

# Activity Monitors for Detection of Estrus in Dairy Cows

**Paul M. Fricke, Ph.D.**

**P.D. Carvalho, J.O. Giordano,  
A. Valenza, G. Lopes Jr.,  
M.C. Amundson**



DEPARTMENT OF  
**DAIRY SCIENCE**  
University of Wisconsin-Madison

# Detection Aids



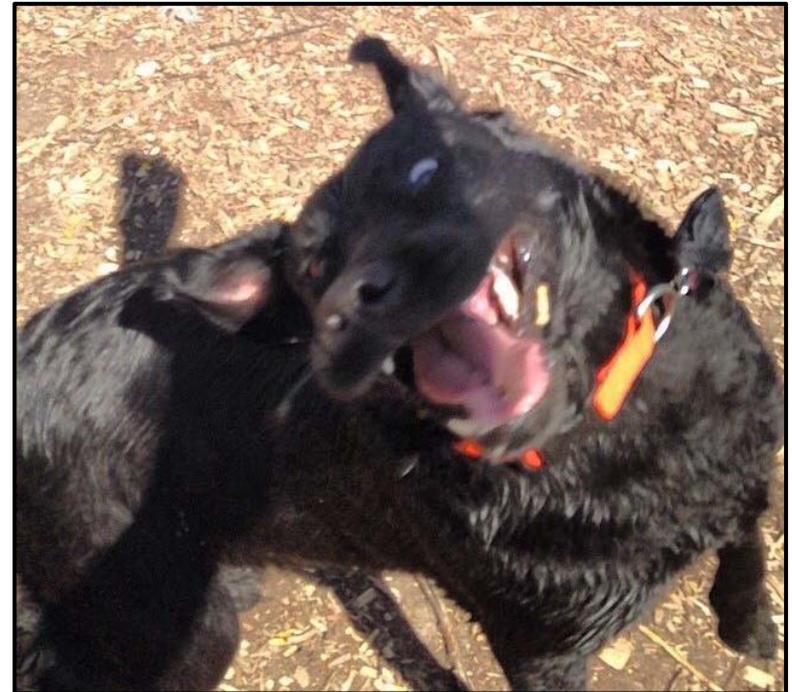
BIOLOGY OF REPRODUCTION 19, 389–395 (1978)

## Detection of Estrus-Related Odors in Cows by Trained Dogs

C. A. KIDDY,<sup>1</sup> D. S. MITCHELL,<sup>2</sup> D. J. BOLT<sup>1</sup> and H. W. HAWK<sup>1</sup>

*Reproduction Laboratory,<sup>1</sup>  
Animal Physiology and Genetics Institute, USDA, SEA,  
Beltsville, Maryland 20705*

*and  
Department of Bioengineering, Behavioral Science Section,<sup>2</sup>  
Southwest Research Institute, 6220 Culebra Road,  
San Antonio, Texas 78284*



## Detection of Estrus-Related Odors in Cows by Trained Dogs

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- 4 dogs were tested in a farmyard setting with live cows.
- Three cows, 1 in estrus and the other 2 between Days 6 and 12 postestrus, were used during each of 12 sessions of testing. New cows were used for each session.
- The dogs averaged **87.3%** correct detections of estrous cows.

# Technology



**Pedometry  
1970's**



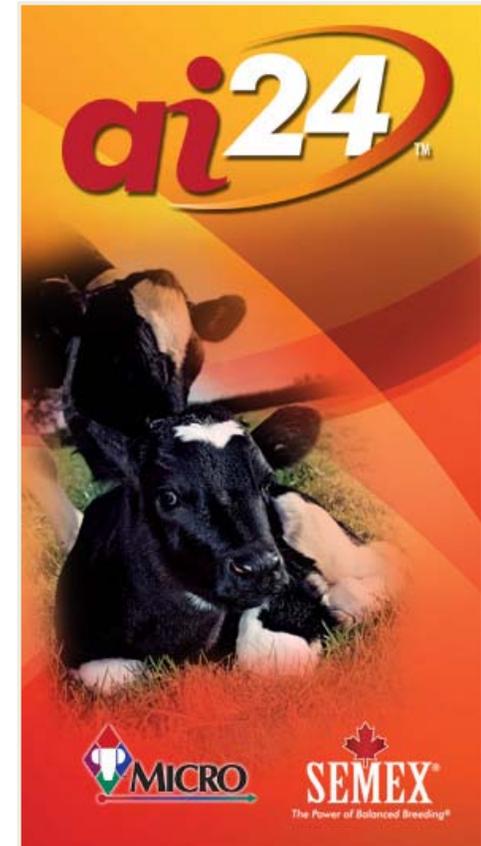
**Radiotelemetry  
1990's**



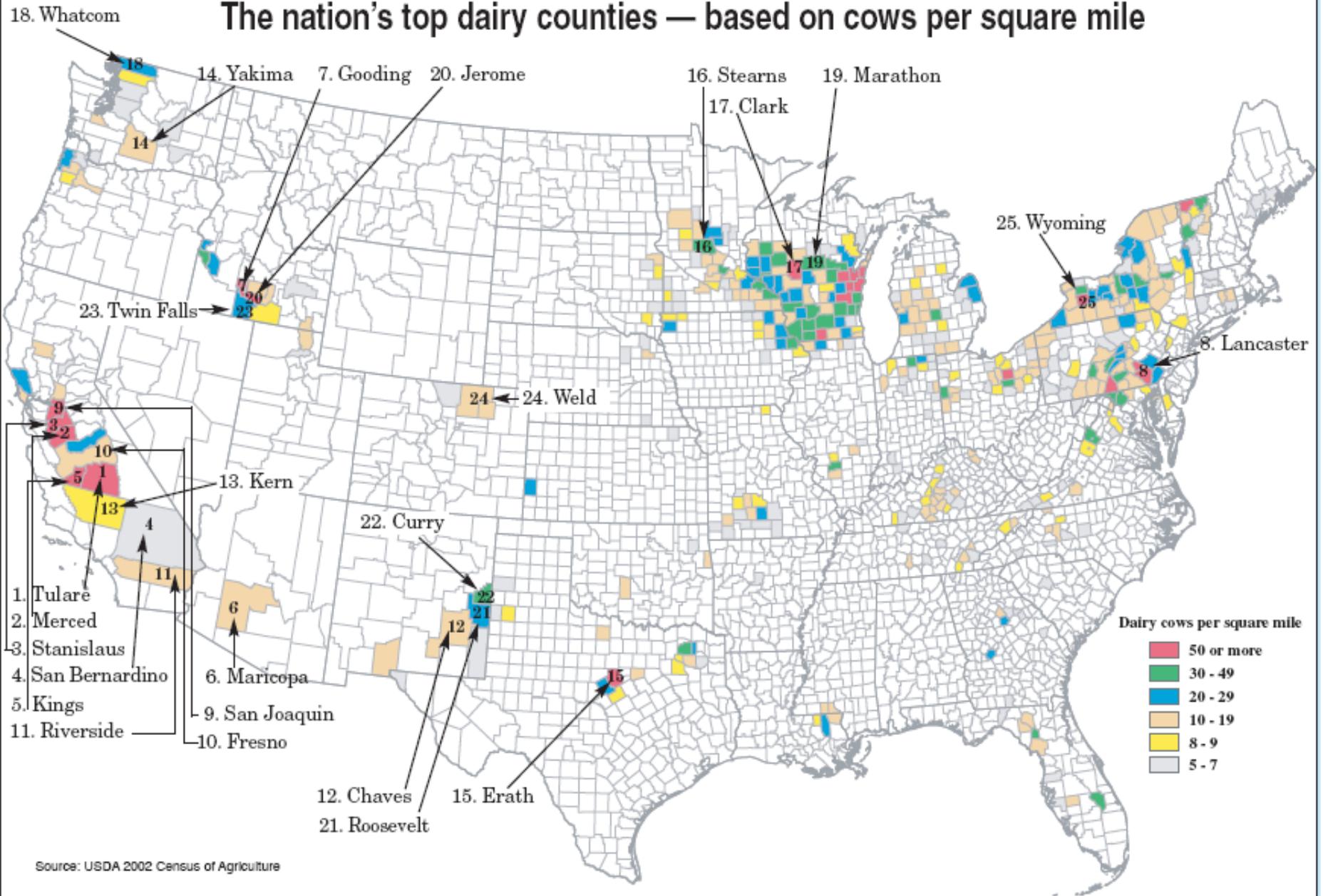
# Accelerometer Systems



## Heatime



# The nation's top dairy counties — based on cows per square mile

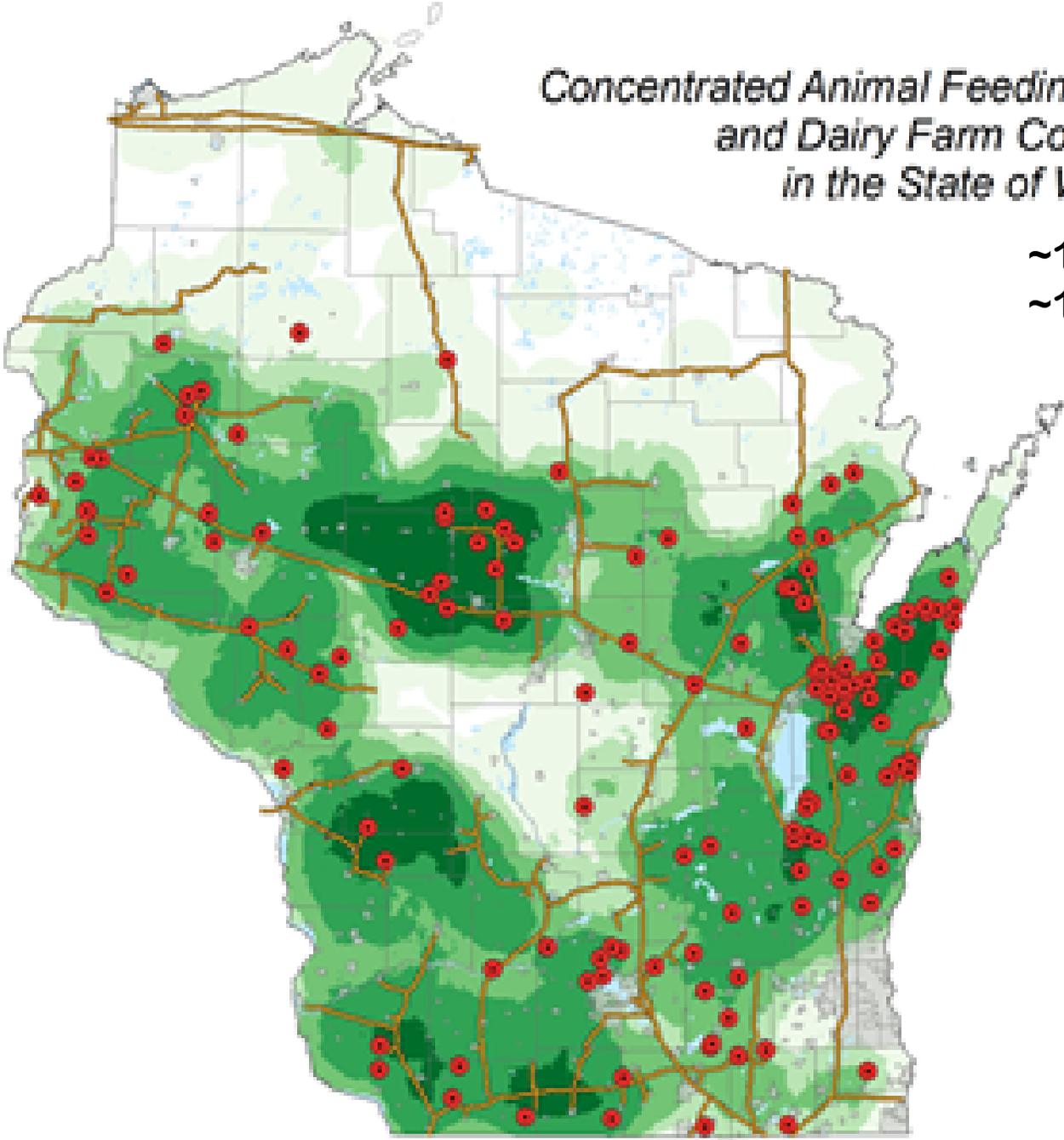


*Concentrated Animal Feeding Operations (CAFOs)  
and Dairy Farm Concentrations  
in the State of Wisconsin*

**~10,500 dairy farms**  
**~1.25 million dairy cows**

**Number of Dairy Farms  
within a 10-mile Radius**

-  1 to 25
-  26 to 50
-  51 to 100
-  101 to 200
-  201 or More
-  City or Village
-  County Border
-  Natural Gas Line
-  CAFO Site



# SCR Systems in Wisconsin 2014



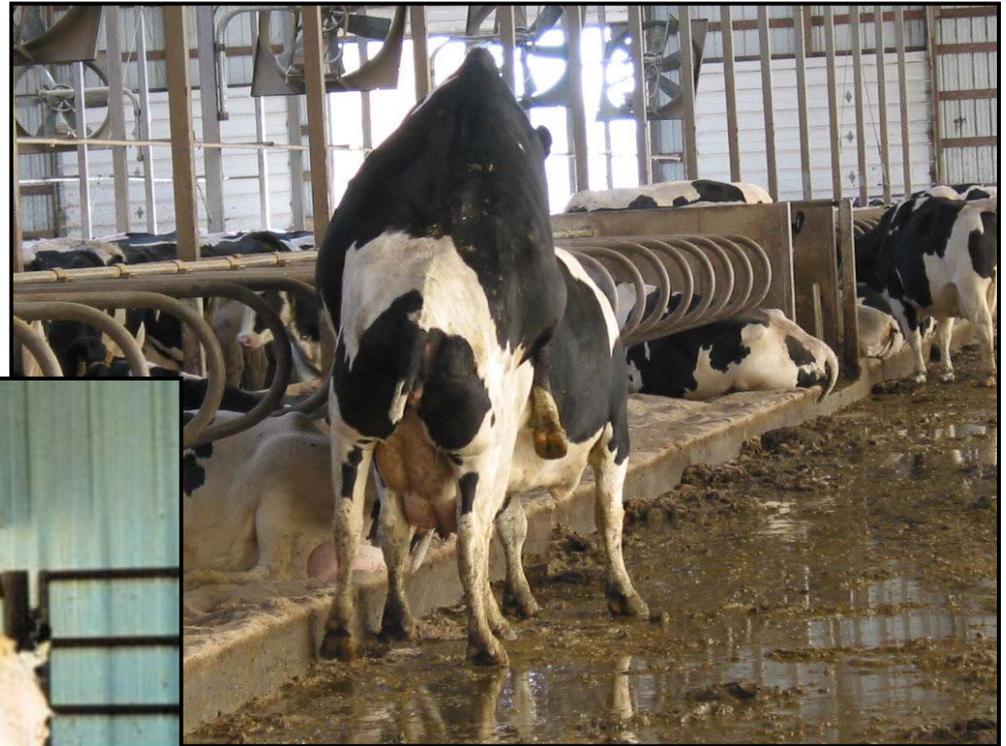
# Email from April 29, 2014

Hello Paul. I am a veterinarian in Fond du Lac county. I recently have had two herds purchase the SCR heat detection system.

