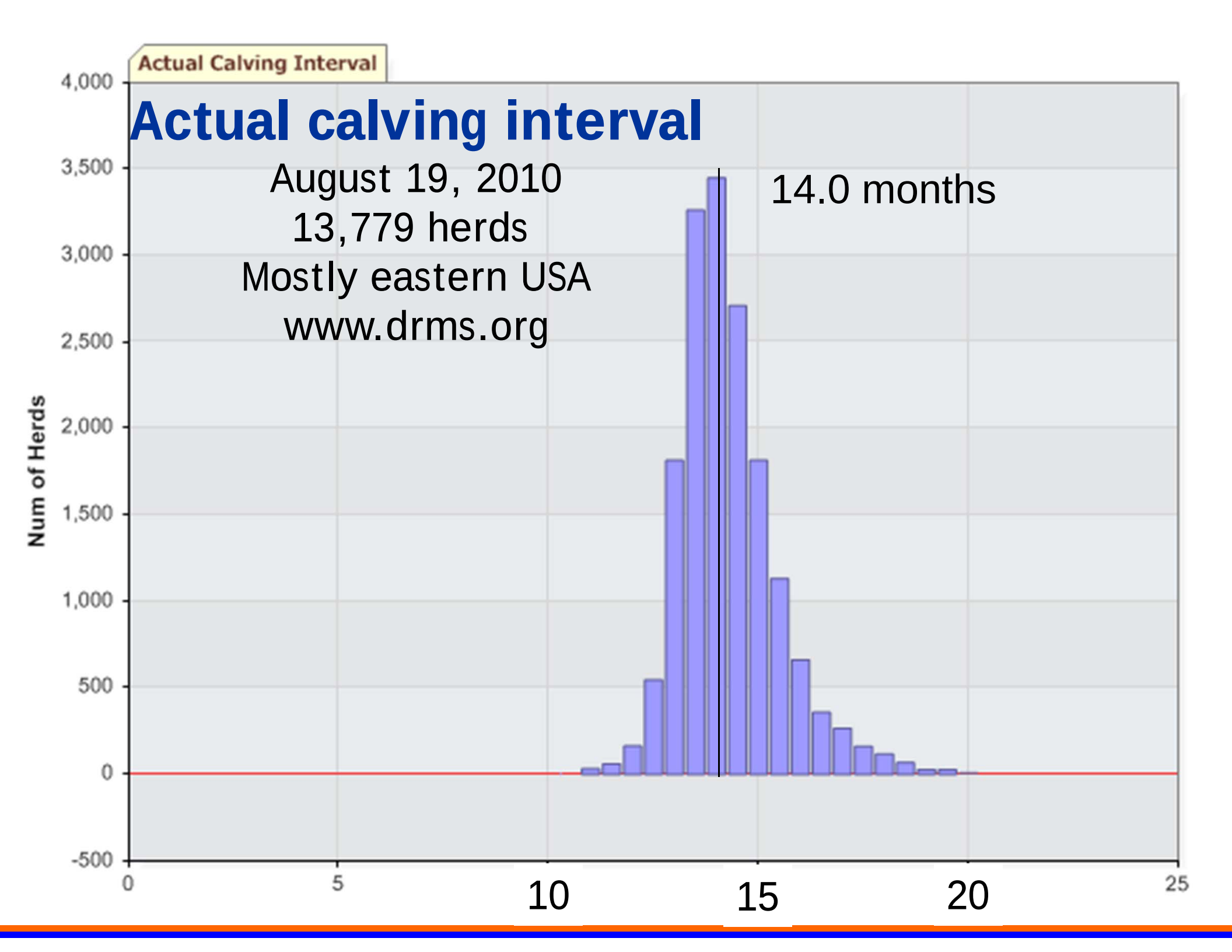
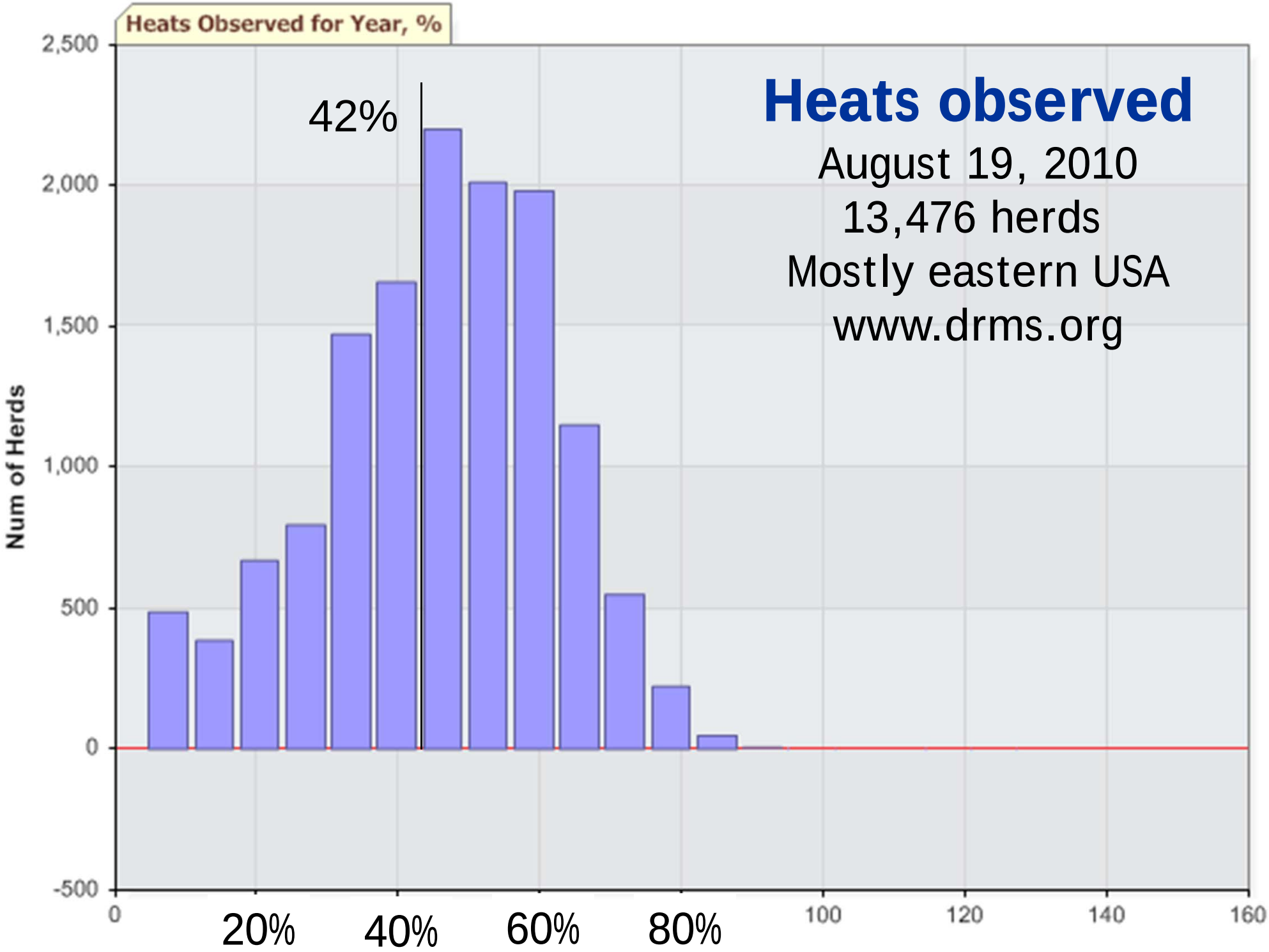
