Estrus Synchronization Protocols for Heifers

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Effective Estrus Synchronization Programs for Beef Cattle

- Facilitate AI & ET
- Reduce time required to detect estrus
- Cycling females conceive earlier in the breeding period
- Induce cyclicity in peripubertal heifers and anestrous postpartum cows

Objective: Development of highly effective & economical estrus synchronization programs

- Peripubertal heifers
- Postpartum cows
  - Anestrus and cycling
- Excellent pregnancy rates
- Reduced AI period and/or fixed-time AI

Products Currently Available

- Prostaglandin
  - Lutalyse, Estrumate, ProstaMate, In Synch, EstroPlan
- GnRH
  - Cystorelin, Factrel, Fertagyl, OvaCyst
- Progestins
  - **MGA**
  - **CIDR**

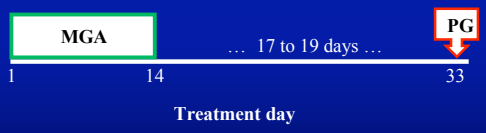
What We Know About Progestins . . .

- Successfully induce puberty in beef heifers
- Prevent expression of behavioral estrus
- Block the preovulatory surge of LH
- Block ovulation

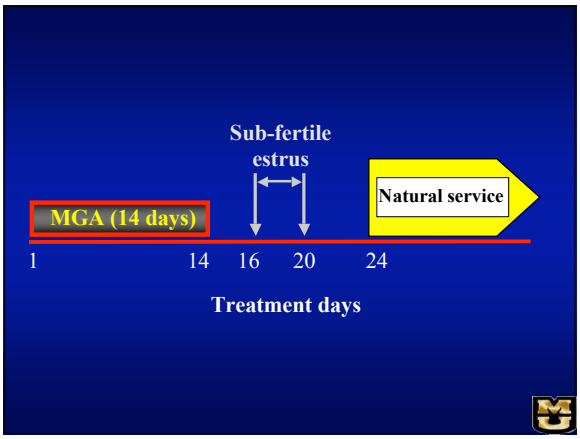
MGA-Based Protocols for Heifers . . .

MGA-PG

- MGA-PG has been the preferred method of estrus synchronization in beef heifers (Brown et al., 1986, Deutscher et al., 2000, Lamb et al., 2000).



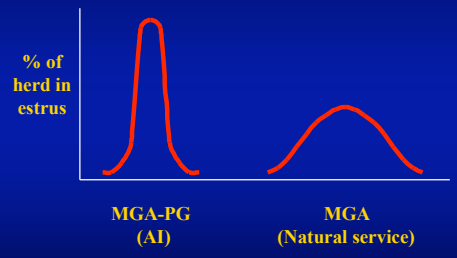
Treatment day



Treatment days

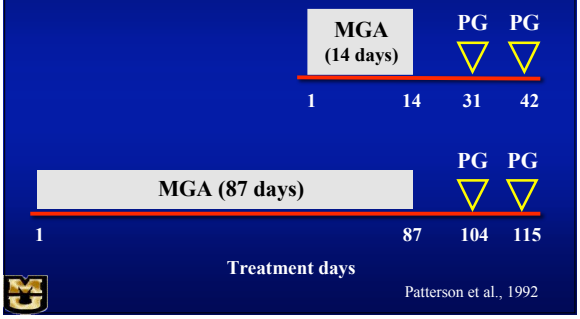
MGA prior to Natural Service or MGA-PG prior to AI

Breeding program	No. heifers	Estrous response	Synchronized conception rate	Synchronized pregnancy rate
Natural service	1749	---	---	1151/1749 66%
AI	4245	3354/4245 79%	2414/3354 72%	2414/4245 57%



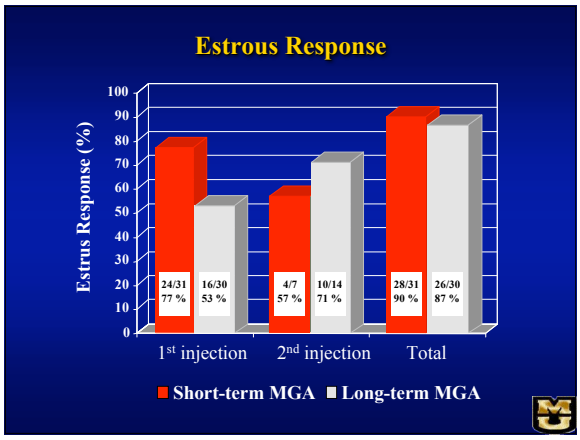
Considerations Regarding Long-term MGA Feeding