My first question is that one of the dairymen asked me when he should breed the cows. Should he breed them as soon as they show up on the list, or is it better to wait some time before breeding and, if he should wait, how many hours before he should breed them?

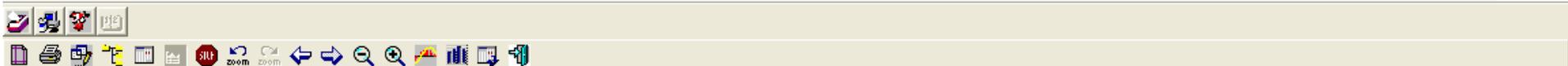
# Behavioral Estrus in Dairy Cows

When is the  
optimal  
time to AI?



~8 to 12 hours  
Before ovulation  
= ~12 h  
After onset of estrus



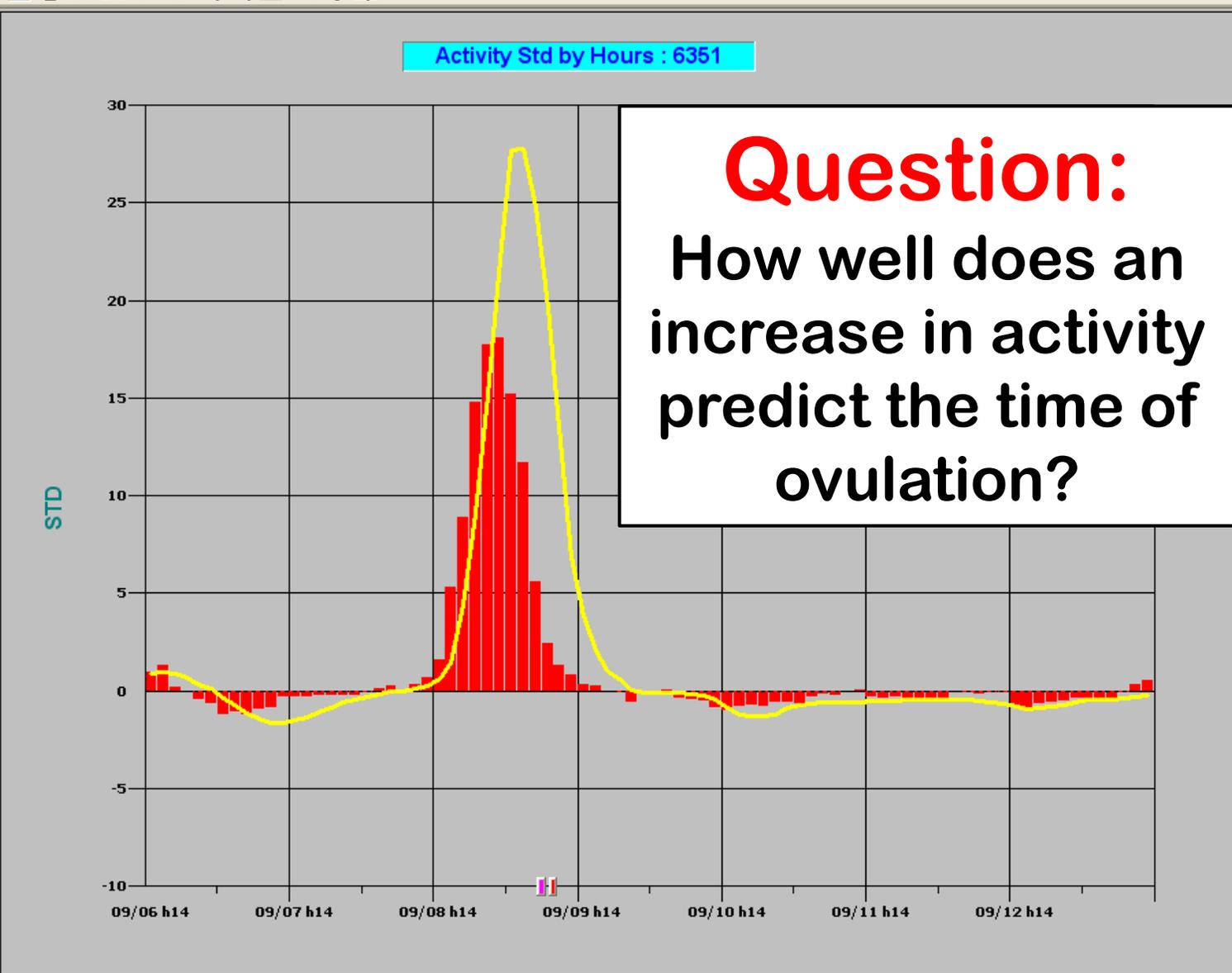


Legend

- STD Activity by 2 Hours
- Weighted Activity

6351

Filtration



**Question:**  
How well does an increase in activity predict the time of ovulation?

Graph Settings

Days since Freshening: 77

Group Name: 2

Lactation Number: 2

Current Lactation Status: Breeding

Days since Breeding: 8



J. Dairy Sci. 95:7115–7127  
<http://dx.doi.org/10.3168/jds.2012-5639>  
© American Dairy Science Association®, 2012.

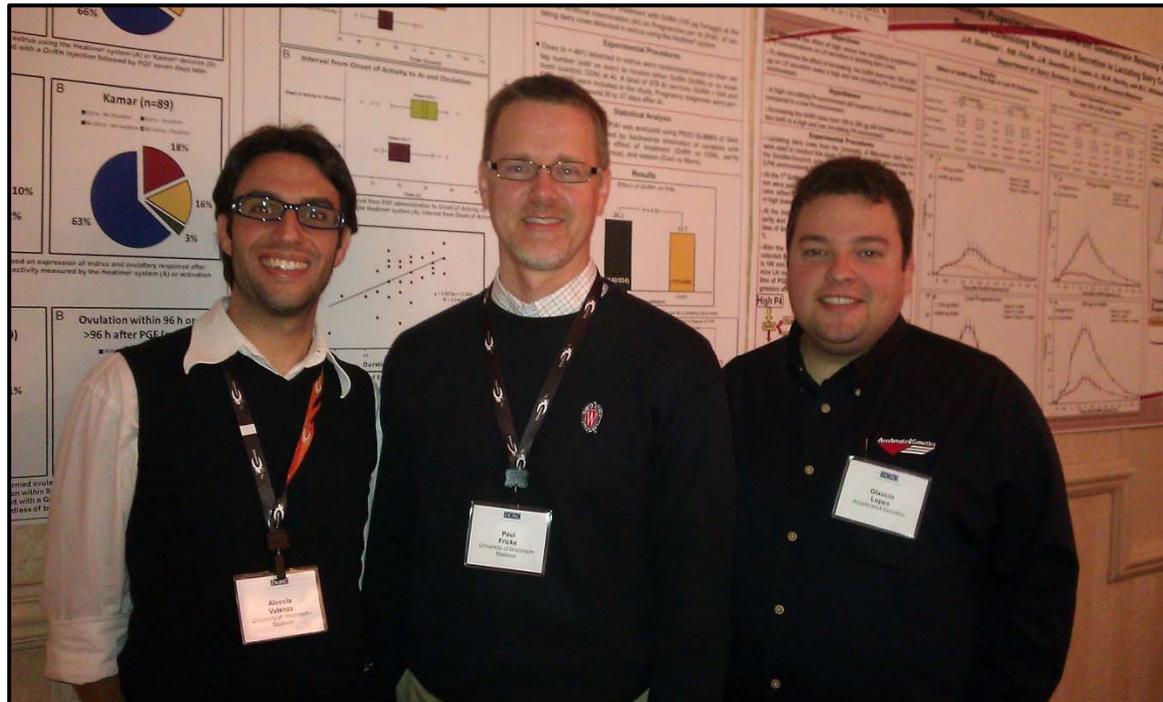
## Assessment of an accelerometer system for detection of estrus and treatment with gonadotropin-releasing hormone at the time of insemination in lactating dairy cows

A. Valenza,\*†‡<sup>1</sup> J. O. Giordano,\*<sup>1</sup> G. Lopes Jr.,\*<sup>1</sup> L. Vincenti,‡ M. C. Amundson,\* and P. M. Fricke\*<sup>2</sup>

\*Department of Dairy Science, University of Wisconsin, Madison 53706

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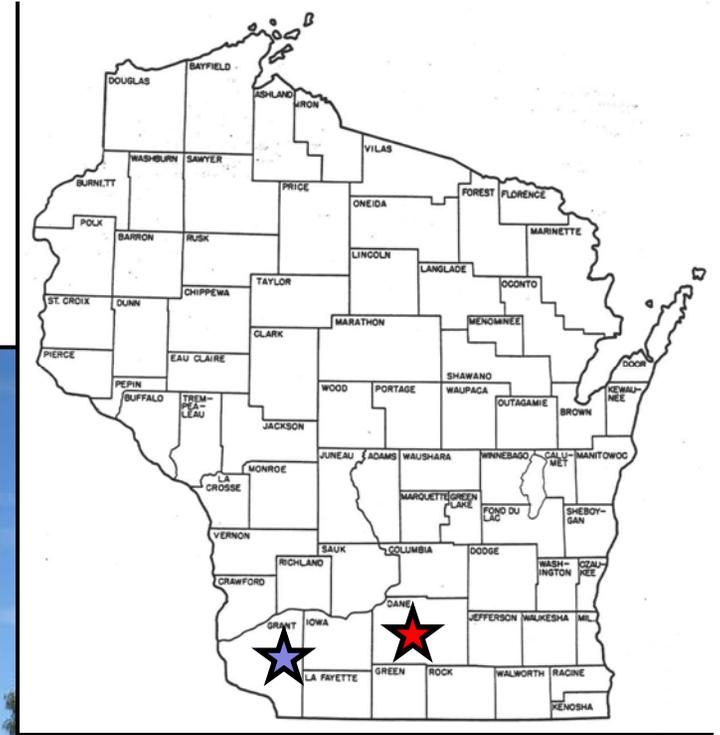
‡Department of Animal Pathology, School of Veterinary Medicine, University of Turin, Turin, Italy 10095



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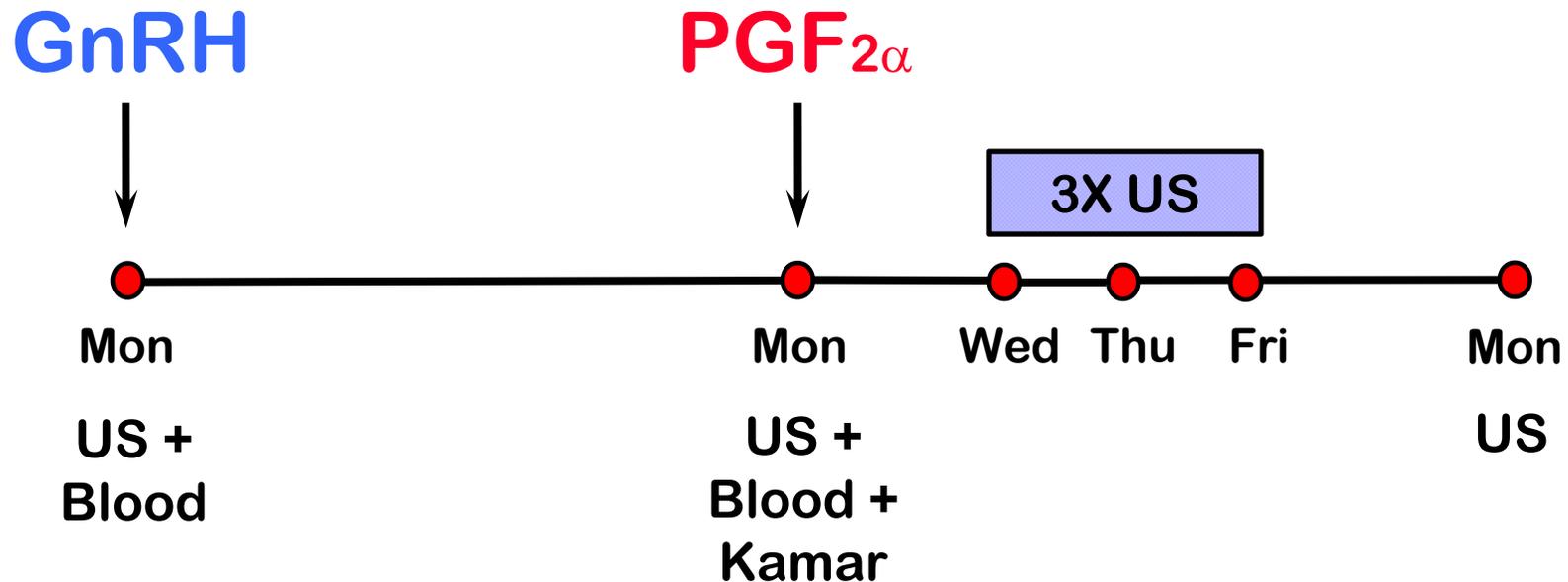
# Majestic View Dairy

