Heifer Repro and Sexed Semen

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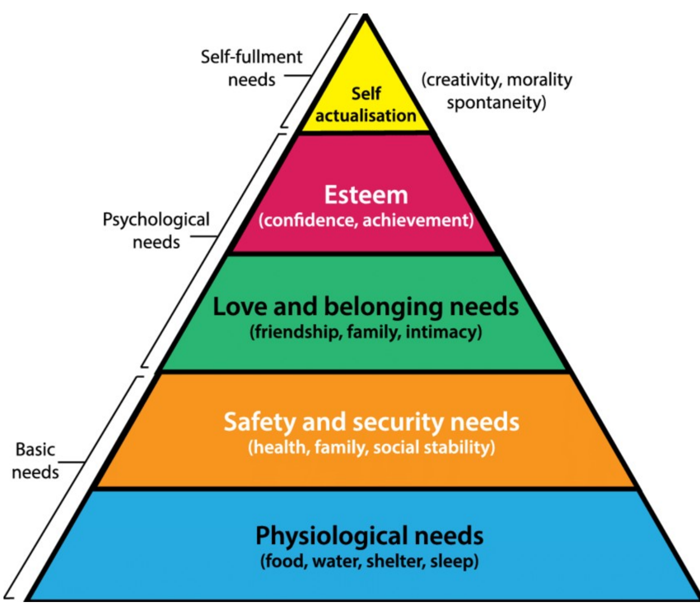
Extension
UNIVERSITY OF WISCONSIN–MADISON

1

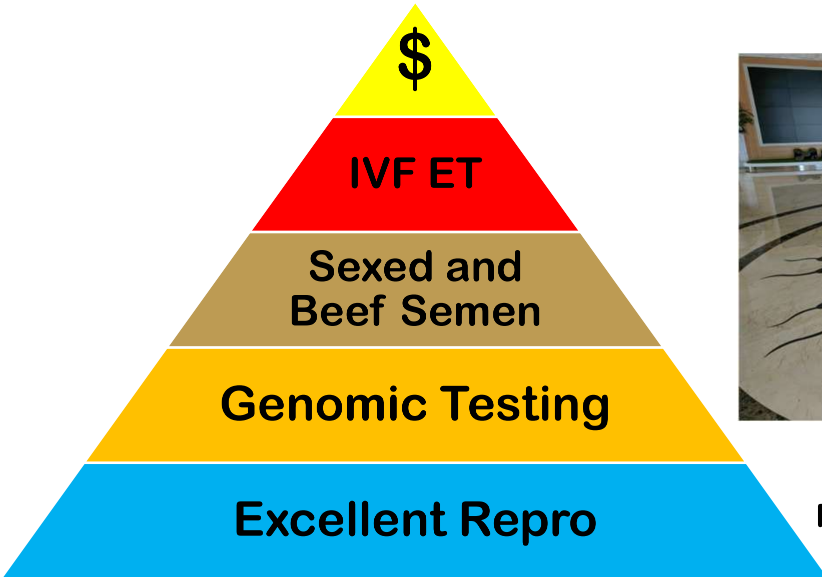
Maslow's Hierarchy of Needs



Abraham H. Maslow
PhD in Psychology
UW-Madison

2

Fricke's Hierarchy of Repro Needs



Paul M. Fricke, PhD

Reproductive Physiologist

UW-Madison

3

J. Dairy Sci. 105:4679–4689
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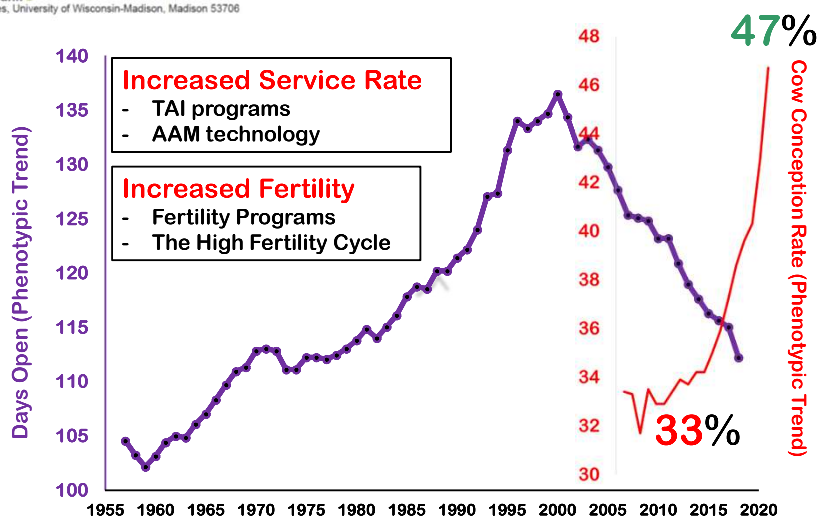
Symposium review: **The implications of spontaneous versus synchronized ovulations on the reproductive performance of lactating dairy cows***

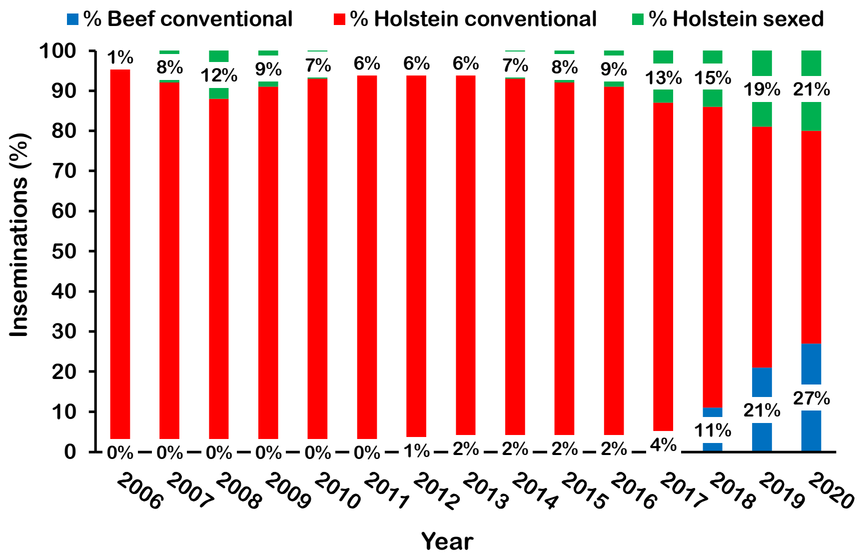
P. M. Fricke† and M. C. Wiltbank
Department of Animal and Dairy Sciences, University of Wisconsin-Madison, Madison 53706

CDCB
COUNCIL ON DAIRY CATTLE BREEDING



4

Inseminations in Holstein Females



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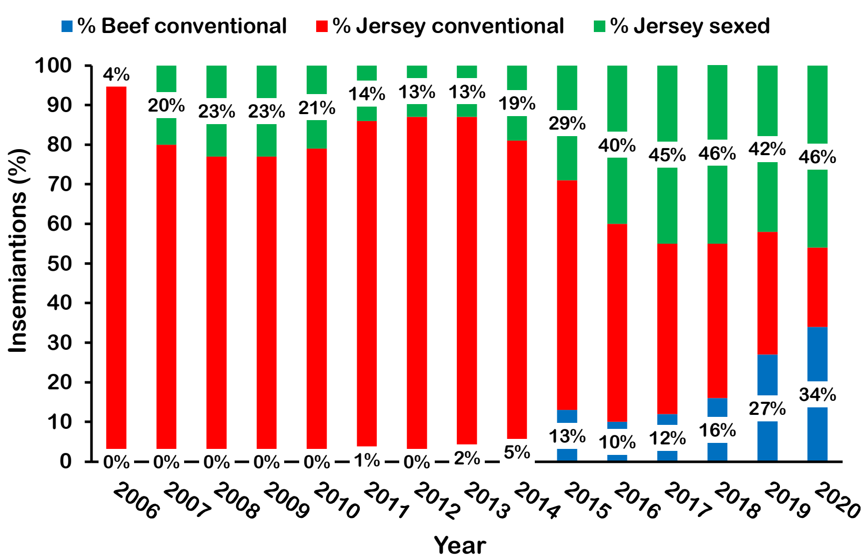
Inseminations in Jersey Females



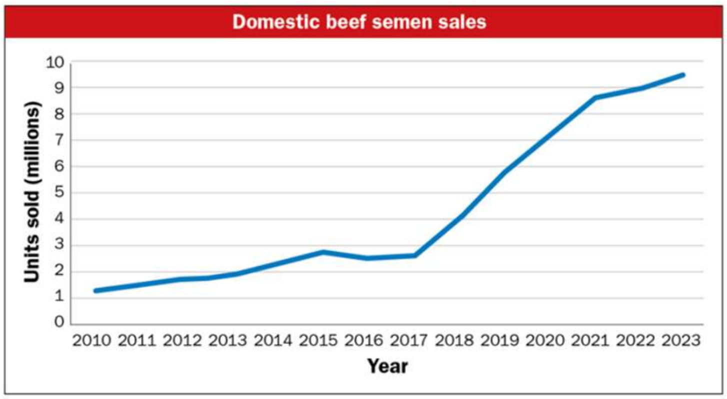
6

HOARD'S DAIRYMAN

Domestic beef semen sales hit a new high

April 15 2024

By Abby Bauer, Managing Editor



- **Of the 9.4 million units of beef semen sold domestically in 2023, 7.9 million units were used in dairy herds (NAAB). That was up nearly 1 million units from the year before.**
- **By contrast, beef semen sold for use in beef cattle, both domestically and in the export market, was down 1.4 million units.**

