Optimizing Lactation Lengths of Dairy Cows and the Role of Nutrition

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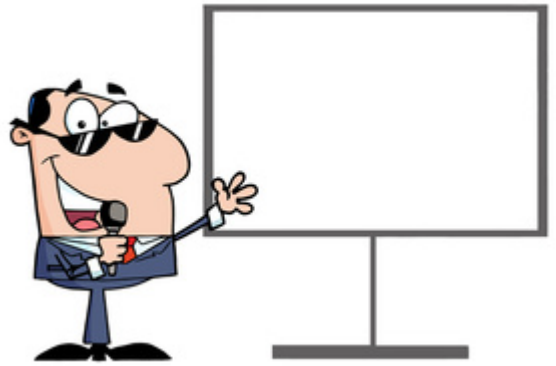
Overview

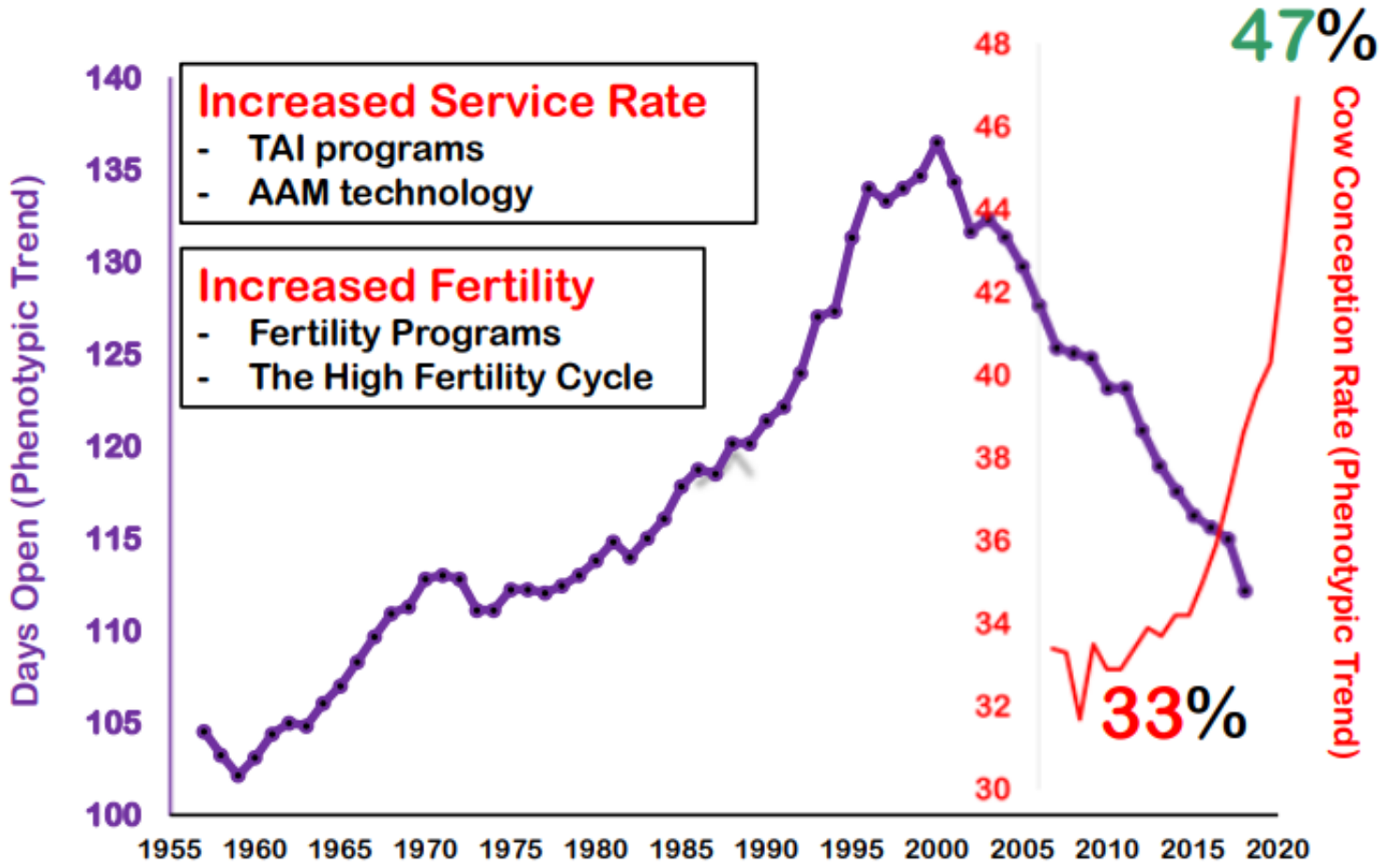
1. Insemination values
2. Fertility, BCS, and days open
3. Extend voluntary waiting period?
4. Conclusions



1. Insemination values

Council on Dairy Cattle Breeding

100,000 to 900,000 records/year

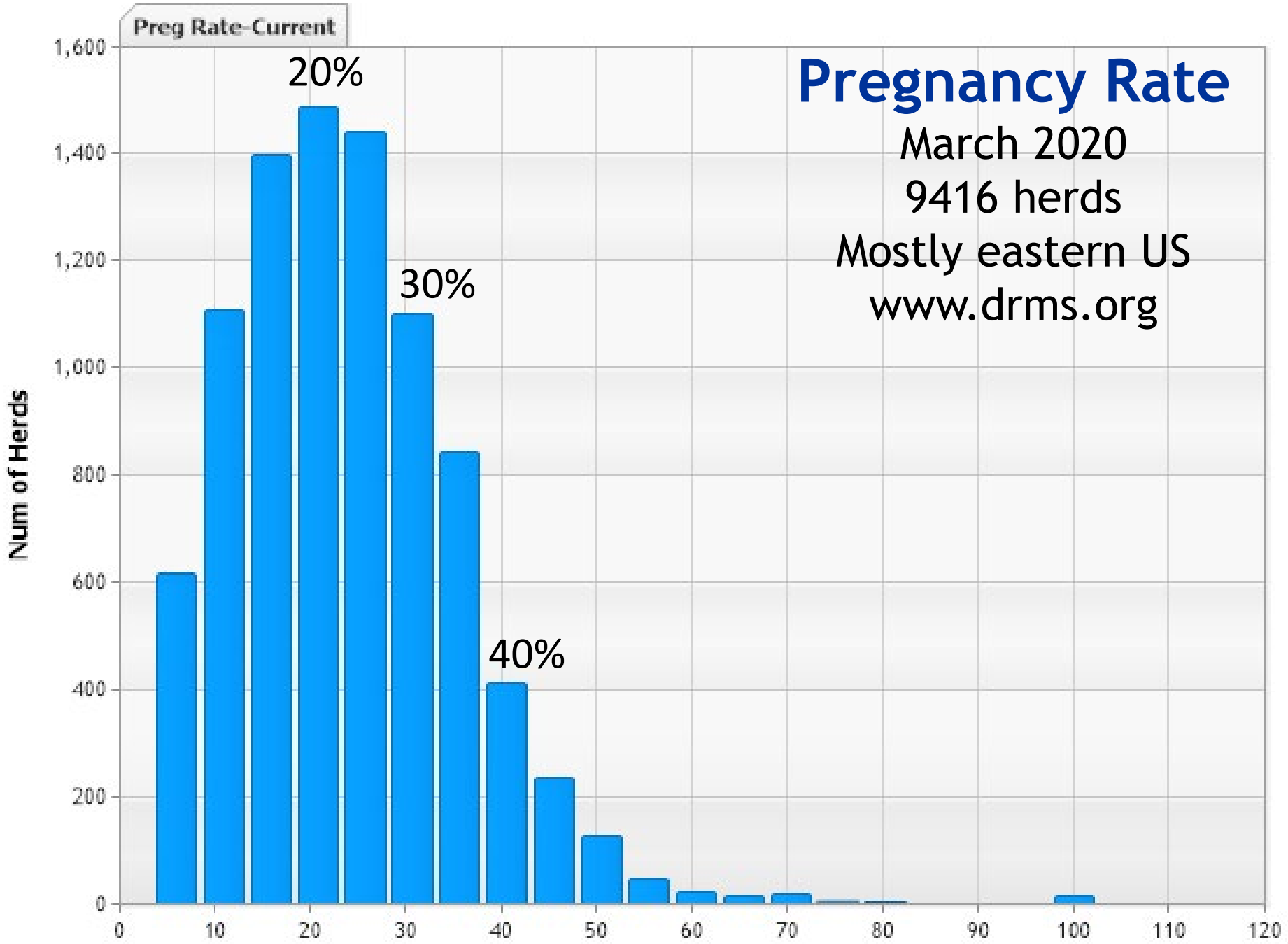


Since early 2000s:

Decrease in days open

Increase in conception rates

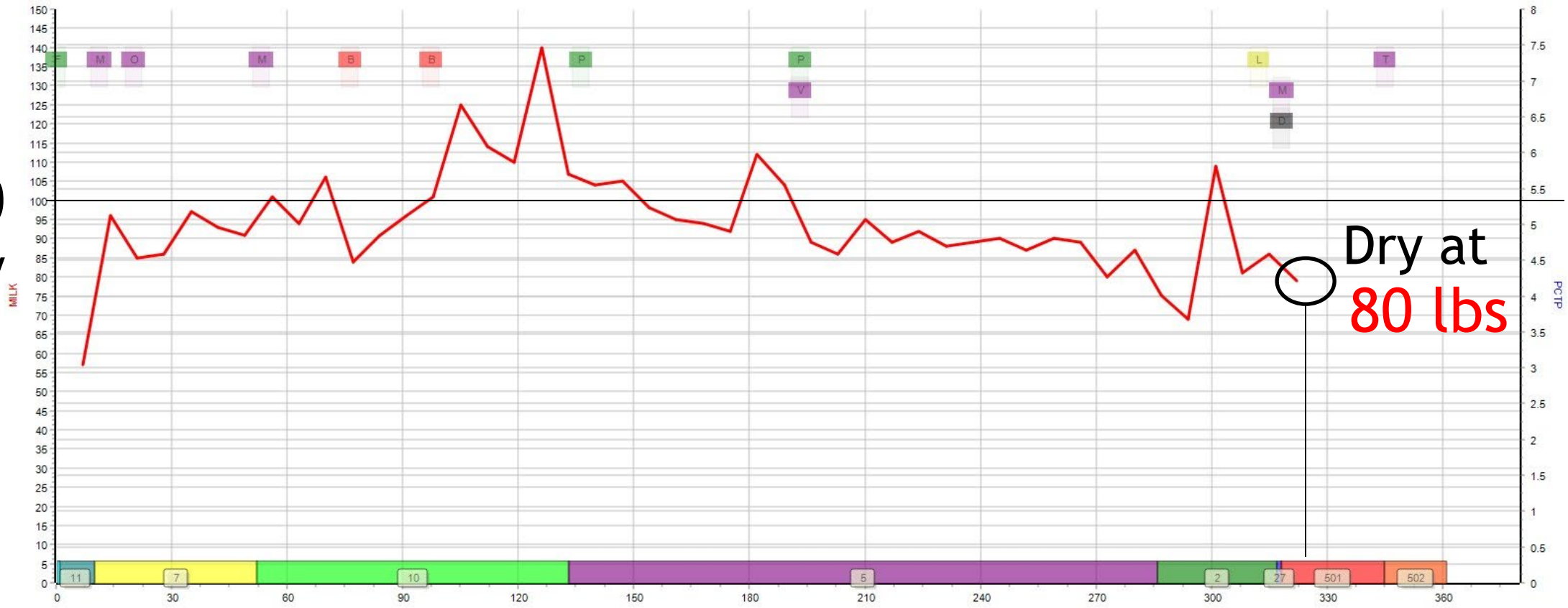
Slide: Dr. Paul Fricke, U of Wisconsin - Madison