Lancaster, Wisconsin



# Synchronization of estrus

Cows (n = 112) from 46 to 52 DIM were submitted to a G-P protocol to synchronize estrus:



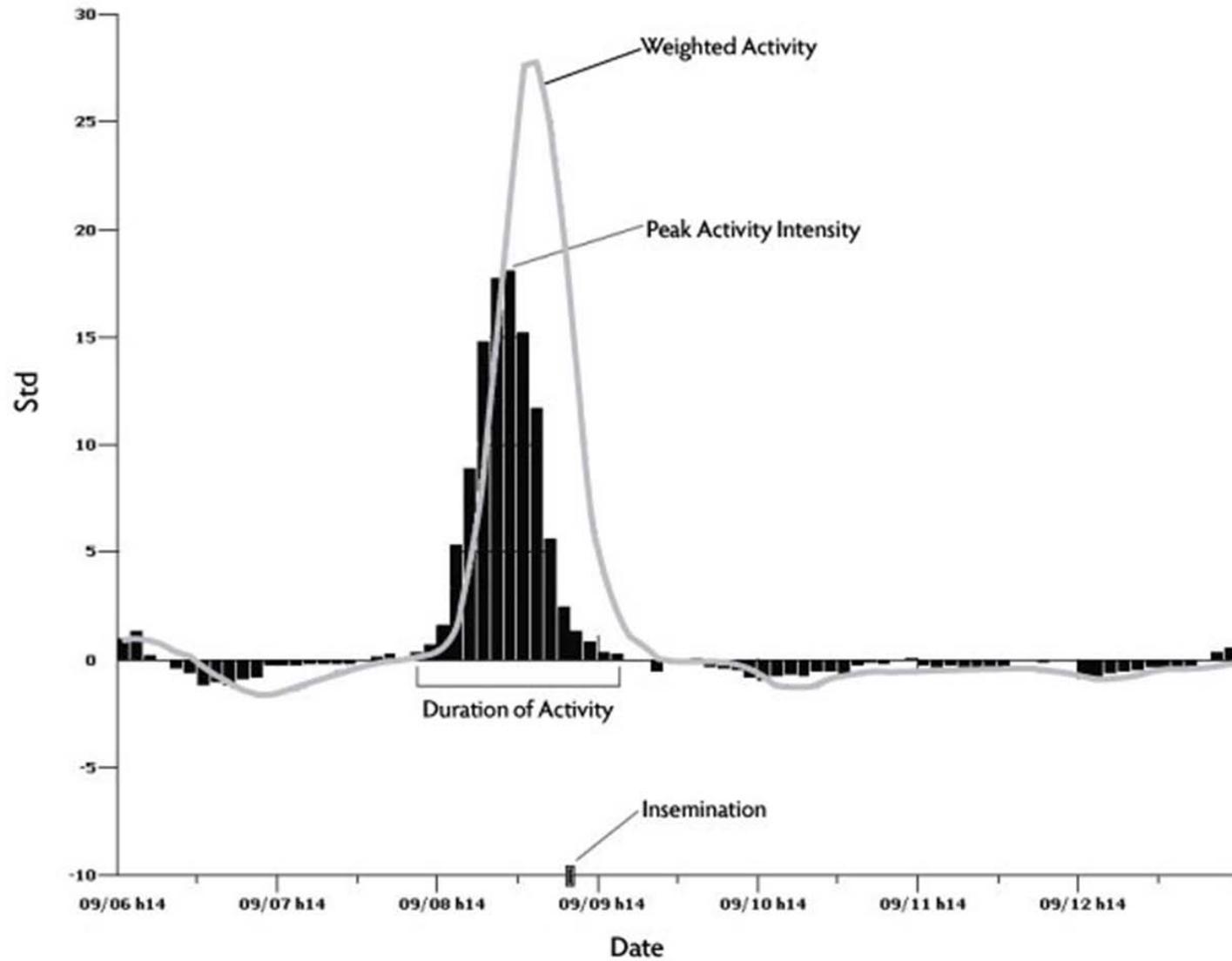
Cows that failed to synchronize (n = 23) were excluded resulting in **89** cows included in the final analysis.

# Percentage of cows determined to be in estrus, and distribution of cows by estrous activity and ovulation

Valenza et al., 2012; J. Dairy Sci. 95:7115-7127

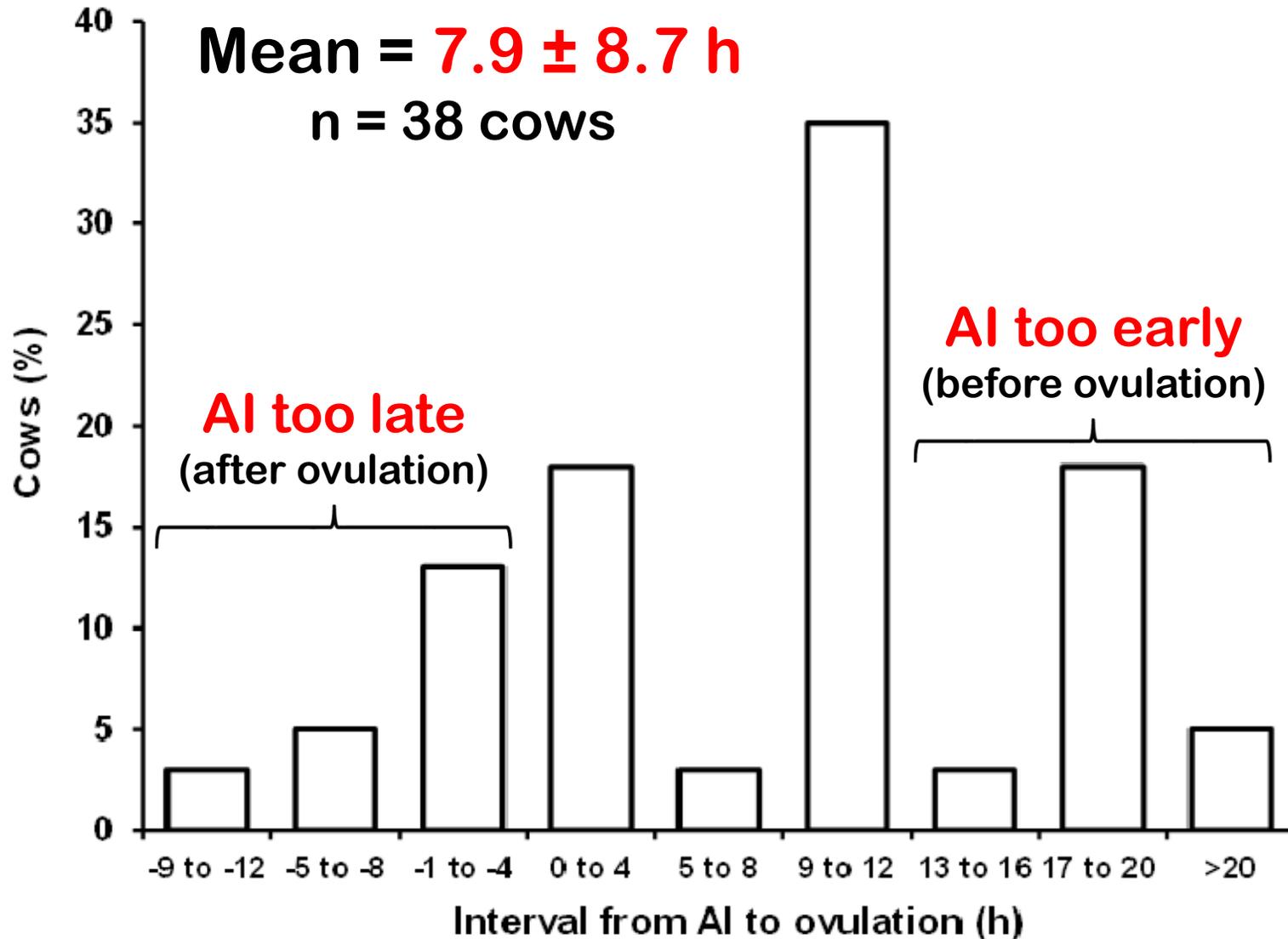
Item	Accelerometer system ----- % (n/n) -----	Heatmount detectors ----- % (n/n) -----
<b>Estrus</b>	<b>71</b> (63/89)	<b>66</b> (59/89)
Ovulation	95 (60/63)	93 (55/59)
No ovulation	5 (3/63)	7 (4/59)
<b>No Estrus</b>	<b>29</b> (26/89)	<b>34</b> (30/89)
Ovulation	35 (9/26) <b>10%</b>	47 (14/30)
No ovulation	65 (17/26) <b>20%</b>	53 (16/30)