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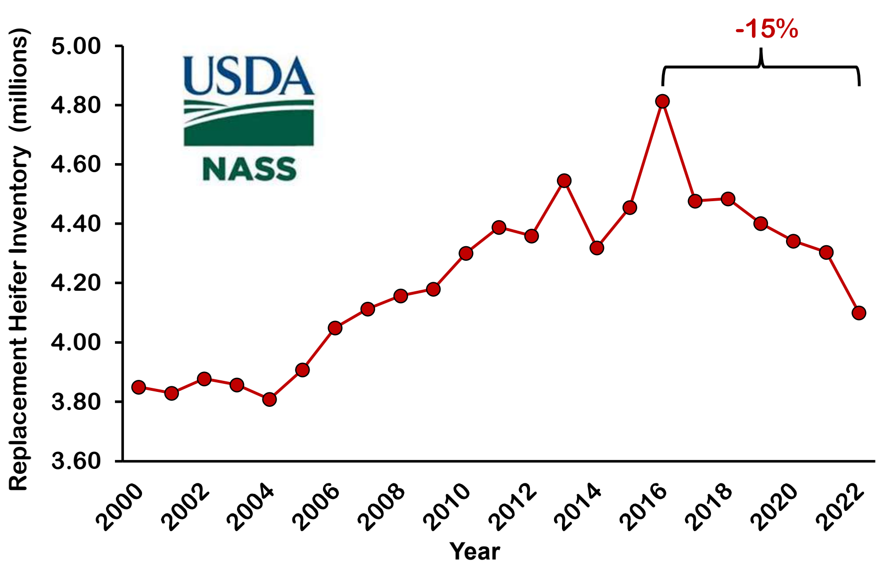
US Heifer Inventory is Decreasing



8

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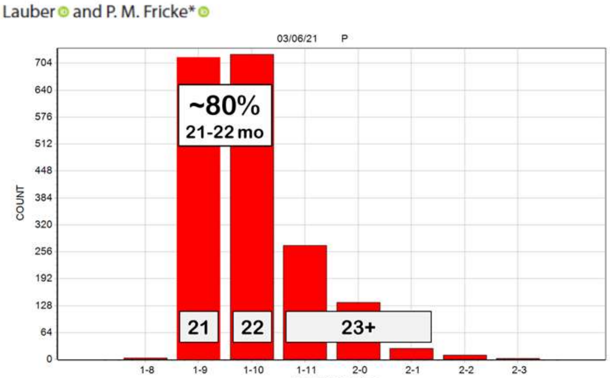
JDS Communications®
2023; 4:428–432
https://doi.org/10.3168/jdsc.2023-0372
Short Communication
Physiology

The association between insemination eligibility and reproductive performance of nulliparous heifers on subsequent body weight and milk production of primiparous Holstein cows

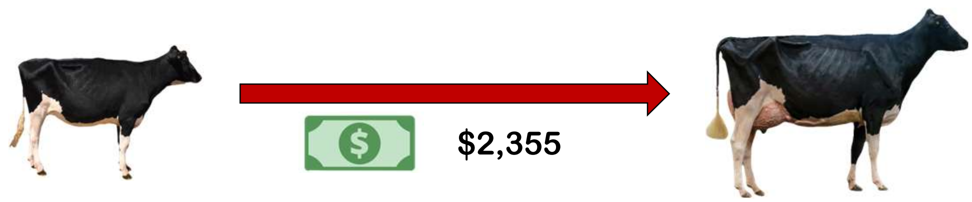
M. R. Lauber and P. M. Fricke*

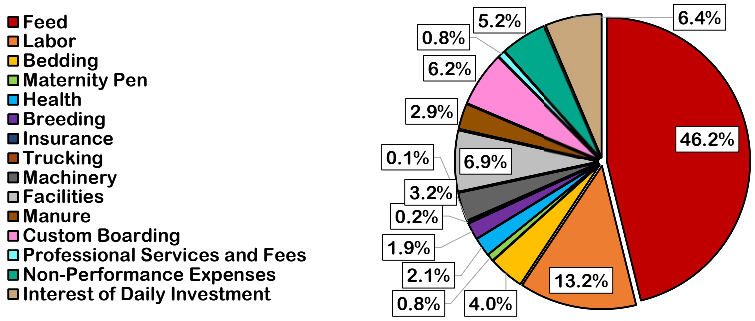


- **Data from a Holstein herd milking ~7,000 cows**
- **Breeding age heifers were inseminated primarily based on age**
- **Percent mature body weight (%MBW) was determined based on 3rd and 4th lactation cows**
- **1st lactation cows were weighed at 30 DIM and grouped into quartiles based on body weight**

10

Heifer Rearing is Costly





Adapted from Karzes and Hill, 2020

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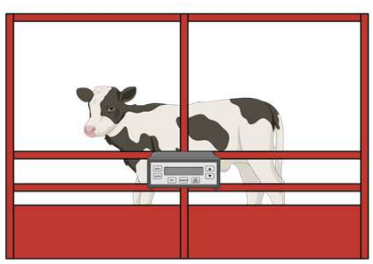
Measuring Heifer Growth



Only 36% of US dairy heifer growers record body weight and average daily gain[1]

	Mature Body Size Benchmarks[2]	
Time	Weight (%)	Height (%)
1st Insemination	55	90
Pre-calving	94	95
Post-calving	85	95

NAHMS, 2011[1]; Van Amburgh and Meyer, 2005[2]; Van Amburgh et al., 1998[2]; Heinrichs and Hargrove, 1987[2]

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Symposium review: **An abundance of replacement heifers: What is the economic impact of raising more than are needed?***

M. W. Overton† and K. C. Dhuyvetter
Elanco Animal Health, Greenfield, IN 46140

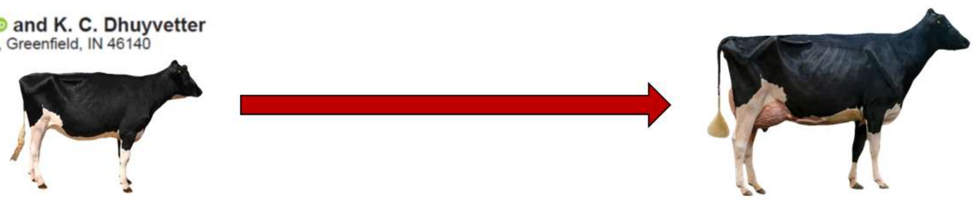

Table 1. Herd-level means, SD, and 95% CI from the 50-herd data set for replacement heifer metrics

Item	Mean	SD	95% CI
% Heifers born alive	94.3	0.51	93.2–95.3
% Survival to 13 mo	89.8	0.81	88.1–91.4
% Sold before 13 mo	4.2	0.75	2.7–5.7
% Dead before 13 mo	6.0	0.47	5.1–7.0
% Heifers over 13 mo that conceived	93.2	0.57	92.1–94.4
% Pregnant heifers that calved	93.6	0.69	92.3–95.0
% Calving events with a heifer birth that calved	73.9	1.00	71.8–76.0

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Body weight at 30 DIM, Mature Body Weight and age at first calving

	Body Weight Quartile			
	Q1 n = 462	Q2 n = 456	Q3 n = 472	Q4 n = 459
BW at 30 DIM (kg)	512.4[a] ± 0.81	552.6[b] ± 0.82	583.3[c] ± 0.80	630.7[d] ± 0.81
MBW[1] (%)	74.7[a] ± 0.001	80.5[b] ± 0.001	85.0[c] ± 0.001	91.9[d] ± 0.001
Age at calving (d)	674.6[a] ± 1.25	681.8[b] ± 1.25	688.2[c] ± 1.24	694.6[d] ± 1.25

[a-d] Within a row, means with different superscripts differ ($P<0.05$)

%MBW Targets:
55% MBW at 1st AI
85% MBW postcalving

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Predicted Transmitting Abilities (PTAs)

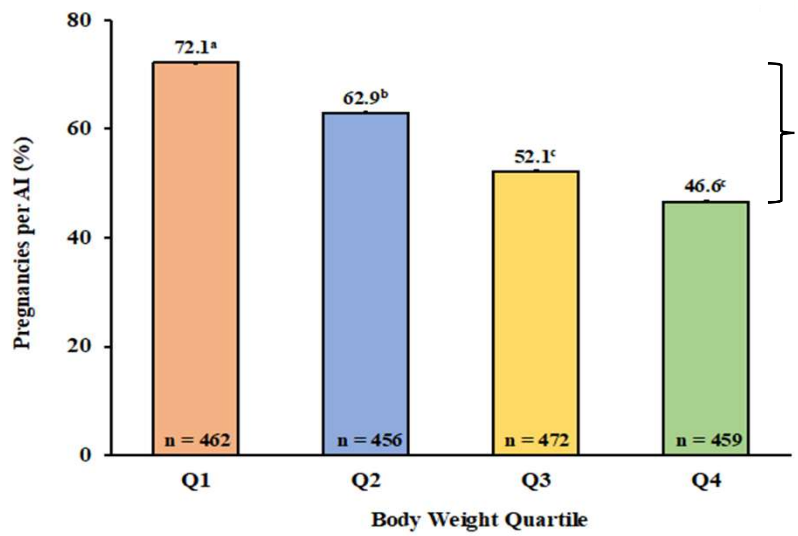
	Body Weight Quartile			
	Q1 n = 462	Q2 n = 456	Q3 n = 472	Q4 n = 459
PTA Milk	173.1[b] ± 9.8	188.6[ab] ± 9.8	179.2[b] ± 9.7	215.0[a] ± 9.8
PTA Stature	-0.56[c] ± 0.03	-0.52[bc] ± 0.03	-0.46[b] ± 0.03	-0.29[a] ± 0.03
PTA Feed Save	31.9[a] ± 2.0	24.6[b] ± 2.0	13.4[c] ± 2.0	5.7[d] ± 2.0
PTA PL	2.4[a] ± 0.04	2.2[bA] ± 0.04	2.1[bcB] ± 0.04	1.9[d] ± 0.04
PTA DPR	0.37[a] ± 0.05	0.27[ab] ± 0.05	0.26[ab] ± 0.05	0.11[b] ± 0.05
PTA HCR	0.03[a] ± 0.04	0.0[a] ± 0.04	-0.08[ab] ± 0.04	-0.16[b] ± 0.04

[a,b] Within a row, means with different superscripts differ ($P<0.05$)

15

Pregnancies per AI

First service as nulliparous heifers



~25 Percentage Points!