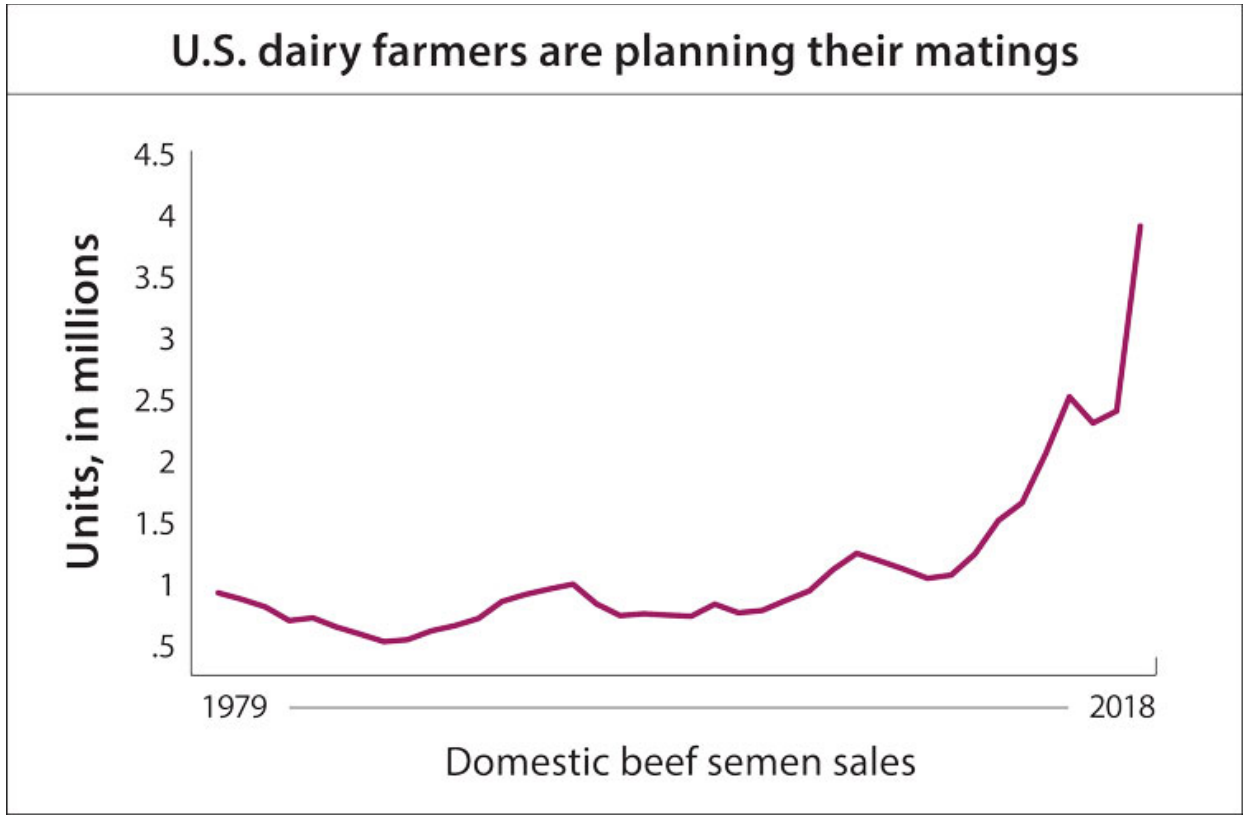

Preg Rate-Current
Num of Herds
1,600
1,400
1,200
1,000
800
600
400
200
0
0
10
20
30
40
50
60
70
80
90
100
110
120
20%
30%
40%
Pregnancy Rate
March 2020
9416 herds
Mostly eastern US
www.drms.org

Cows are dried off at high milk yields

DIM	318
LACT	1
PEN	502
PPEN	500
DSLH	264
DUE	12/31/21
PMILK	72
TRANS	0

100
lbs/day





HOARD'S DAIRYMAN INTEL March 23 2020 08:05 AM

7 Total Shares

It's either sexed or beef semen for them

BY MAGGIE GILLES, KANSAS DAIRY FARMER

Trend:
Sexed semen + beef-on-dairy
How many heifers do we need?

https://extension.umd.edu/resource/managing-heifer-inventory-dairy

This cow is eligible for insemination. Now what?

- Inseminate?
- When?
- Which sire?

Funding:
Food and Agriculture Cyberinformatics and Tools grant no. 2019-67021-28823 of USDA-NIFA

https://www.dairynz.co.nz/milking/new-dairies-and-technology/automated-heat-detection/

inseminatiewaarde

June 2021

CRV developed a new metric called "Insemination value"

Based on 1980s literature

CRV

CRV
June 25, 2021 ·

Nog een keer insemineren of gust laten en afvoeren? CRV heeft een kengetal ontwikkeld dat je helpt bij die afweging: de inseminatiewaarde (iw). Deze geeft weer wat het verwachte extra rendement is als de koe na inseminatie drachtig wordt, in vergelijking met afvoeren op een later moment.

De inseminatiewaarde houdt rekening met de leeftijd van de koe, het lactatiestadium, de lactatiewaarde van de laatste monstername en de lactatiewaarde van de vorige lactatie. De inseminatie... See more

63 12 Comments 1 Share

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Author
CRV
We kregen naar aanleiding van dit bericht veel vragen over de inseminatiewaarde en andere kengetallen. Meer weten over hoe het ook al weer zit met al die cijfers? Lees dan de digitale versie van ons handboek 'beslissen van kalf tot koe'. Vorig jaar is ... See more

CRV4ALL.NL
Handboek Beslissen van kal...

Like · Reply · 28w

Geert Hol

Insemination values, multiple sires (UF idea)

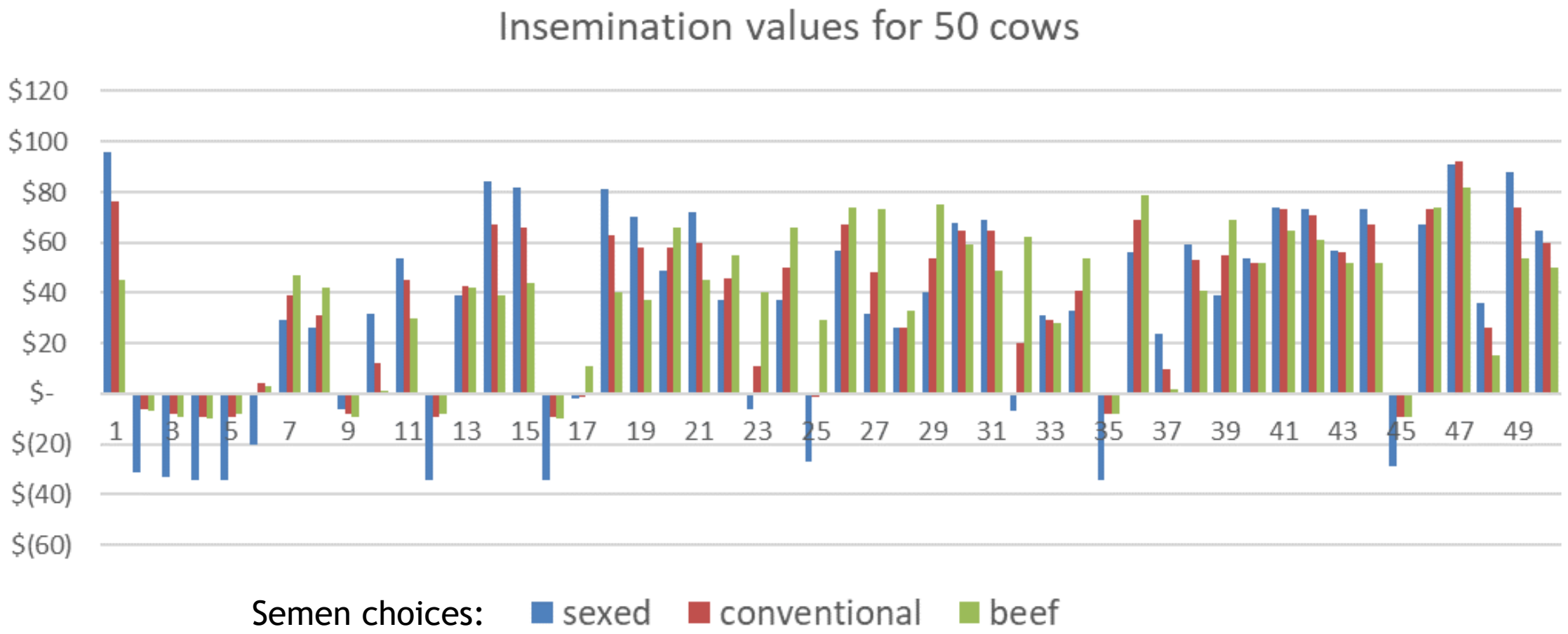
Predict net present value (NPV) of future cash flows following each insemination opportunity:

NPV(future cash flow (insemination, sire A))
– NPV(future cash flow (delay insemination))
= Insemination value (sire A)

Repeat for every potential sire B, C, D, …

Choose sire with highest insemination value (subject to constraints)

Illustration: 50 real cows (3 semen choices)



Cash flow predictions

- Future cash flow affected by value of keeping cow in the herd (vs. replace) and value of calf

Attributes:

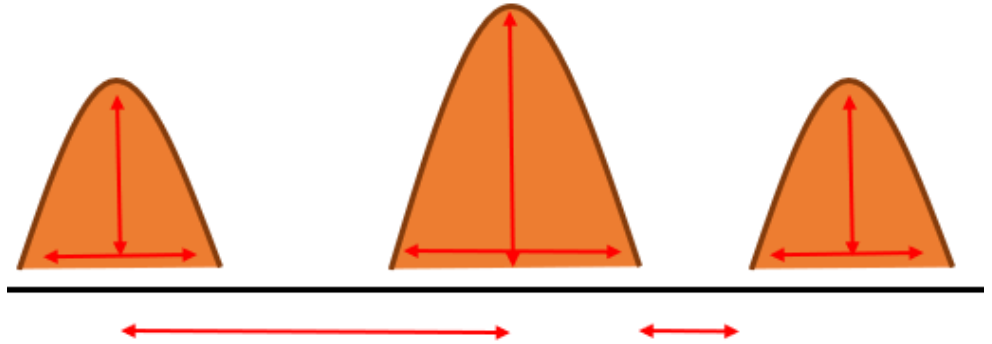
- Dam: Lactation, DIM, fertility, milk production, genetic merit, …
- Sire: Semen type, breed, price, sire conception rate, risk of abortion, genetic merit, …
- Mating: Dam + Sire (+ inbreeding + …)