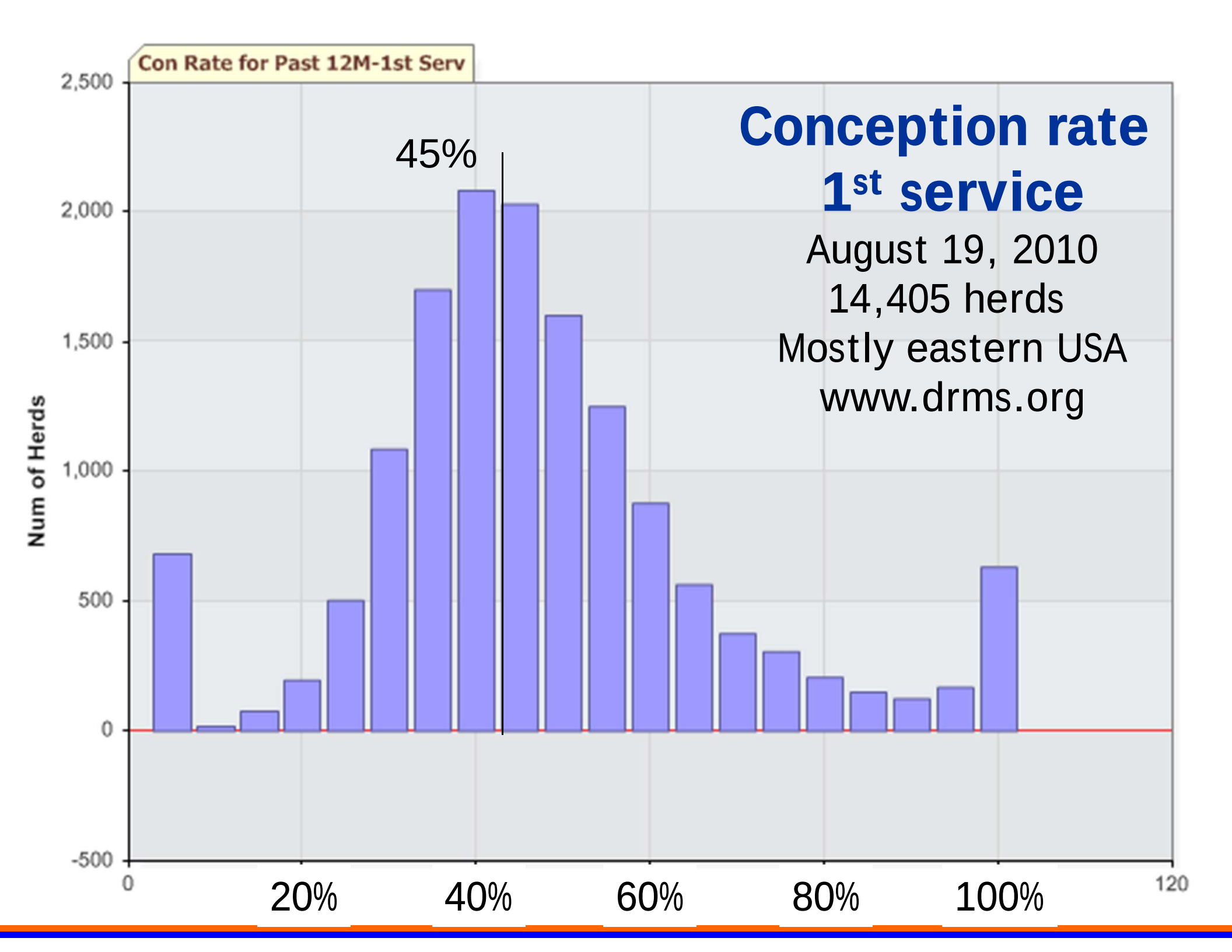
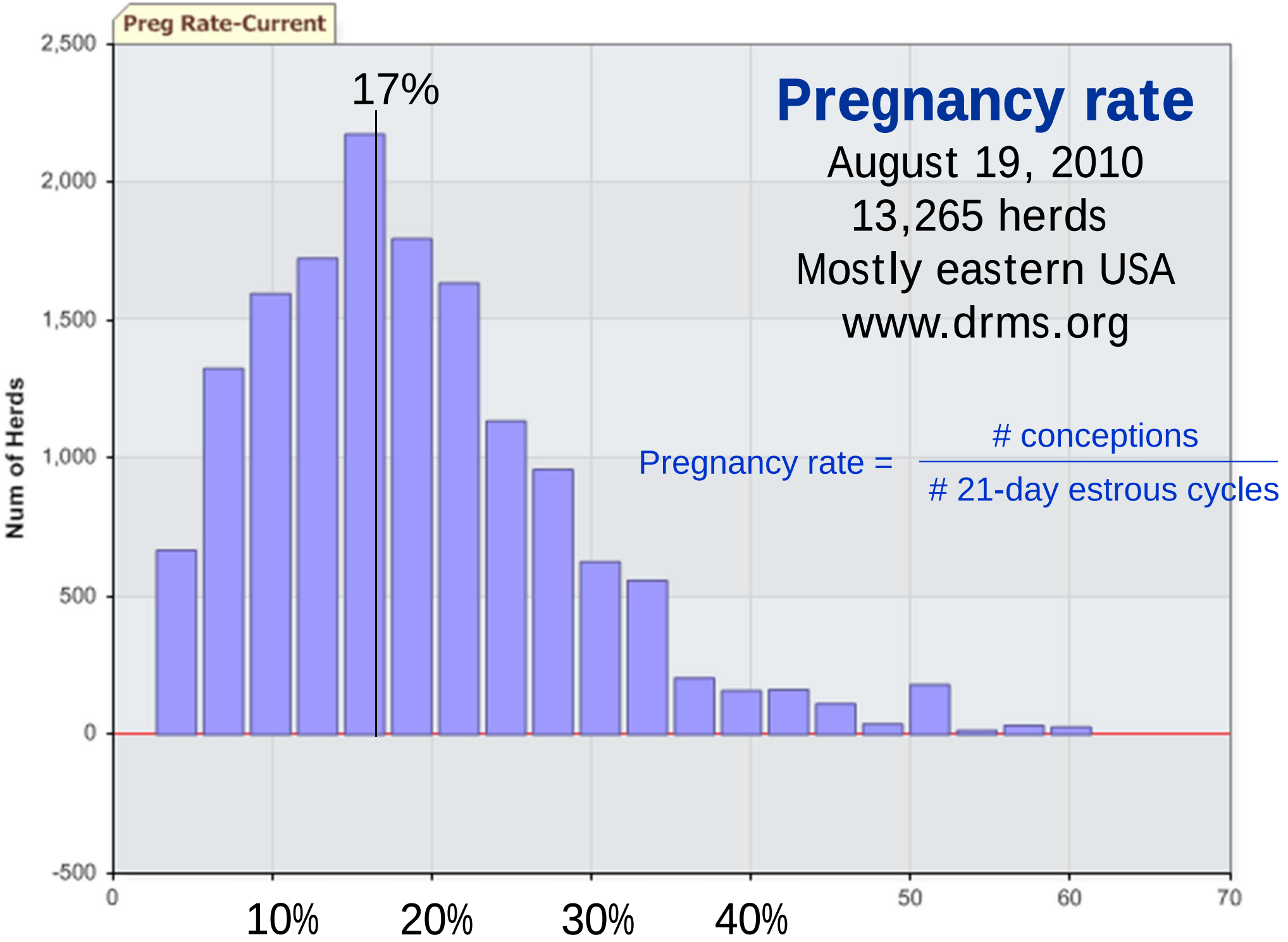