# Characteristics of Activity

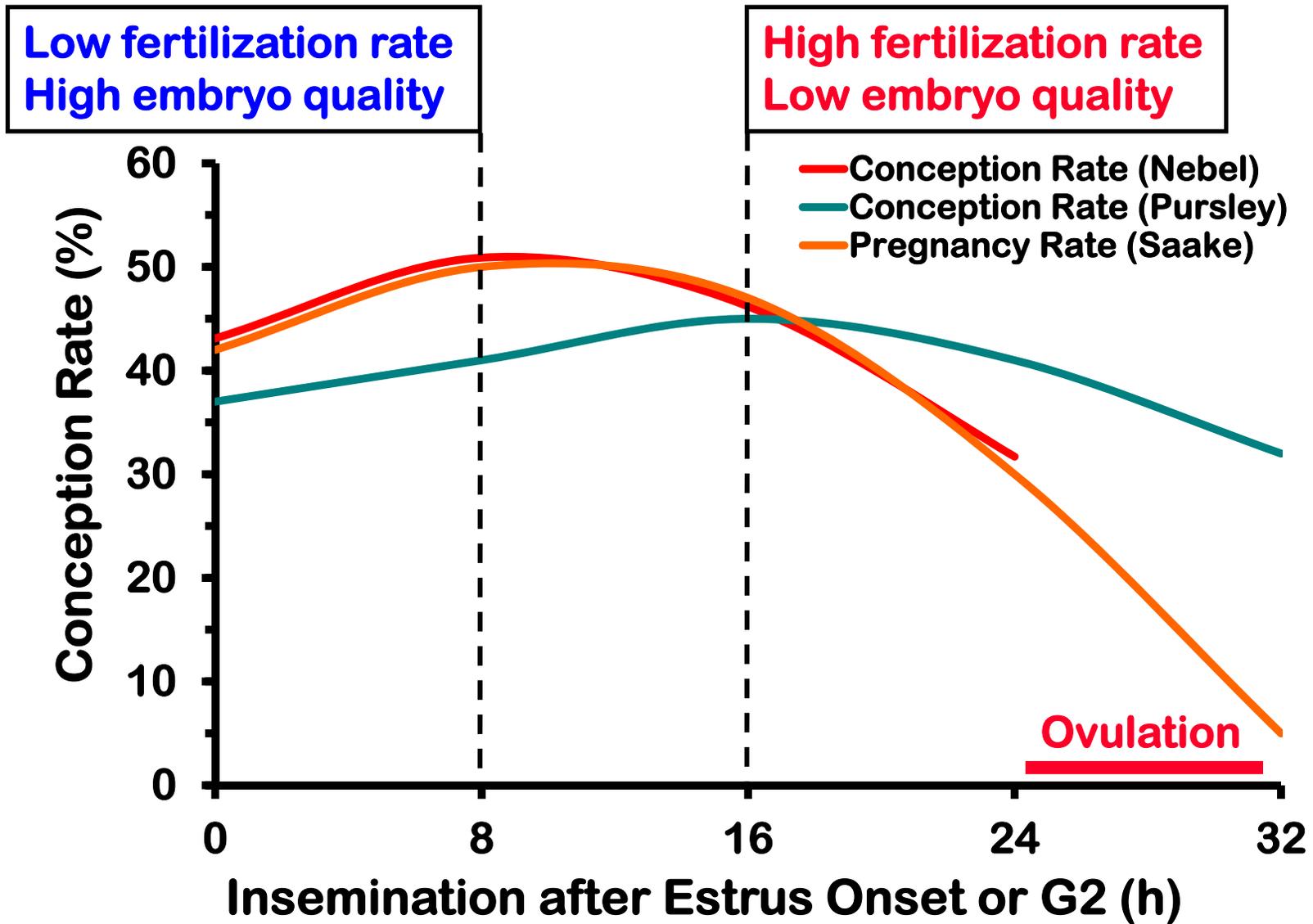


# Interval from AI to ovulation

Valenza et al., 2012; J. Dairy Sci. 95:7115-7127

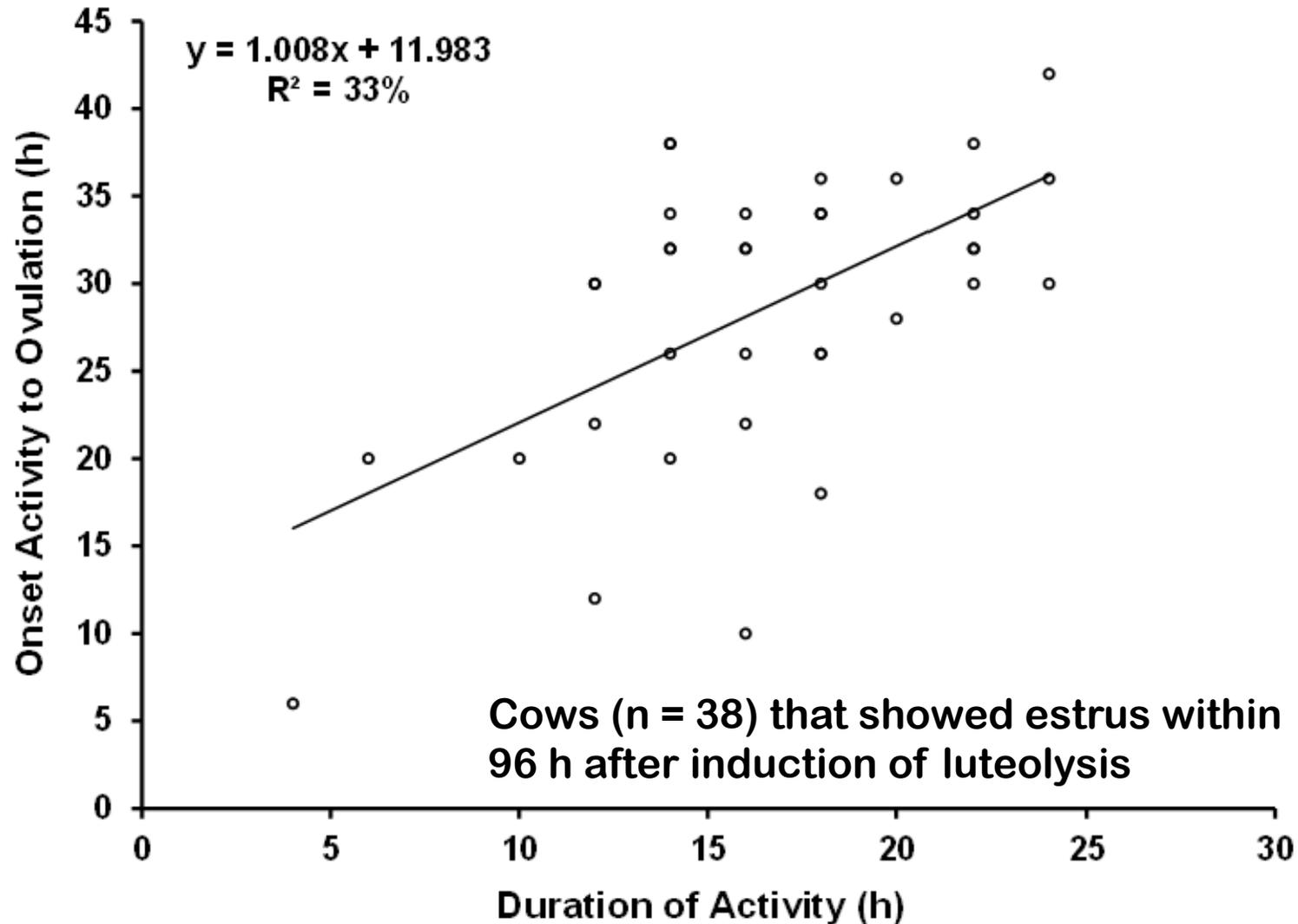


# Compromise for Time of AI



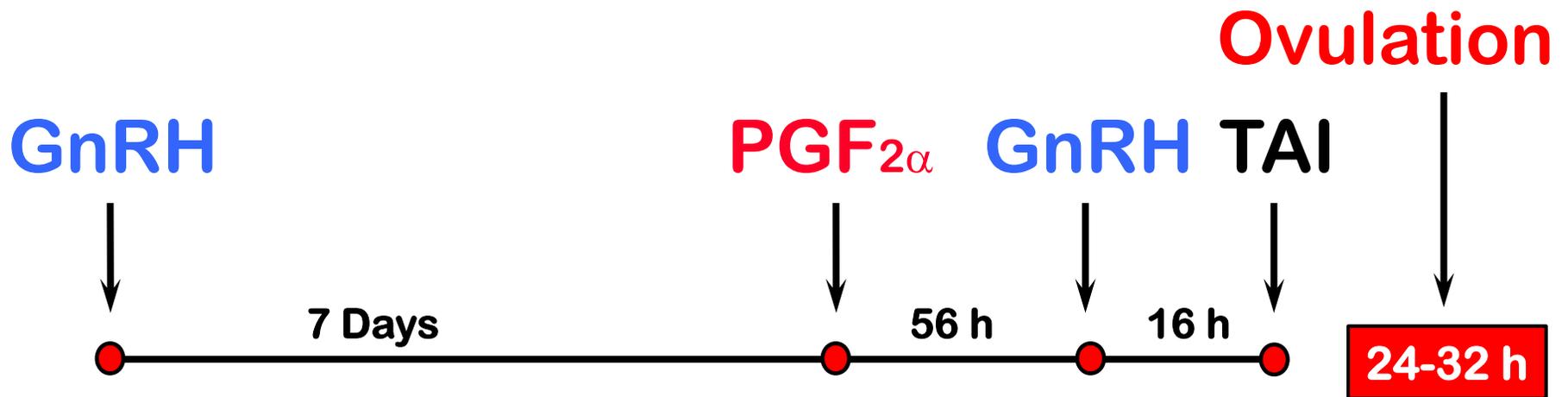
# Relationship between duration of activity and the interval from onset of activity to ovulation

Valenza et al., 2012; J. Dairy Sci. 95:7115-7127



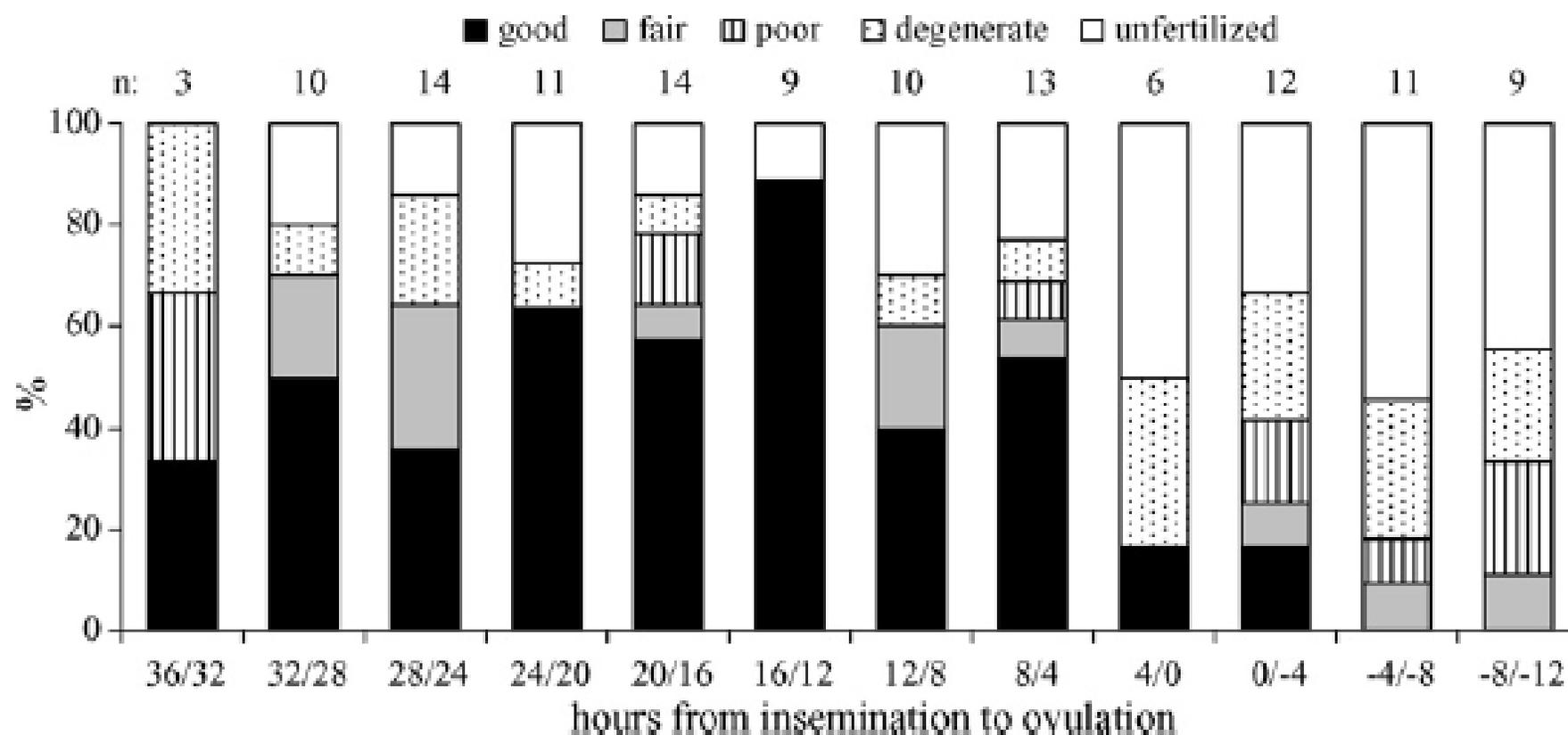
# Ovsynch

Pursley et al., 1995; Theriogenology 44:915.



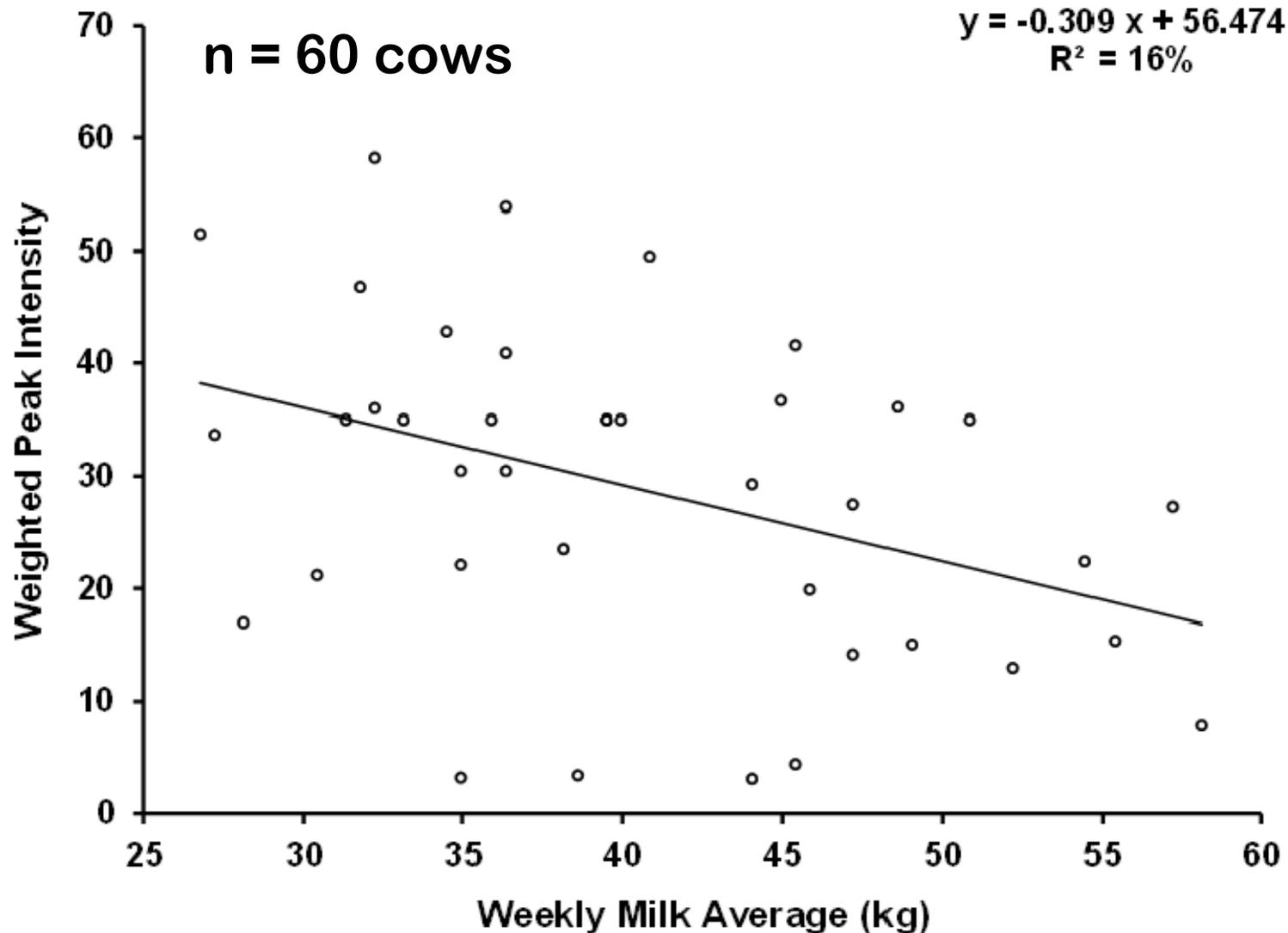
# Effect of AI to Ovulation Interval on Embryo Quality

