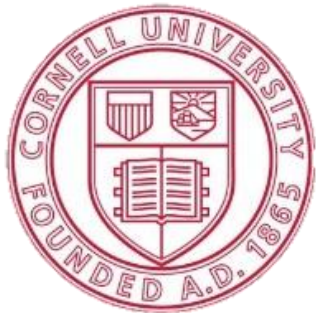




Reducing Heifer Rearing Cost through Improved Reproductive Management

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Cornell
CALS

College of Agriculture
and Life Sciences

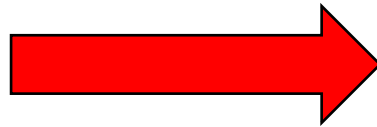
Animal Science

Outline for today's presentation

1. Does **time to pregnancy** affect the heifer enterprise **economics**?
2. Does **earlier AFC** negatively affect **reproductive performance** during first lactation?
3. Are there effective programs designed to maximize **AI at detected estrus**?
4. Are there effective **TAI** programs available?
5. What are the most profitable **reproductive management programs**?

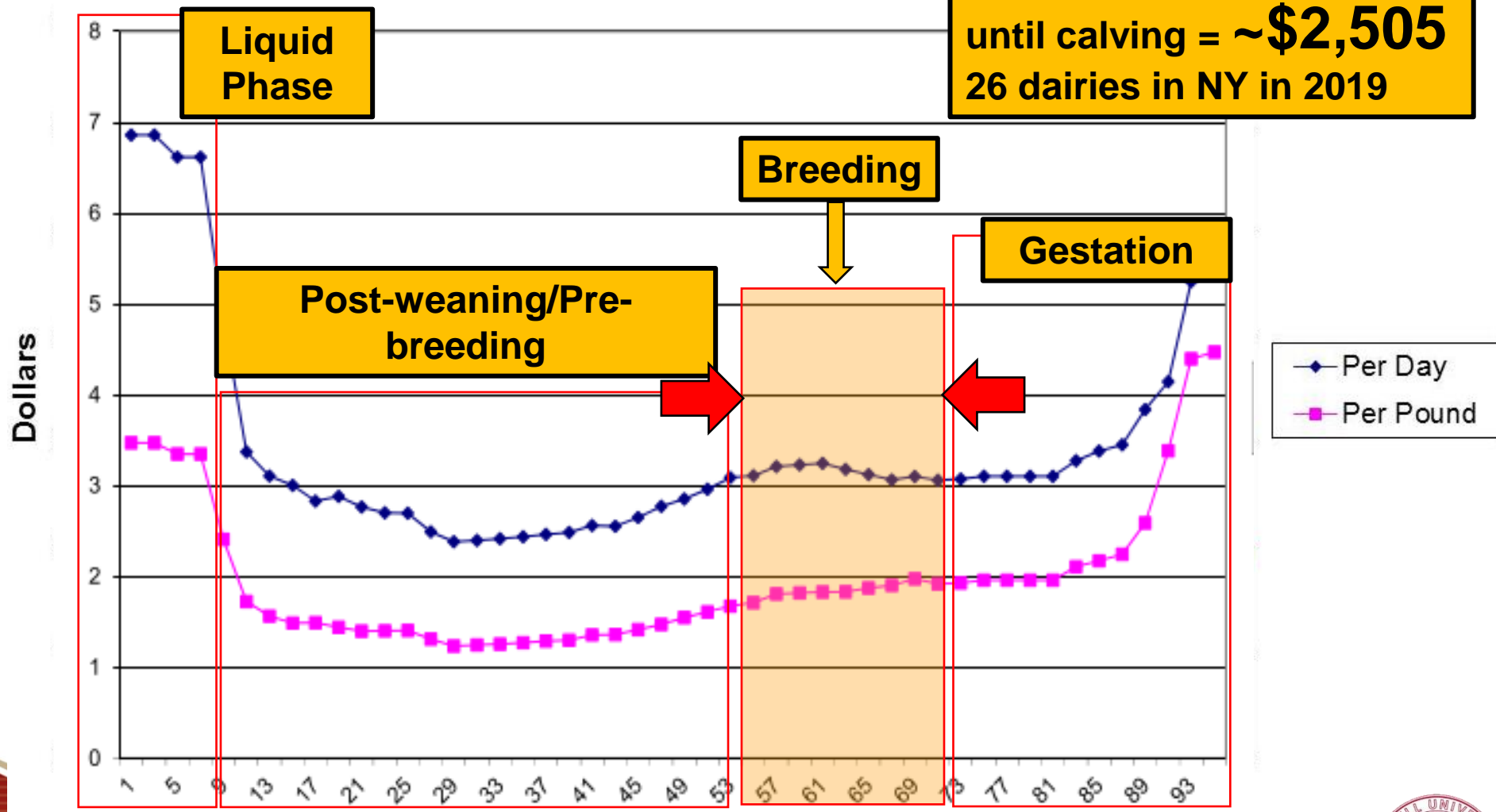


Does the reduction in AFC due to a reduction in time to pregnancy affect the heifer enterprise economics?