Actual Calving Interval
Actual calving interval
August 19, 2010
13,779 herds
Mostly eastern USA
www.drms.org
14.0 months
Num of Herds
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
-500
0
5
10
15
20
25


Heats Observed for Year, %
42%
Num of Herds
2,500
2,000
1,500
1,000
500
0
-500
0
20%
40%
60%
80%
100
120
140
160
Heats observed
August 19, 2010
13,476 herds
Mostly eastern USA
www.drms.org


Con Rate for Past 12M-1st Serv
Num of Herds
2,500
2,000
1,500
1,000
500
0
-500
0
20%
40%
60%
80%
100%
120
45%
Conception rate
1st service
August 19, 2010
14,405 herds
Mostly eastern USA
www.drms.org



Pregnancy rate

August 19, 2010

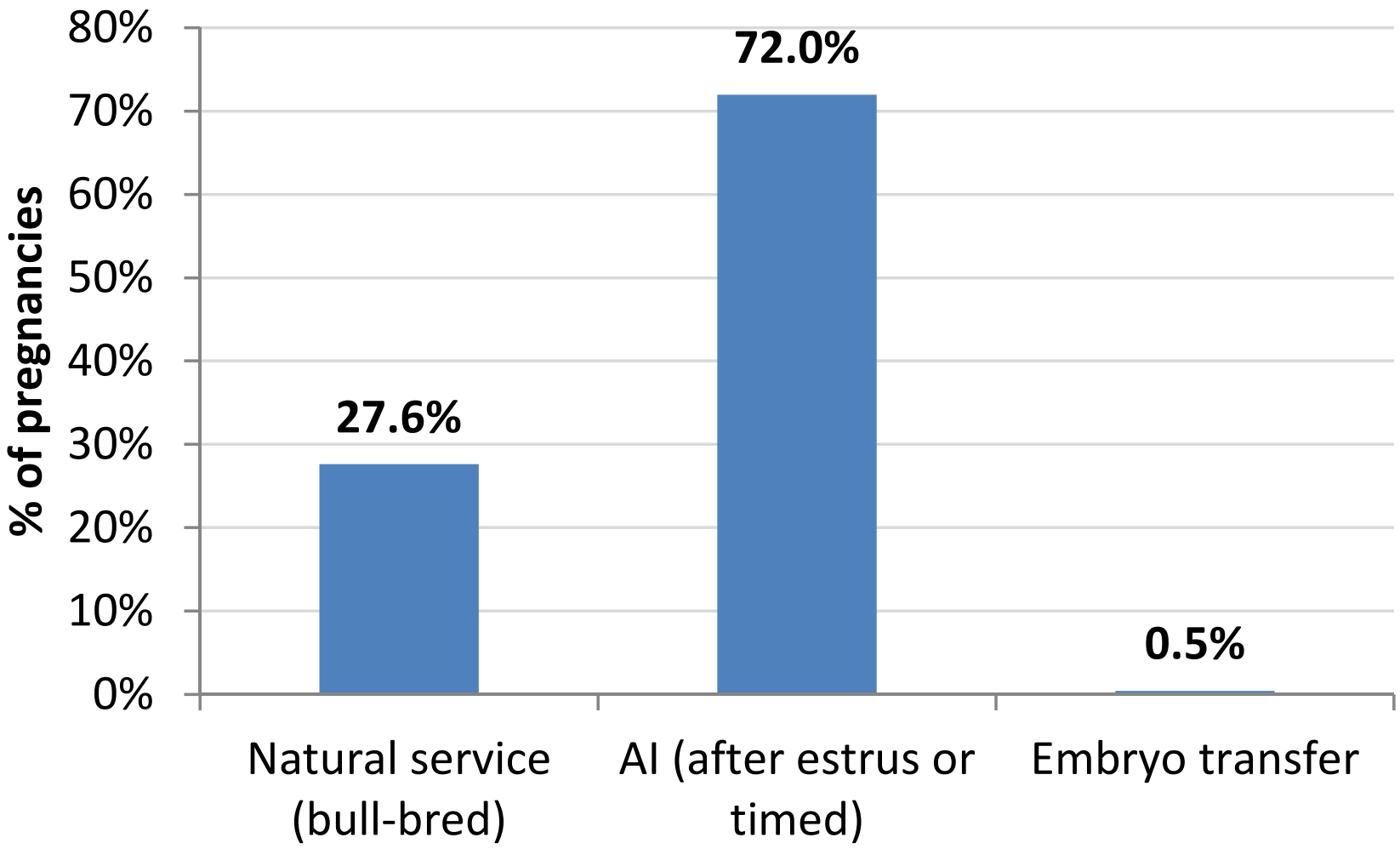
13,265 herds

Mostly eastern USA

www.drms.org

$$\text{Pregnancy rate} = \frac{\text{\# conceptions}}{\text{\# 21-day estrous cycles}}$$

Pregnancies by breeding method



55% of all operations used natural service bulls

NAHMS Dairy 2007 (2009)

Why Do We Use Synchronization Protocols?

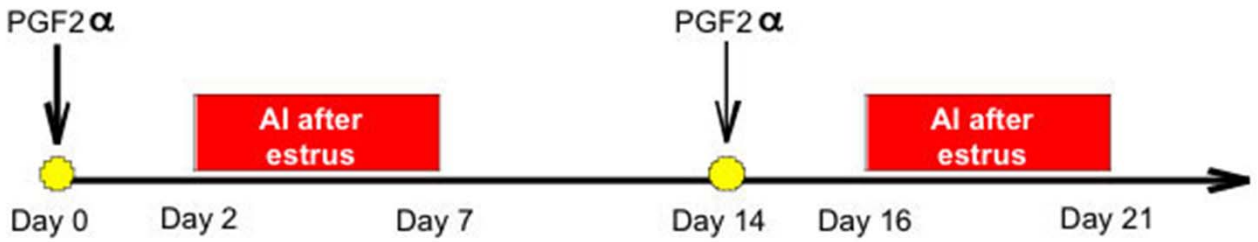
- Inefficiencies have led to much research in the area of timed artificial insemination (TAI).
  - Ensures all cows get bred by certain day post calving
  - Reduces the need for estrus detection
- Pursley et al. (1995) Ovsynch protocol
- Many changes in synchronization protocols in the past 15 years
- Ability to manipulate cows estrous cycles has drastically improved P/AI for first postpartum TAI

Dr. Todd Bilby, Texas A&M University

Some synchronization programs + Cost

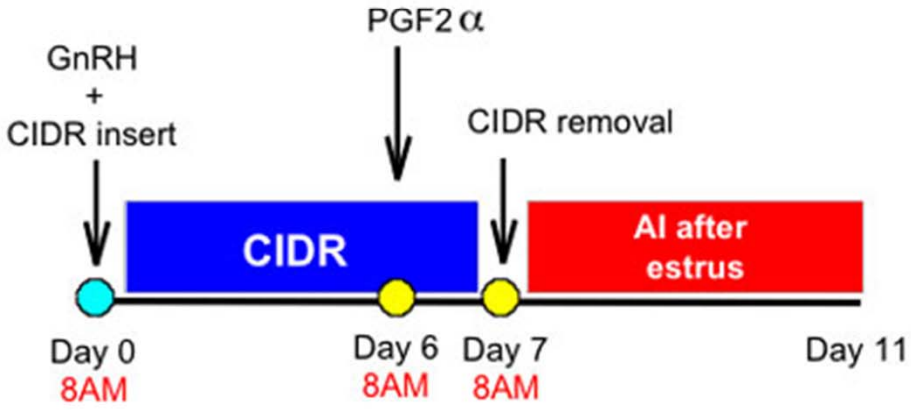
combinations of: prostaglandin, GnRH, progesteron

