

Timing of AI Relative to Behavioral Estrus and Synchronized Ovulations in Lactating Dairy Cows

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Behavioral Estrus in Dairy Cattle



The AM/PM Rule for Timing AI

- A cow observed in estrus in the morning (AM) should receive AI 12 h later (PM)
- A cow observed in estrus in the afternoon or evening (PM) should receive AI 12 h later the next morning (AM)



Origin of the AM/PM rule

Trimberger & Davis, 1943. Nebraska Agric. Exp. Sta. Bull. No. 129.

Time of AI	n	Conception Rate (%)
Start of Estrus	25	44
Middle of Estrus	40	82
End of Estrus	40	75
After estrus (h)		
6	40	36
12	25	32
18	25	28
24	25	12
36	25	8
48	25	0

Once daily AI vs. the AM/PM rule

Treatment	# of cows	75 d Nonreturn Rate (%)
a.m./p.m. rule	3659	60.1
Once Daily	3581	60.6

Nebel et al., 1994. J. Dairy Sci. 77:3185-3191.

Once-Daily AI (0800 – 0900 h) vs. a.m./p.m. rule

Treatment	# of heifers	Conception Rate (%)
a.m./p.m. rule	132	62.9
Once Daily	129	62.0

Gonzalez et al., 1985. Theriogenology 24:495-500.

Estrus Detection



Effect of time of AI relative to a detected estrus on fertility

Interval (h)	# of AI	75 d Nonreturn Rate (%)
0-6	1126	59.9 ^a
6-12	2352	60.7 ^a
12-18	2455	55.5 ^b
18-24	962	53.4 ^{bc}
24-30	99	49.6 ^c

Nebel et al., 1994. J. Dairy Sci. 77:3185-3191

Heat Watch



When does ovulation occur in relation to behavioral estrus?

- **27.6 ± 5.4 h** after the first standing event of estrus

Walker et al., 1996. J. Dairy Sci. 79:1555

Effect of interval from first standing event of estrus on conception rate of lactating dairy cows

Interval from onset of estrus to AI (h)	AI (no.)	Conception rate (%)	Odds ratio	95% confidence interval
0 to 4	327	43.1	1.00	–
>4 to 8	735	50.9	1.35	1.03 – 1.77
>8 to 12	677	51.1	1.33	1.01 – 1.75
>12 to 16	459	46.2	1.12	0.83 – 1.50
>16 to 20	317	28.1	0.51	0.36 – 0.71
>20 to 24	139	31.7	0.57	0.37 – 0.87
>24 to 26	7	14.3	0.18	0.02 – 1.56

Dransfield et al., 1998. J. Dairy Sci. 81:1874-1882.

Timing of AI to a Detected Estrus – Conclusions

- ❑ Make sure farm workers know the primary sign of estrus behavior
- ❑ It is not necessary to strictly adhere to the AM/PM rule

The AM/PM rule works IF you could determine the first standing event of estrus

Once daily AI programs result in acceptable fertility

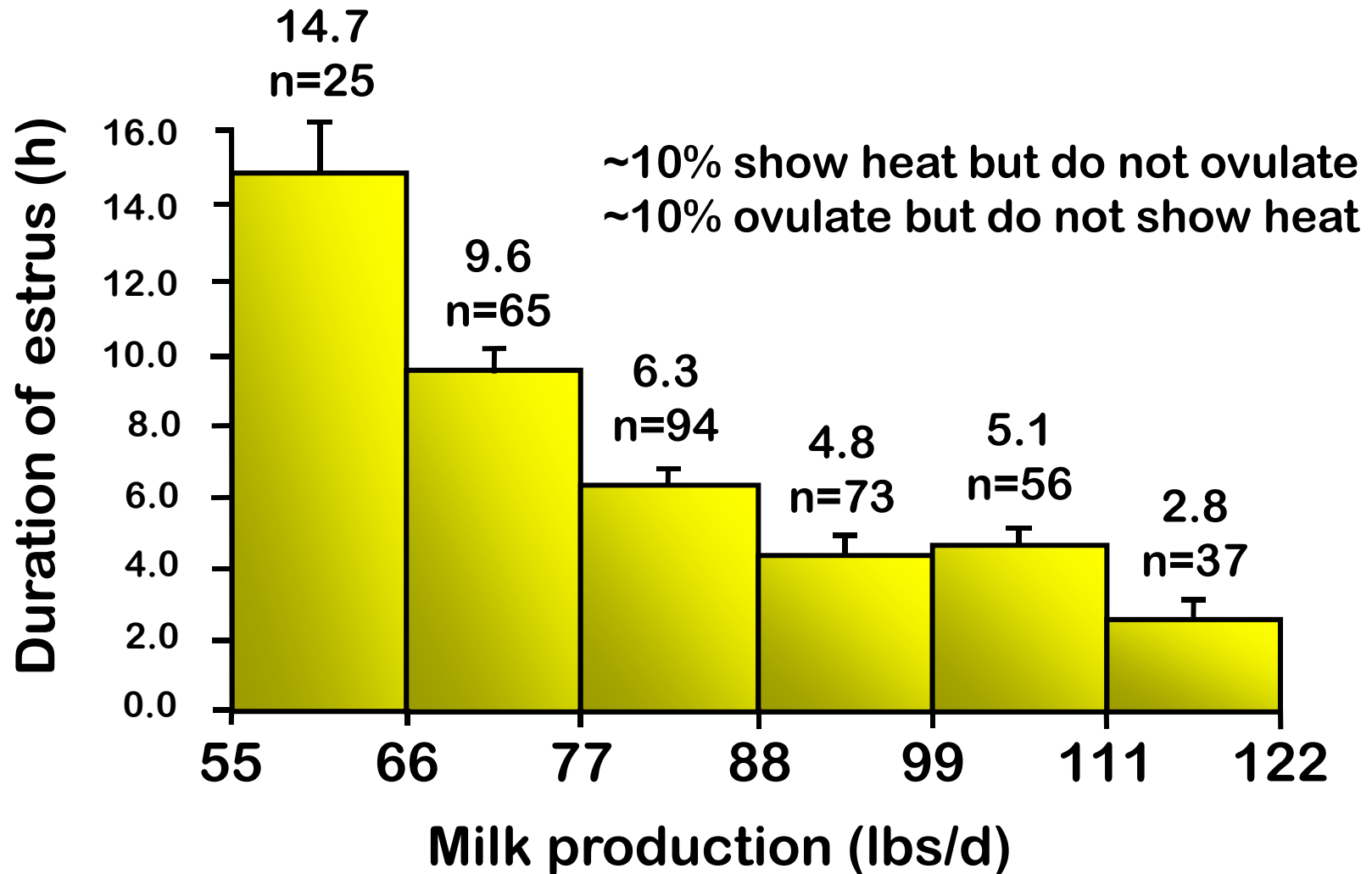
A cow that is observed in estrus can be inseminated immediately rather than waiting 12 h