Dynamic programming to calculate future cash flows

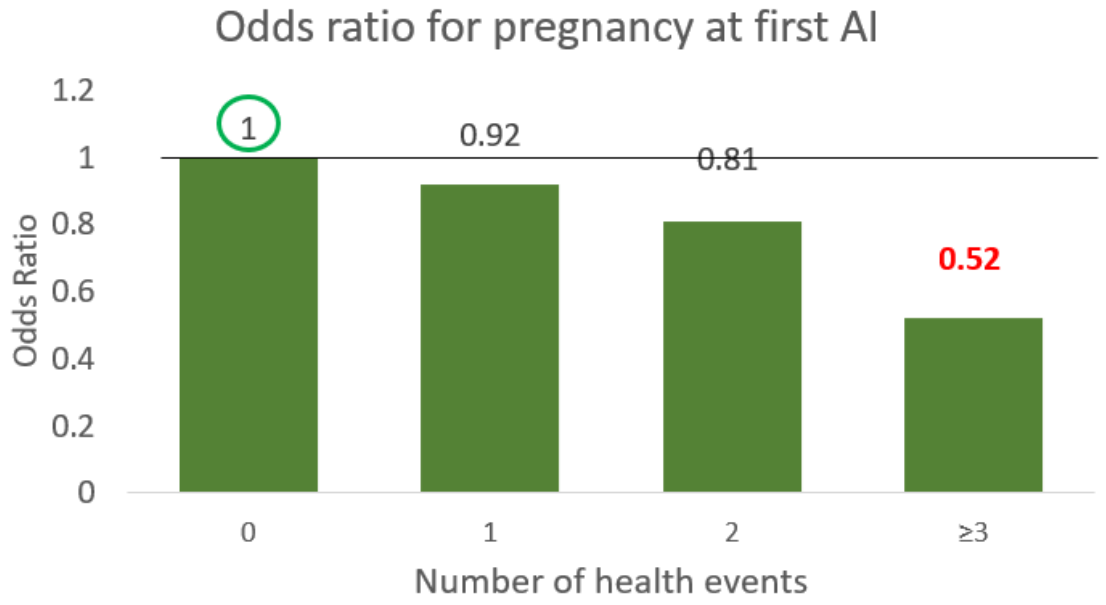
Insemination values more accurate through ...

- Better prediction fertility
- Better prediction milk yields, health, dry matter intake, bodyweight, BCS, …
- Use all past relevant data
- Data silos

Quantifying estrous behavior



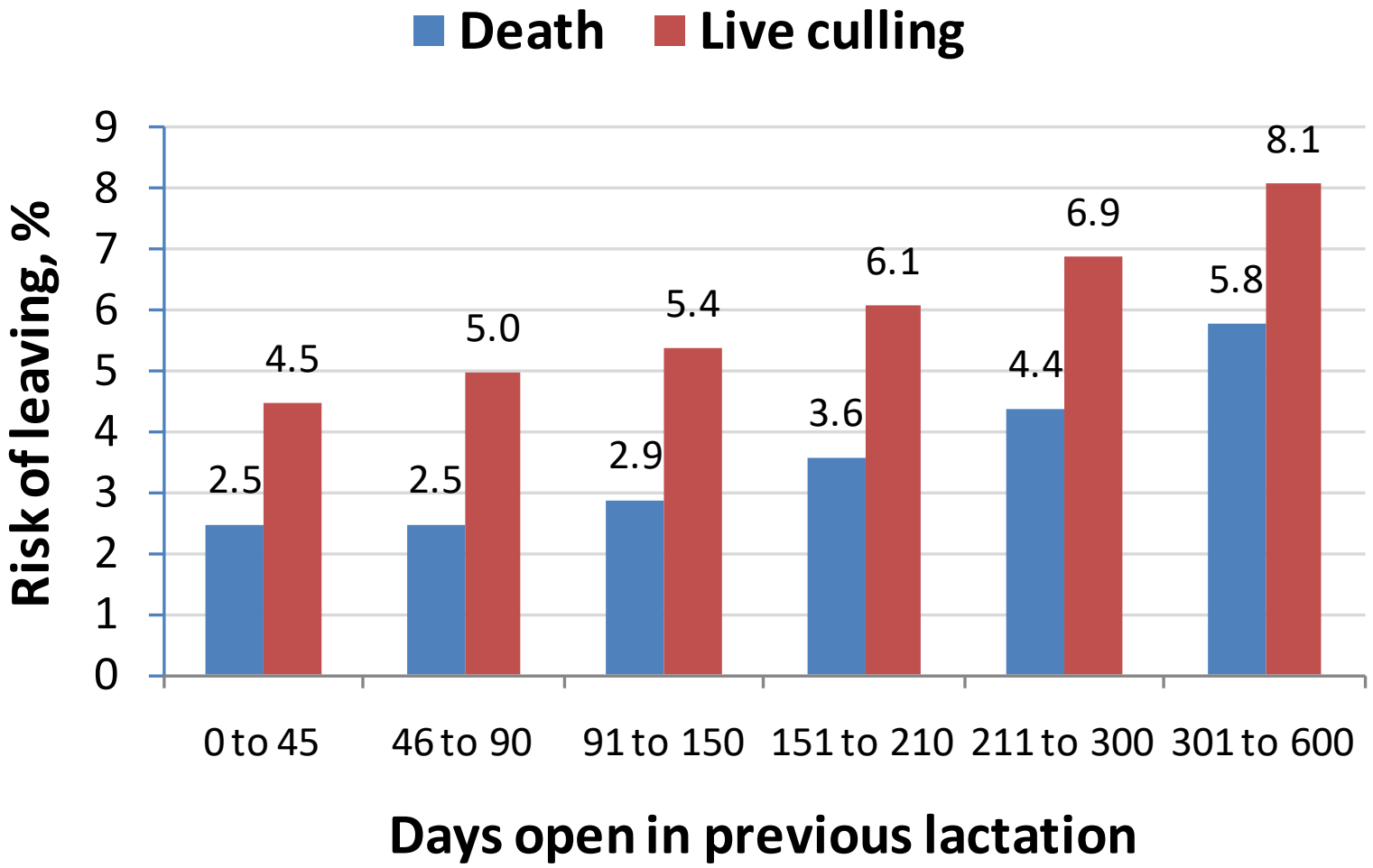
Ronaldo Cerri, UBC, Canada



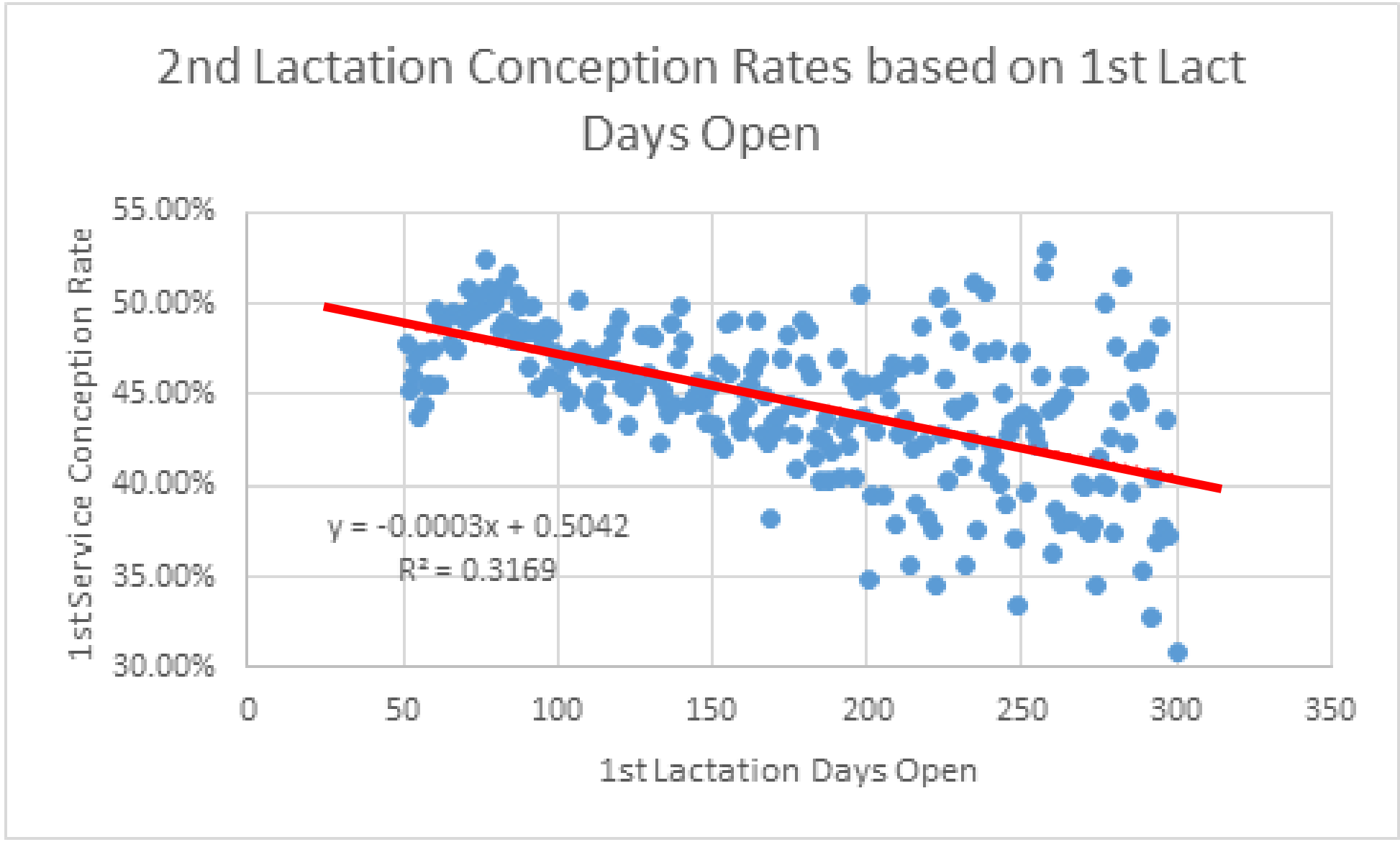
Pablo Pinedo, CSU, USA

2. Fertility, BCS, and days open

Longer days open increases risk of leaving herd in first 60 days of next lactation



Pinedo and De Vries, 2010 (J. Dairy Sci. 93:968)