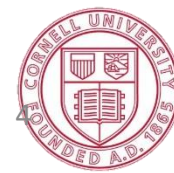


Role of reproduction in heifer rearing cost dynamics

Average rearing cost until calving = ~\$2,505
26 dairies in NY in 2019



Age in Weeks
Karzsez and Hill, 2020 Pro-Dairy



Does time to pregnancy affect the heifer enterprise economics?

Hypothesis:

Reduced AFC due to improved reproductive performance would improve the economics of Holstein replacements

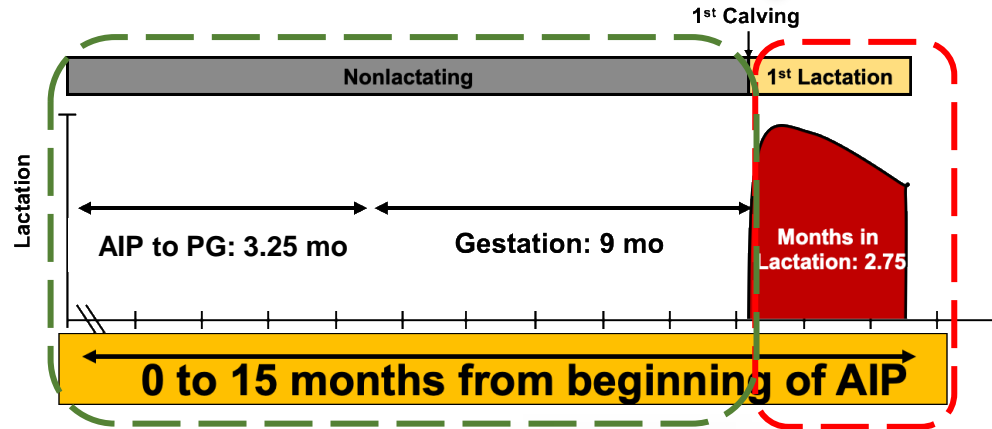
- ❑ Nulliparous Holstein heifers from 3 commercial farms in NY (n = 1,144)
- ❑ Eligible for AI at 368 ± 10 days (12 mo) of age
- ❑ After calving, heifers were **retrospectively** assigned to 1 of 3 groups based on AFC tertiles within farm:
 - Low (n = 391; 20.2 to 21.8 mo)**
 - Medium (n = 376; 21.4 to 22.8 mo)**
 - High (n = 377; 22.1 to 28.7 mo)**



Cash flow estimations conducted per 15 mo per slot



AIP = artificial insemination period



Cash flow rearing period = Repro cost + Feed cost + Replacement Cost + Other operating expenses

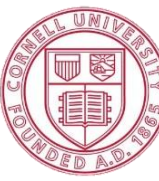
Cash flow lactating period = IOFC+ Calf value + Replacement Cost + Other operating expenses

Cash flow (\$/slot/15 mo)



Differences in AFC among groups were explained by differences in age and P/AI at first service

	AFC group			
	Low (n = 391)	Medium (n = 376)	High (n = 377)	P-value
Age 1 st AI (d)	371 ± 0.5 ^a	376 ± 0.5 ^a	378 ± 0.5 ^b	<0.01
P/AI 1 st AI	95.9% ^a	33.2% ^b	0.3% ^c	<0.01

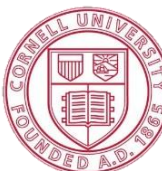


Reduced AFC led to greater cash flow per slot per unit of time

Item (per slot)	AFC Groups			P-value
	Low (n = 391)	Medium (n = 376)	High (n = 377)	
Repro cost, \$	39.9 ± 0.9 ^a	57.0 ± 0.9 ^b	94.6 ± 0.9 ^c	< 0.01
TOTAL RP cost, \$	807 ± 22 ^a	900 ± 22 ^b	1,099 ± 22 ^c	< 0.01
TOTAL FLP profit, \$	454 ± 45 ^a	408 ± 45 ^a	304 ± 45 ^b	< 0.01
Cash Flow 15-mo, \$	-354 ± 63 ^a	-492 ± 63 ^b	-795 ± 63 ^c	< 0.01

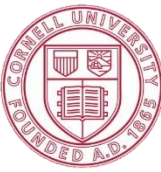
-354 ± 63^a
-492 ± 63^b
-795 ± 63^c

-\$138
-\$441

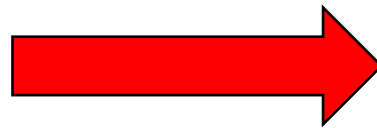
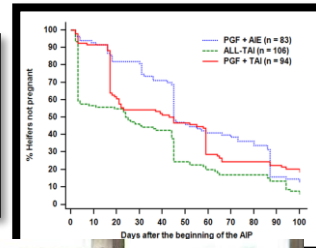
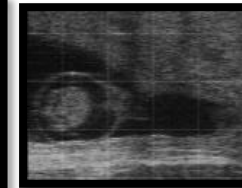
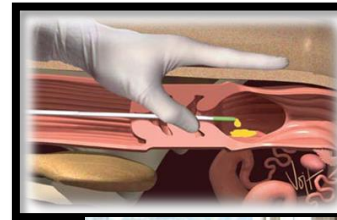


Does time to pregnancy affect the heifer enterprise economics?