Problems with detection of estrus



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

What percentage of dairy cattle are not cycling at 65-75 days in milk?

- ❑ **24%** based on serum P_4 (n = 600) Stevenson et al., 2006; J. Dairy Sci. 89:2567–2578.
- ❑ **20%** based on weekly ultrasound and serum P_4 (n = 316) Gumen et al., 2003; J. Dairy Sci. 86: 3184-3194.
- ❑ **28%** based on weekly ultrasound and serum P_4 (n = 267) Lopez et al., 2003; J. Dairy Sci. 87: 139-145.
- ❑ **24%** based on CL at 1st GnRH of Presynch/Ovsynch (n = 766) Sterry et al., 2006; J. Dairy Sci. 89:2099-2109.

Synchronization Systems

Resynch **Ovsynch**

Pursley & Wiltbank, 1995

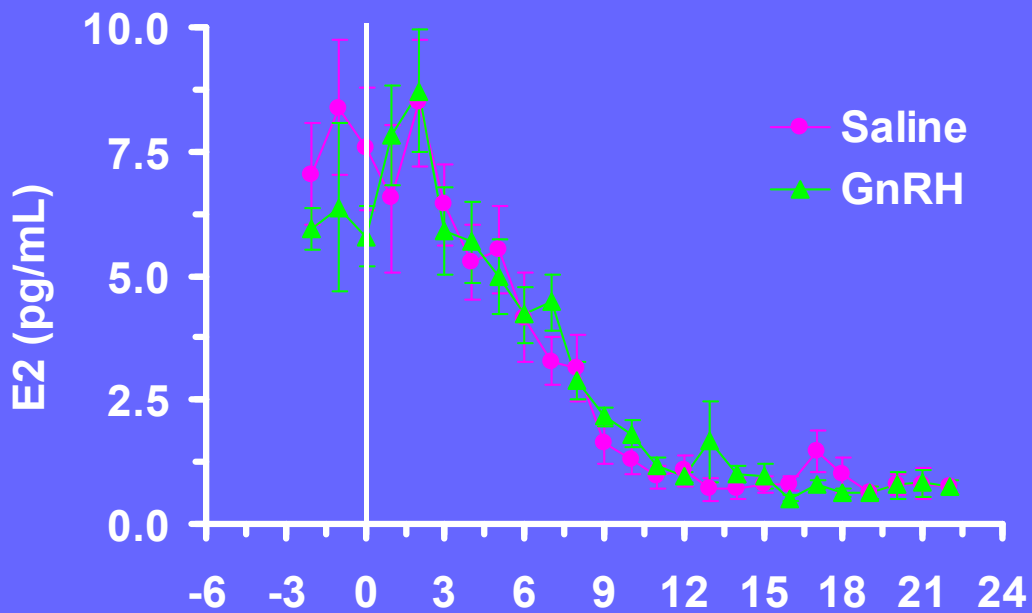
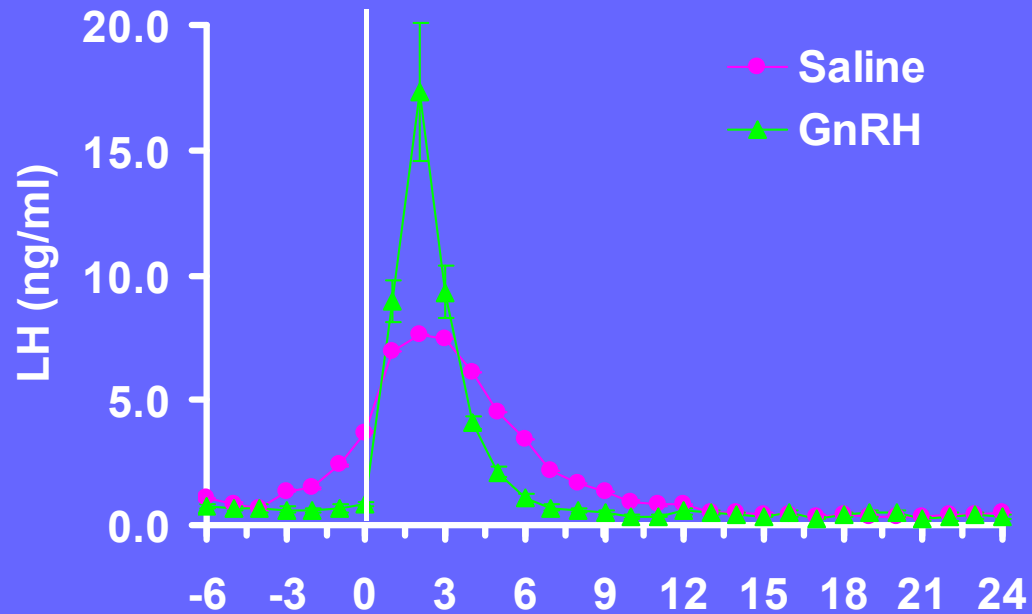
Presynch