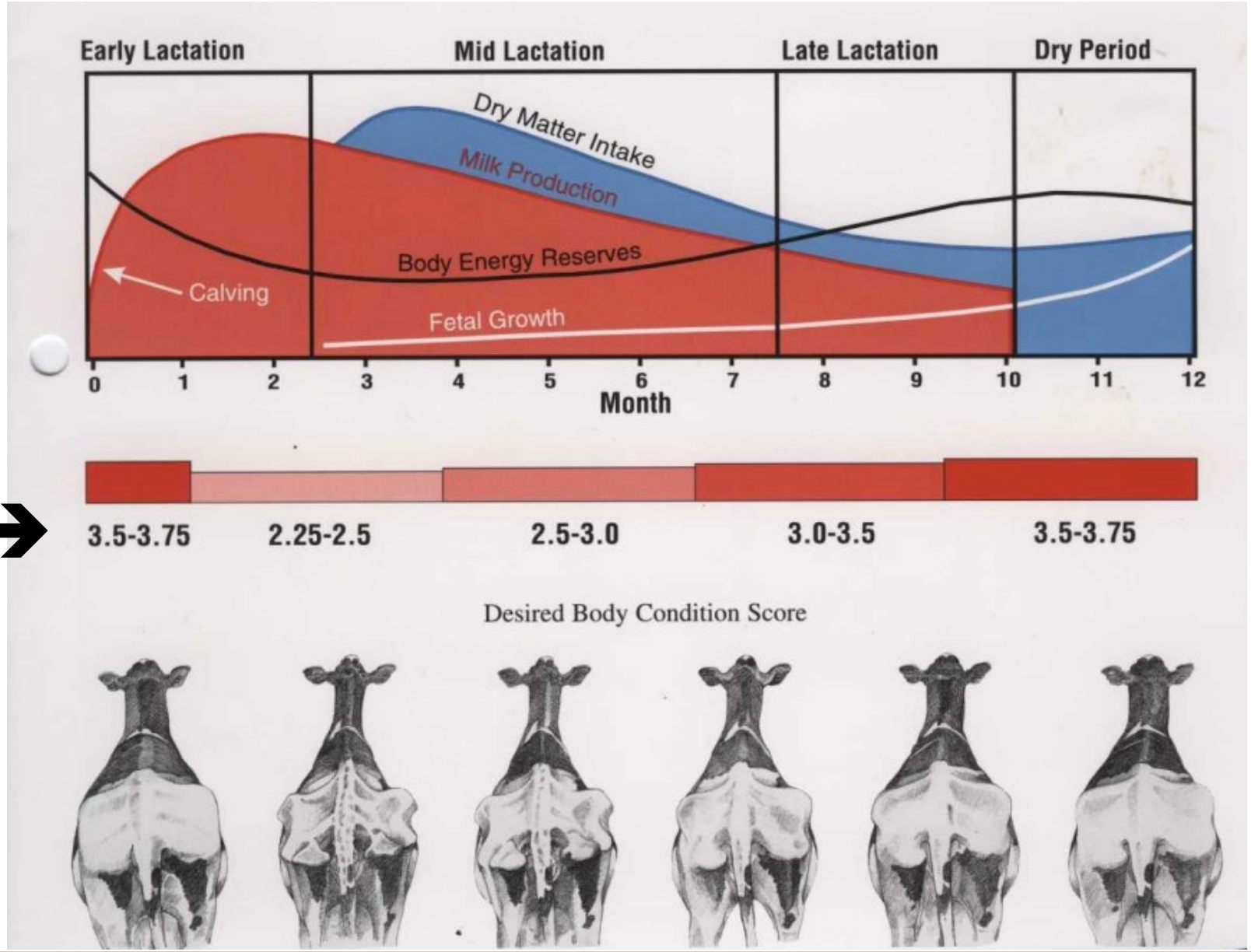


+100 days longer open decreases next lactation 1st service CR by 3 %points

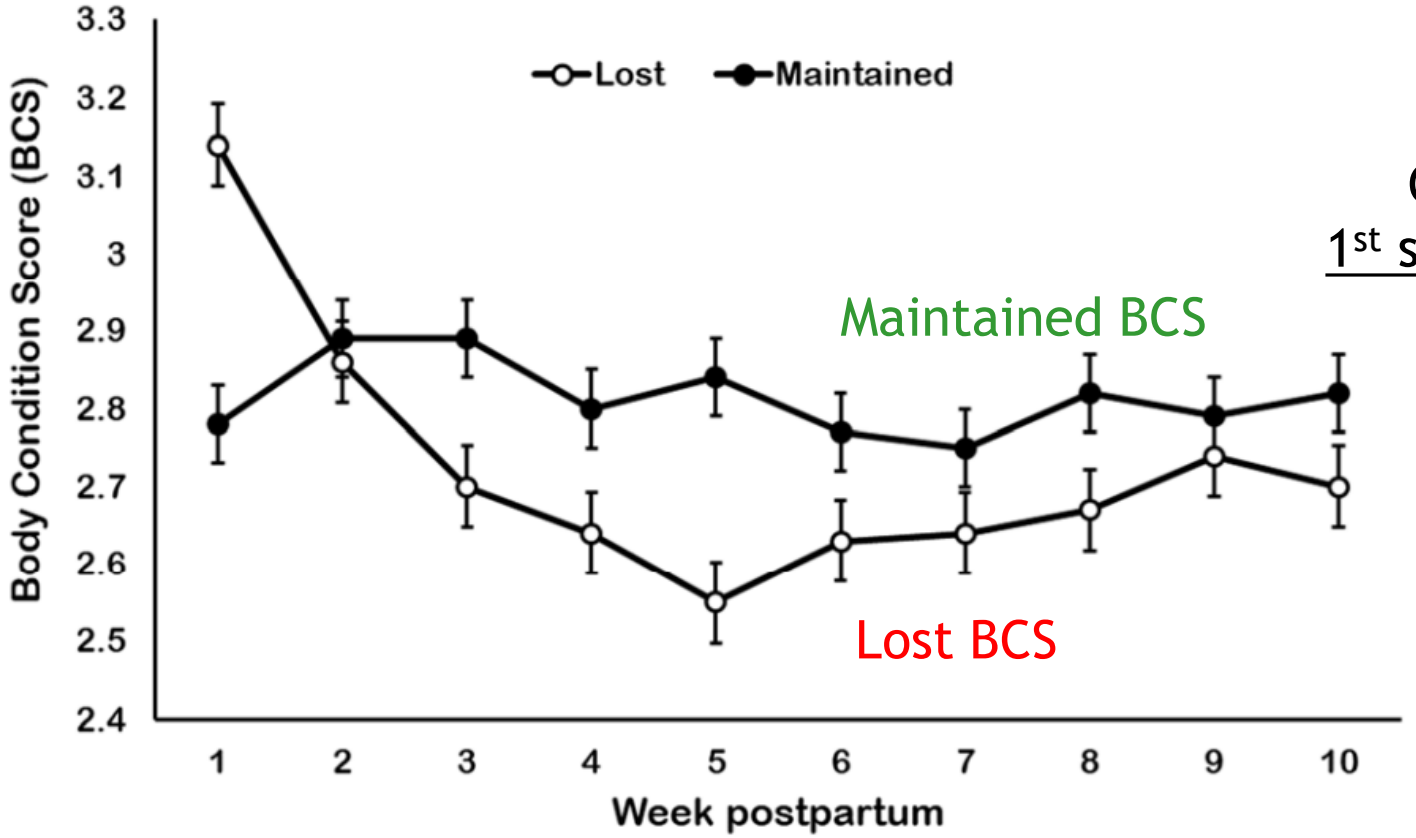
Source: Dr. Robert Fourdraine, Dairy Records Management Systems, NC (2022)

Body condition scoring in cattle (1998. Elanco)

BCS ➔



Cows that maintain BCS post partum have greater P/AI



Britt (1992)
Conception rates

	1st service	all services
Maintained BCS	62%	61%
Lost BCS	25%	42%

The “Britt Hypothesis” (Britt, 1992). Credits Dr. Paul Fricke, U of Wisconsin-Madison

Effect of change in BCS early in lactation on conception rates (P/AI) 1887 cows. 2 WI farms. From Carvalho et al. (2014)

	BCS change first 21 DIM		
	Lost	Maintained	Gained
%cows	42%	36%	22%
P/AI at 40 d	25%	38%	84%
P/AI at 70 d	23%	36%	78%
BCS at calving	2.93%	2.89%	2.85%
BCS at 21 DIM	2.64%	2.89%	3.10%
BCS change	-0.29%	0.00%	+0.25%
1st ECM (lbs/d)	68.0	69.3	63.1

Credits Dr. Paul Fricke, U of Wisconsin-Madison

BCS around calving

- Cows with a higher BCS at calving (Barletta et al., 2017):
  - Greater BCS loss
  - Lower fertility
  - More health issues

- Cows with longer days open (Middleton et al., 2019):
  - Greater BCS at calving
  - Greater BCS loss after calving

Credits Dr. Paul Fricke, U of Wisconsin-Madison

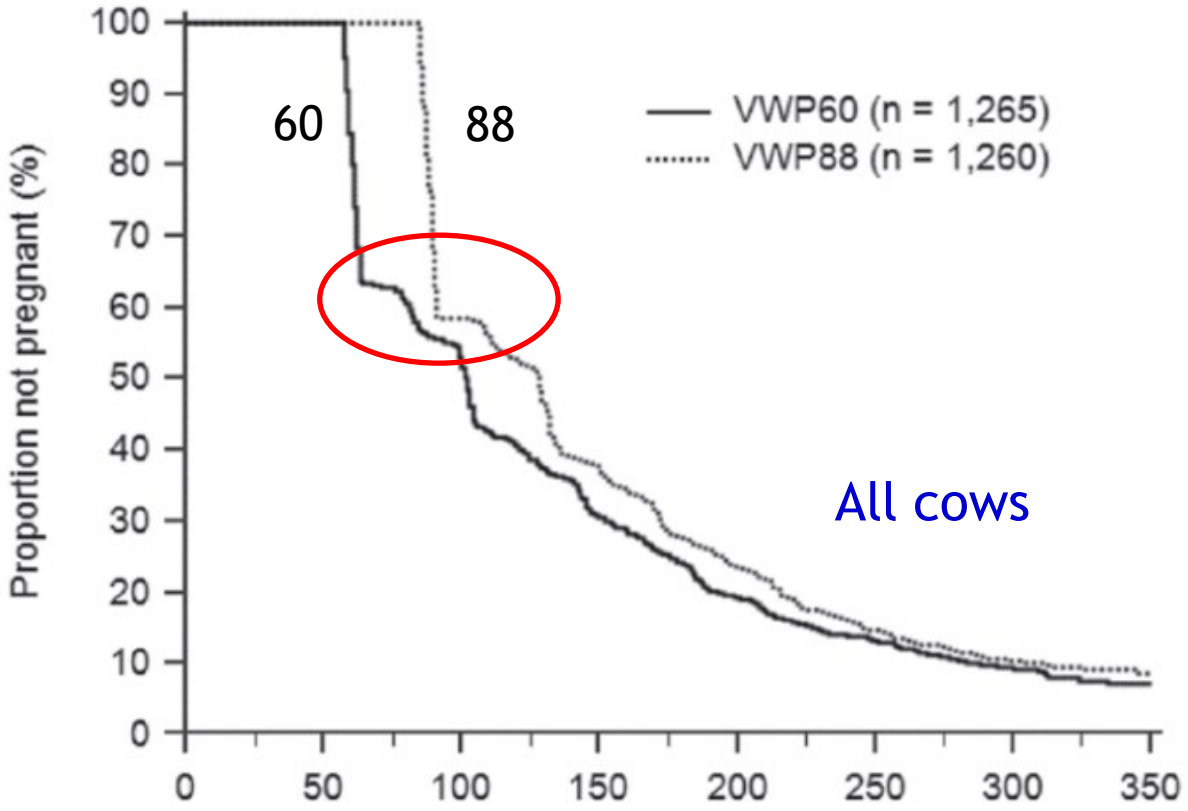
3. Extend voluntary waiting period?