Prostaglandin
$4.50



Presynch + Ovsynch-56
$10.95

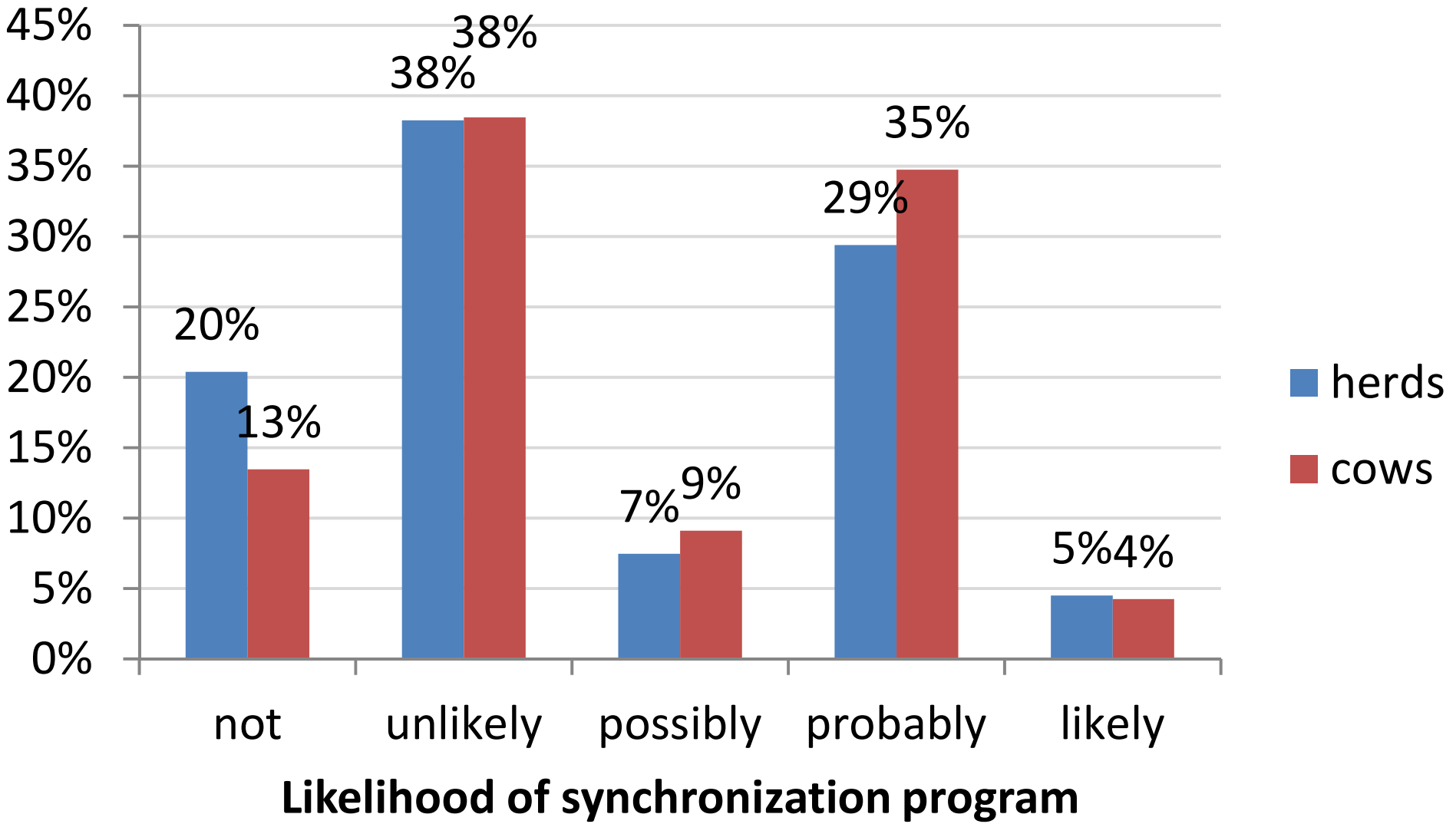
CIDR-6
$13.27



Pictures: www.accelgen.com

How likely is estrous synchronization?

727 herds, eastern USA, >200 cows (2006)



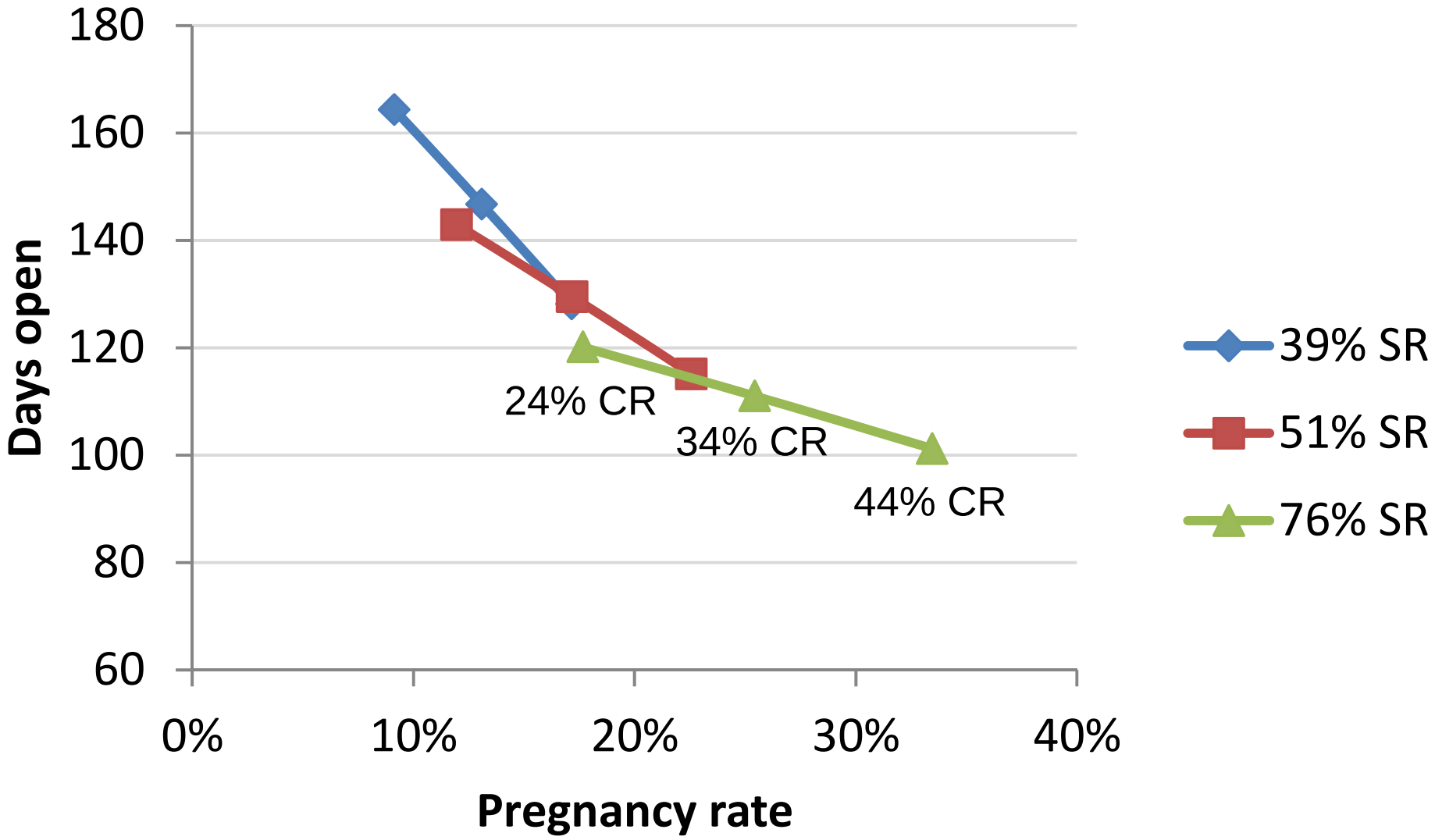
De Vries et al. (2010)