Moreira et al., 2001



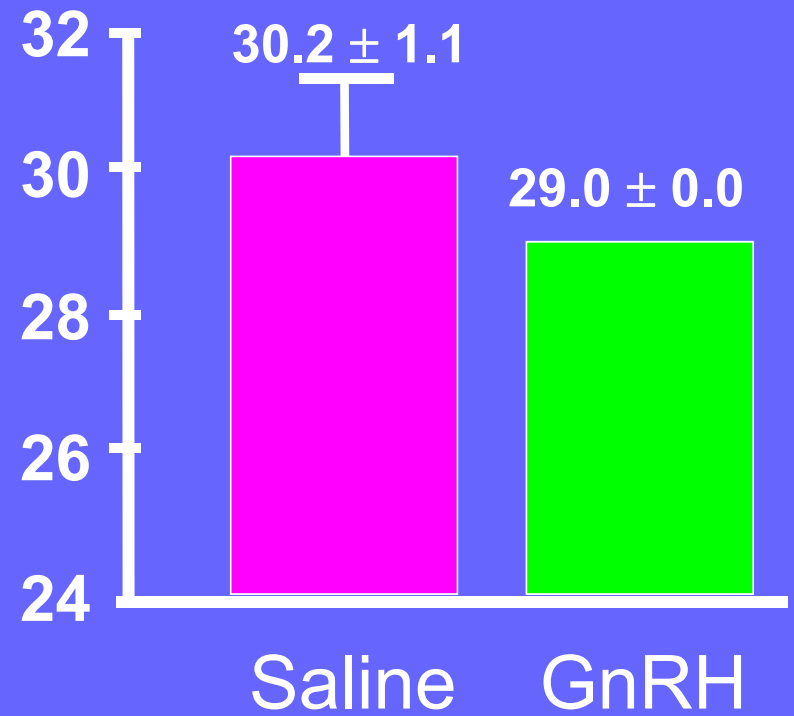
Ovsynch Schedule

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		GnRH				
		PGF		GnRH		



Hours from LH > 4.5 ng / ml

Hours to Ovulation



When does ovulation occur?