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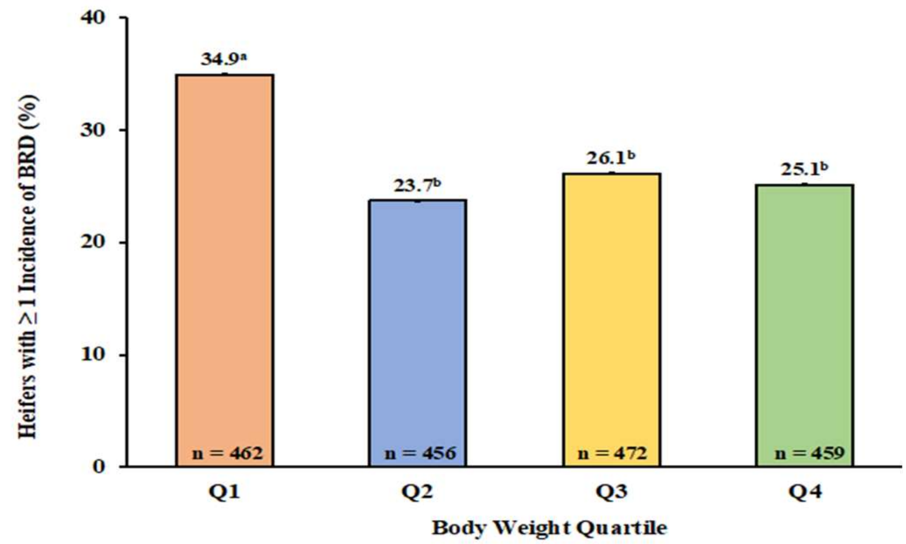
Bovine respiratory disease (BRD)

As nulliparous heifers



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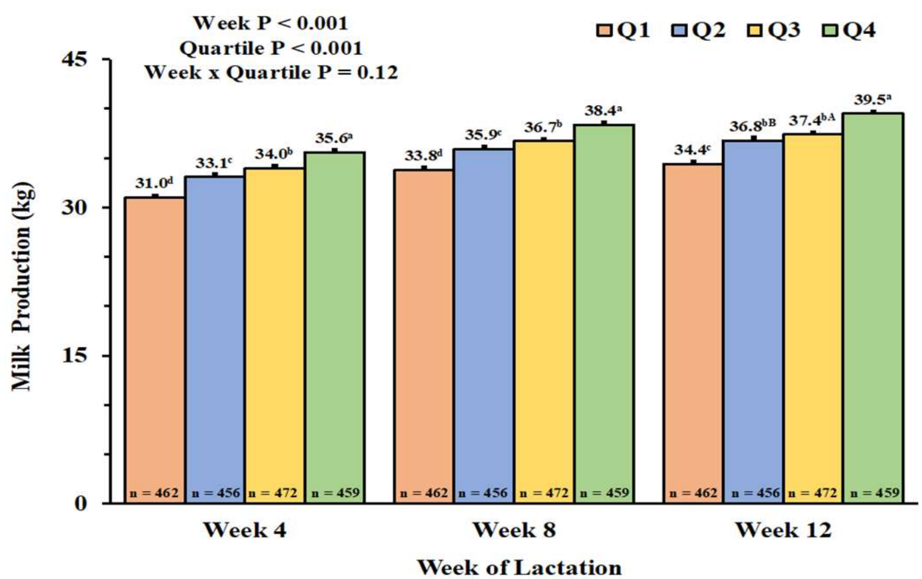
Milk Production



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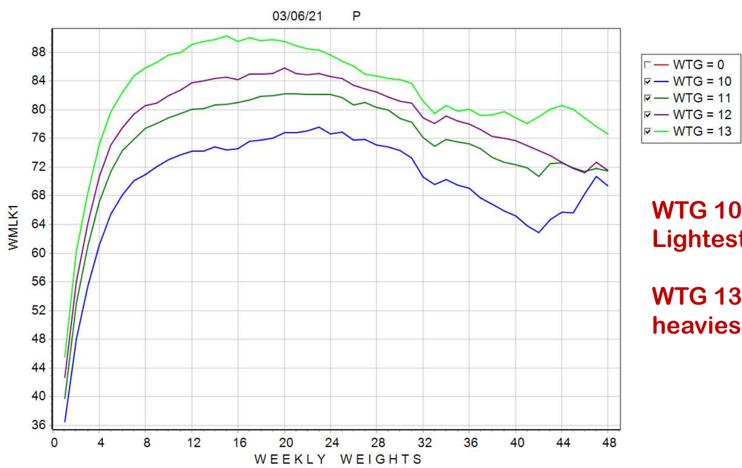
PLOT WMLK1 FOR LCTGP=1 BY WTG

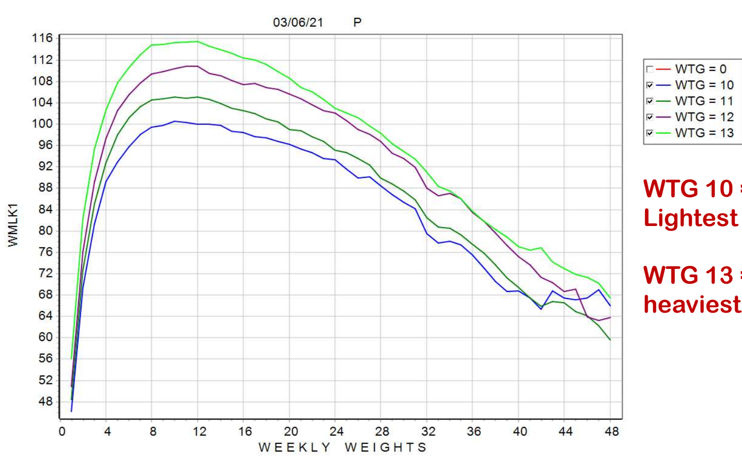


WTG 10 =
Lightest weight

WTG 13 =
heaviest weight

19

PLOT WMLK1 FOR LCTGP=2 BY WTG

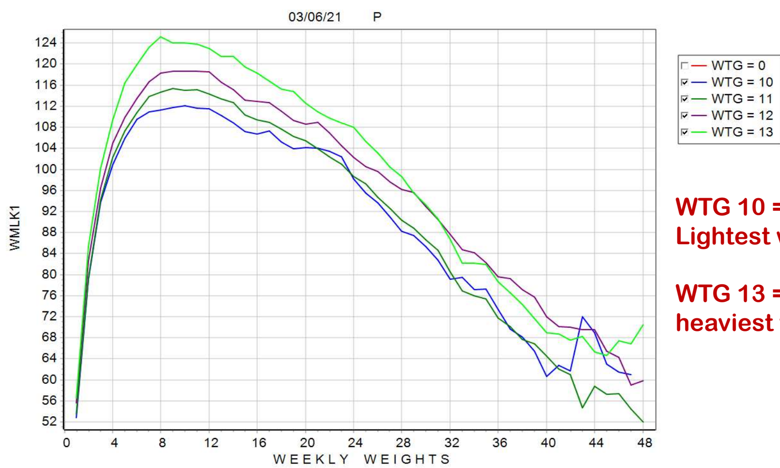


WTG 10 =
Lightest weight

WTG 13 =
heaviest weight

20

PLOT WMLK1 FOR LCTGP=3 BY WTG



WTG 10 = Lightest weight

WTG 13 = heaviest weight

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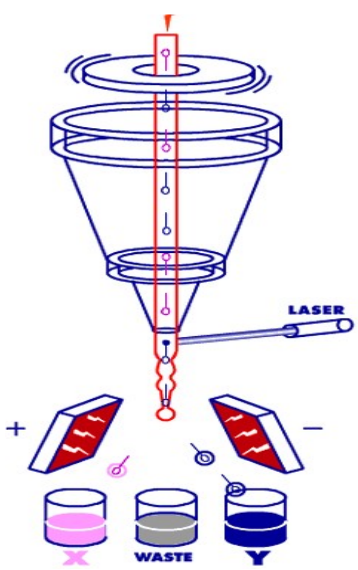
Methods for Sexing Semen



Sexing TECHNOLOGIES

Sexcel Sexed Genetics

- **X-chromosome has 4% more DNA**
- **Sperm stained with dye & sorted or killed by laser**
- **85 to 90% accuracy**
- **Many sperm are damaged or wasted**