- Differences in time to pregnancy driven by differences in reproductive performance (not on growth) led to **substantial benefits**:
 - **Reduced reproductive cost**
 - **Reduced rearing cost** after the beginning of the insemination period
 - **Earlier first lactation revenue** ---- more profits per unit of time
- A major driver of the reduction in time to pregnancy is **days to and fertility after first service**



Does earlier AFC negatively impact reproductive performance during first lactation?



Evaluated effect of AFC on first lactation reproductive outcomes

Retrospective Cohort Study

- Primiparous Holstein lactating dairy cows from 5 farms in NY (n = 2,235)
- Cows grouped by AFC tertiles within farm (n; mean; range):
 - **Low 21.5 (18.5-22.4)**
 - **Medium 22.1 (21.3-23.3)**
 - **High 23.5 (21.8-29.7)**
- Cows managed with program designed to either inseminate as many cows after detection of estrus or synchronization of ovulation as possible



Summary

We **did not observe** significant **negative consequences** for heifers in the **Low** and **Medium AFC** categories for:

- AI at detected estrus
- Pregnancy per AI to first service for AI at detected estrus or TAI services
- Percent pregnant by 200 DIM
- Percent sold and died by 200 DIM

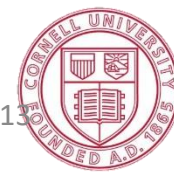
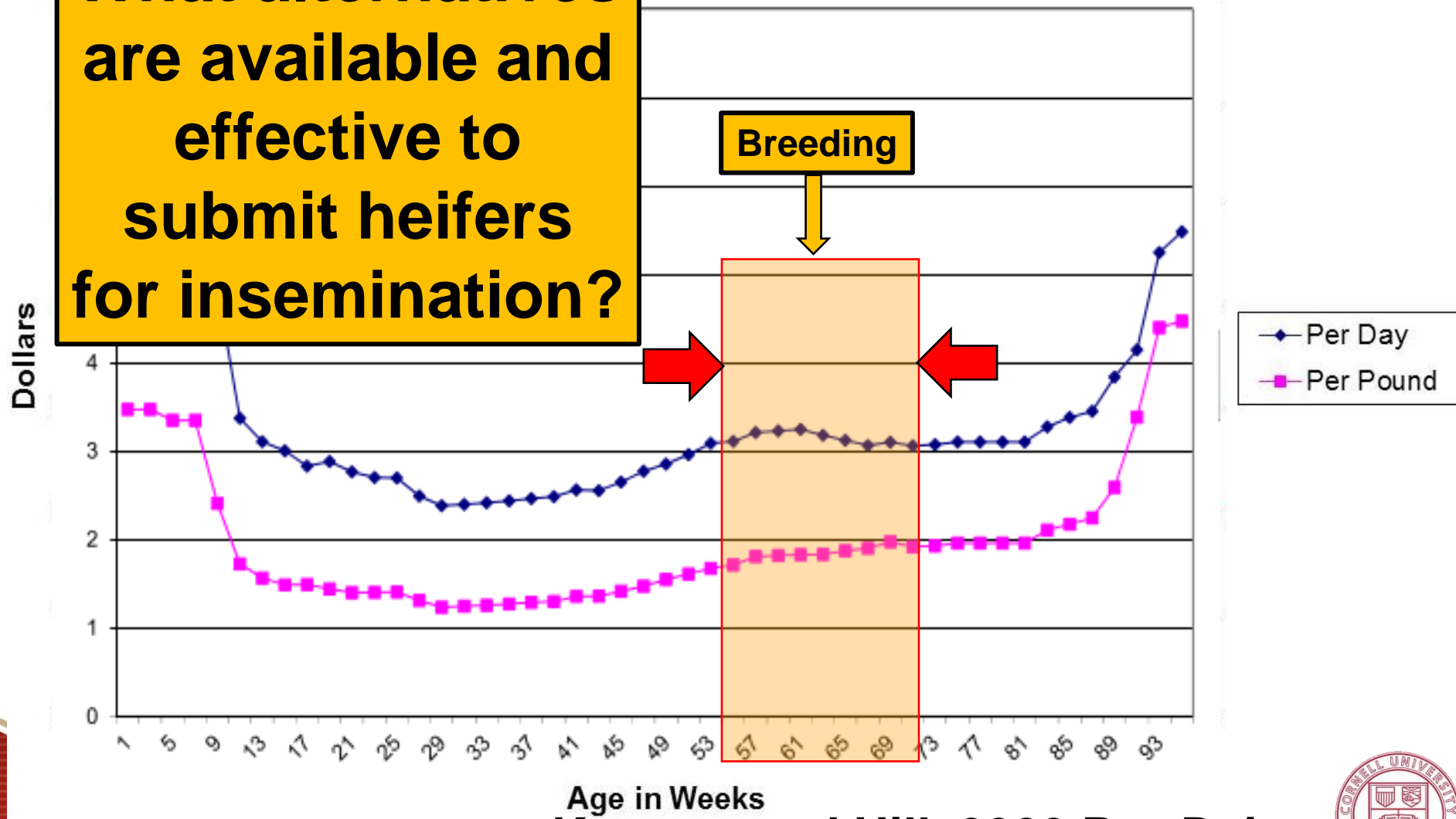
In fact, we observed some **positive effects** for **Low** and **Medium AFC** for:

- AI at detected estrus
- Pregnant by 200 DIM



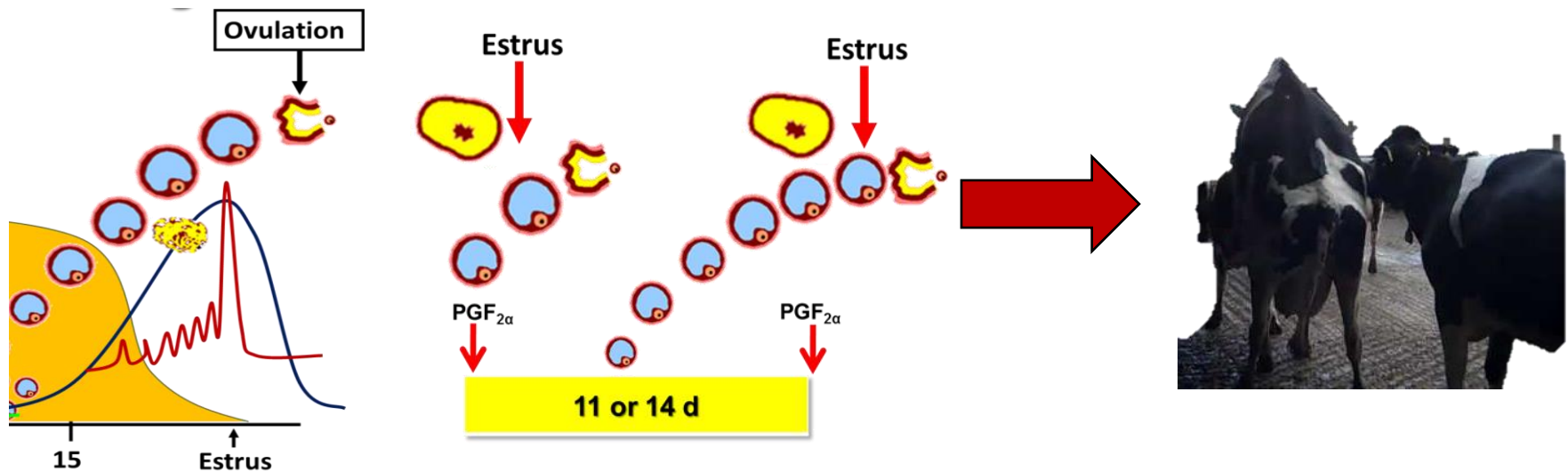
Heifer rearing cost dynamics

What alternatives are available and effective to submit heifers for insemination?



Are there effective programs designed to maximize AI at detected estrus?

Predominant AIE (estrus-based AI) programs are generally effective for dairy heifers



Expression of Estrus is Not (or should not be) a Limitation for Dairy Heifers



- Heifers **DO NOT** present same **limitations to estrus expression** as cows
 - No milk production
 - Less metabolically challenged
 - Fewer health issues
- Key factors for success
 - Good **nutrition**
 - Good **health**
 - Reasonable **environmental conditions**



Dairies with poor detection of estrus could improve their estrous detection efficiency

Traditional methods



Automated detection of estrus



- Heifers **DO NOT** present same **limitations to estrus expression** as cows
- No milk production
- Less metabolically challenged
- Fewer health issues
- Key factors for success
 - Good **nutrition**
 - Good **health**
 - Reasonable **environmental conditions**
- **Unlikely** to present **biological limitations** to express estrus!!!



Automated estrus detection systems are effective for heifers



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Genomic merit for reproductive traits. I: Estrous characteristics and fertility in Holstein heifers

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²Merck Animal Health, Madison, NJ 07940

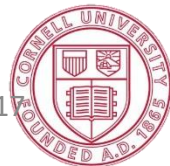
³Department of Animal Sciences, University of Florida, Gainesville 32610



- There were no significant differences for detection of estrus and P/AI for an **AED system** versus **tail-head mount detectors**

	Group		P-value
	AED (n = 260)	Mount detector (n = 236)	
First service rate	No difference		0.11
P/IA for AI services	50.6%	50.6%	0.30
Pregnancy rate ET	26.7%	31.1%	0.14

No difference for 2+ IA P/AI. Tendency (P = 0.06) to reduce days to second AI for AED system .