- **27.6 ± 5.4 h** after the first standing event of estrus

Walker et al., 1996. J. Dairy Sci. 79:1555

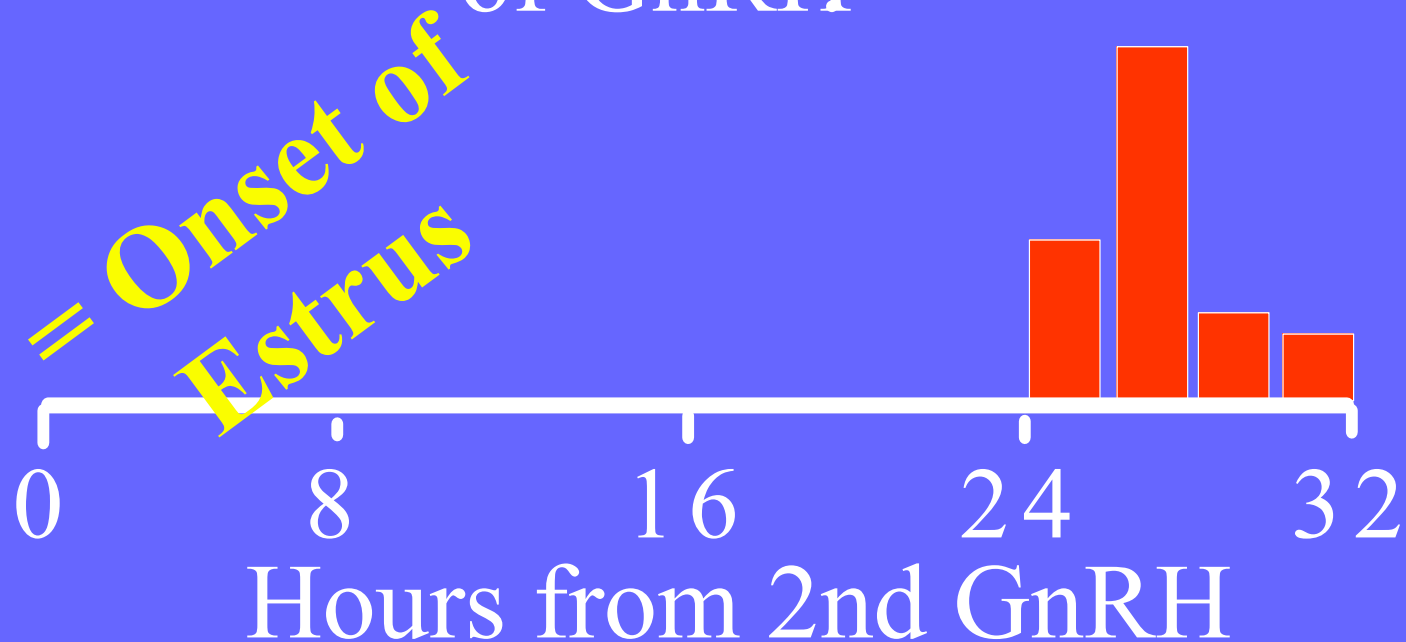
- All cows (n=20) ovulated within **24 to 32 h** after the second GnRH injection of Ovsynch

Pursley et al., 1995. Theriogenology 44:915

- Thus, timing of ovulation is similar when comparing the interval to ovulation from the first standing event of estrus and the second GnRH injection of Ovsynch

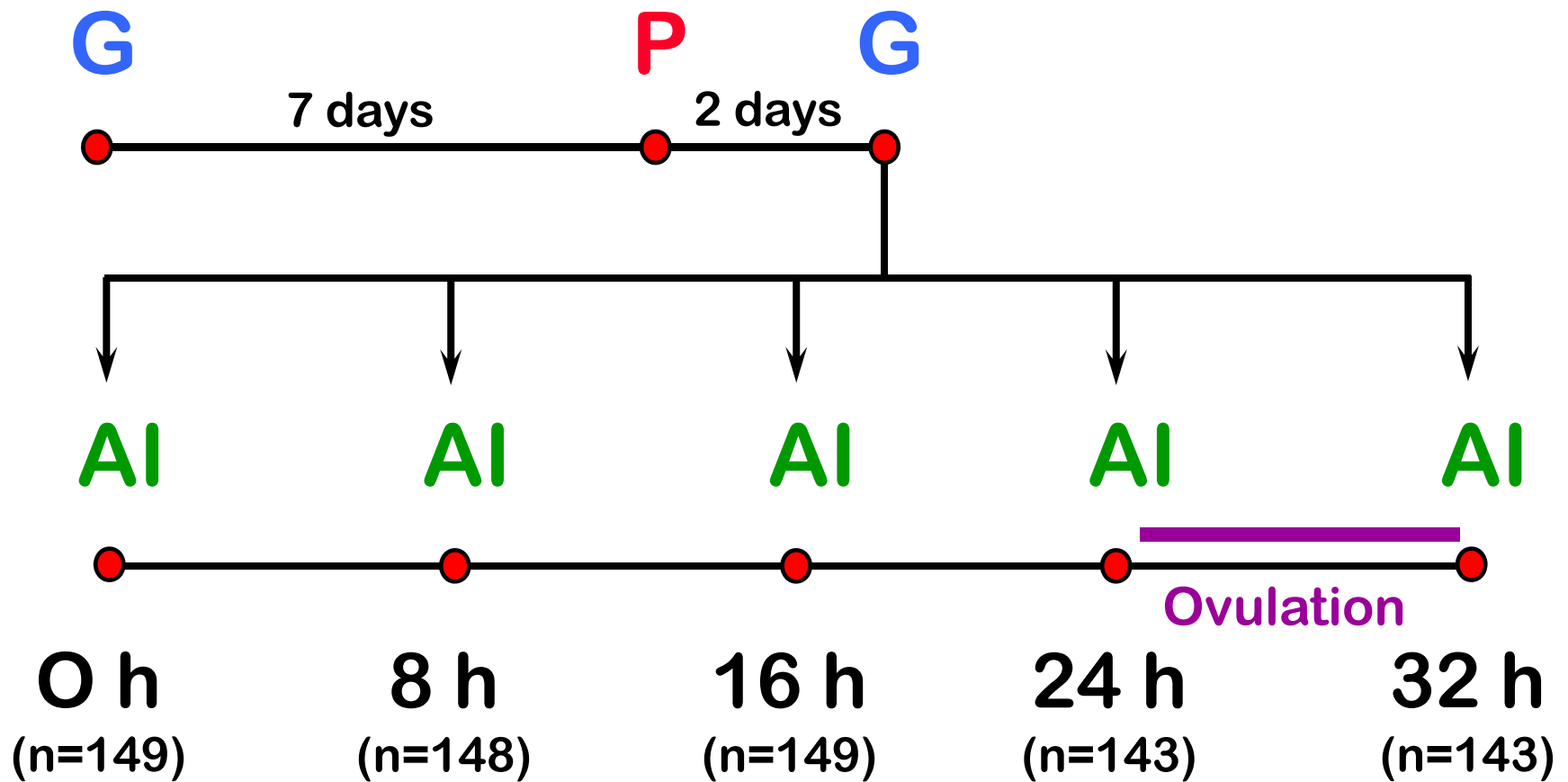
Question

What is the optimal time of AI
from the second injection
of GnRH?