J. Dairy Sci. 101:717–735
https://doi.org/10.3168/jds.2017-13046

Extending the duration of the voluntary waiting period from 60 to 88 days in cows that received timed artificial insemination after the Double-Ovsynch protocol affected the reproductive performance, herd exit dynamics, and lactation performance of dairy cows

M. L. Stangaferro,* R. Wijma,* M. Masello,* Mark J. Thomas,† and J. O. Giordano*[1]
*Department of Animal Science, Cornell University, Ithaca, NY 14853
†Dairy Health and Management Services, Lowville, NY 13367

- First TAI, P/AI (first lact.)
  - VWP60: 46%
  - VWP88: 55%
- First TAI, P/AI (all cows):
  - VWP60: 40%
  - VWP88: 46%
- VWP60 got cows pregnant faster



J. Dairy Sci. 101:7500–7516
https://doi.org/10.3168/jds.2018-14484

Economic performance of lactating dairy cows submitted for first service timed artificial insemination after a voluntary waiting period of 60 or 88 days

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*Department of Animal Science, Cornell University, Ithaca, NY 14853
†Dairy Health and Management Services, Lowville, NY 13367

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	Primiparous				Multiparous			
	VWP60	VWP88	Diff	P<0.05	VWP60	VWP88	Diff	P<0.05
#cows	480	471			785	789		
Milk income over feed cost	3806	3803	-3	NS	4363	4324	-39	NS
Calf value	101	103	2	NS	81	78	-3	NS
Replacement cost	327	259	-68	NS	625	674	49	NS
Reproductive cost	98	91	-7	*	104	94	-10	*
bST cost	216	222	6	*	219	225	6	*
Other expenses	1512	1512	0	NS	1512	1512	0	NS
Cash flow (18 months)	1756	**1824**	+68	NS	**2006**	1921	-85	NS
Cash flow per day	3.25	3.37	+0.12	NS	3.71	3.56	-0.15	NS

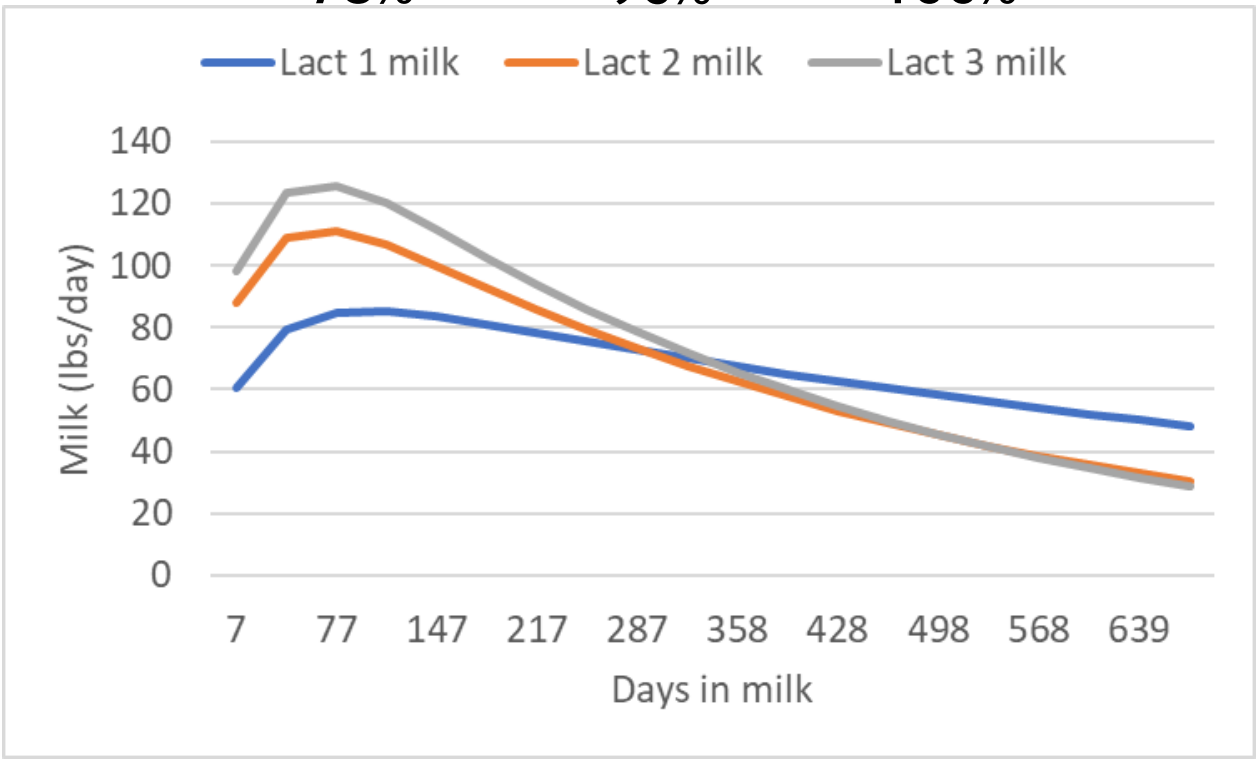
Study of optimal VWP (TAI) with *Insemination values* algorithm

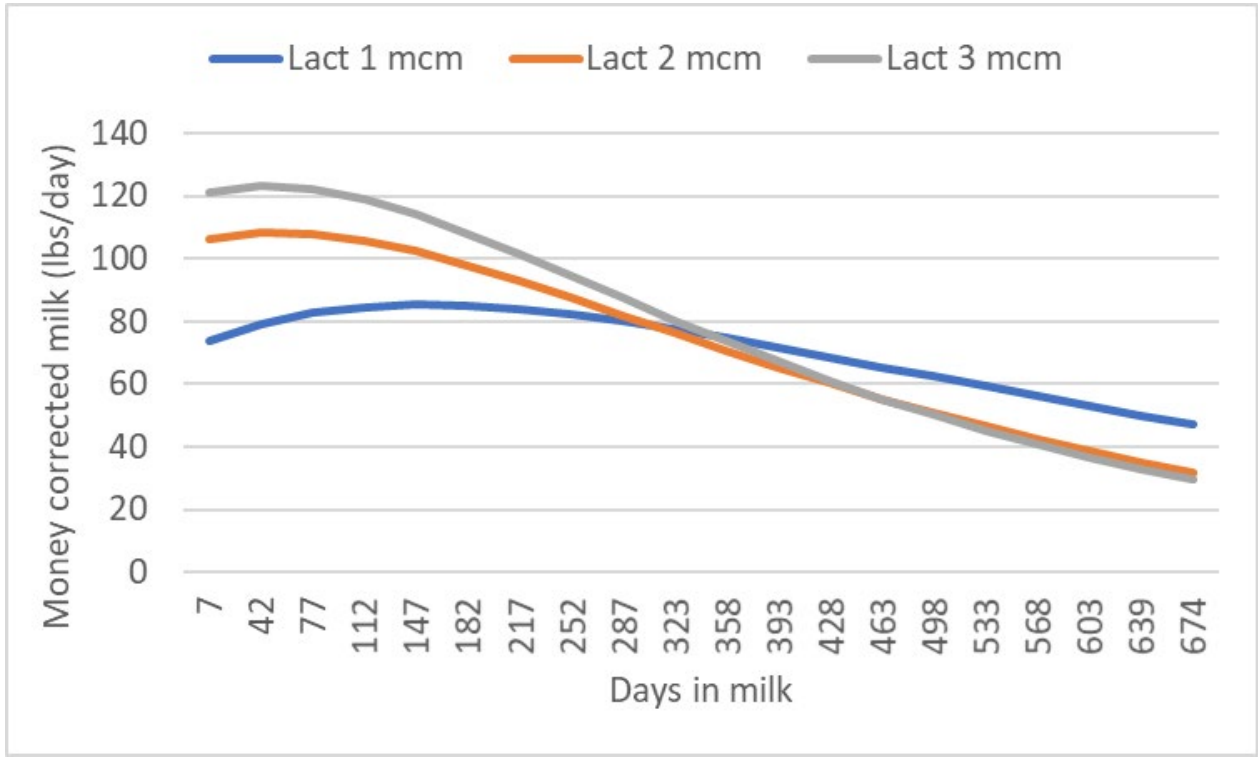
- Many inputs:
  - Milk, fat, protein lactation curves, body weights, dmi, fertility, prices, …
  - *Effect of days open on culling and fertility next lactation*
  - Optimal decision-making: replacement, insemination decisions
- Experiment:
  - Vary week of first insemination: observe cash flow (difference from highest)
  - Vary inputs like P/AI and milk yield maturity
- Cows to watch:
  - First, second, third lactation
  - 5 levels of money-corrected milk yield (80%, 90%, 100%, 110%, 120%)