*J.B. Roelofs et al. / Theriogenology 66 (2006) 2173–2181*



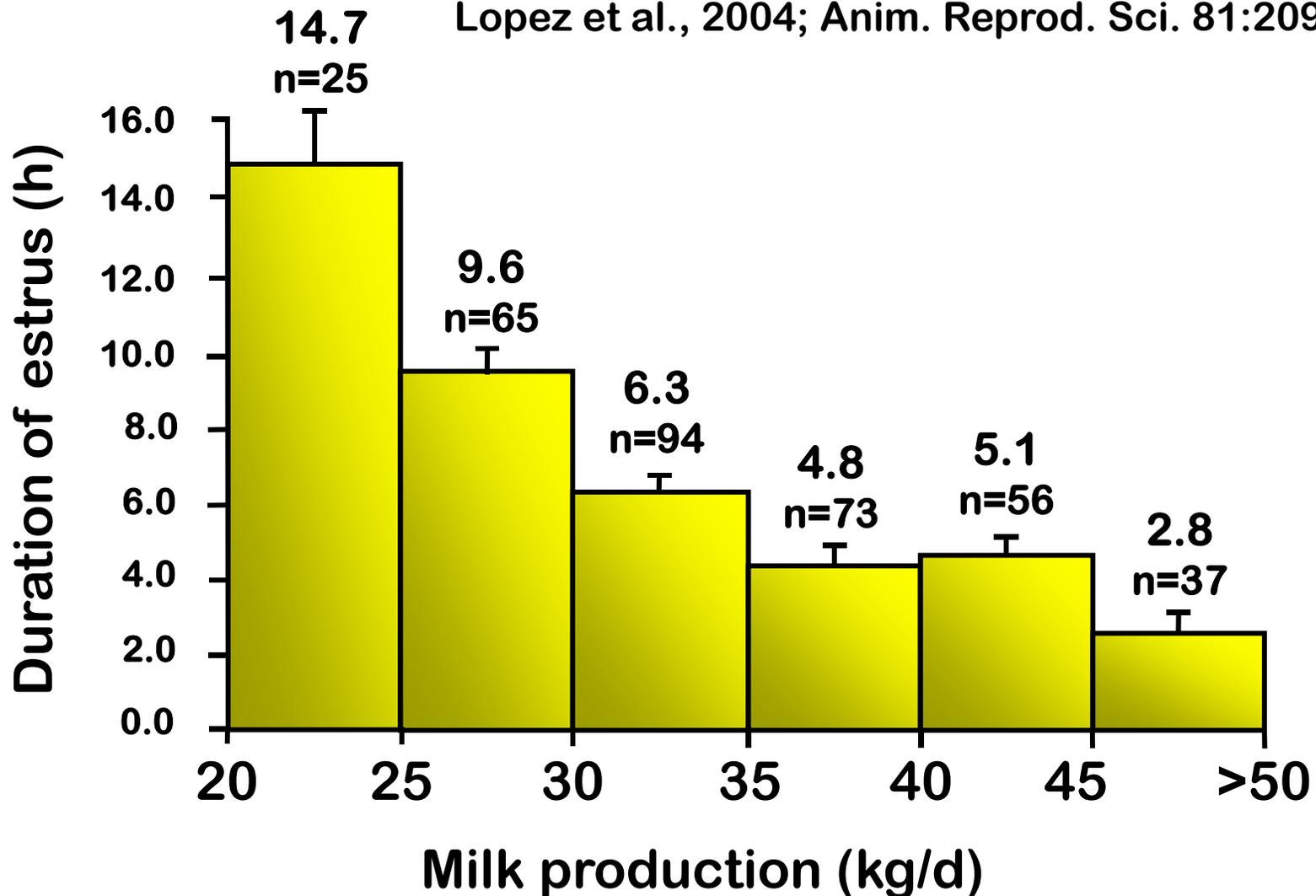
# Relationship between milk production and weighted peak intensity

Valenza et al., 2012



# Duration of estrus in relation to milk production

Lopez et al., 2004; Anim. Reprod. Sci. 81:209-223



- Analysis included all single ovulations (n=350) except first postpartum ovulations
- Average milk production during the 10 days before estrus

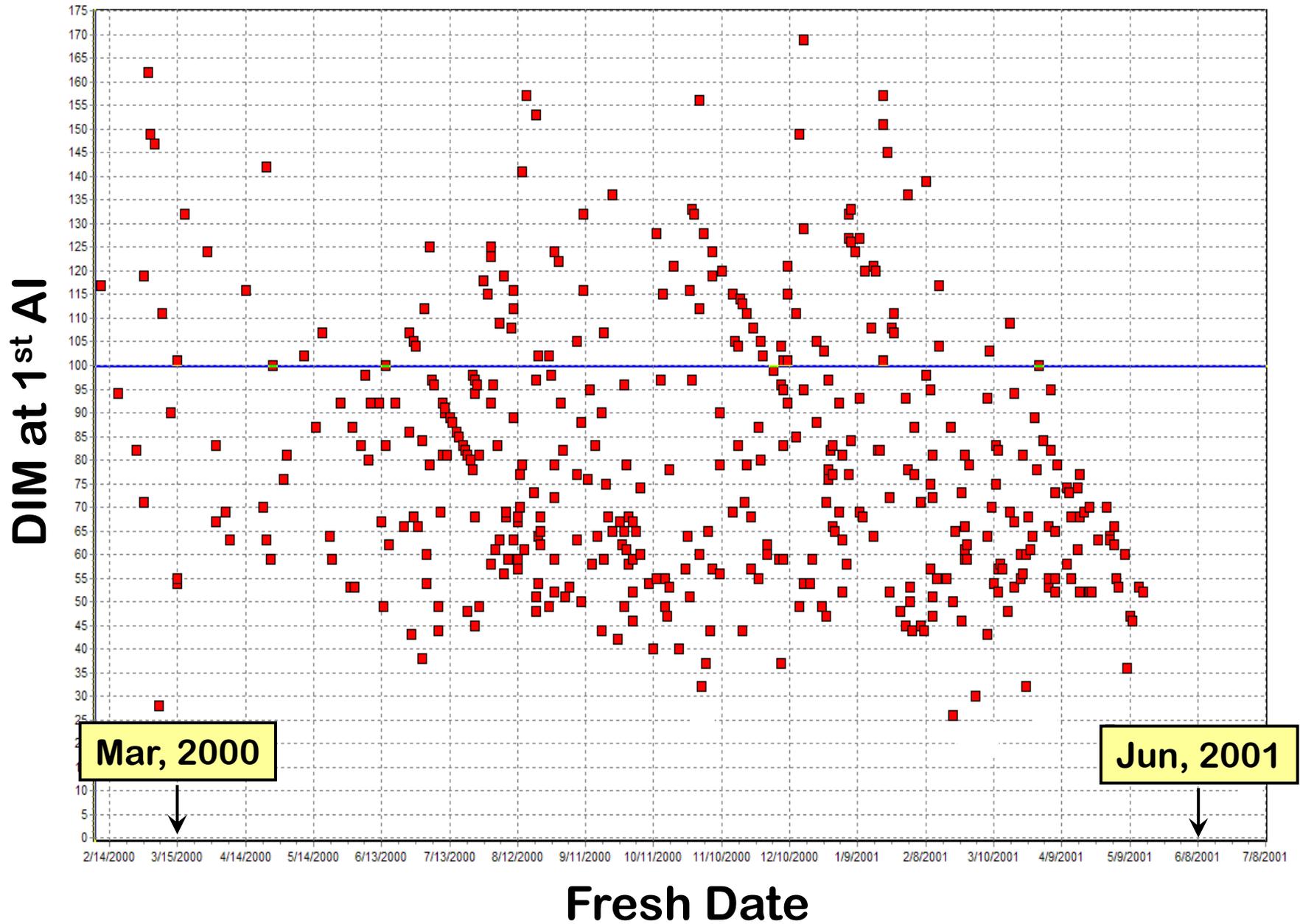
# Email from April 29, 2014

Hello Paul. I am a veterinarian in Fond du Lac county. I recently have had two herds purchase the SCR heat detection system.

My second question is what kind of breeding protocols work best with the system? Do you suggest presynching the cows? How many DIM before you intervene with a synch program and what program would you suggest?