Automated estrus detection systems are effective for heifers



Contents lists available at ScienceDirect

Theriogenology

journal homepage: www.theriojournal.com



Performance and optimization of an ear tag automated activity monitor for estrus prediction in dairy heifers[☆]



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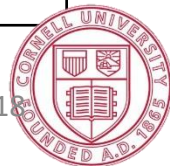
^b Department of Large Animal Clinical Sciences, Western College of Veterinary Medicine, University of Saskatchewan, Saskatoon, SK, S7N 5B4, Canada

^c Livestock Systems Section, Alberta Agriculture and Forestry, Edmonton, AB, T6H 5T6, Canada

- AED system (eSense, Allflex) detected the **vast majority (>90%) of estrus events** and generated a **reasonable number of false positives (<10%)** when using mount detectors as control

Reference method	Sensitivity	False positives	PPV ¹
Mount patches (Estrotec) (n = 468)	91.0%	8.0%	83.5%

¹PPV = positive predictive value



Dairies with poor detection of estrus could improve their estrous detection efficiency with AED systems

- AED systems **effective** but **not superior to** traditional methods of detection of estrus (at least under research conditions)
- **Useful tool** for implementation of reproductive management programs that depends primarily on AI at detected estrus

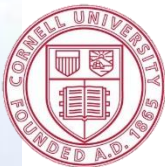
AED systems



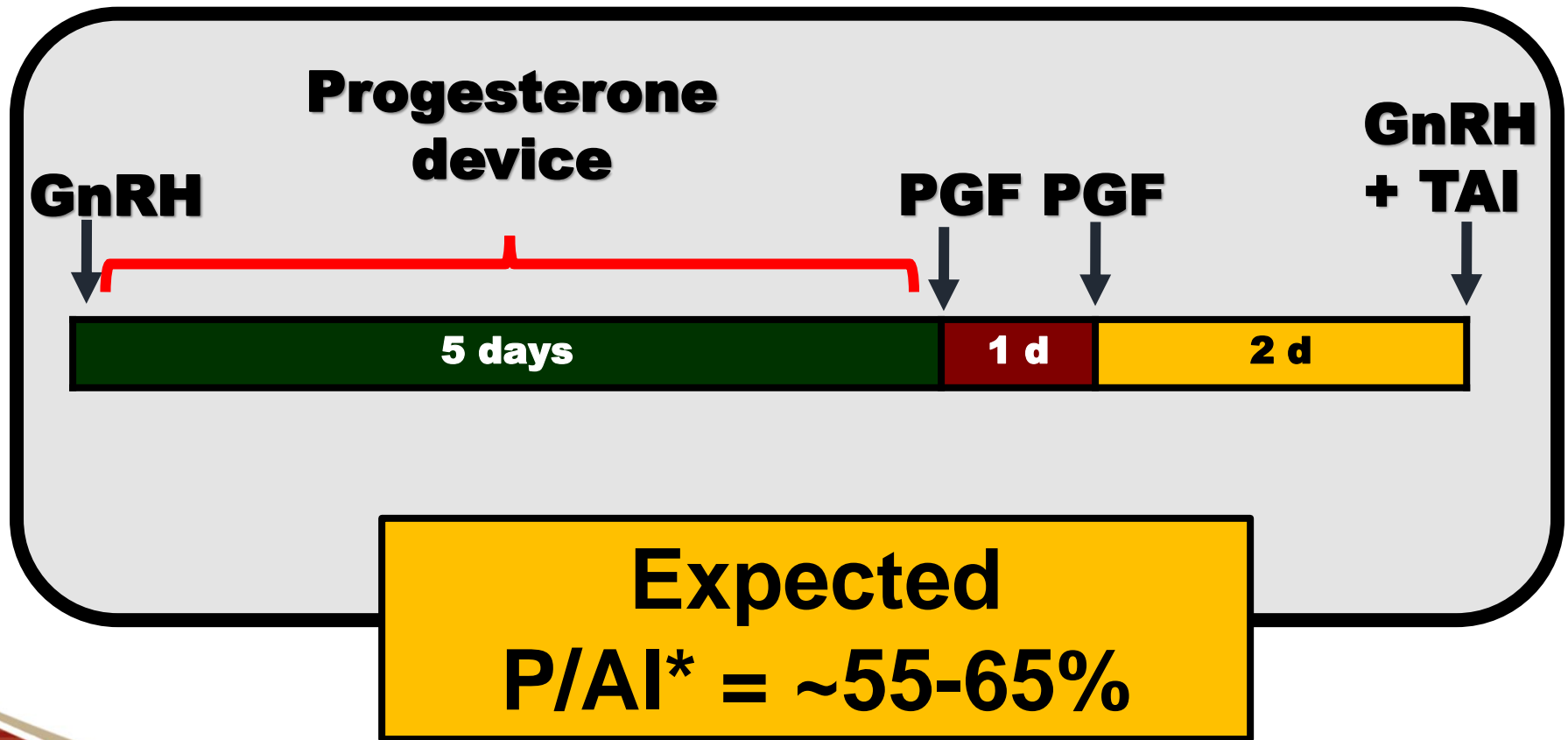
Are effective TAI programs available for heifers?