Assumed average lactation curves

Milk and money-corrected milk

75% 90% 100%

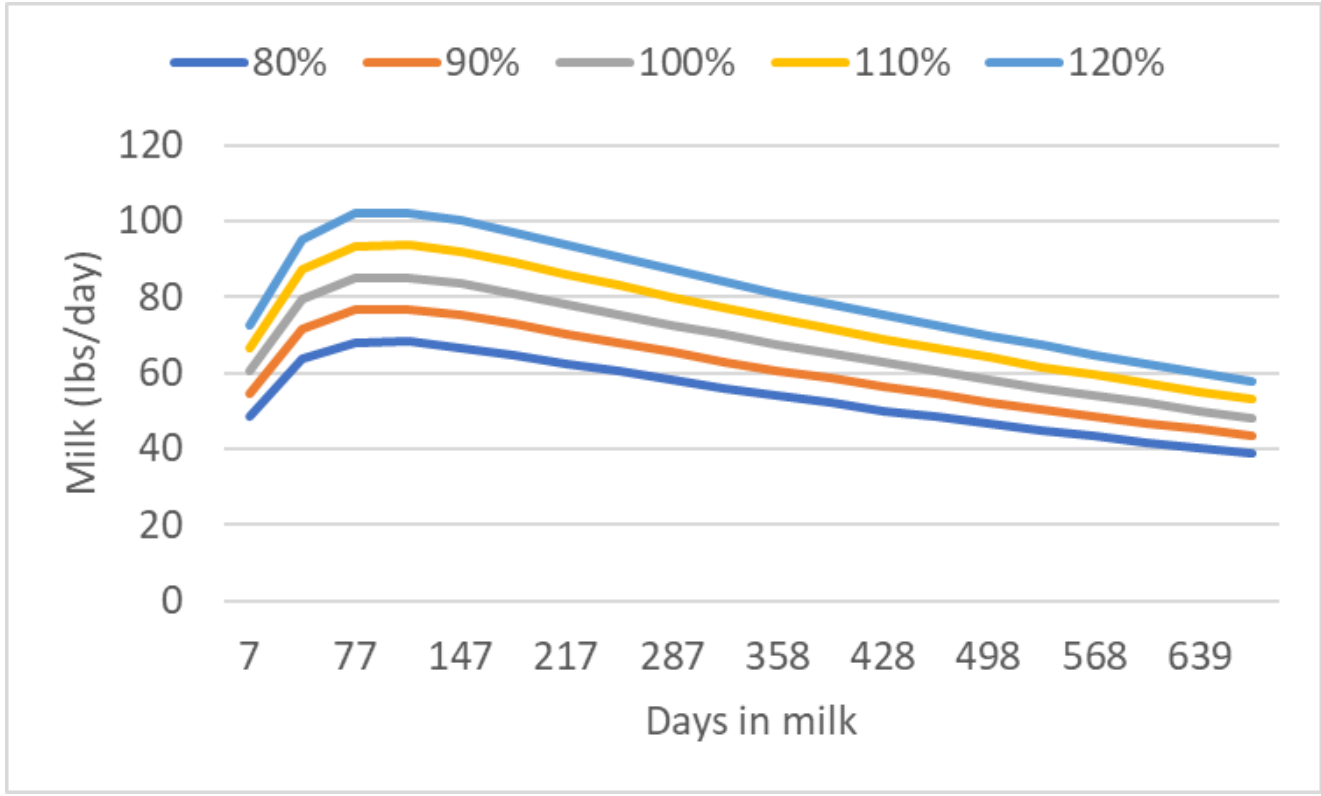




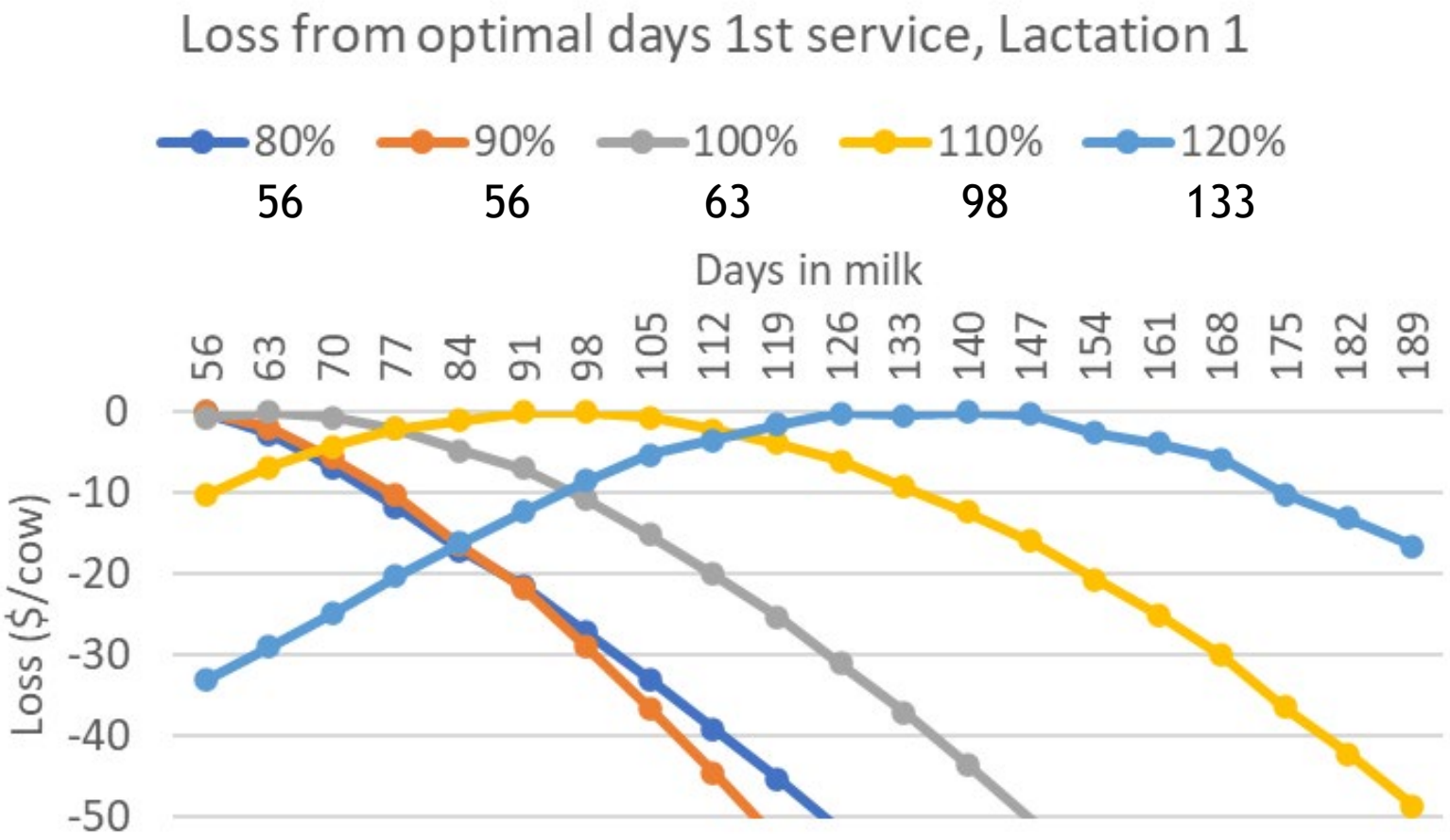
Milk, fat, protein curves: Pattamanont et al. (2020) J. Dairy Sci. 104:486–500

5 levels of milk yield

- 80%, 90%, 100%, 110%, 120% of standard lactation curves
- 50% regression-to-the-mean for next lactation yields:
  - 90%, 95%, 100%, 105%, 110%



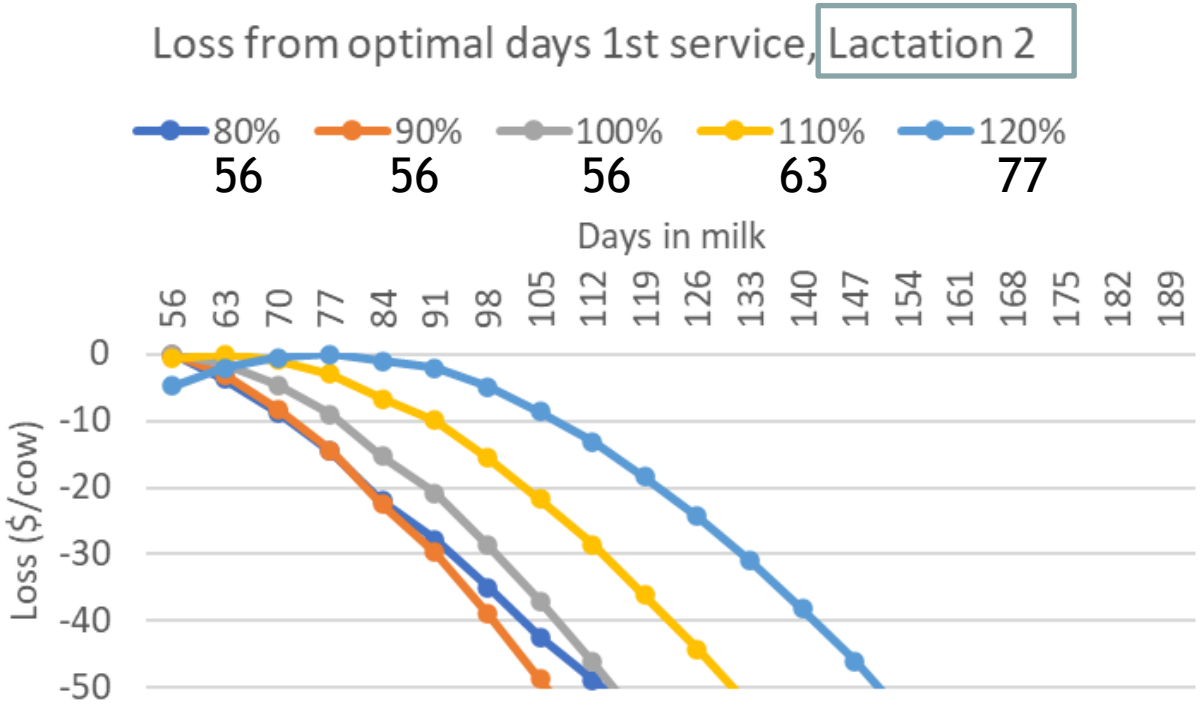
Optimal days 1st service, first lactation cows
Default: 45% P/AI first service, 40% P/AI later services