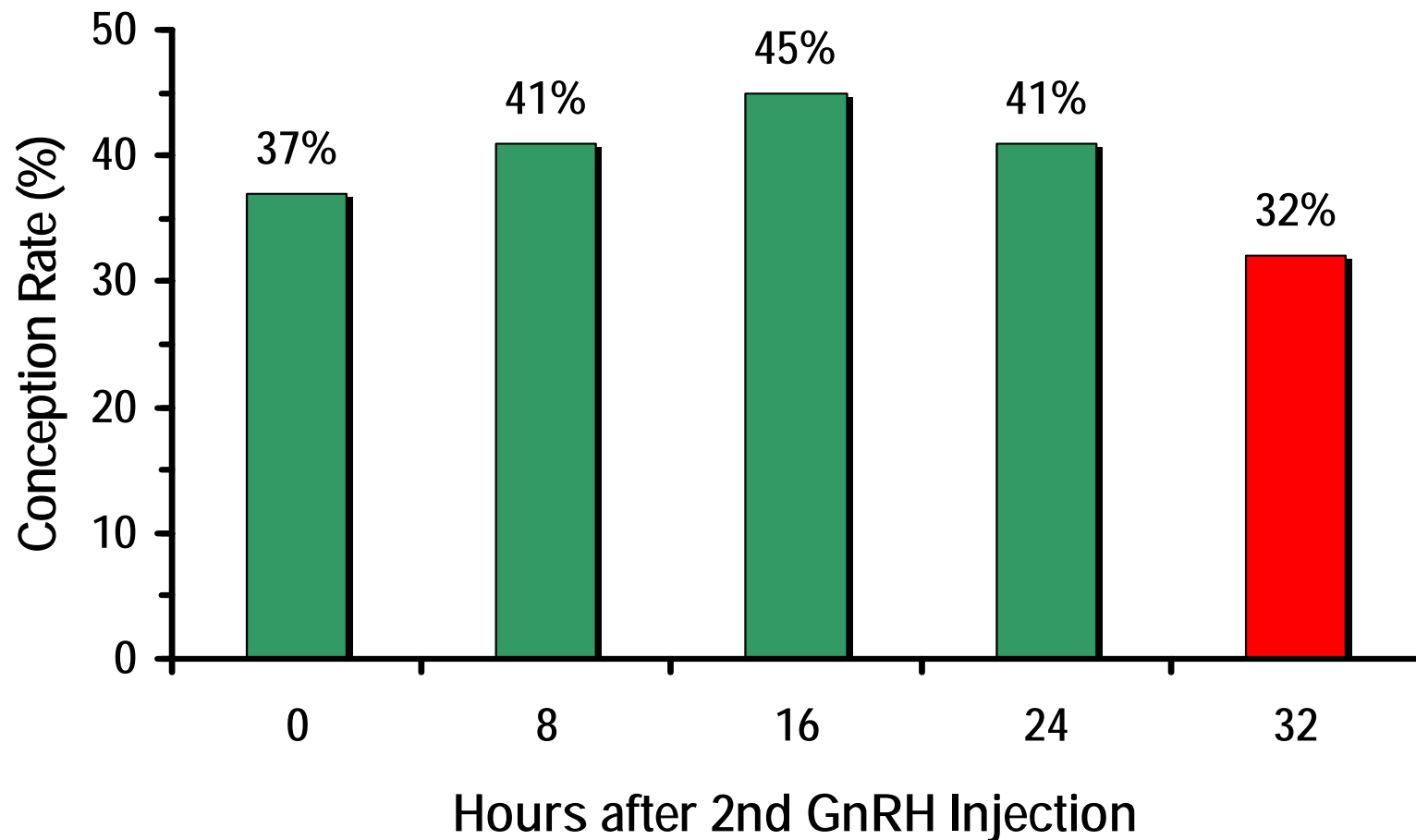
Experimental Design

Pursley et al., 1998. J. Dairy Sci. 81:2139-2144

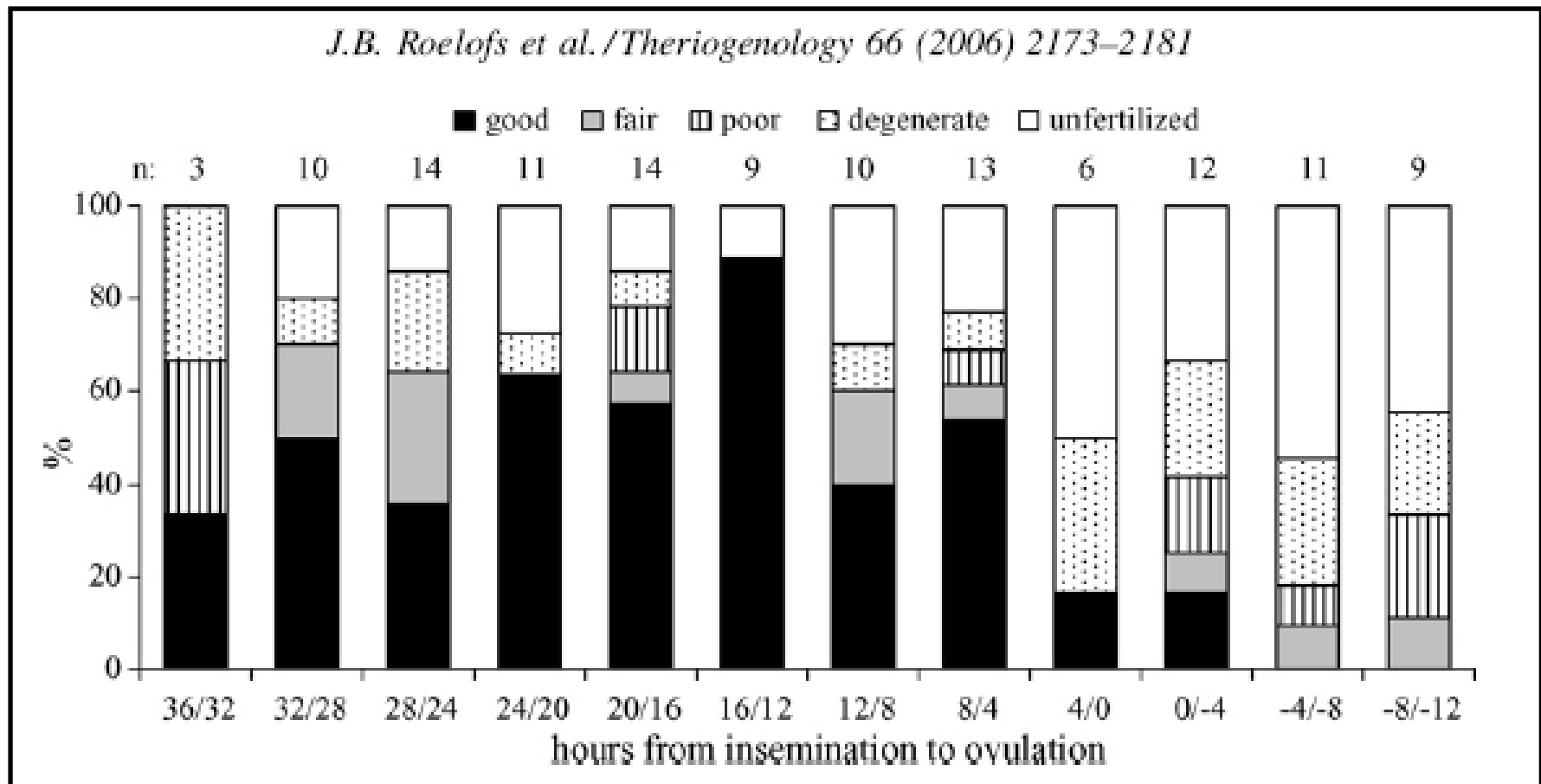


Conception Rates of Lactating Cows Receiving TAI at Various Intervals from the Second GnRH Injection of Ovsynch

Pursley et al., 1998. J. Dairy Sci. 81:2139-2144.



Effect of AI to Ovulation Interval on Embryo Quality



Effect of interval from first standing event of estrus on conception rate of lactating dairy cows