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J. Dairy Sci. 106:3748–3760
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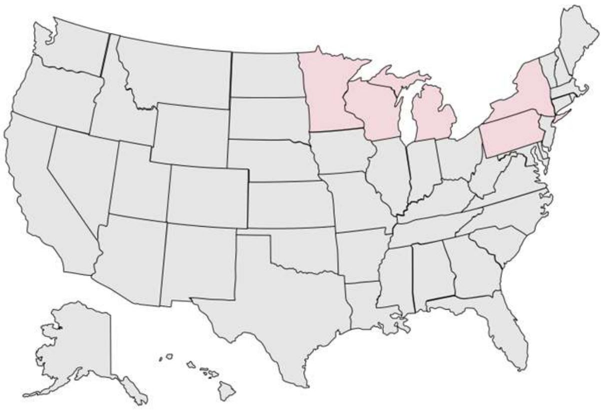
Characterization of semen type prevalence and allocation in Holstein and Jersey females in the United States

M. R. Lauber,[1] F. Peñagaricano,[1] R. H. Fourdraine,[2] J. S. Clay,[2] and P. M. Fricke[1*]
[1]Department of Animal and Dairy Sciences, University of Wisconsin-Madison, Madison 53706
[2]Dairy Records Management Systems, Raleigh, NC 27603

DRMS



1. New York: 16.9%
2. Wisconsin: 14.5%
3. Pennsylvania: 13.7%
4. Michigan: 10.1%
5. Minnesota: 9.1%

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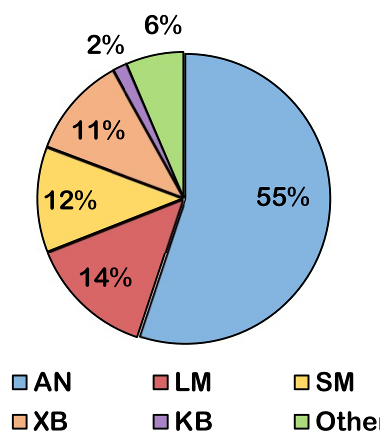
Service Sires




National Association of Animal Breeders

Conventional
Sexed



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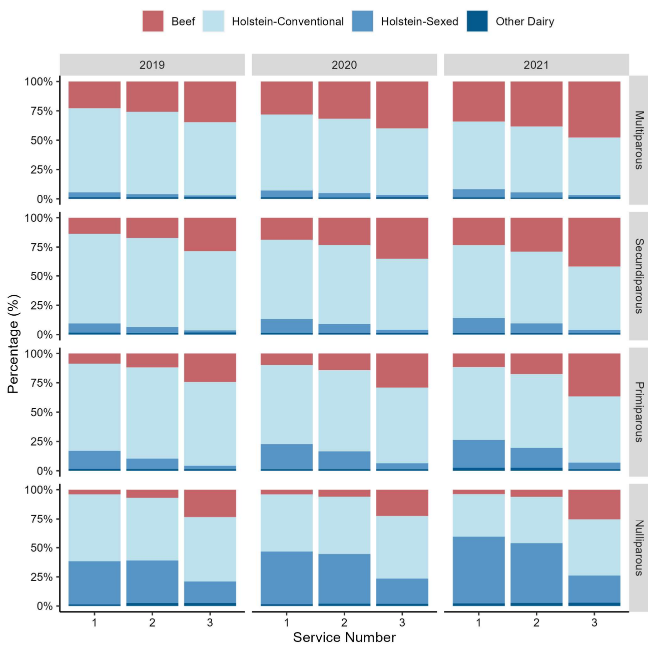
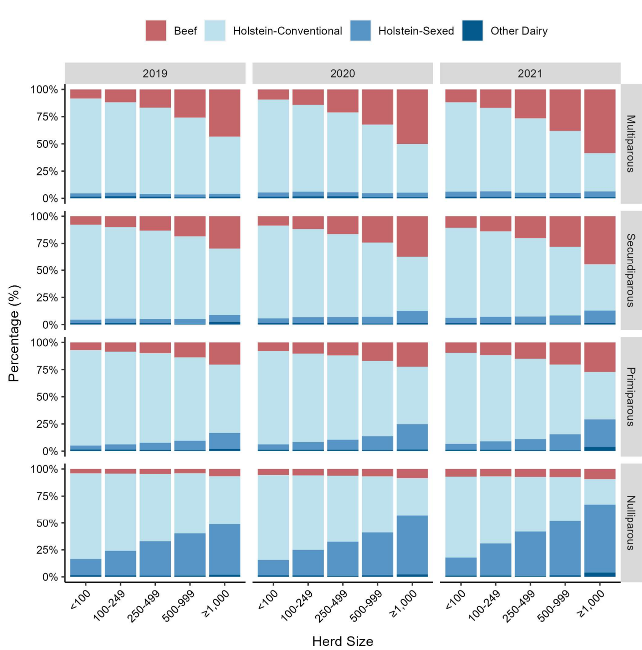


Lauber et al., 2023. Characterization of semen type prevalence and allocation in Holstein and Jersey females in the United States.
J. Dairy Sci. 106:3748–3760

8,284,770 insemination records from 3,115,224 Holstein females from 9,196 herds

25



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8,284,770 insemination records from 3,115,224 Holstein females from 9,196 herds

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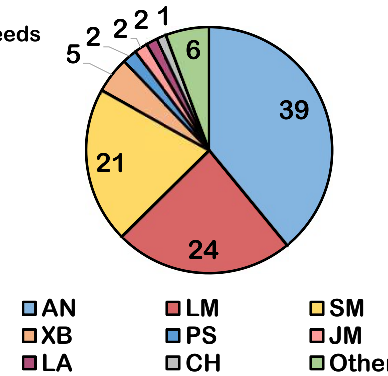
Service Sires

National Association of Animal Breeders

Conventional semen
Sexed semen

Other Dairy
6 other U.S. dairy breeds



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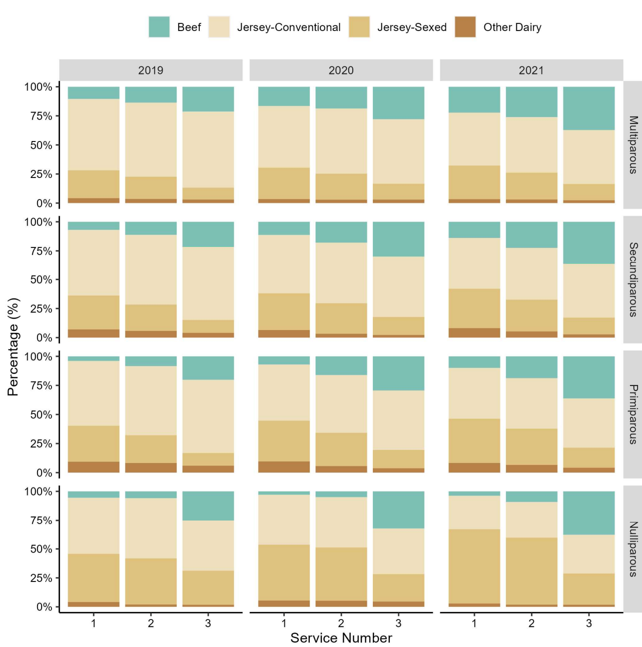

Lauber et al., 2023. Characterization of semen type prevalence and allocation in Holstein and Jersey females in the United States. J. Dairy Sci. 106:3748–3760

437,081 insemination records from 176,742 Jersey females from 2,780 herds

DRMS

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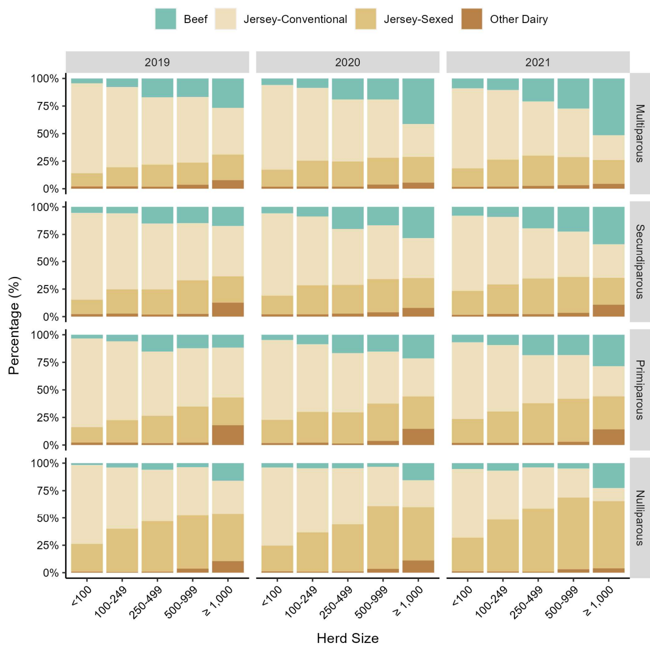

Lauber et al., 2023. Characterization of semen type prevalence and allocation in Holstein and Jersey females in the United States.
J. Dairy Sci. 106:3748–3760

437,081 insemination records from 176,742 Jersey females from 2,780 herds

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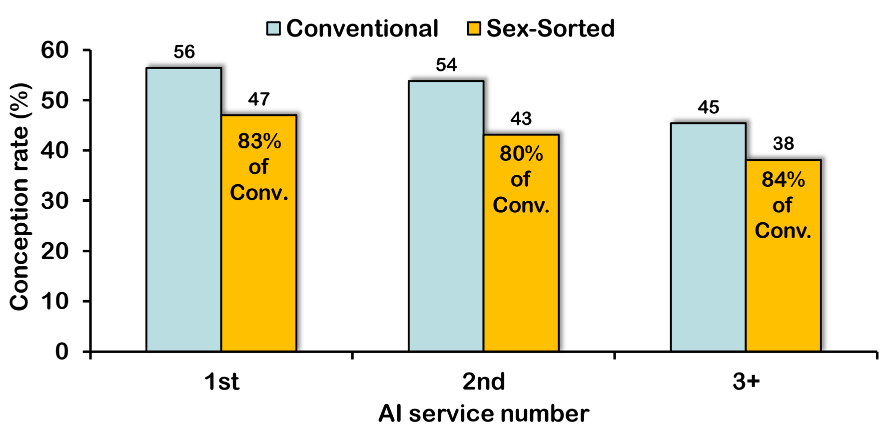
Commercial Application of Sexed Semen in Holstein Heifers

DeJarnette et al., J. Dairy Sci. 91:459; 2008 (Abstr.)