Value of increased
reproductive efficiency

Actual farm data not available

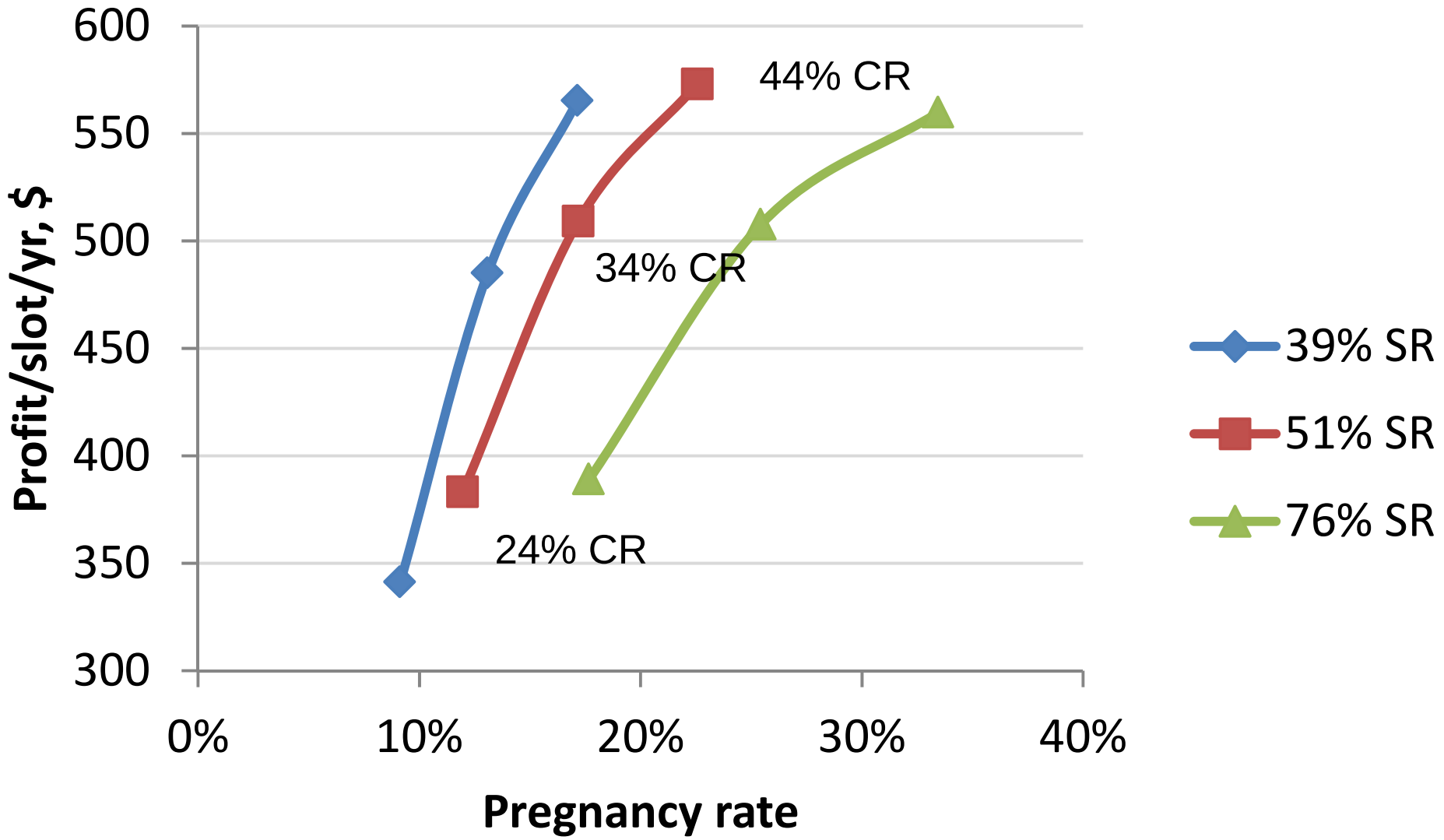
Pregnancy rate vs. days open

by service rate (SR) and conception rate (CR)



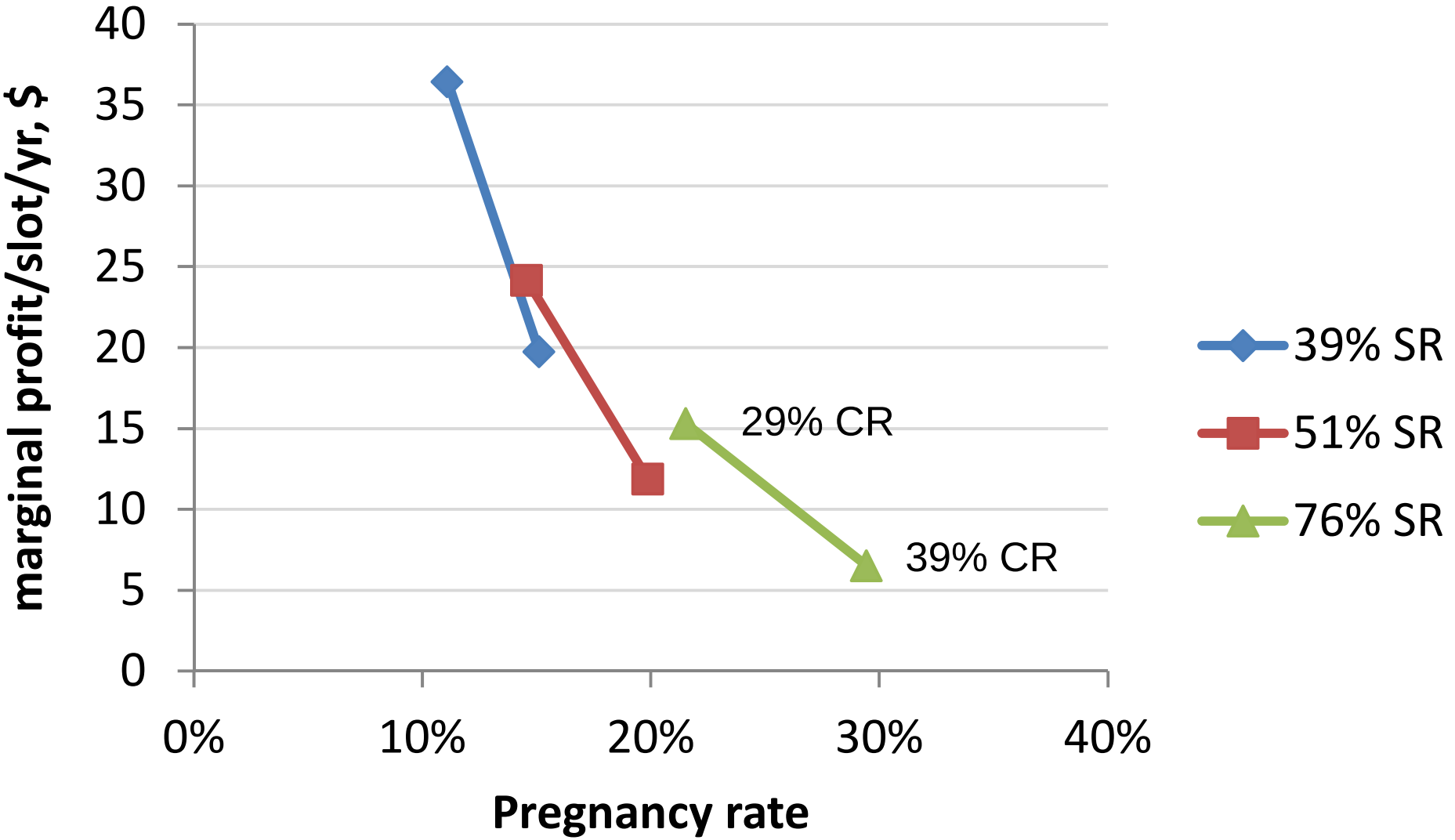
Simulation; De Vries (2010)