Effects of long-term MGA feeding on reproduction in beef heifers



Treatment days

Patterson et al., 1992

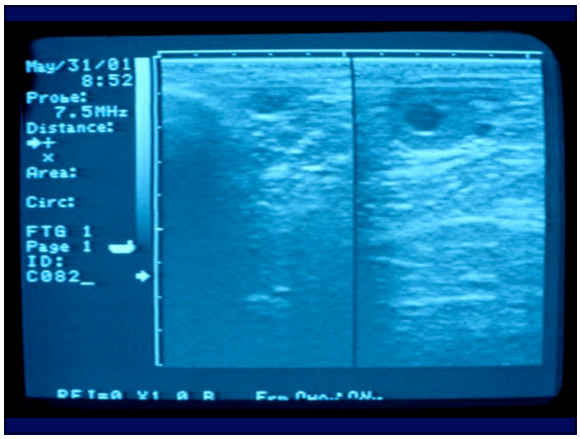


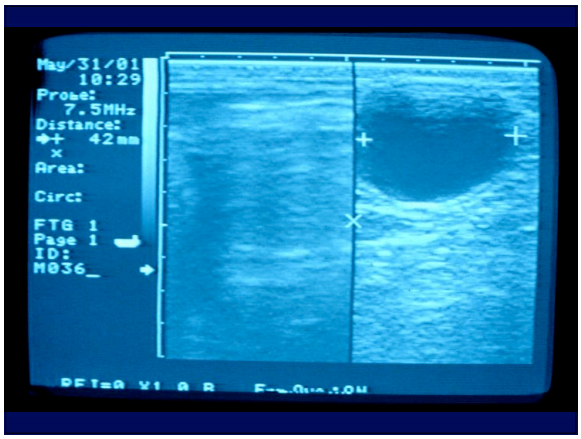
Ovarian Morphology

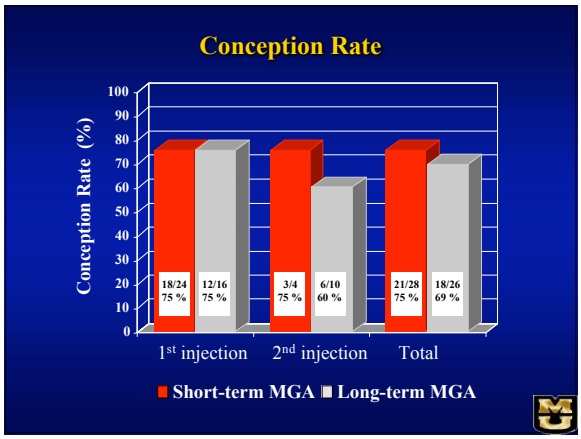
Treatment	Normal	Abnormal
Short-term MGA	31/31 100 %	0/31 0 %*
Long-term MGA	19/30 63 %	11/30 37 %*

Abnormal = Luteinized follicular cyst

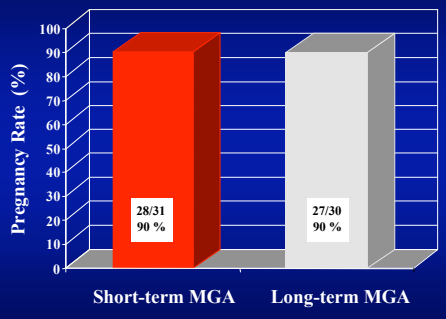
* P < 0.01





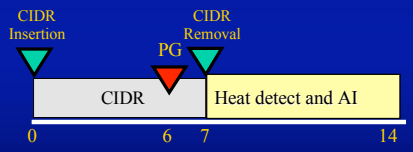


Pregnancy Rate



Development of CIDR-Based Protocols for Heifers

Efficacy of the CIDR insert and PG for synchronizing estrus in beef heifers



Lucy et al., 2001

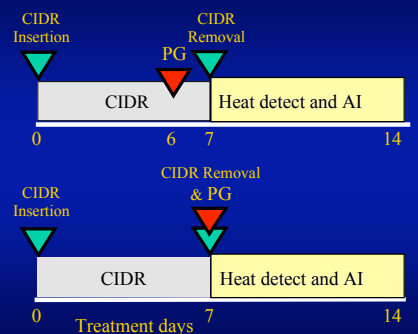
Experimental treatments
(Lucy et al., 2001)

- Untreated control
- Single injection of PG
- CIDR + PG
  - CIDR inserted for 7 days
  - PG administered on day 6

Lucy et al., 2001

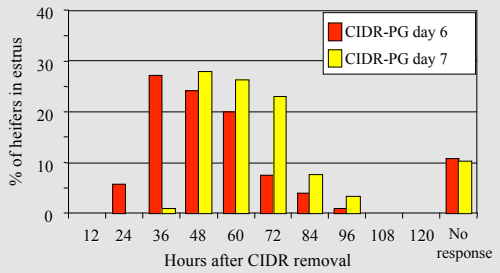
- CIDR successfully induced cylicity in prepubertal heifers
- CIDR + PG improved estrous response over control and PG treated contemporaries
- CIDR + PG improved pregnancy rates during the synchronized period over control and PG treated contemporaries