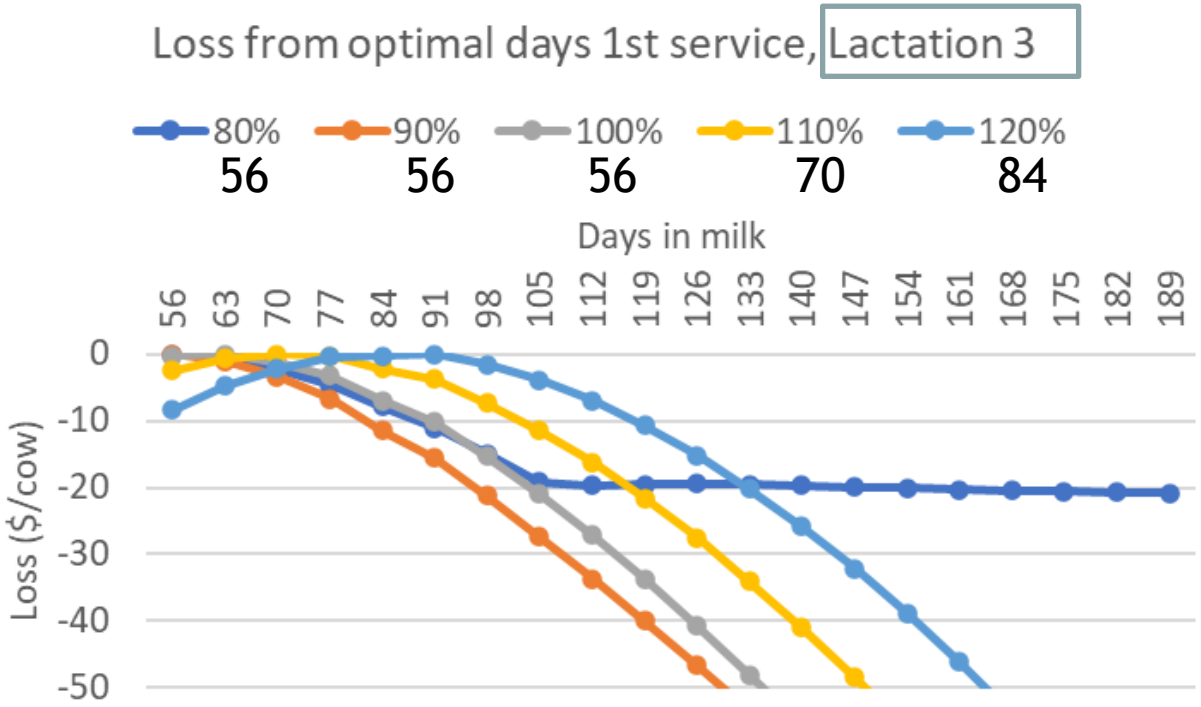


Above average milk yield: delay first service

Optimal days 1st service, second and third lactation cows

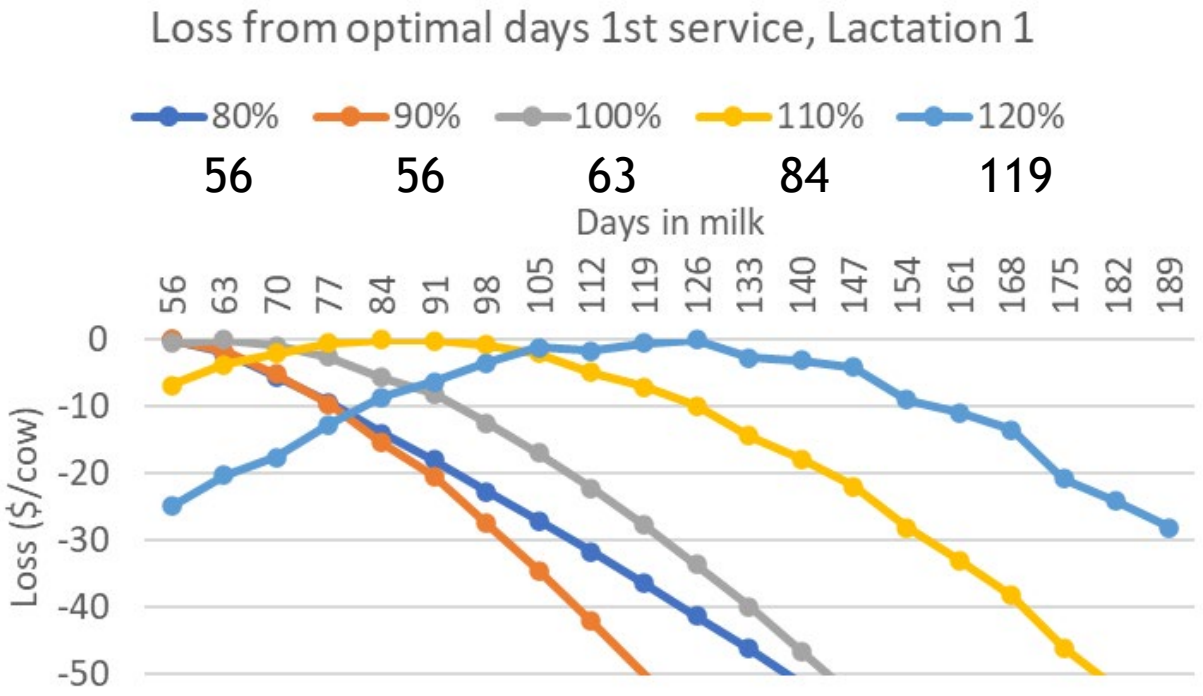
Default: 45% P/AI first service, 40% P/AI later services

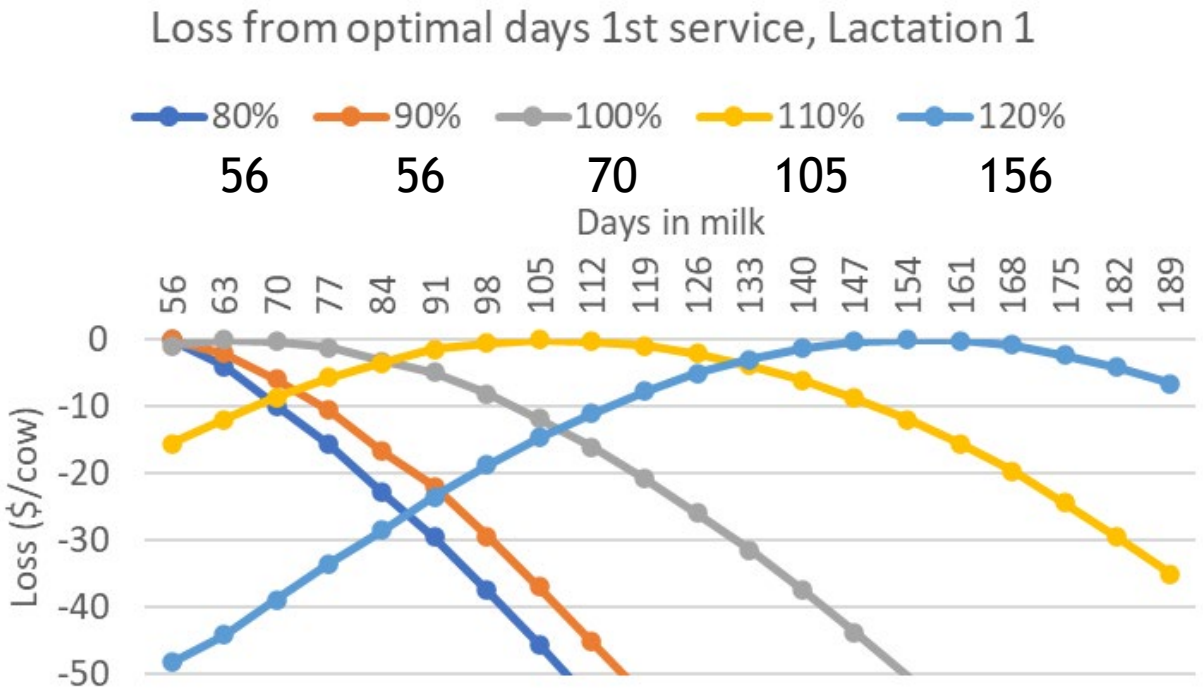




Above average milk yield: delay first service, but less delay than first lactation cows

Optimal days 1st service, first lactation cows
Left: 35% P/AI first service. Right: 70% P/AI first service