49 herds from Jan 2005 to Jan 2008; 41,398 sexed semen AI services.
Sexed semen resulted in ~45% CR and ~90% female calves in Holstein heifers.



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J. Dairy Sci. 89:4907–4920
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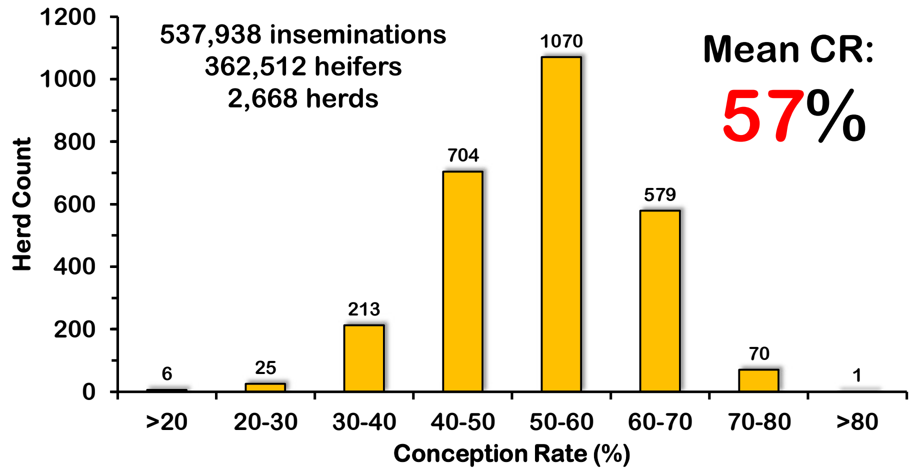
Characterization of Holstein Heifer Fertility in the United States

M. T. Kuhn, J. L. Hutchison, and G. R. Wiggans
Animal Improvement Programs Laboratory, Agricultural Research Service, USDA, Beltsville, MD 20705-2350



Mean CR:

57%

31

J. Dairy Sci. 96:7054–7065
http://dx.doi.org/10.3168/jds.2013-7093
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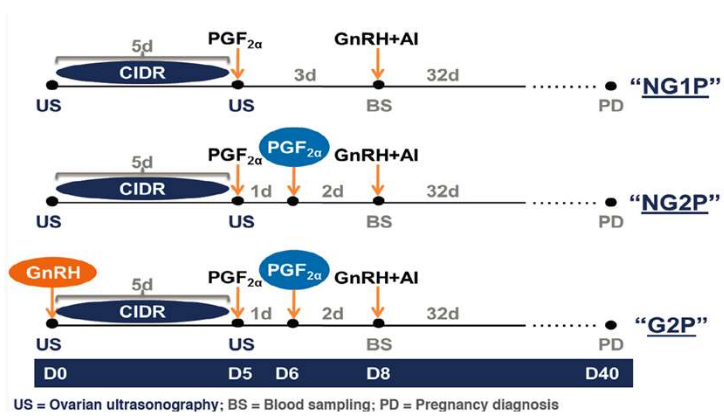
Hormonal manipulations in the 5-day timed artificial insemination protocol to optimize estrous cycle synchrony and fertility in dairy heifers

F. S. Lima,* E. S. Ribeiro,* R. S. Bisinotto,* L. F. Greco,* N. Martinez,* M. Amstalden,† W. W. Thatcher,* and J. E. P. Santos*[1]
*Department of Animal Sciences, University of Florida, Gainesville 32611
†Department of Animal Sciences, Texas A&M University, College Station 77843



P/AI, 60 d

49%
(348/711)

52%
(359/696)

59%
(420/711)

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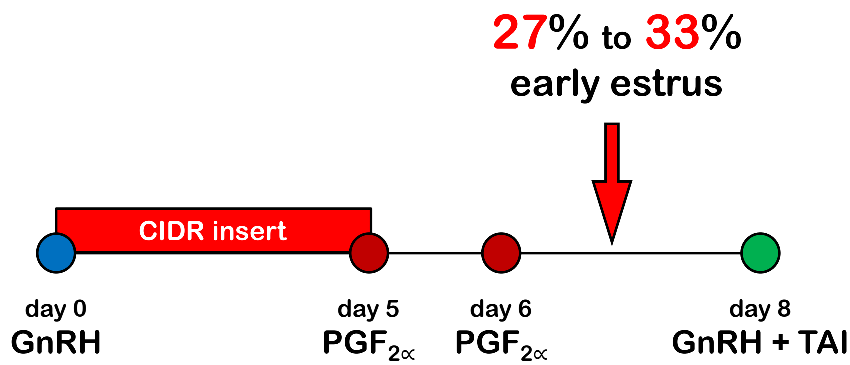
5-day CIDR-Synch Protocol

Masello et al., 2019; Silva et al., 2015



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J. Dairy Sci. 104:12953–12967
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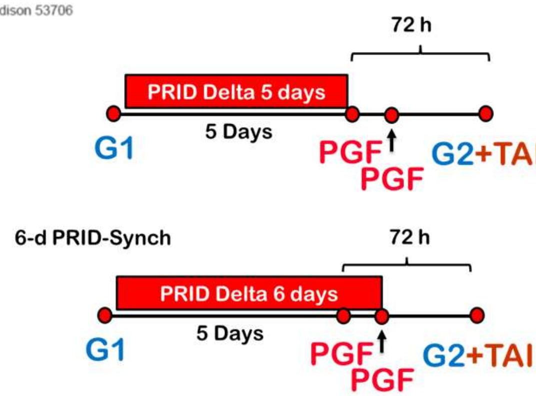
Comparison of reproductive management programs for submission of Holstein heifers for first insemination with conventional or sexed semen based on expression of estrus, pregnancy outcomes, and cost per pregnancy

M. R. Lauber,[1] E. M. Cabrera,[1] V. G. Santos,[1] P. D. Carvalho,[1] C. Maia,[2] B. Carneiro,[2] A. Valenza,[3] V. E. Cabrera,[1] J. J. Parrish,[1] and P. M. Fricke[1*]
[1]Department of Animal and Dairy Sciences, University of Wisconsin-Madison, Madison 53706
[2]Diessen Serviços Veterinários Lda, 7001 Évora, Portugal
[3]CEVA Santé Animale, 10 Avenue de la Ballastiere, 33500 Libourne, France

Experiment 1

Conventional Semen



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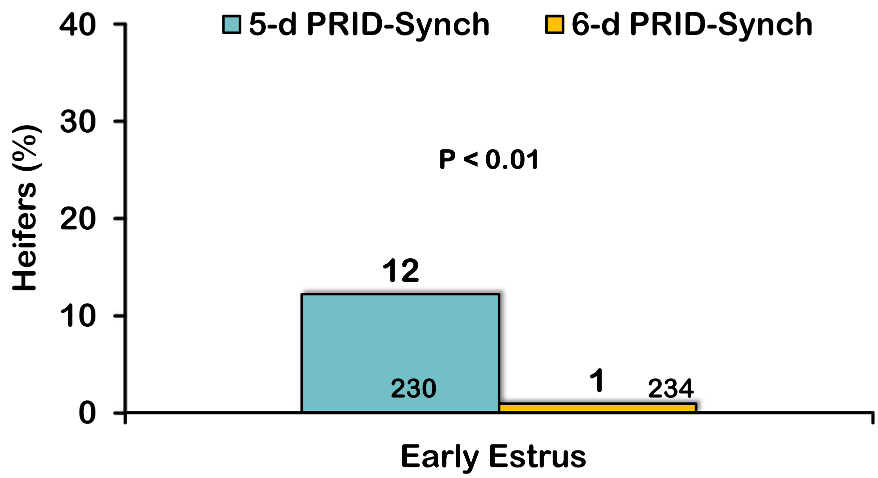
Effect of treatment on early estrus before TAI