CIDR-PG Protocol



DeJarnette et al., unpublished data

CIDR-PG Protocol
Estrous Response

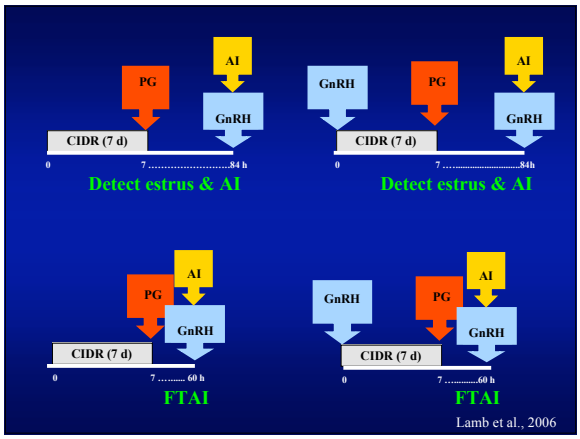


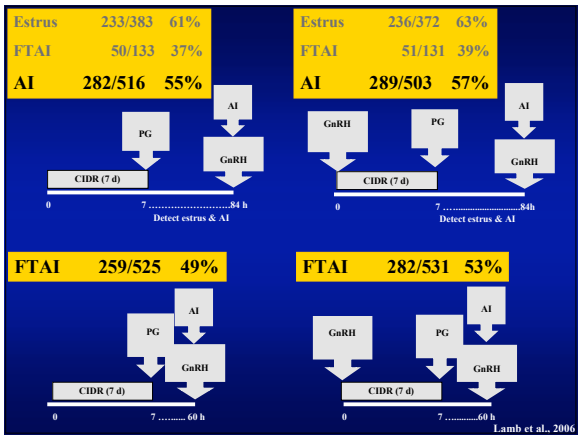
❑ PG injection on day 6 or 7 altered the timing of estrus after CIDR removal

DeJarnette et al., unpublished data

The Multi-State CIDR Trial

Lamb et al., 2006





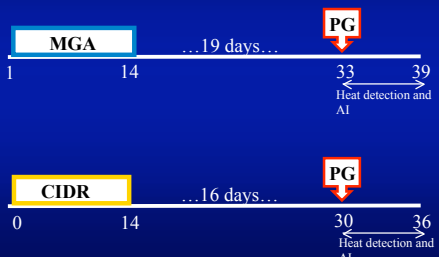
Multi-state CIDR Trial

- GnRH at CIDR insertion did not improve pregnancy rates after FTAI
- GnRH at CIDR insertion did not alter the percentage of heifers detected in estrus or the distribution of estrus after PG
- A combination of detecting estrus and AI before clean-up AI enhanced pregnancy rates over FTAI

Lamb et al., 2006

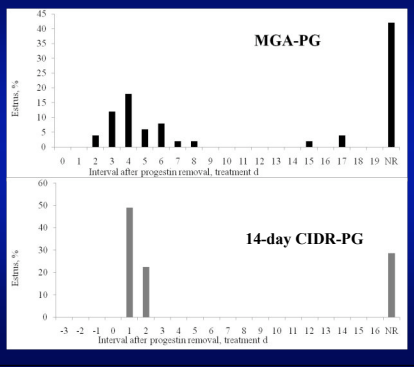
How do MGA- and CIDR-based protocols compare in heifers?

Treatments



Mallory, et al., 2009

Estrous distribution after MGA or CIDR



Mean interval to estrus and variance for interval to estrus after MGA or CIDR

	Treatment	
	MGA-PG	14-day CIDR-PG
Overall mean interval to estrus, h	134.3 ± 12.6[a]	37.8 ± 11.2[b]
Variance for interval to estrus	9172[a]	136[b]

[a,b] Means within rows with different superscripts differ ($P < 0.01$)

Mallory, et al., 2009

Estrous response after PG

	Treatment	
	MGA-PG	14-day CIDR-PG
Overall estrous response	170/200 85[a]	180/196 92[b]
Estrous cycling	135/154 88[x]	138/151 91
Prepubertal	35/46 76[c,y]	42/45 93[d]

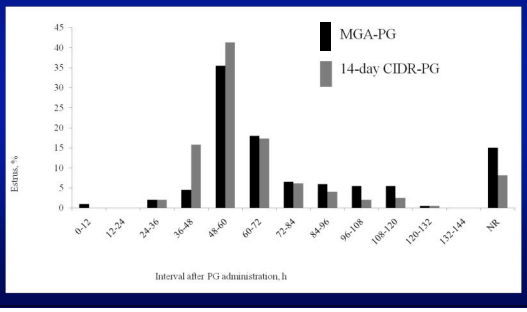
[a,b] Means within rows with different superscripts differ ($P = 0.01$)