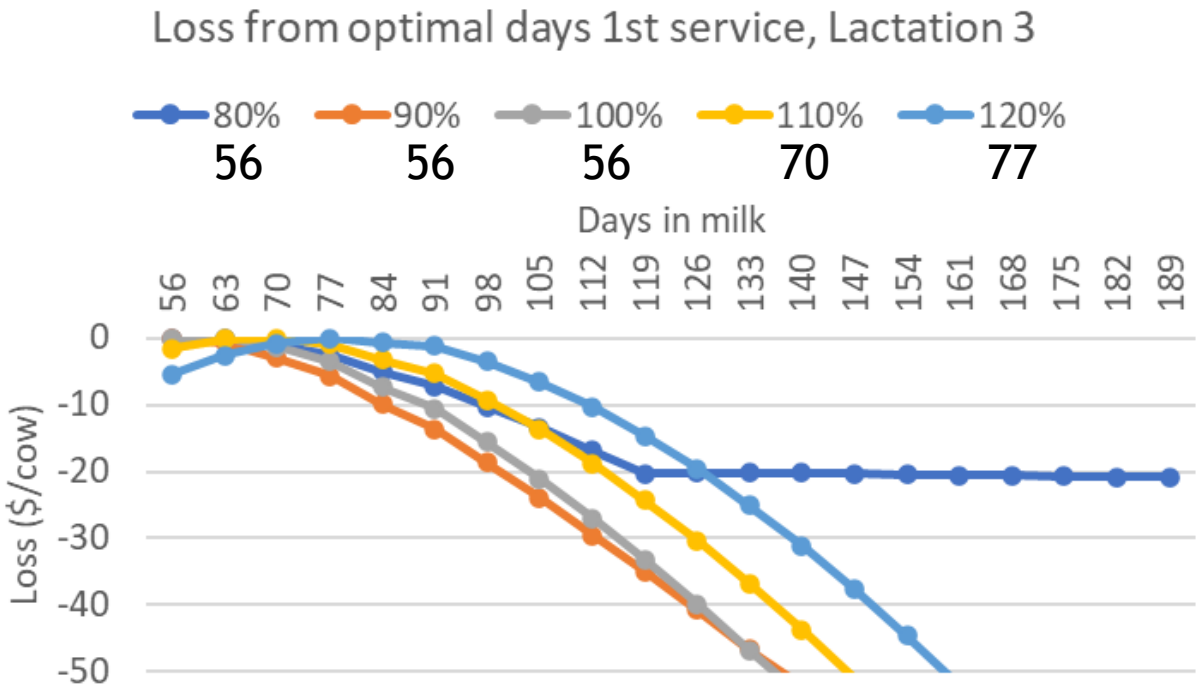


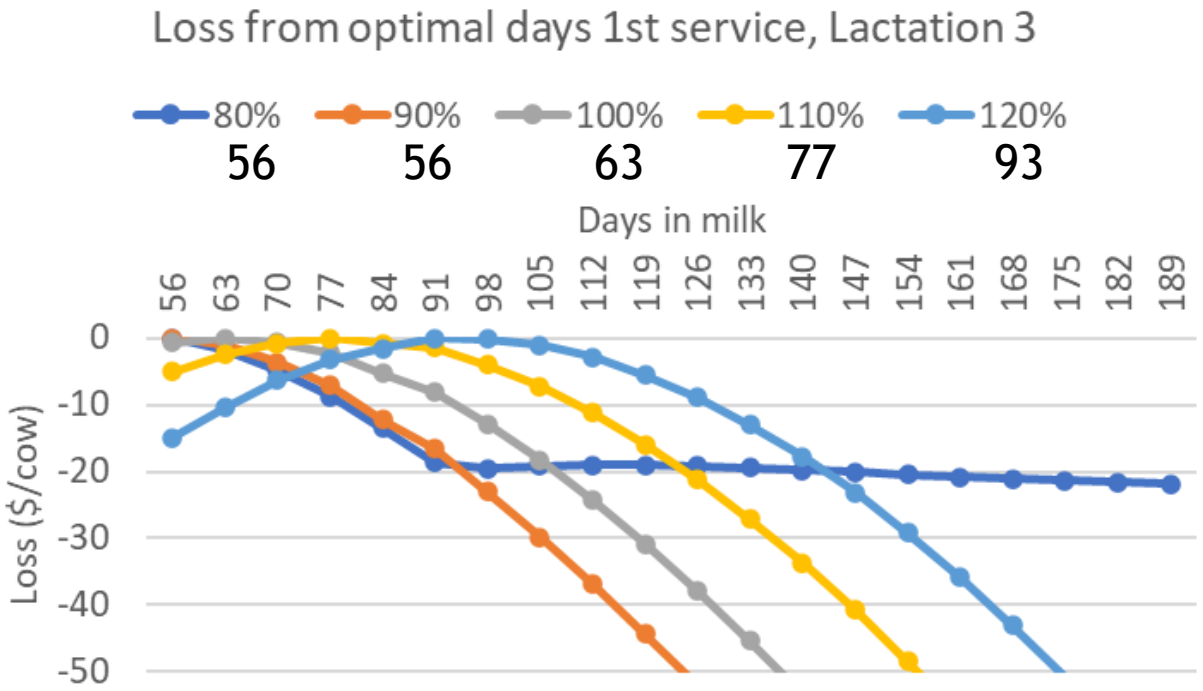


Above average milk yield: more delay first service with greater P/AI

Optimal days 1st service, third lactation cows

Left: 35% P/AI first service. Right: 70% P/AI first service

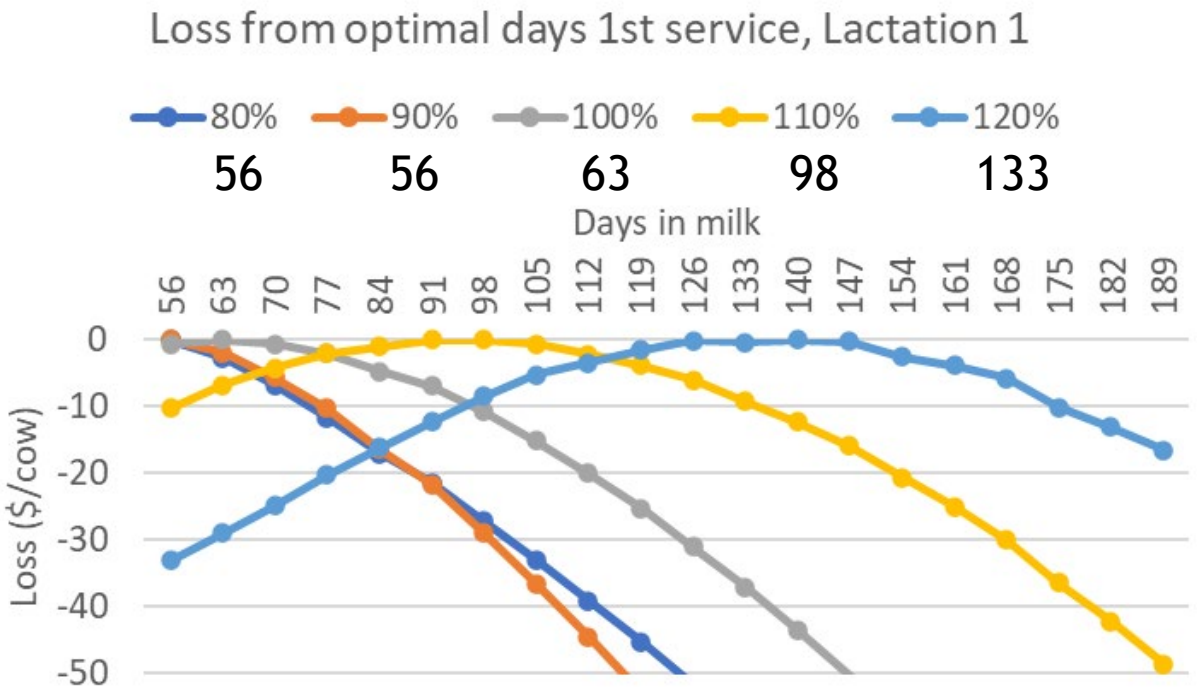


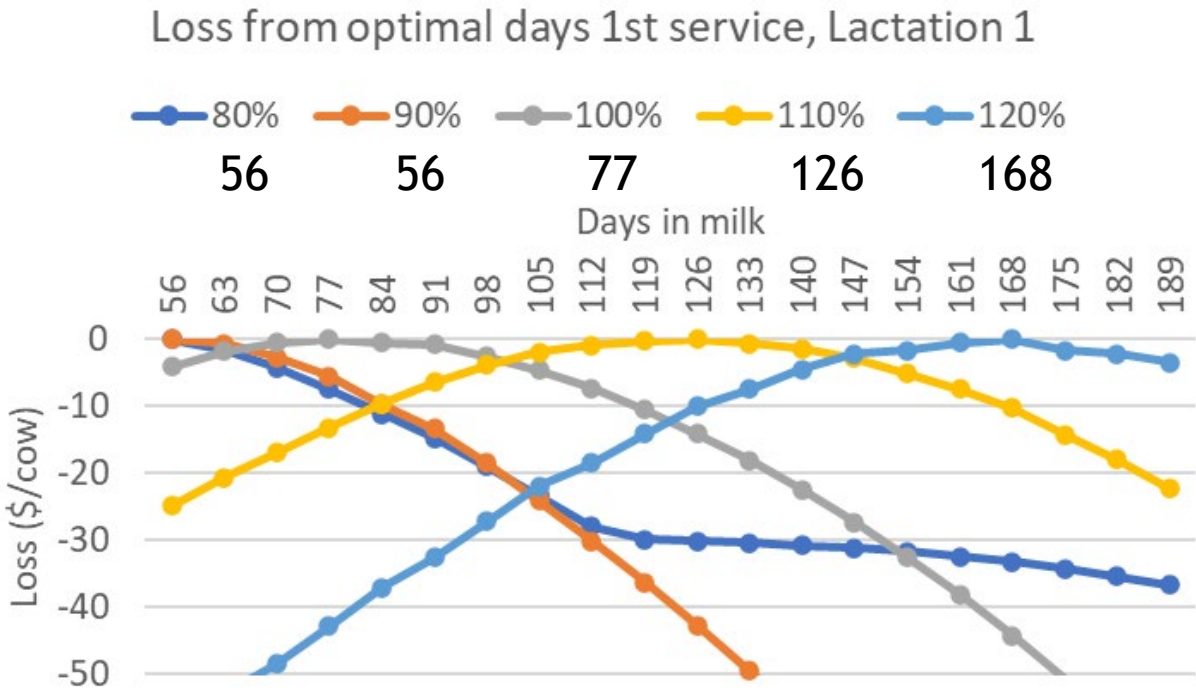


Higher milk yield: delay first service with greater P/AI, but less delay than first lactation cows

Optimal days 1st service, first lactation cows

Left: 75% maturity. Right: 80% maturity

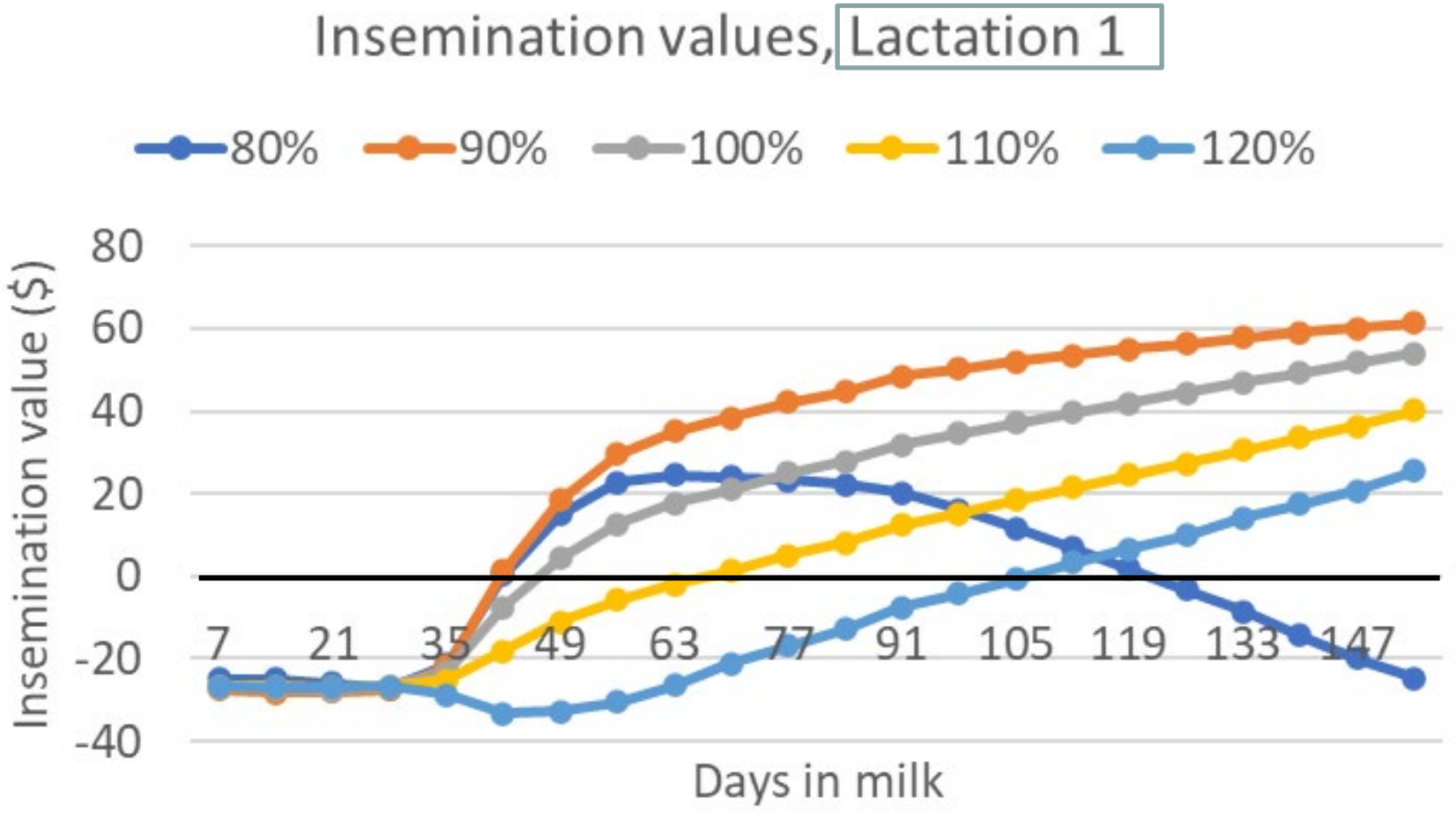




Greater maturity in first lactation cows: delay first service for above average cows

Insemination values, first lactation cows

Default: 45% P/AI first service, 40% P/AI later services

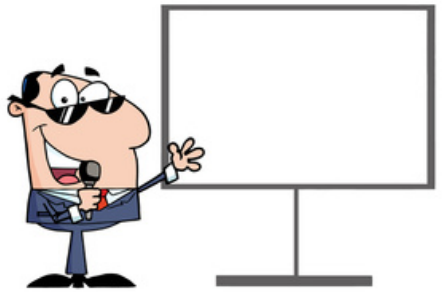


Higher milk yield: delay first service

Below average producing cows: get less time to get pregnant, are culled earlier

4. Conclusions

Conclusions (preliminary)



1. It is complicated. Many factors drive results
2. Extend VWP for cows producing higher than average
   - How well can we predict milk yield? Regression-to-the-mean
3. Economic losses from non-optimal VWP are minor
4. Higher fertility → more likely to extend VWP
5. How do we get an optimal BCS pattern?

Thank you

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