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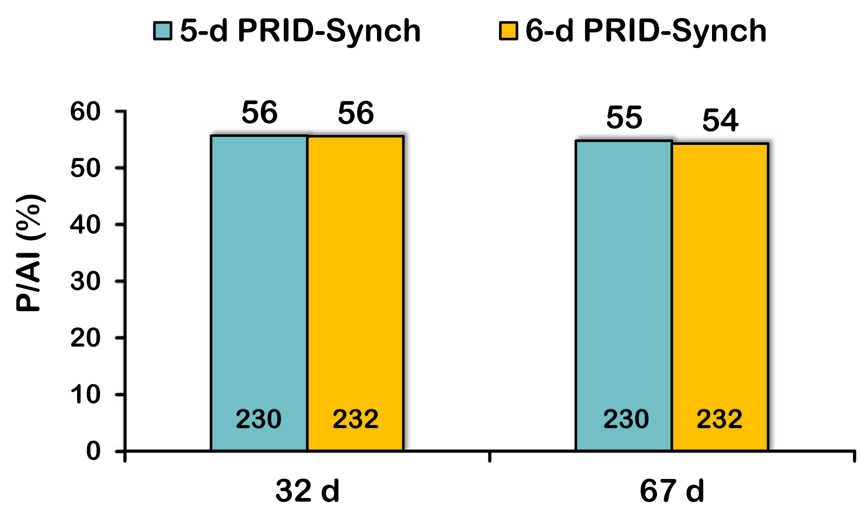
Effect of treatment on Pregnancies per AI with conventional semen



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[1]Department of Animal and Dairy Sciences, University of Wisconsin-Madison, Madison 53706
[2]Diessen Serviços Veterinários Lda, 7001 Évora, Portugal
[3]CEVA Santé Animale, 10 Avenue de la Ballastiere, 33500 Libourne, France

Objective:

To evaluate reproductive management programs for submission of Holstein heifers for first insemination with sexed semen

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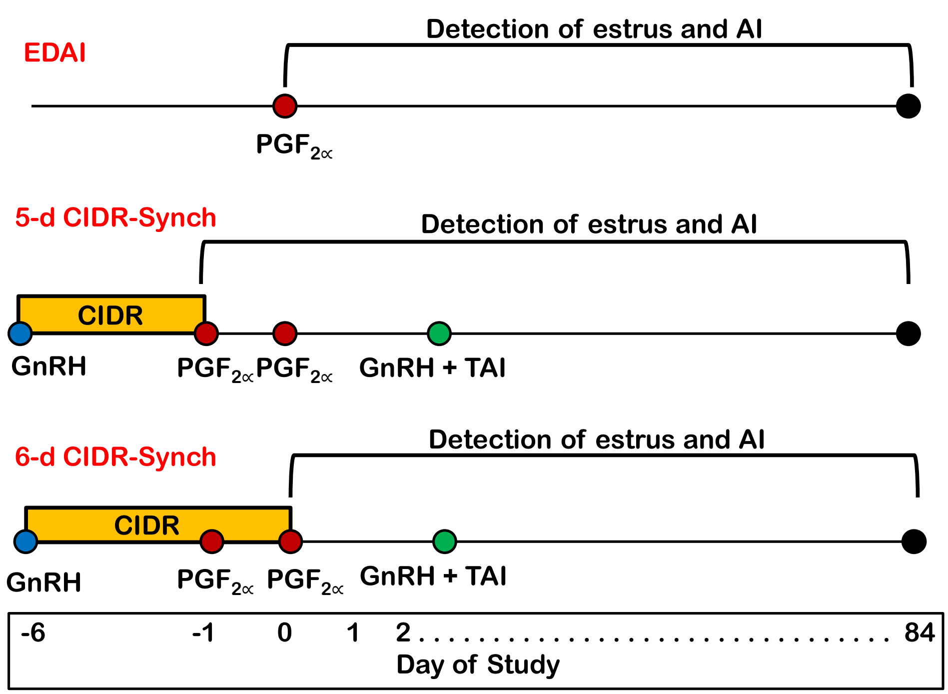

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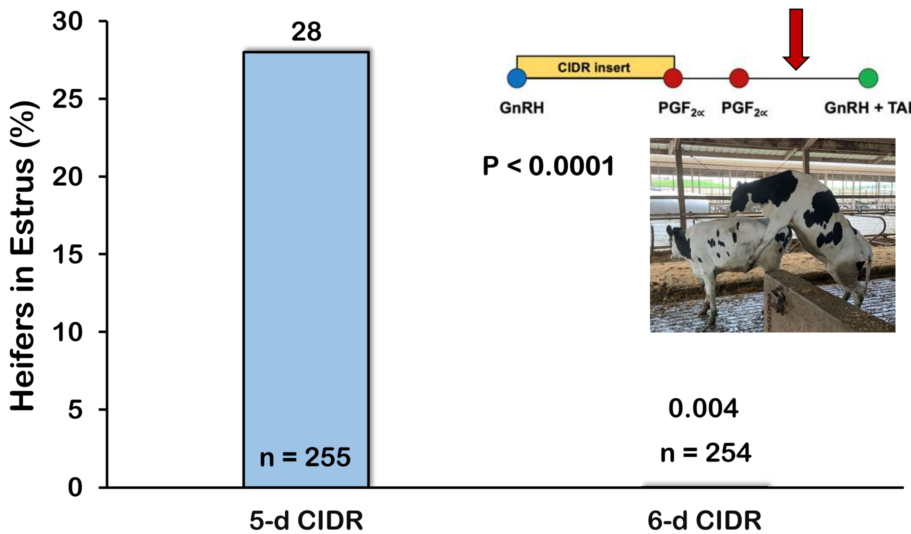
Early estrus ≥ 24 h before TAI (d 1)



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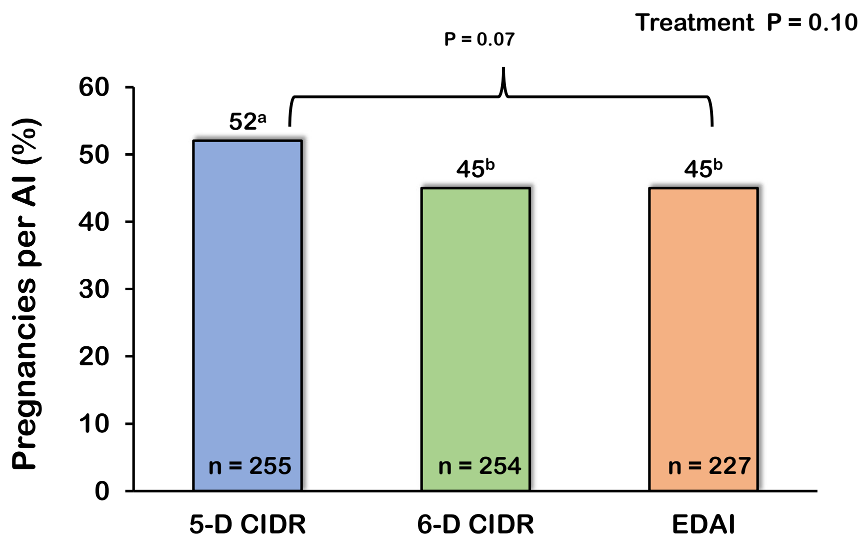
P/AI d 64 ± 5 d after AI

Overall



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Effect of delayed timing of artificial insemination with sex-sorted semen on pregnancy per artificial insemination in synchronized dairy heifers managed in a seasonal-calving pasture-based system

S. G. Moore,[1] A. D. Crowe,[1,2] F. Randi,[3] and S. T. Butler[1]*

JDS Communications®
2023; 4:417–421

Objective

To compare P/AI in dairy heifers enrolled in a 6 d Co-Synch protocol and inseminated with sex-sorted semen either at the time of G2 or 8 h later.

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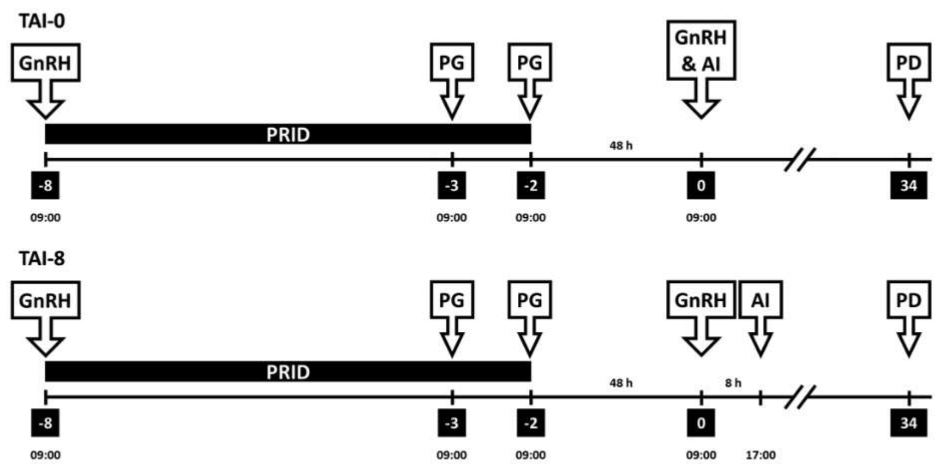
Experimental Design



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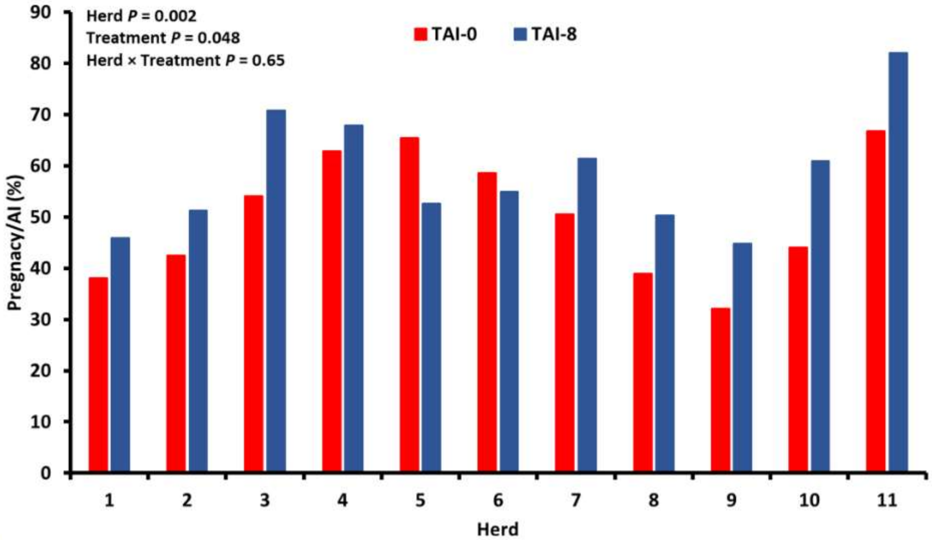
P/AI at day 34



P/AI was 8.7 percentage points greater for heifers assigned to TAI-8 (59.1%) compared with heifers assigned to TAI-0 (50.4%).