Effective **TAI** programs are available for **heifers**

- ✓ Entail **complex** treatment schemes of difficult implementation for some farms
- ✓ May be **more expensive** to implement than predominant EDAI programs
- ✓ May be **more profitable** through a reduction of time to pregnancy

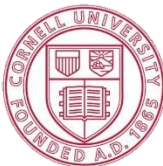


5 d-Cosynch + Progesterone Maximizes P/AI in Heifers



Rabaglino et al., 2010, Lima et al., 2013; Santos et al., 2011

*with conventional semen



Which are the most effective reproductive management programs for heifers?

AIE



TAI



- Are all AIE or TAI programs the best alternative for heifer management?
- What are the implications of estrous detection efficiency on program performance?
- Are combined programs a more effective strategy for heifers (AIE+TAI)?

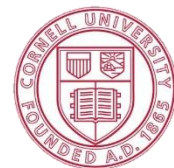
Which are the most effective reproductive management programs for heifers?

AIE



TAI

**Most Effective
and Profitable
Reproductive
Program Not
Clearly Defined**





Reproductive performance of replacement dairy heifers submitted to first service with programs that favor insemination at detected estrus, timed artificial insemination, or a combination of both

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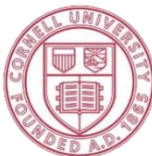
Effect of reproductive management programs for first service on replacement dairy heifer economics

M. Masello,¹ M. M. Perez,¹ G. E. Granados,¹ M. L. Stangaferro,¹ B. Ceglowski,² M. J. Thomas,² and J. O. Giordano^{1*}

¹Department of Animal Science, Cornell University, Ithaca, NY 14853

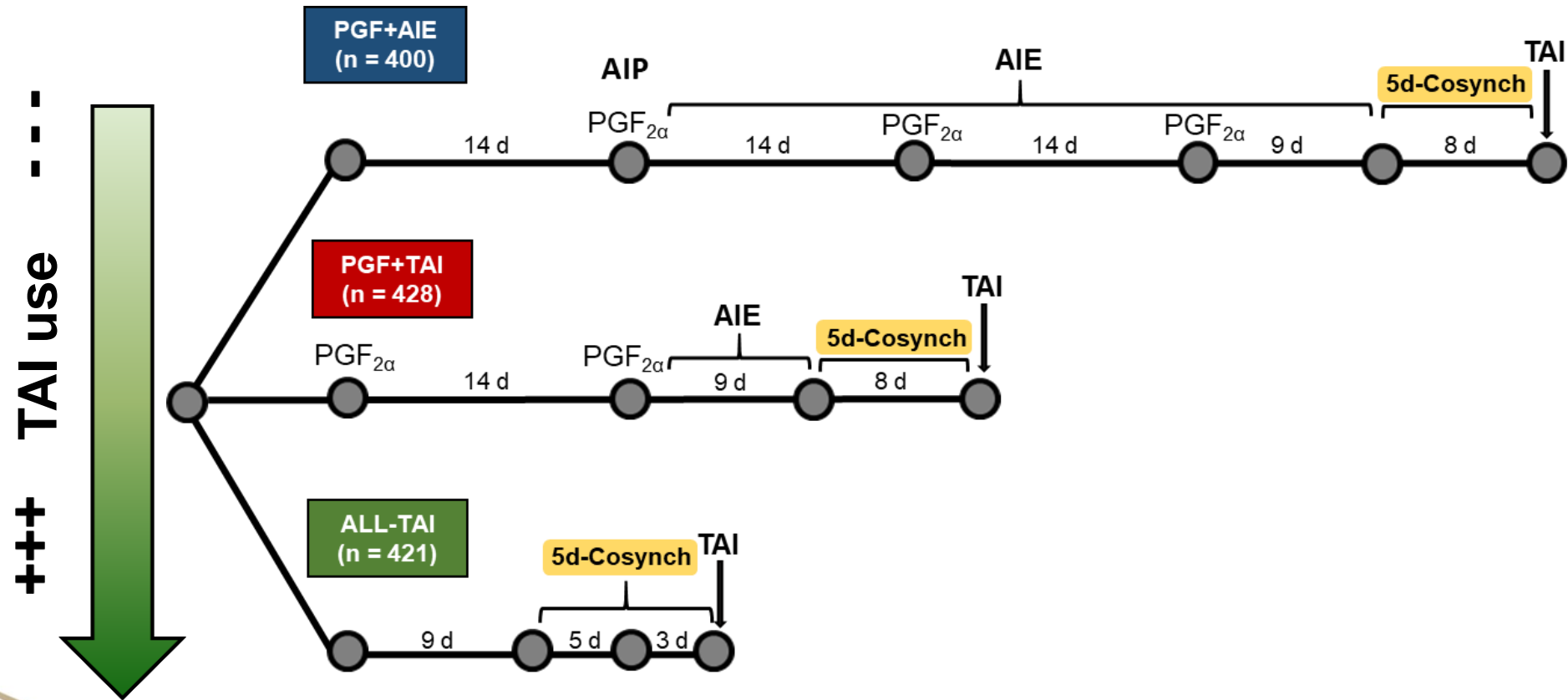
²Dairy Health and Management Services, Lowville, NY 13367