# Distribution of DIM at 1st AI Service

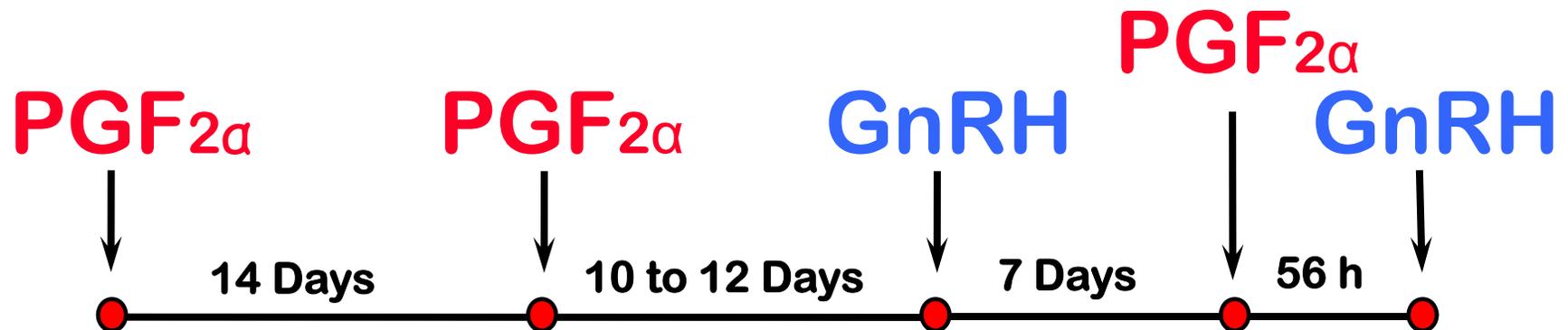
GRAPH BRED1 BY FDAT FOR FDAT > 1/15/00



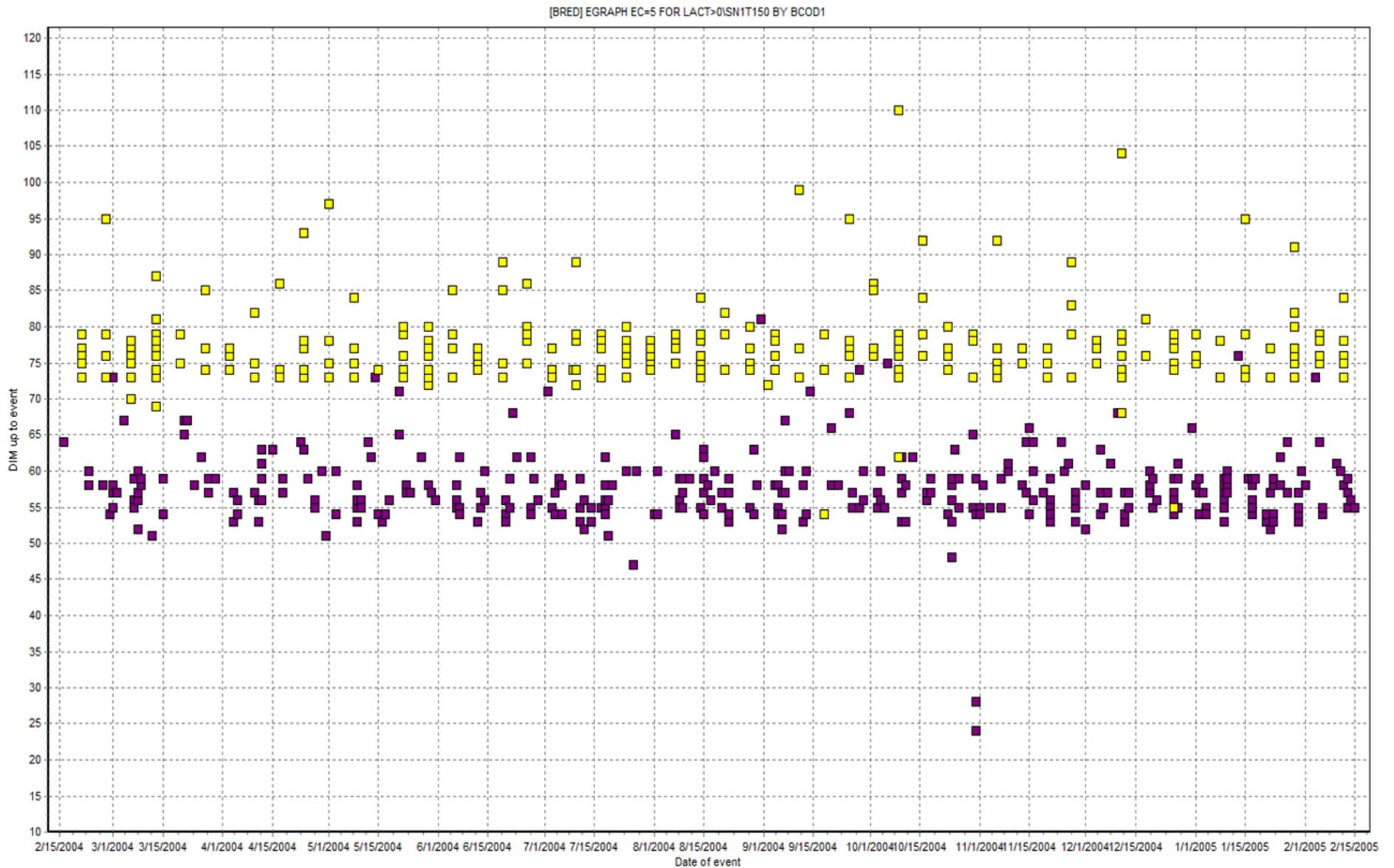
# Presynch Ovsynch



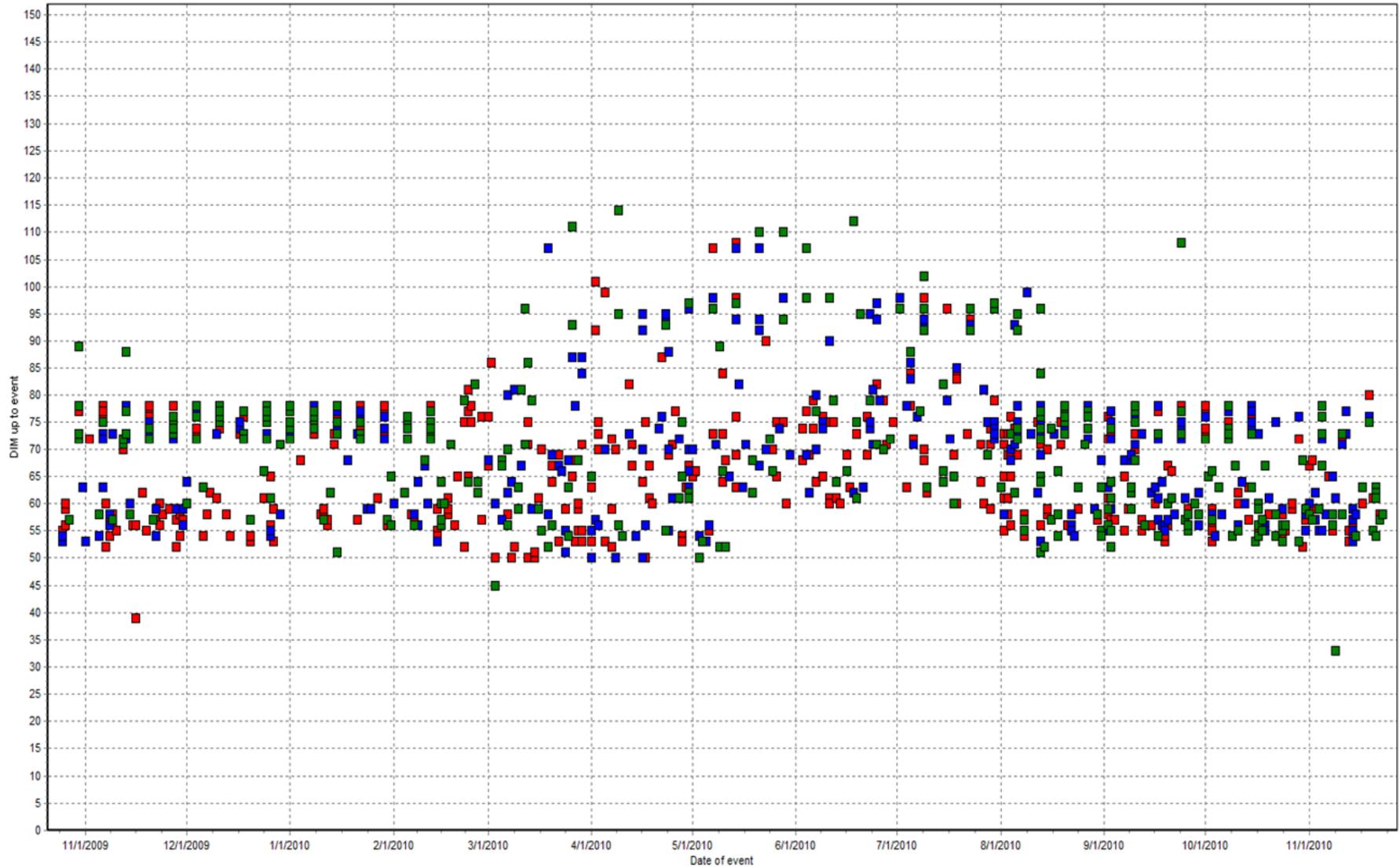
Moriera et al., 2001; J. Dairy Sci. 84:1646-1659.



# Presynch-Ovsynch with AI to estrus



# Whole-Farm Drug Rehab Program

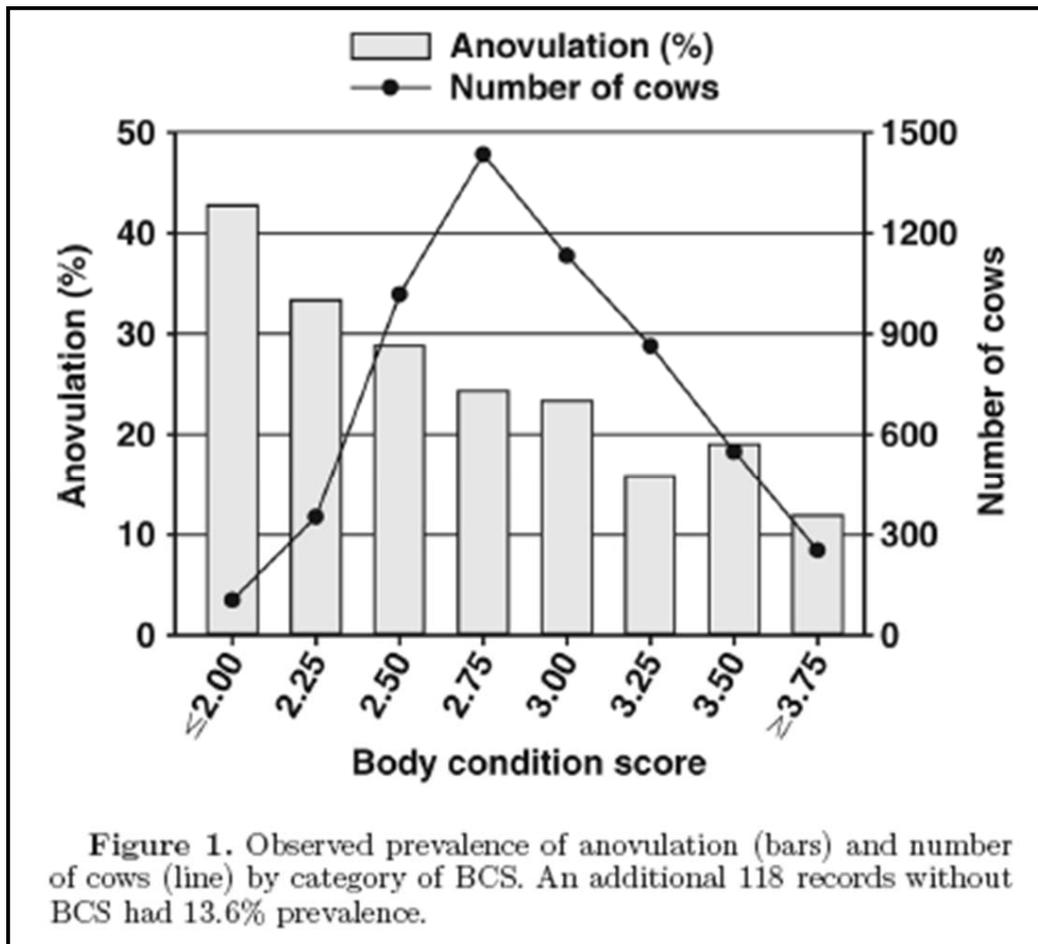


## Genetic parameters for anovulation and pregnancy loss in dairy cattle

R. L. Bamber,<sup>\*1</sup> G. E. Shook,<sup>\*2</sup> M. C. Wiltbank,<sup>\*</sup> J. E. P. Santos,<sup>†</sup> and P. M. Fricke<sup>\*</sup>

<sup>\*</sup>Dairy Science Department, University of Wisconsin, Madison 53706

<sup>†</sup>Department of Animal Sciences, University of Florida, Gainesville 32611-0910



5,818 records from  
13 studies in 8 herds  
prevalence = **23.3%**



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J. Dairy Sci. 97:2771–2781

<http://dx.doi.org/10.3168/jds.2013-7366>

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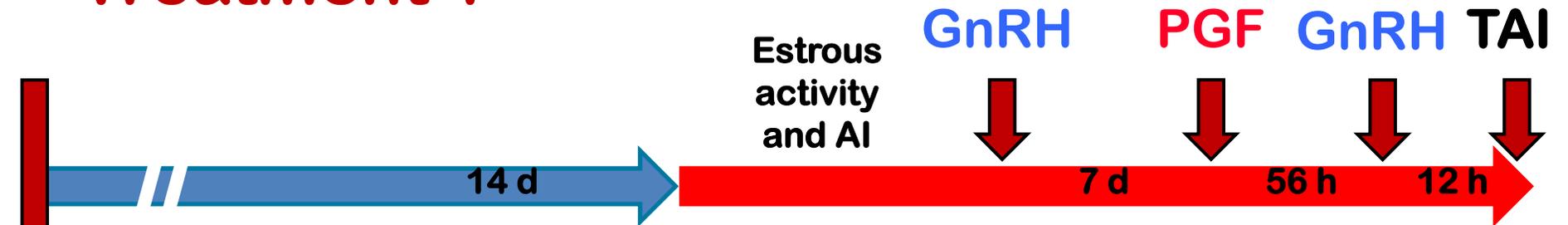
## Reproductive performance of lactating dairy cows managed for first service using timed artificial insemination with or without detection of estrus using an activity-monitoring system

P. M. Fricke,<sup>1</sup> J. O. Giordano,<sup>2</sup> A. Valenza, G. Lopes Jr., M. C. Amundson, and P. D. Carvalho  
Department of Dairy Science, University of Wisconsin, Madison 53706