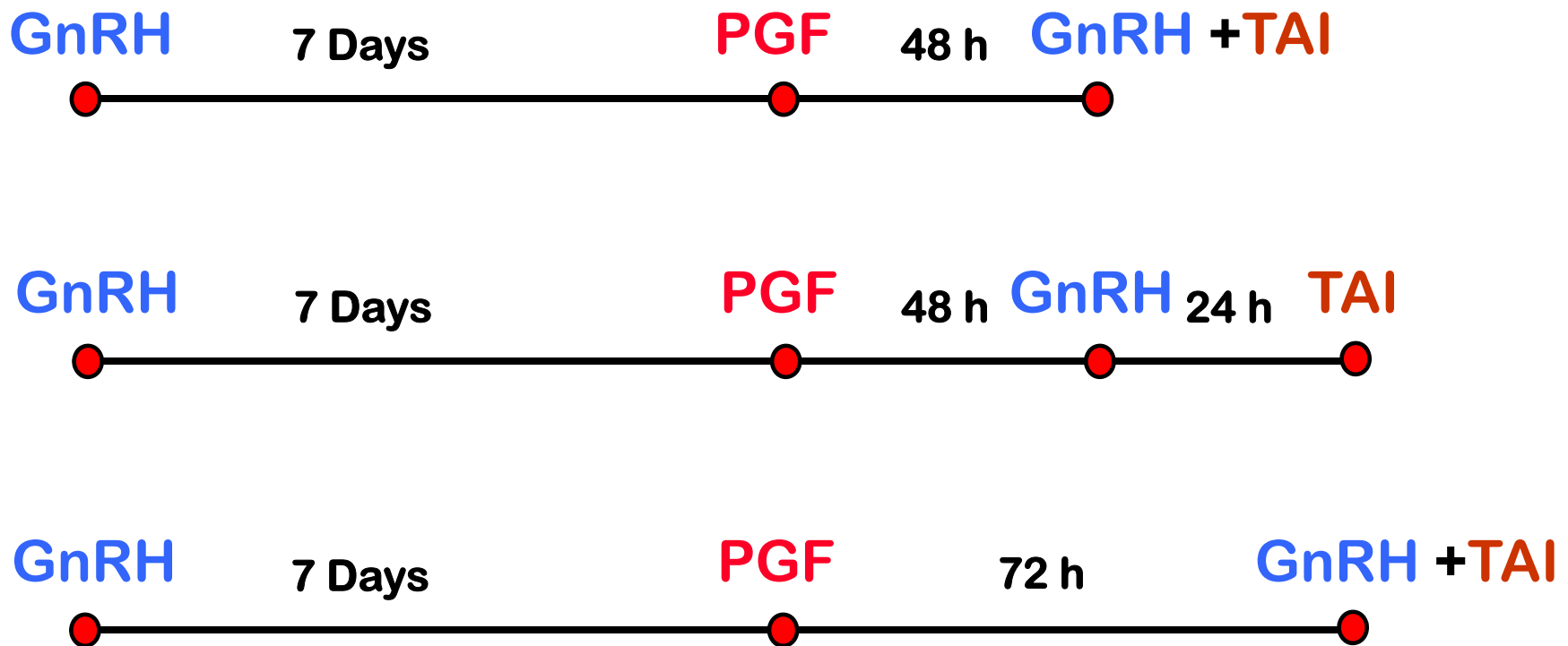
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Dransfield et al., 1998. J. Dairy Sci. 81:1874-1882.

Comparison of variations of Ovsynch

Portaluppi & Stevenson. J. Dairy Sci. 88:914-921

- All cows were presynchronized using two injections of $\text{PGF}_{2\alpha}$ 14 d apart and second $\text{PGF}_{2\alpha}$ given 12 d before initiating 3 treatments
- Cows were only bred to TAI even if detected in heat early



Conception rate at 40-41 d after TAI

Portaluppi & Stevenson. J. Dairy Sci. 88:914-921

Herd	Treatment			Overall
	G48 TAI 48	G48 TAI 72	G72 TAI 72	
1	13 (80)	14 (78)	22 (77)	16 (235)
2	28 (144)	29 (143)	36 (143)	31 (430)
Overall	23 ^a (224)	24 ^a (221)	32 ^b (220)	26 (665)

^{a,b}G48+TAI48 and G48+TAI72 treatments combined differed ($P < 0.05$) from the G72+TAI72 treatment.

Effect of Timing of Cosynch on Fertility of Lactating Holstein Cows after First Postpartum and Resynch Timed AI Services

Sterry et al., 2007. Theriogenology 67:1211-1216.

	Cosynch 48		Cosynch 72	
	Primi	Multi	Primi	Multi
Presynch	34.1 (15/44)	27.5 (28/102)	40.6 (39/96)	33.6 (37/110)
Resynch	39.6 (19/48)	25.0 (47/188)	33.3 (23/69)	28.1 (43/153)
Overall	37.0 (34/92)	25.9 (75/290)	37.6 (62/165)	30.4 (80/263)

No treatment effect: Presynch (p=0.13); Resynch (p=0.93); Overall (p=0.30)