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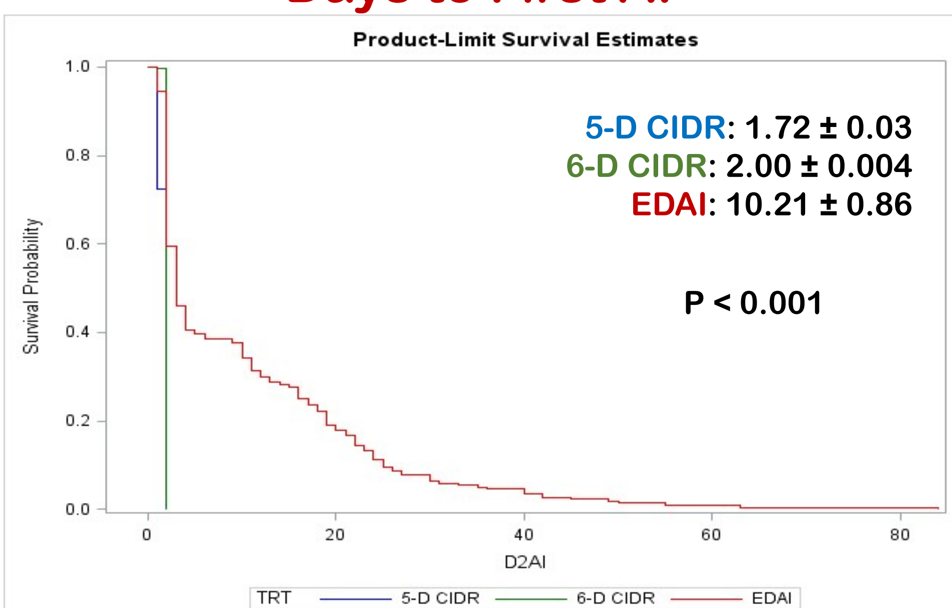
Days to First AI



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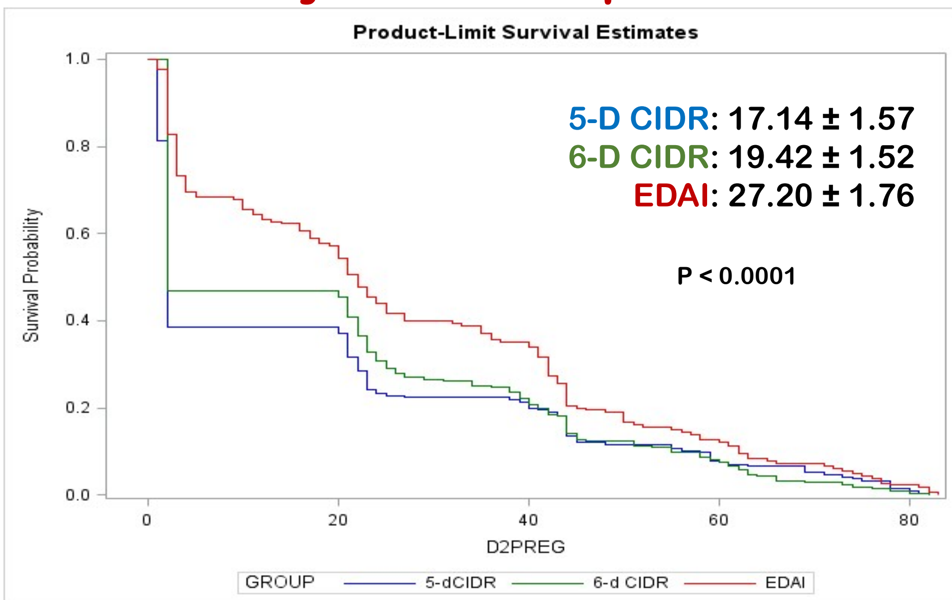
Days to Conception



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Partial Budget Analysis

Cost per pregnancy, US$ (Actual Farm Costs)	Treatment EDAI n = 181	 CIDR5 n = 225	 CIDR6 n = 218	P- value
Hormonal treatment	4.05 ± 0.38[a]	22.29 ± 0.36[b]	21.85 ± 0.36[b]	< 0.0001
Detection of estrus	3.04 ± 0.19[a]	2.03 ± 0.18[b]	2.18 ± 0.17[b]	< 0.0001
Semen and AI	70.50 ± 2.47	69.78 ± 2.37	72.02 ± 2.28	0.39
Pregnancy diagnosis	9.55 ± 0.24	9.50 ± 0.14	9.42 ± 0.13	0.42
Feed	82.79 ± 3.01[a]	50.10 ± 2.73[b]	56.84 ± 2.56[b]	< 0.0001
Total per pregnancy	169.92 ± 5.55[a]	153.26 ± 5.36[b]	162.75 ± 5.03[ab]	0.04

$169.92 - $153.26 = $16.66

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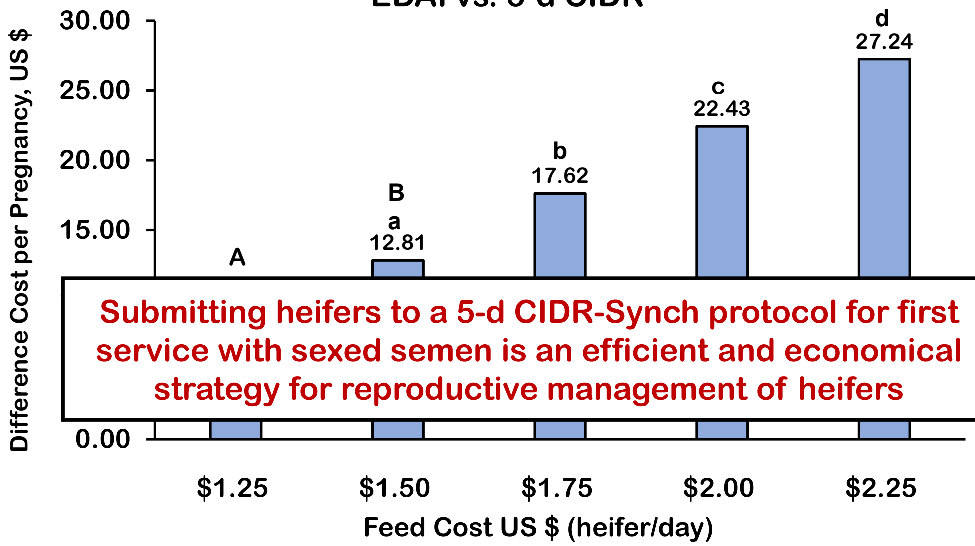
Feed Cost Sensitivity Analysis

Difference in Cost per Pregnancy by 84 d
EDAI vs. 5-d CIDR



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Effect of postpartum body condition score change on the pregnancy outcomes of lactating Jersey cows inseminated at first service with sexed Jersey or conventional beef semen after a synchronized estrus versus a synchronized ovulation

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Fertility of lactating Holstein cows submitted to a Double-Ovsynch protocol and timed artificial insemination versus artificial insemination after synchronization of estrus at a similar day in milk range

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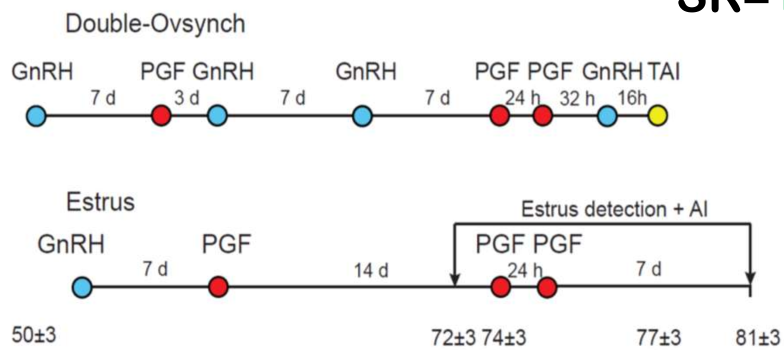
Conventional Semen