Effect of service rate (SR) and conception rate (CR) on profitability



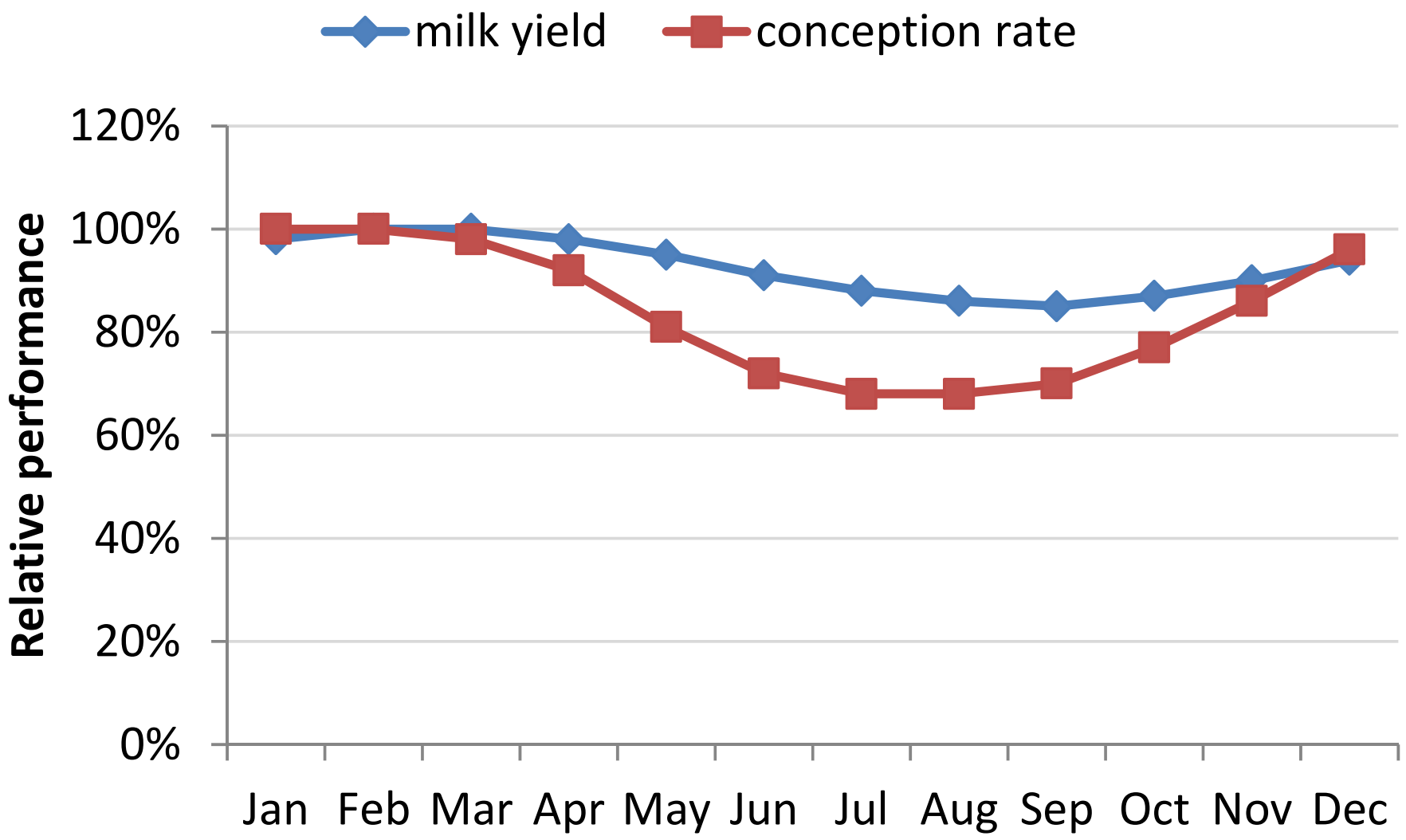
Value of 1 percentage unit increase in pregnancy rate

by service rate (SR) and conception rate (CR)