- **Holstein heifers 3 commercial farms in NY**
 - **Farms A & B** → relatively equal repro management (**MORE** effort on estrus detection)
 - **Farm C** → different approach to repro management (**LESS** effort on estrus detection)
- **Enrolled at 368 ± 10 days (12 mo) of age**
- **Semen use**
 - **1st service - 100% sexed semen**
 - **2+ AI service – 100% conventional semen**



Compared predominant AIE, TAI, or combined programs

1st AI Service – Sexed sorted semen



Time to Pregnancy for up to 100 d

ED+AI



TAI



TAI



Farms A & B

**“inseminated more heifers
at detected estrus”**



**Heifer biology facilitates
good estrus detection**

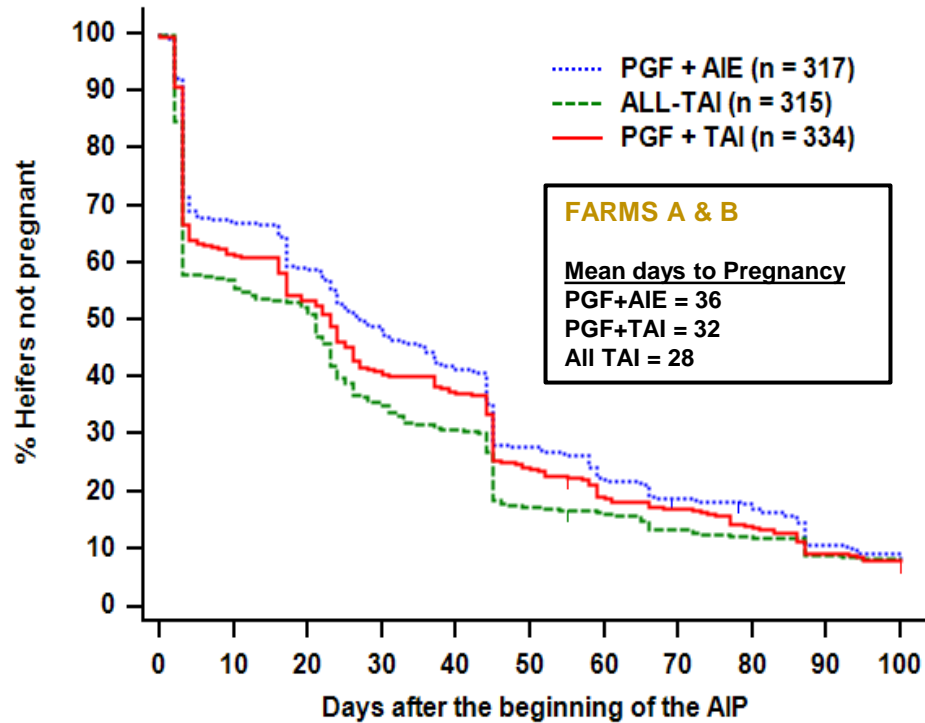
Farms C

**“inseminated more
heifers through TAI”**

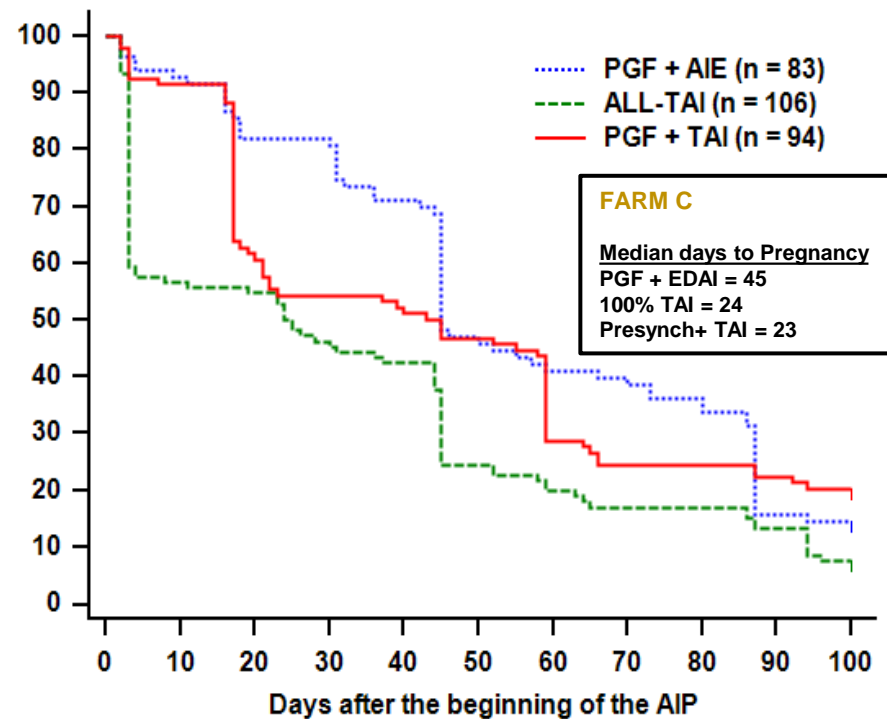


**Management decision
rather than heifer
biological limitation**

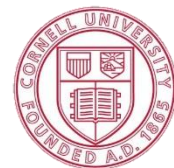
Time to Pregnancy for up to 100 d affected by Treatment and Farm



Hazard Ratios (95% CI)		
PGF + EDAI	100% TAI	Presynch + TAI
REF	1.20 (1.02 - 1.42)	1.13 (0.96 - 1.32)



Hazard Ratios (95% CI)		
PGF + EDAI	100% TAI	Presynch + TAI
REF	1.69 (1.24 - 2.30)	1.58 (0.77 - 1.49)



Economics –

“Up to 15 mo of VWP”

FARMS A & B

Variable	Treatment Groups			P-value
	PGF+AIE (n = 313)	PGF + TAI (n = 330)	100% TAI (n = 306)	
Repro cost (\$/heifer slot)	69.9 ± 2.0a	72.3 ± 2.0a	85.1 ± 2.3b	<0.001
Rearing cost (\$/heifer slot)	931 ± 9	911 ± 10	900 ± 10	0.08
First lact profit (\$/heifer slot)	393 ± 20	424 ± 18	405 ± 19	0.48
Total cash flow (\$/ heifer slot)	(-538) ± 24	(-486) ± 21	(-495) ± 21	0.22

+\$52 X
Presynch+TAI

+\$43 X
100%TAI

✓ **Presynch + TAI** strategy most (numerically) profitable when accounting for rearing cost and opportunity cost of lactation in herds with **GOOD** detection of estrus!!!

Economics –

“Up to 15 mo of VWP”

FARM C

Variable	Treatment Groups			P-value
	PGF+AIE (n = 83)	PGF + TAI (n = 94)	100% TAI (n = 106)	