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# Treatment 1



# Treatment 2



# Treatment 3



**DIM**

**39±3**

**VWP = 53±3**

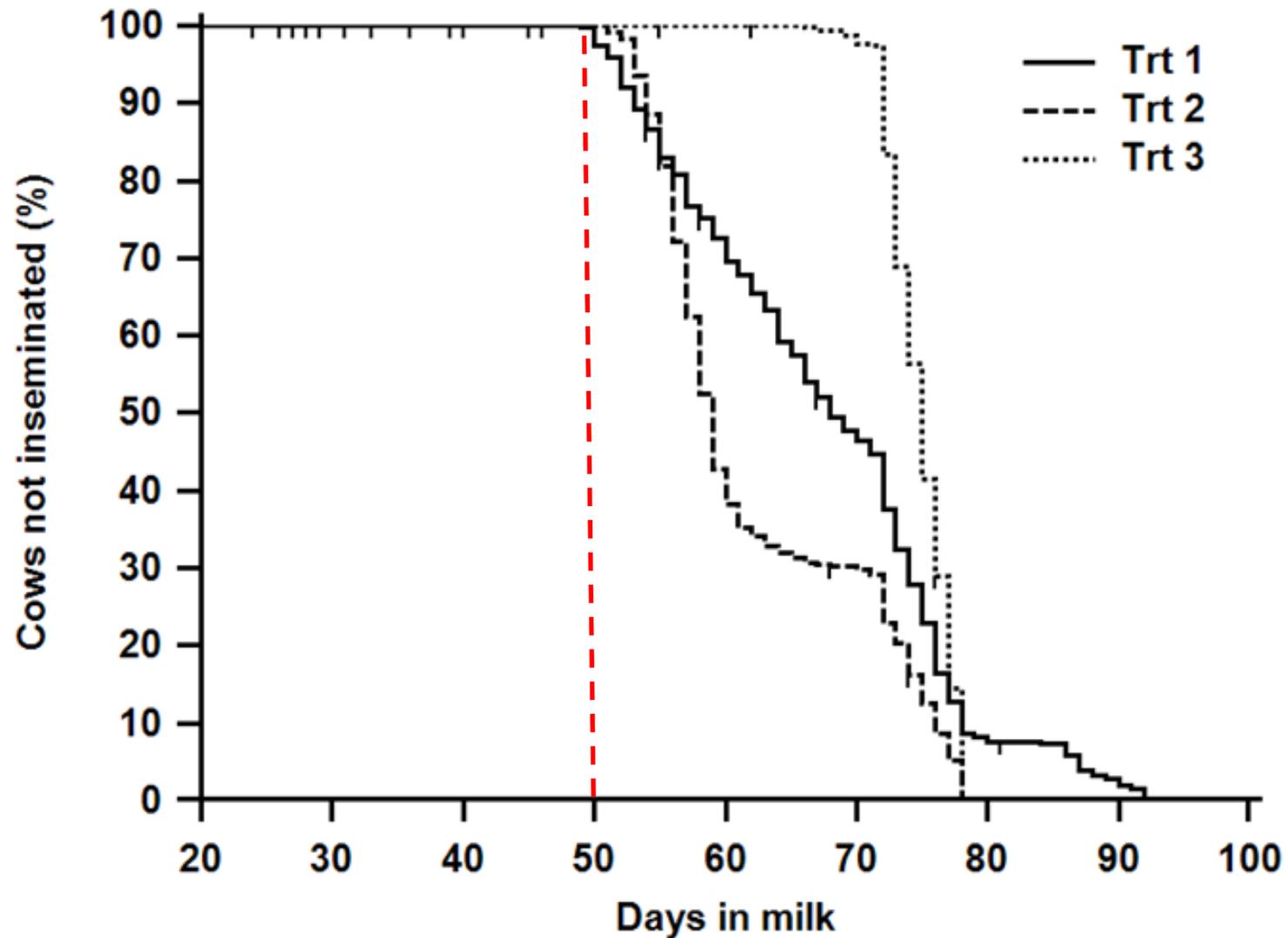
**65±3**

**72±3**

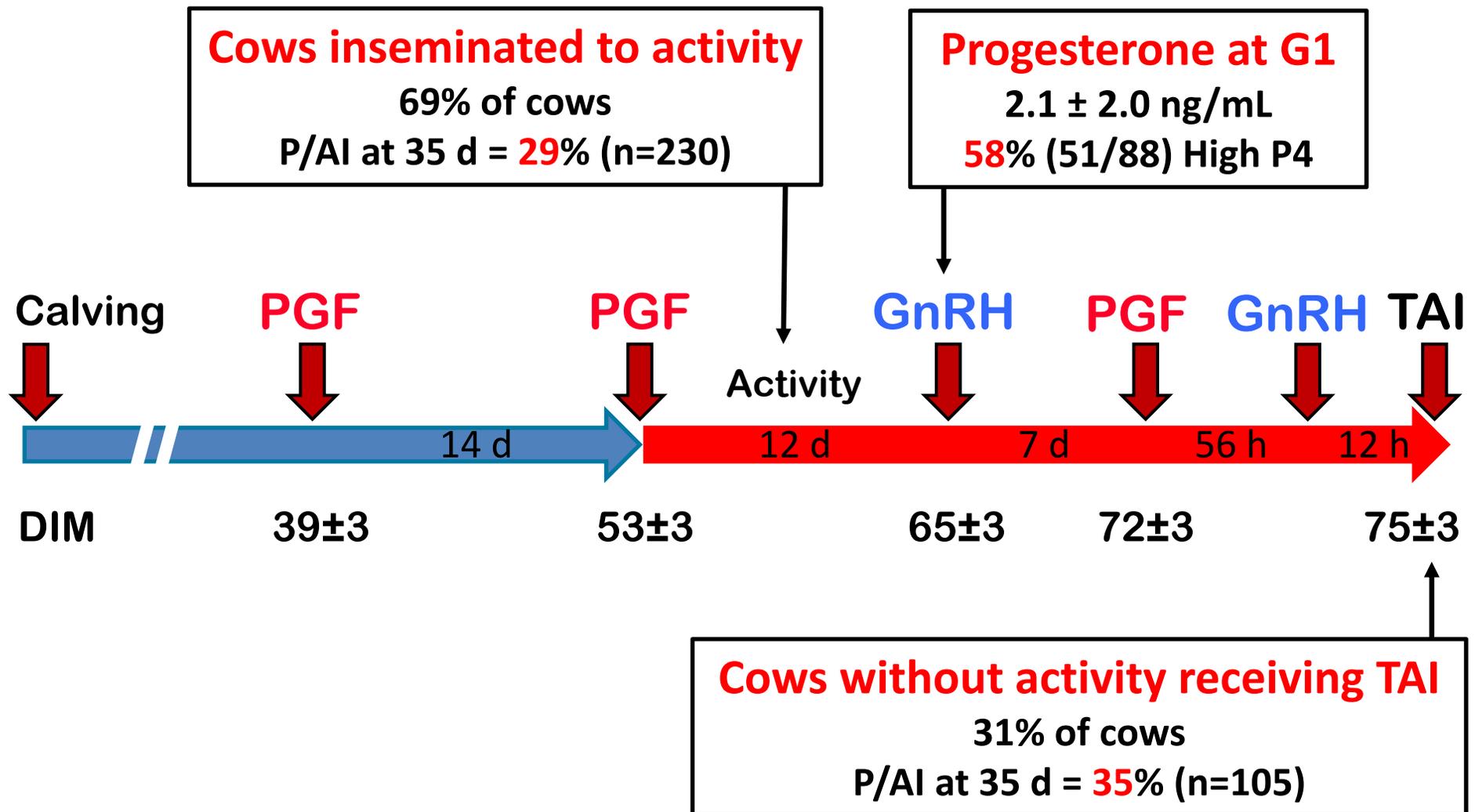
**75±3**

# Effect of Treatment on Survival to First AI

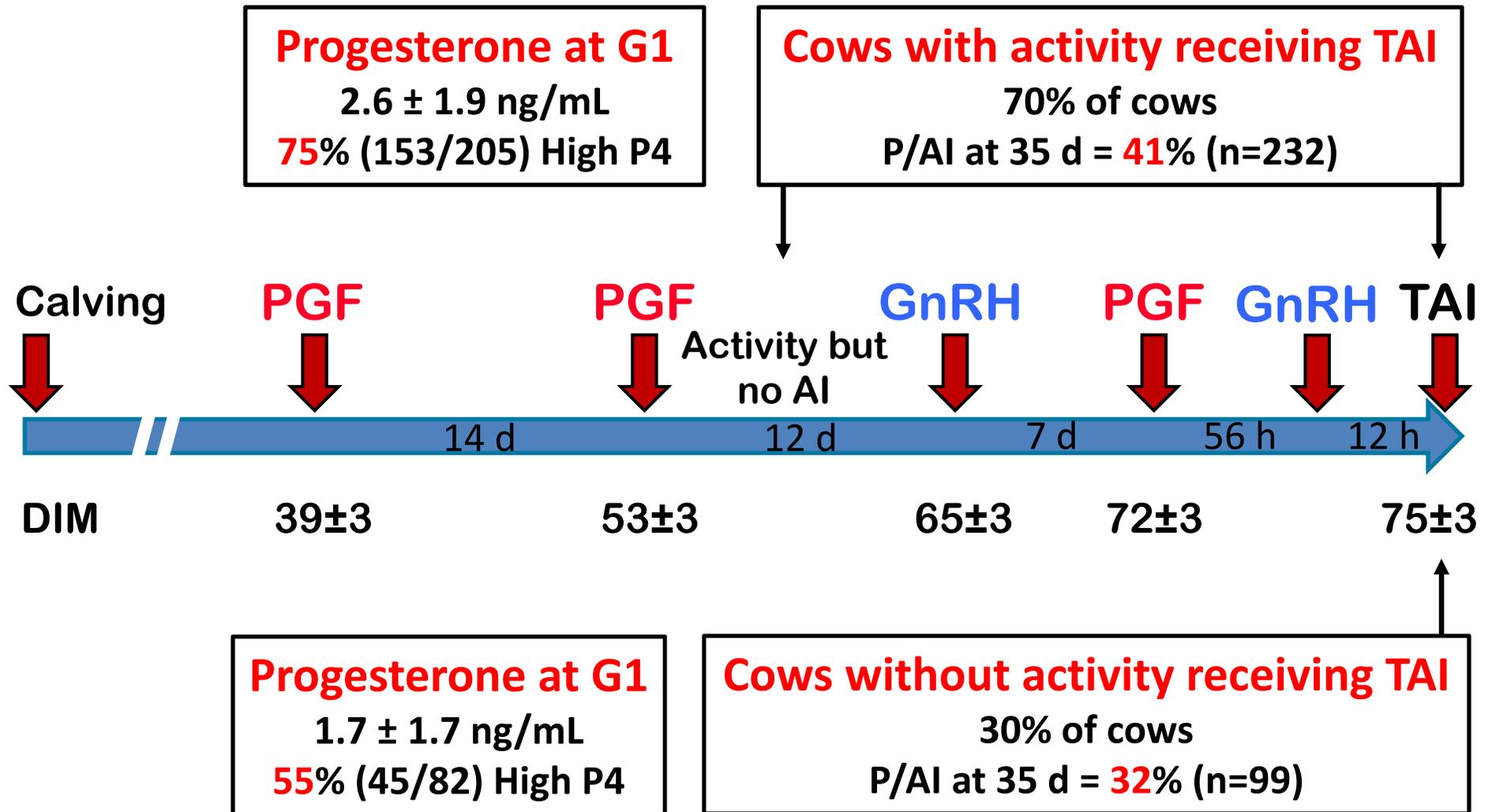
Fricke et al., 2014; J. Dairy Sci. 97:2771-2781.



## Treatment 2: Presynch-Ovsynch with AI to activity



# Treatment 3: Presynch/Ovsynch with 100% TAI



## Effect of treatment and parity on pregnancies per AI (P/AI).

Treatment	Parity		P-value
	Primiparous	Multiparous	
1	36.5 (46/126)	27.7 (56/202)	0.10
2	32.3 (41/127)	30.4 (63/207)	0.72
3	47.3 (61/129)	32.7 (66/202)	0.01
Overall	38.7 (148/382)	30.3 (185/611)	0.01

Fricke et al., 2014; J. Dairy Sci. 97:2771-2781



J. Dairy Sci. 94:6216–6232

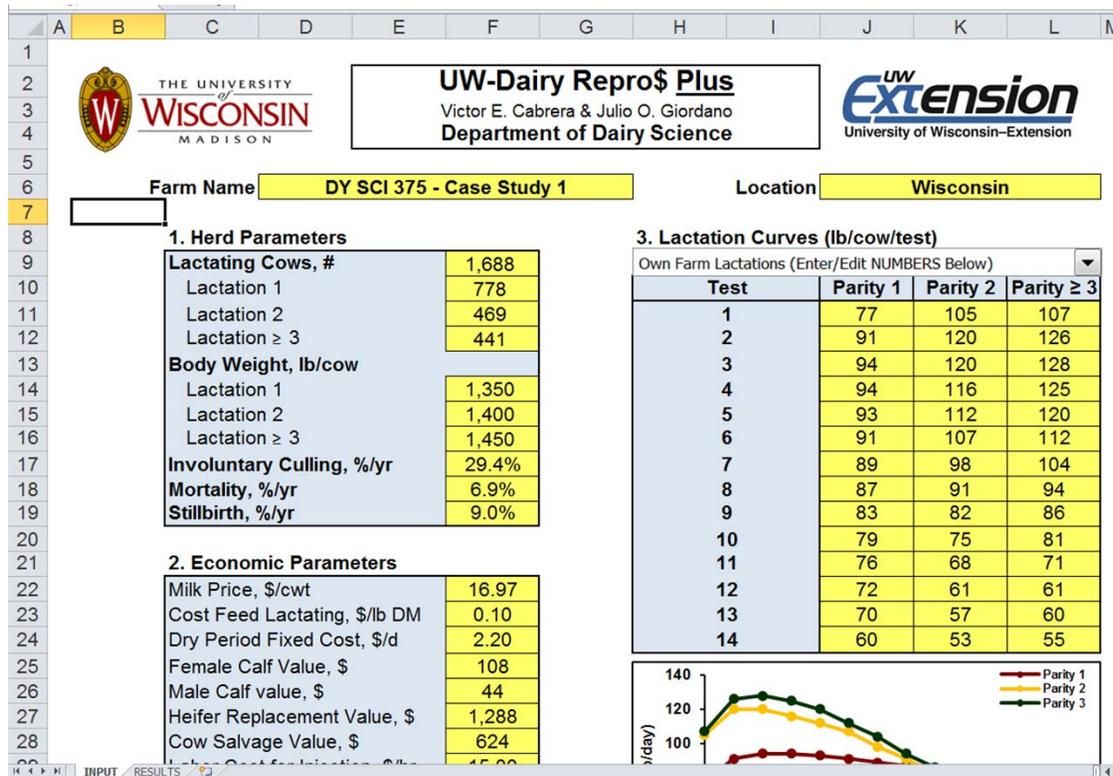
doi:10.3168/jds.2011-4376

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# An economic decision-making support system for selection of reproductive management programs on dairy farms

J. O. Giordano, P. M. Fricke, M. C. Wiltbank, and V. E. Cabrera<sup>1</sup>

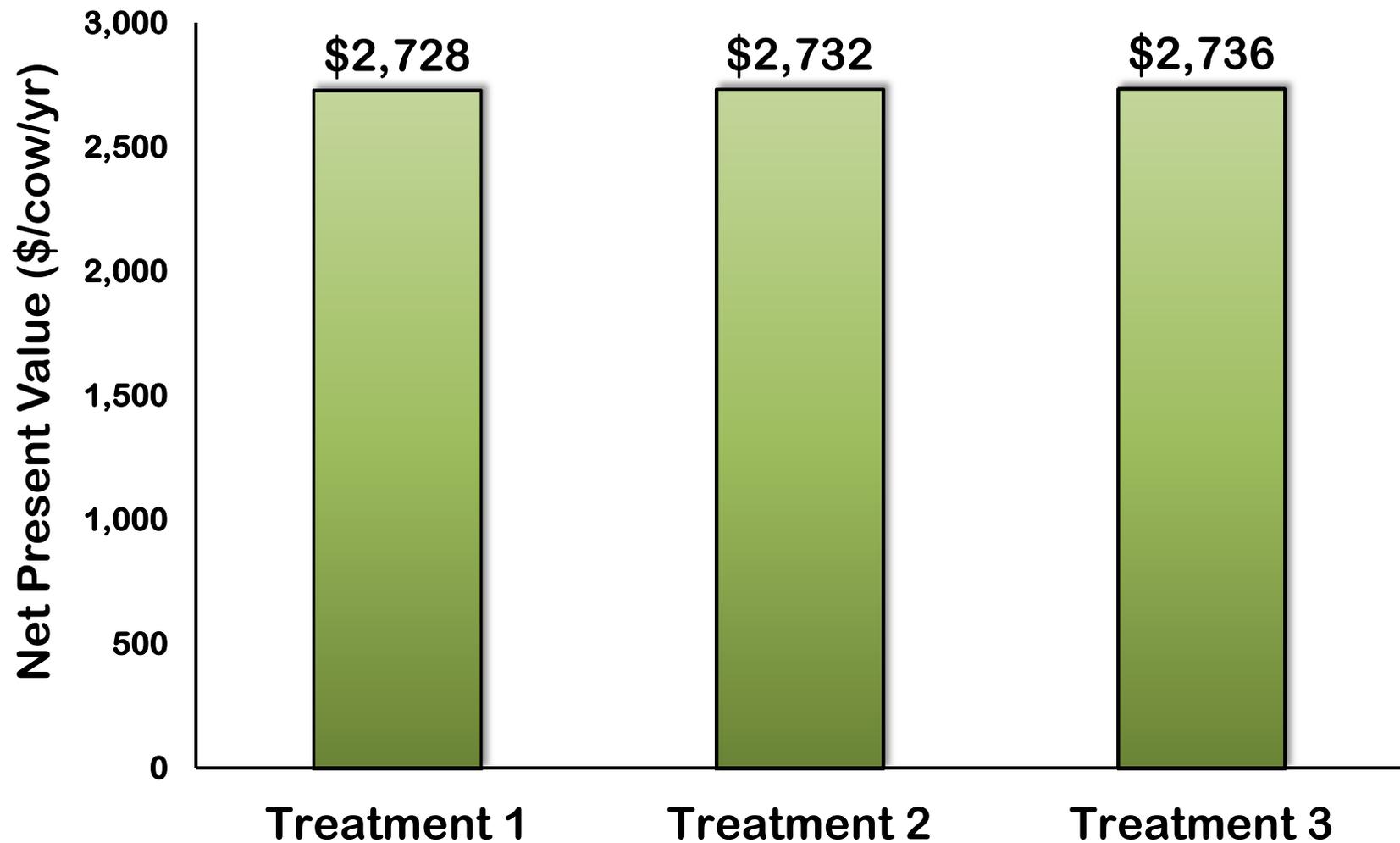
Department of Dairy Science, University of Wisconsin, Madison 53706