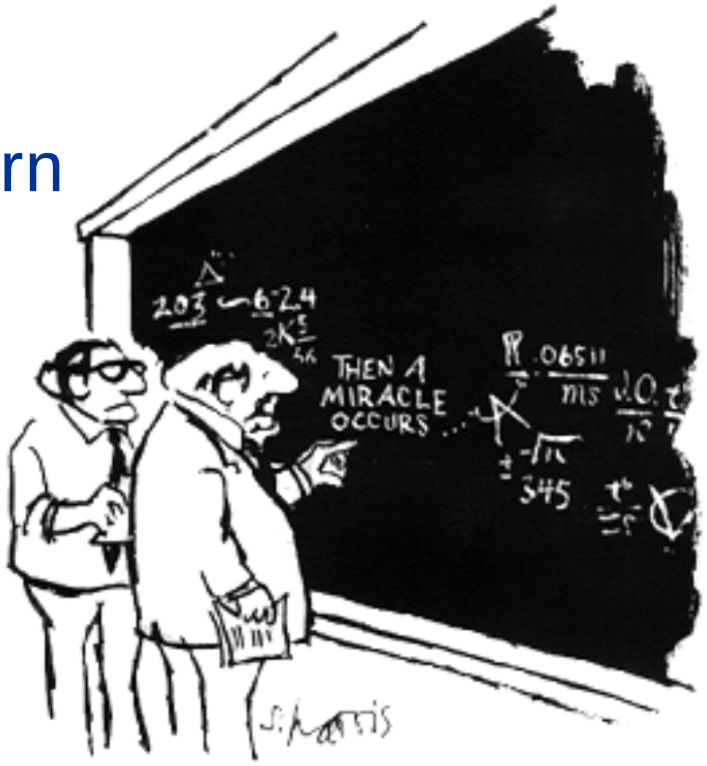

Summer heat stress

Florida seasonality



Linear programming model

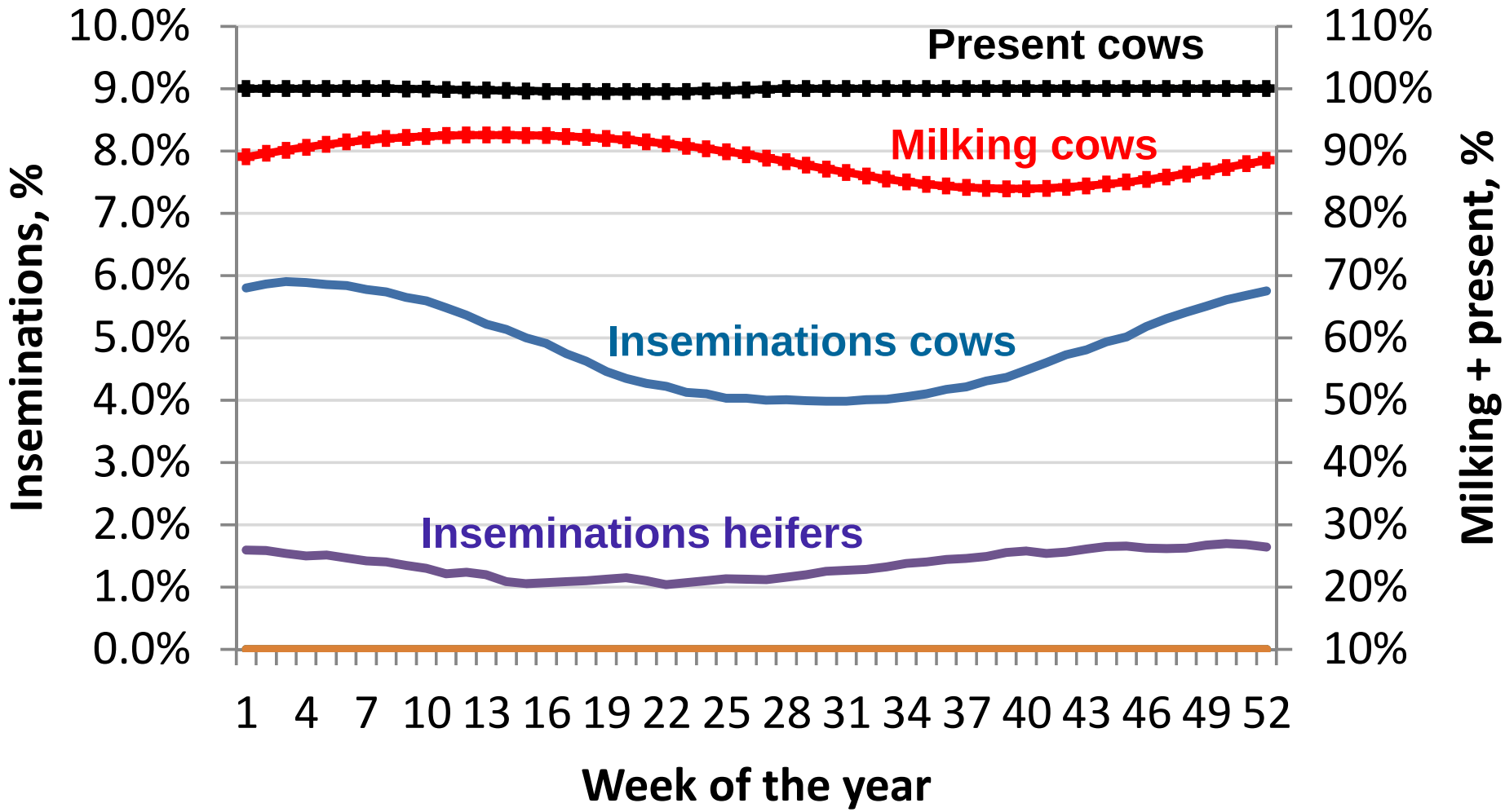
- Individual animal decisions
  - Parity (0-10), stage (1-11), season (1-52)
  - %kept (1), %inseminated (3), %heifer calves kept (3)
- Herd constraints
  - Heifer calves kept > heifer calves born
  - Available cow slots, …
- Objective
  - Profit/cow slot/year, …
- Model
  - 76,000 decision variables
  - Excel 2010 + Gurobi Solver



"I think you should be more explicit here in step two."