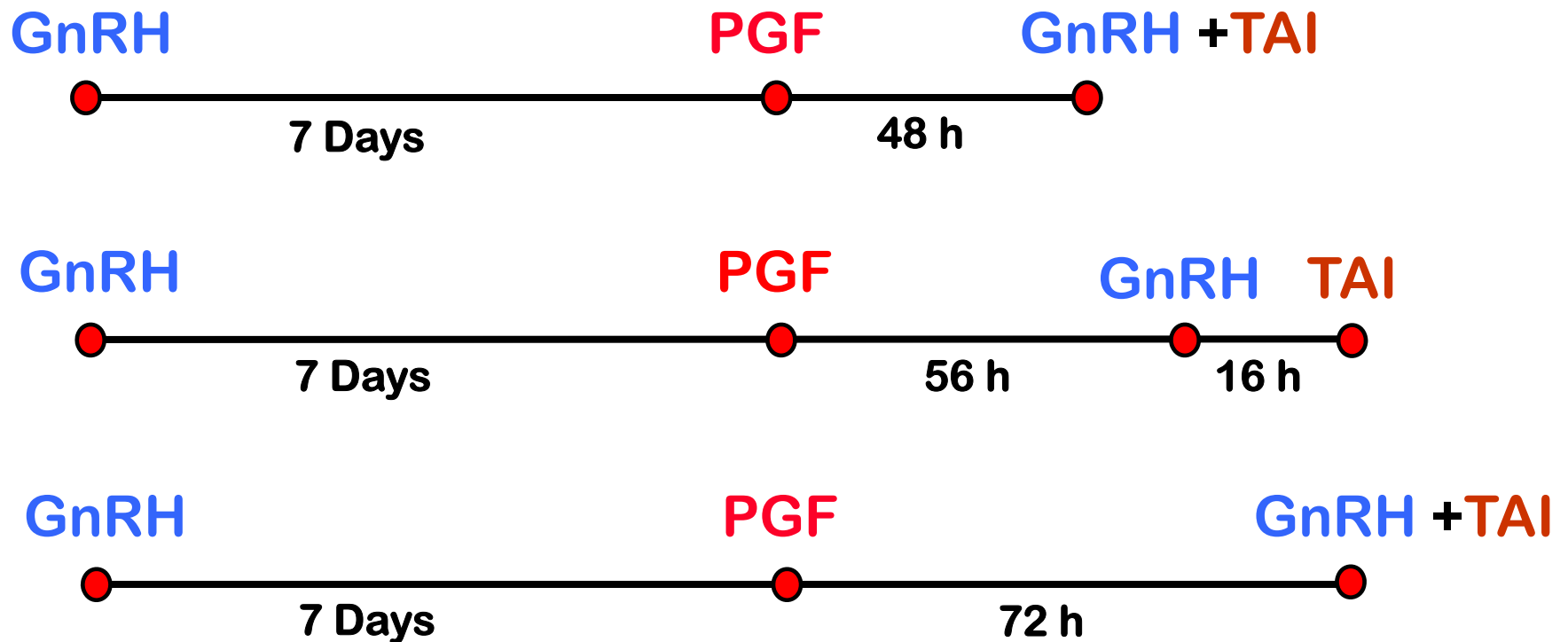
Parity effect: Presynch (p=0.91); Resynch (p=0.09); Overall (p=0.01)

Comparison among Cosynch and Ovsynch 56 protocols

Brusveen et al., 2008. J. Dairy Sci. 91:1044-1052.

Cows were submitted for TAI after Presynch or as Resynch treatment

1507 TAI in 927 lactating Holstein cows



Effect of Treatment on conception rate and pregnancy loss

Brusveen et al., 2008. J. Dairy Sci. 91:1044-1052.

	Cosynch 48	Ovsynch 56	Cosynch 72
CR d 31-33 (%)	27 (494)	36 (494)	27 (494)
Least squares est.	29^a	39^b	25^a
CR d 52-54 (%)	25 (493)	33 (494)	25 (494)
Least squares est.	27^a	36^b	23^a
Preg. Loss (%)	5 (131)	5 (158)	7 (137)

^{a,b} Within a row, treatments differ (P<0.05)

Effect of Treatment on Conception Rate and Pregnancy Loss by AI Service Number

Brusveen et al., 2008. J. Dairy Sci. 91:1044-1052.

Treatment	Presynch/Ovsynch			Resynch 32		
	48	56	72	48	56	72
n	108	115	120	386	342	397
CR d 31-33 (%)	36 ^{a,b}	45 ^a	25 ^b	23 ^y	33 ^z	26 ^{y,z}
CR 52-54 (%)	34 ^{A,a,b}	43 ^a	22 ^{B,b}	22 ^y	30 ^z	24 ^{y,z}
Preg. Loss (%)	7	2	7	4.4	6.5	6.6

Values with different superscripts ^{a,b} (for first service) or ^{y,z} (for later services) within a row are different (P<0.05)

Values with different superscripts ^{A,B} (for first service)

Effect of Treatment on Conception Rate and Pregnancy Loss by Parity

Brusveen et al., 2008. J. Dairy Sci. 91:1044-1052.

Treatment	Primiparous			Multiparous		
	48	56	72	48	56	72
n	167	184	225	327	273	292
CR d32-33 (%)	34 ^{a,b}	41 ^a	30 ^b	23 ^y	33 ^z	25 ^y
CR d53-54 (%)	31 ^{A,B}	37 ^A	28 ^B	22 ^y	31 ^z	23 ^y
Preg. Loss (%)	11	10	6	1 ^Y	1 ^Y	7 ^Z

Values with different superscripts ^{a,b} (for primiparous) or ^{y,z} (for multiparous) within a row are different (P<0.05)

Values with different superscripts ^{A,B} (for primiparous) or ^{Y,Z} (for multiparous) within a row are different (P<0.1)

Comparison of first postpartum TAI after Ovsynch 56 and Cosynch 72 protocols in lactating dairy cows

Parity	Treatment		P-value
	Ovsynch 56	Cosynch 72	
Primiparous	37 (134)	31 (148)	0.33
Multiparous	47 (204)	25 (253)	<0.05
Overall	43 (338)	27 (401)	

Nebel et al., 2008. J. Dairy Sci. 90(E-suppl. 1):248 (Abstr.)

Timing of the 2nd GnRH injection and TAI - Conclusions

- ❑ Although Cosynch protocols are often times easier to implement on dairies, Timing of AI in relation to the timing of ovulation is not optimized
- ❑ Ovsynch 56 yields significantly greater fertility than Cosynch 48 or Cosynch 72
- ❑ **STOP DOING COSYNCH!**