SR=100%



49%
n=294

39%
n=284

SR=78%

% pregnant cows at 110 DIM: 49 vs. 30

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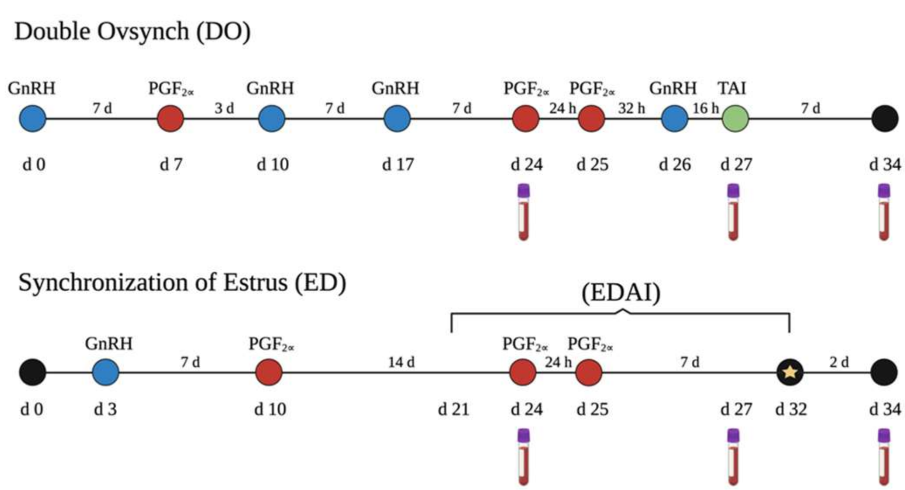
Experimental Design

Sexed and Conventional Beef Semen in Lactating Jersey Cows



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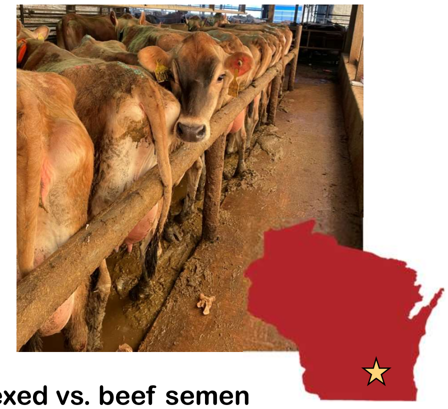
Enrollment

336 primiparous and 950 multiparous Jersey cows

	Treatment		
Semen	DO	EDAI	Total
Beef	317	227	544
Sexed	398	344	742
Total	715	571	1,286



The decision to inseminate cows with sexed vs. beef semen was made by the farm. Mated cows were then randomized to treatment *within* each semen type.

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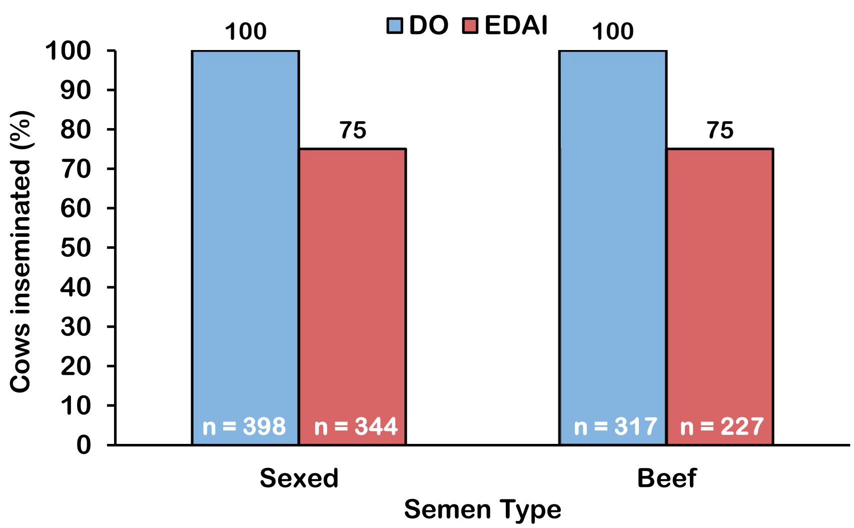
Cows Inseminated

by Semen Type



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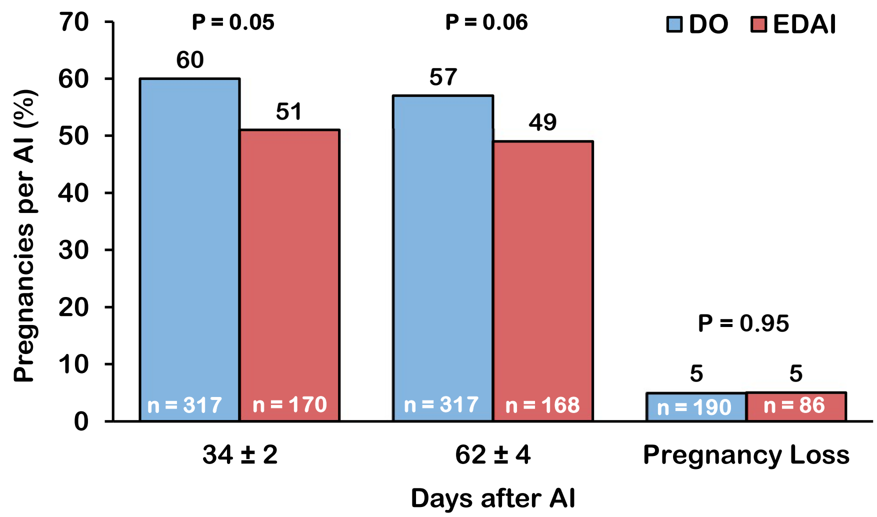
Effect of Treatment on P/AI

Beef Semen



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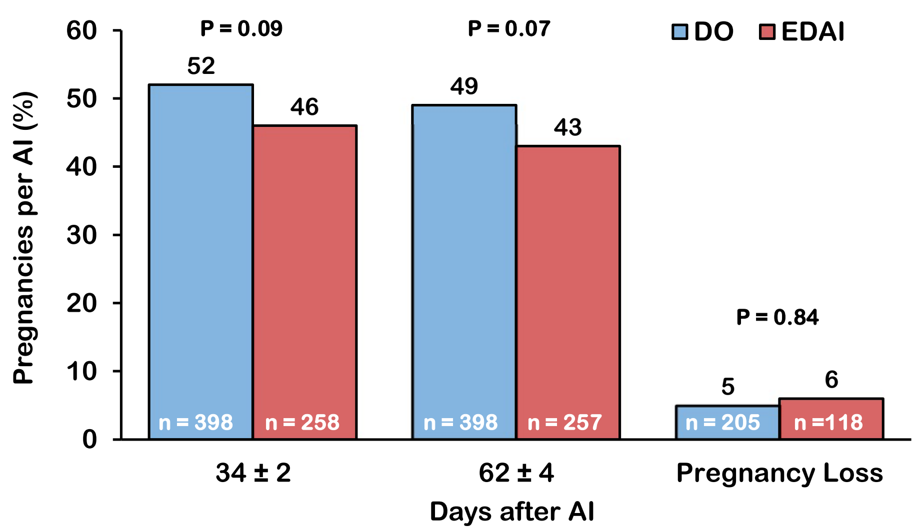
Effect of Treatment on P/AI

Sexed Semen



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Timing of AI Case Study

Altering the Time of the Second Gonadotropin-Releasing Hormone Injection and Artificial Insemination (AI) During Ovsynch Affects Pregnancies per AI in Lactating Dairy Cows

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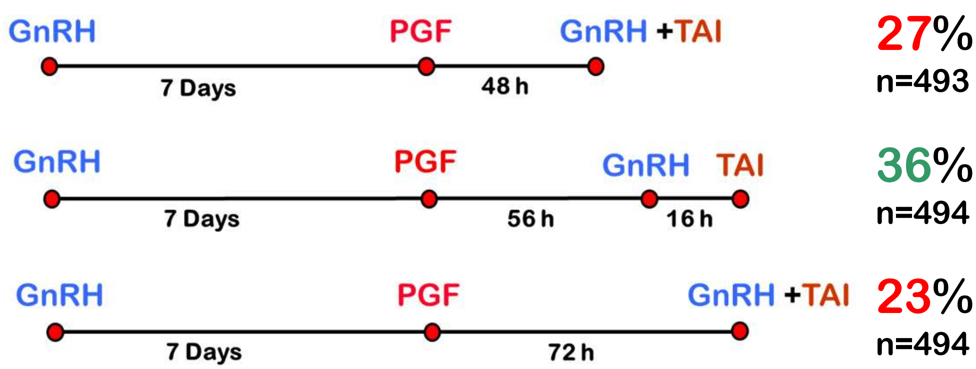
Conventional Semen



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2023 Timing of AI Case Study

1,850-cow Holstein herd in Wisconsin

Cow – 1st Service CoSync vs OvSync56

Below you'll find cow conception rates for 1st service ONLY by semen type for the different protocols.

The chart below is ONLY 1st service CoSync – up to Nov 24th

Semen Type	95% CI	%Conc	#Preg	#Open	Other	Abort	Total	%Tot	SPC
Sexed	22-32	26	79	221	6	2	306	70	3.8
Beef	45-62	54	69	59	6	3	134	30	1.9
TOTALS	30-39	35	148	280	12	5	440	100	2.9

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Take-Home Messages

- Heifers should be inseminated at 55% MBW and be 85% MBW postcalving.
- Conception rates in Holstein heifers inseminated using conventional semen are ~60%
- Delaying CIDR removal by 24 h in a 5-d CIDR-Synch protocol for first TAI eliminated early estrus without affecting fertility when heifers were inseminated with conventional semen.
- Submission of heifers to a 5-d CIDR-Synch protocol for first TAI when using sexed semen increased fertility and decreased total days on feed compared with heifers detected in estrus after treatment with $PGF_{2\alpha}$ for first AI.

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