Seasonal herd demographics

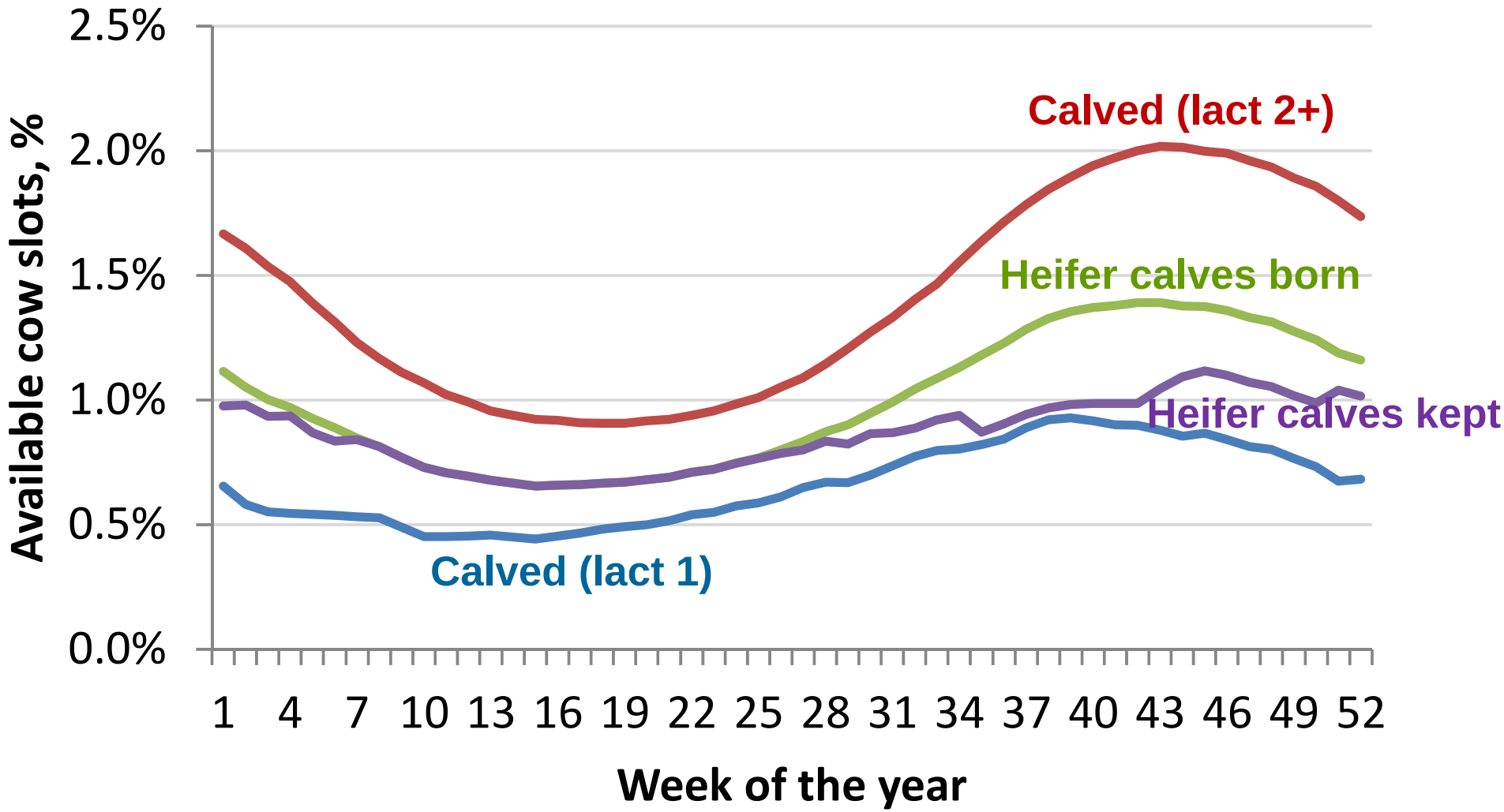
constraint: available cow slots



1 insemination type: relative conception rate 100%; cost $20

Calvings and heifer calves

constraint: available cow slots



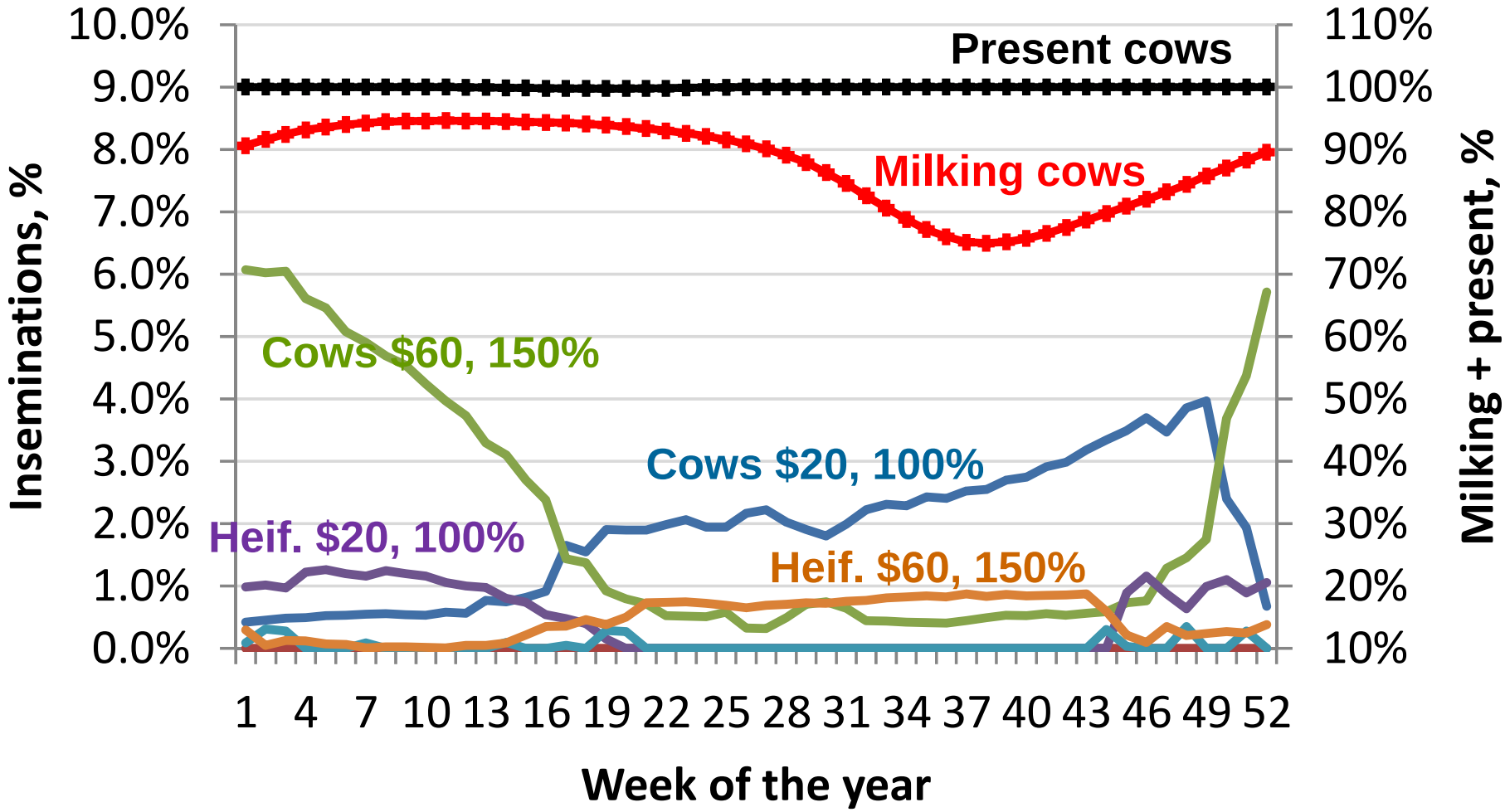
Improved reproduction

- Choice of 3 insemination options
  - **$20**, relative conception rate **100%** (default)
  - **$40**, relative conception rate **125%**
  - **$60**, relative conception rate **150%** (embryo transfer)

- **Which option is best for each individual animal class? (optimal mix?)**

Optimal mix

constraint: available cow slots



3 insemination types available: cost, relative conception rate

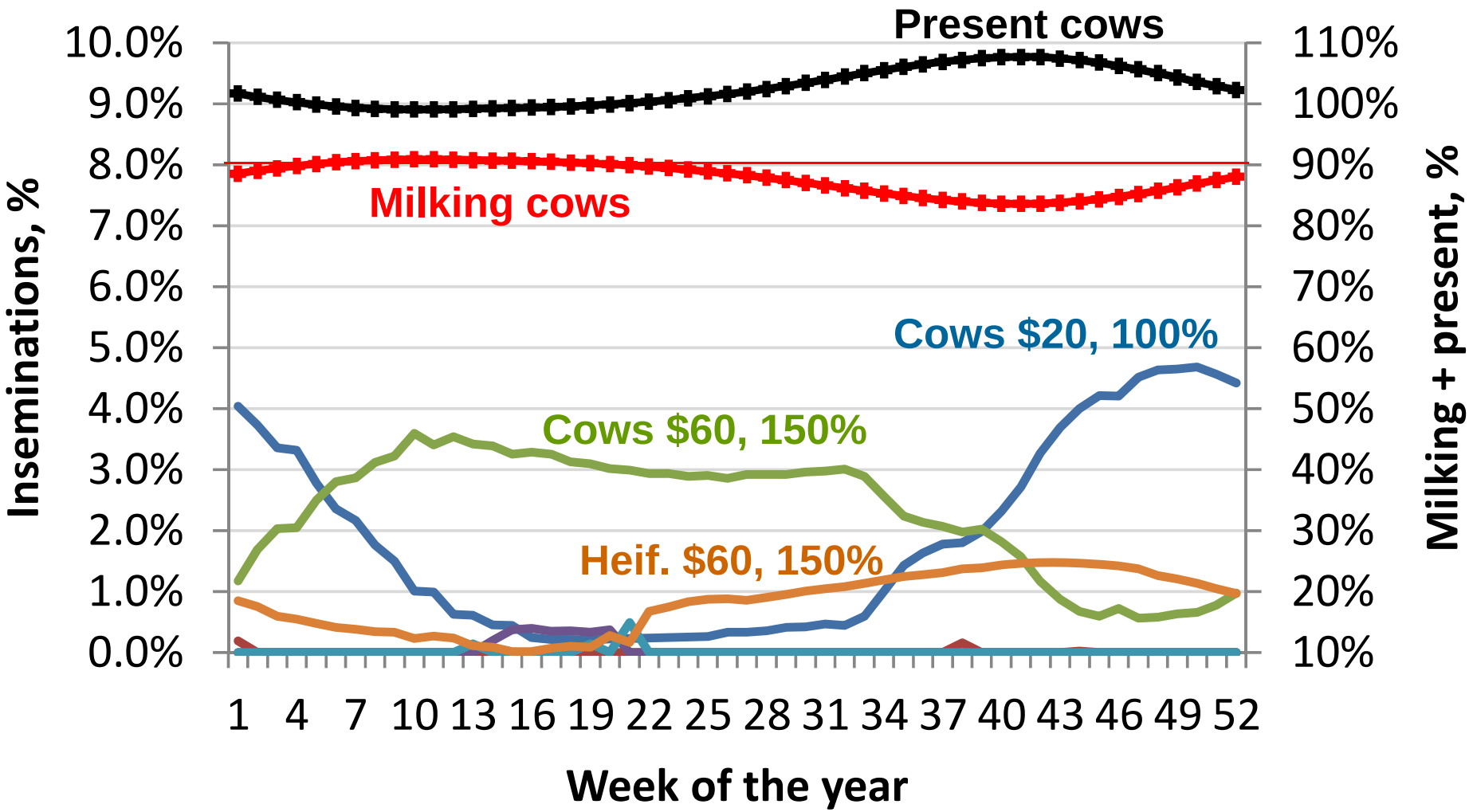
Results 4 scenarios

Scenario	Profit/slot/year	Profit/100kg milk
Only $20, 100% rel. CR	$354	$3.75
Only $40, 125% rel. CR	$371	$3.89
Only $60, 150% rel. CR	$378	$3.94
Optimal mix	$390	$4.07


Milking parlor constraint

Optimal mix

constraint: available milking slots



3 insemination types available: cost, relative conception rate

Summary

- Natural service bulls and estrous synchronization programs are widely used in USA
- Few economic comparisons of repro programs
- Value of reproductive improvement depends on level of reproductive efficiency and herd constraints

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Thank you