Repro cost (\$/heifer slot)	87.8 ± 5.1	100 ± 5.7	89.7 ± 4.4	0.19
Rearing cost (\$/heifer slot)	1046 ± 33 a	968 ± 21	1182 ± 29 b	<0.01
First lact profit (\$/heifer slot)	291 ± 29	199 ± 4	291 ± 29	0.09
Total cash flow (\$/ heifer slot)	(-755) ± 48 ab	(-769) ± 50 a	(-637) ± 33 b	0.05

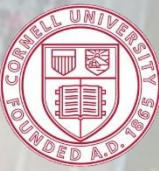
-\$14 X Presynch+TAI	+\$118 100%TAI
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✔ **100% TAI strategy** most profitable when accounting for rearing cost and opportunity cost of lactation in herd with **LOW detection of estrus!!!**



Take Home...

- ✔ Reducing AFC by **minimizing days to pregnancy** has **substantial positive economic consequences**
- ✔ Optimal reproductive program highly influenced by **estrous detection efficiency** - mostly under **management control**
- ✔ **Combined (AIE + TAI) or all TAI** for 1st AI may be more profitable than **predominant AIE** programs - even for farms with reasonable estrous detection efficiency



Take Home...

- ✓ Aggressive **all TAI programs** are effective for improving the economics of the heifer enterprise in herds with **suboptimal detection of estrus**
- ✓ **Early AFC** defined as **~<23 mo** of age **did not negatively affect** reproductive performance during first lactation and **improved** some outcomes

Develop and implement and aggressive and effective program to get heifers pregnant as soon as possible



Acknowledgements



NY *farm viability*
INSTITUTE

Project # OAR 15 020: Increasing Dairy Farm Profitability by Reducing Replacement Heifers Rearing Cost through Improved Reproductive Management



United States Department of Agriculture
National Institute of Food and Agriculture



Cornell University
College of Agriculture and Life Sciences

Dairy Cattle Biology & Management Laboratory



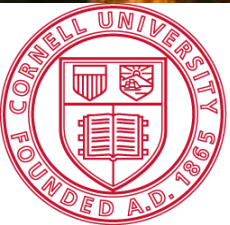
Commercial dairy farms



Dr. Jim Ehrlich



Thank you!



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