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# Economic comparison

Fricke et al., 2014; J. Dairy Sci. 97:2771-2781



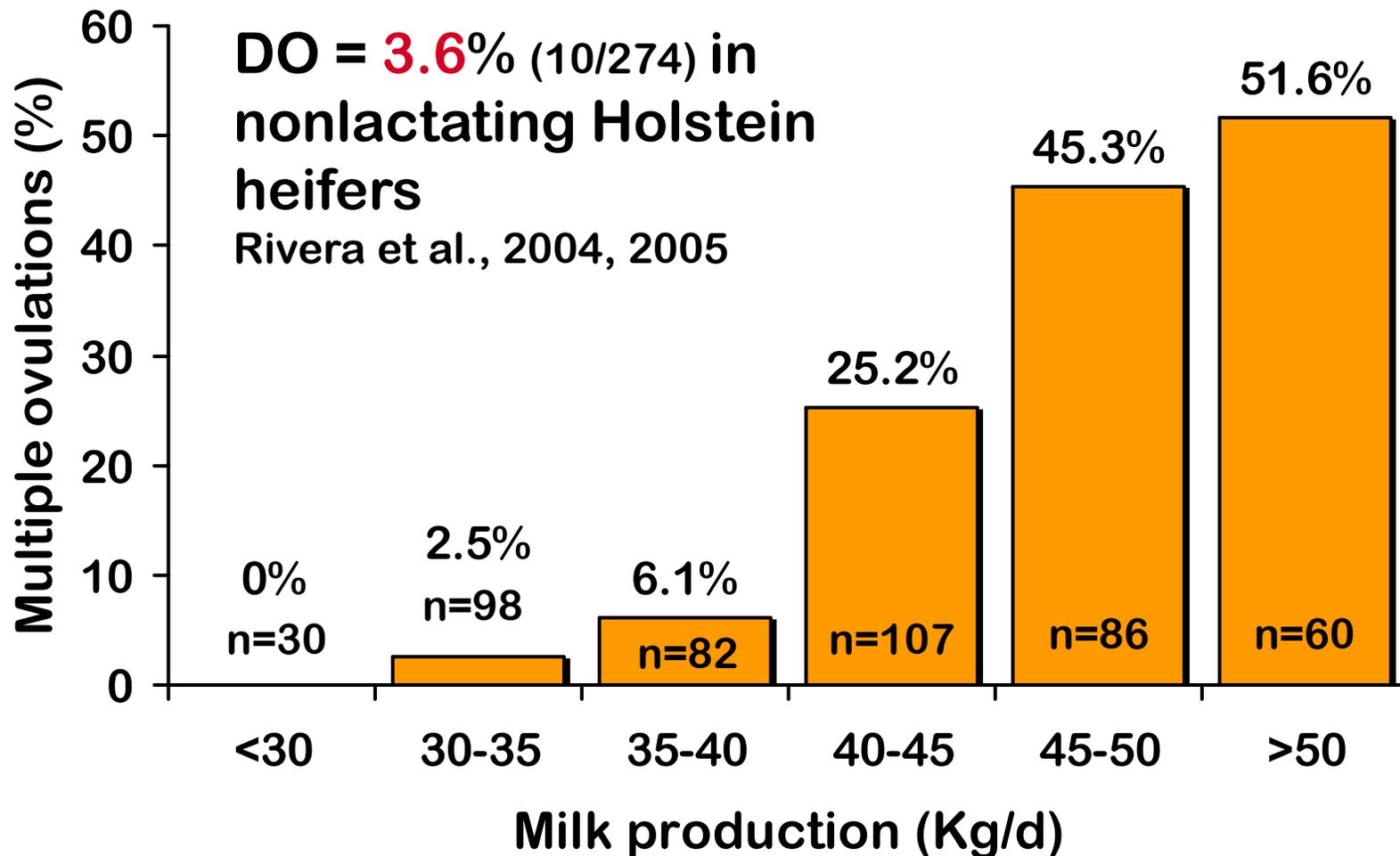
# Twinning In Dairy Cattle



**Question:**  
Does Ovsynch cause twinning?

# Effect of Milk production on Multiple Ovation Rate

Lopez et al., J. Dairy Sci. 88:2783; 2005



# A Breeder Apart: Farmers Say Goodbye to the Bull Who Sired 500,000 Offspring

Fans Commemorate 'Toystory,' a Dairy Legend With a Ravenous Libido



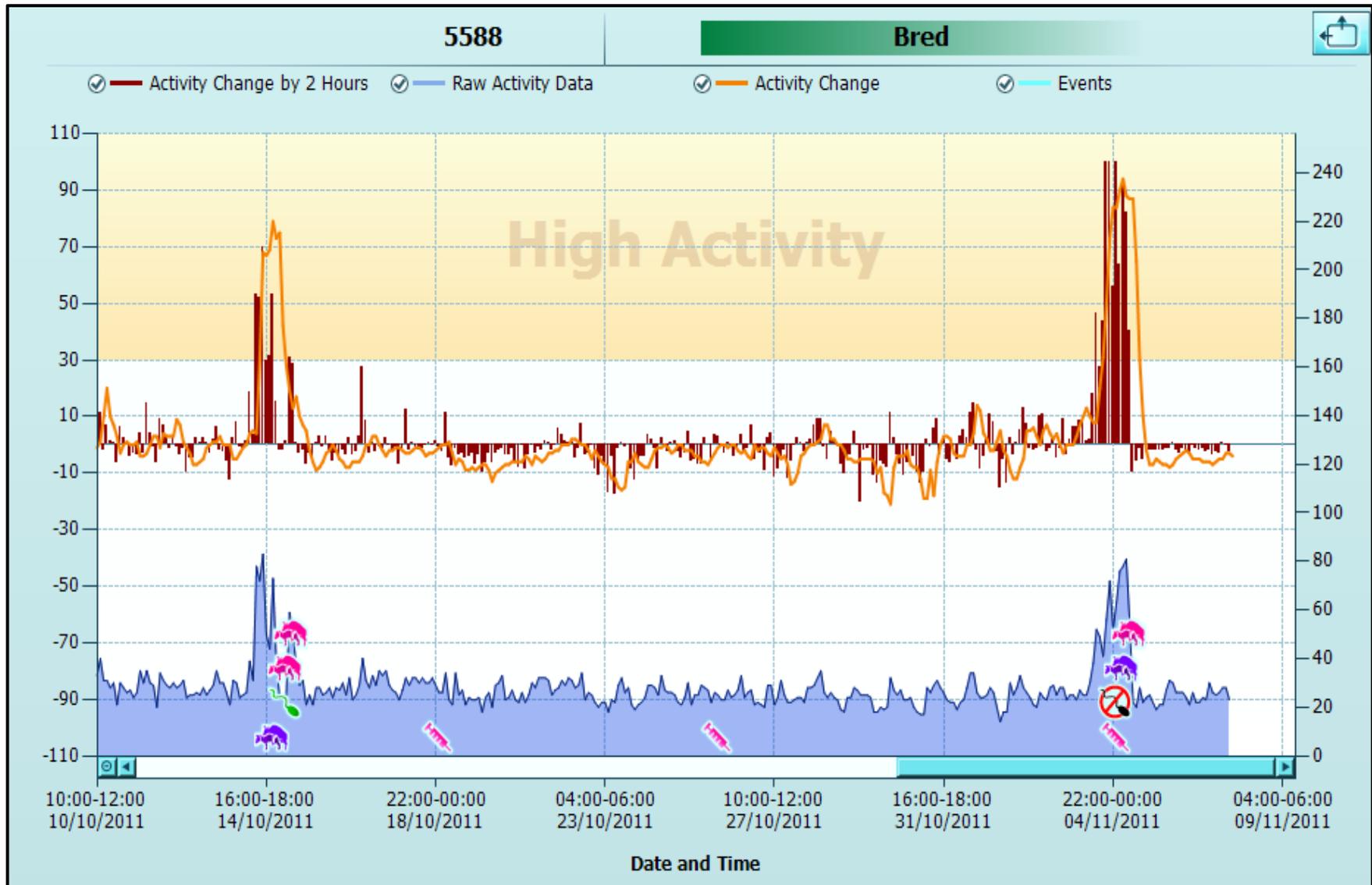
Toystory, a Wisconsin bull who set a record for semen production, was 2,700 pounds and sired an estimated 500,000 offspring. The famed bull died on Thanksgiving. *PHOTO: GENEX*

**“I used to think Ovsynch caused twinning - until I tried to stop using Ovsynch”**

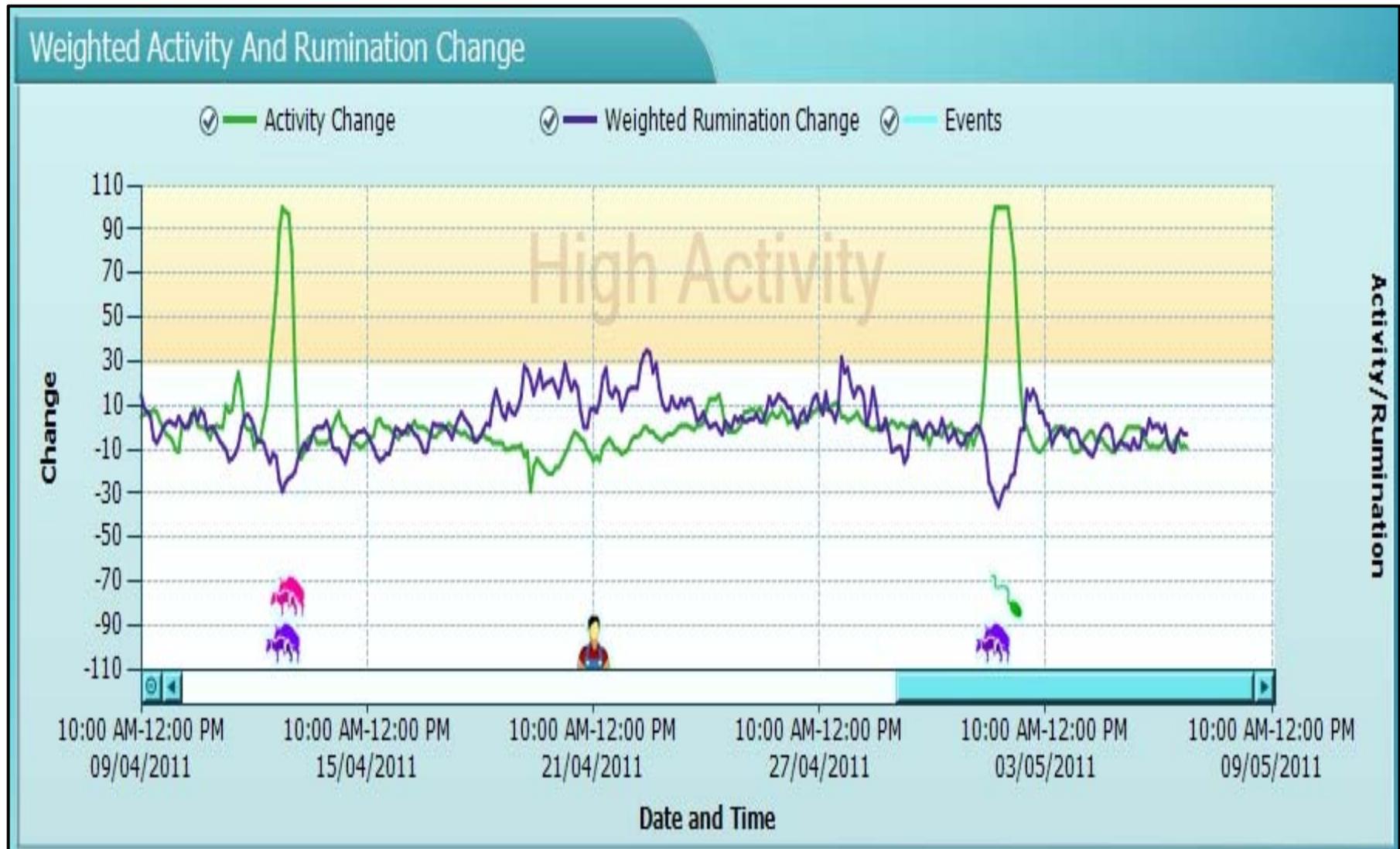
**Mitch Breunig**  
Mystic Valley Dairy  
Sauk City, WI



# Activity Graph



# Activity + Rumination Graph



# Summary & Conclusions

- Accelerometer technology is here to stay, and this and other technologies will continue to evolve and improve moving forward.
- Anovular cows represent a significant population of cows in herds that present a problem for accelerometer systems.
- Mean time of AI relative to ovulation determined by the accelerometer system was acceptable for some cows with increased activity; however, variability among cows in the interval from onset of activity to ovulation decreases conception rate to AI.

# Summary & Conclusions

- A variety of strategies using a combination of AI based on increased activity and synchronization of ovulation and TAI can be used to submit cows for first AI.
- Some level of synchronization of ovulation and TAI will improve reproductive performance in almost all dairies.
- Conception rates to TAI appear to be greater for cows receiving TAI after a Presynch-Ovsynch protocol compared to cows receiving AI after increased activity.

**Thank You!**