[c,d] Means within rows with different superscripts differ ($P = 0.03$)

[x,y] Means within rows with different superscripts tend to differ ($P = 0.06$)

Mallory, et al., 2009

Distribution of estrus after PG



Mean interval to estrus and variance for interval to estrus after PG

	Treatment	
	MGA-PG	14-day CIDR-PG
Overall mean interval to estrus, h	57.4 ± 2.5	56.2 ± 2.5
Variance for interval to estrus after PG	466[a]	282[b]

[a,b] Means within rows with different superscripts differ ($P = 0.01$)

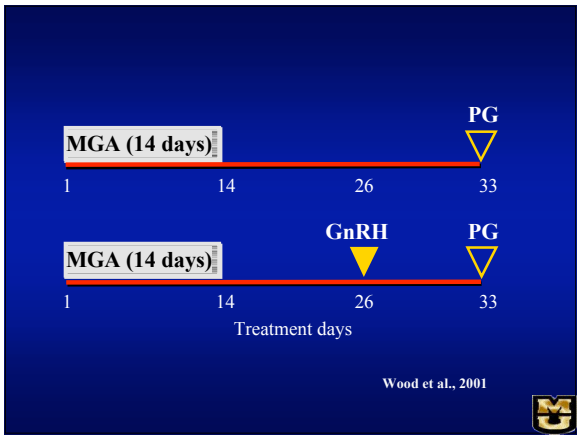
Mallory, et al., 2009

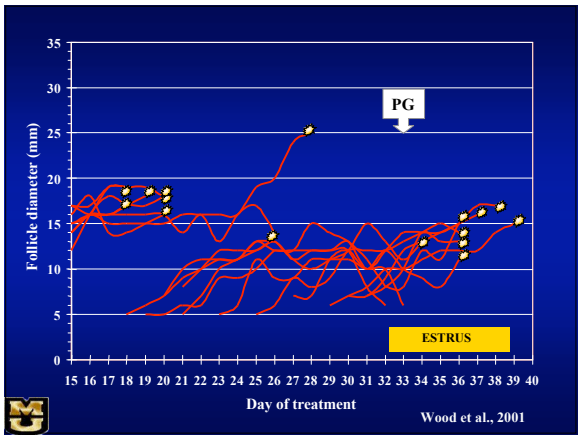
Conclusion

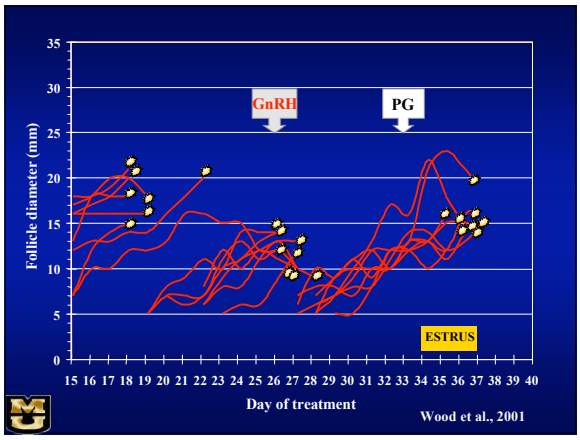
- Estrous response ($P = 0.01$) and synchrony of estrus ($P < 0.01$) were significantly improved among heifers assigned to the 14-day CIDR-PG protocol.
- There were no differences between treatments for synchronized conception or pregnancy rates.
- Presynchronization with 14-d CIDR followed 16 d later with PG provides an effective alternative for use in synchronizing estrus in replacement beef heifers.

Mallory, et al., 2009

Does the addition of ***GnRH*** to a long-term progestin-based protocol enhance synchrony of estrus or total estrous response?





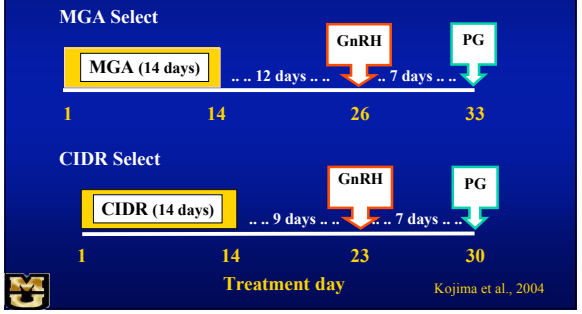


When to Add GnRH to an MGA-PG Protocol for Heifers

- **Consideration of . . . .**
  - **Age**
  - **Weight**
  - **Reproductive tract score (RTS)**
    - **Pubertal status**

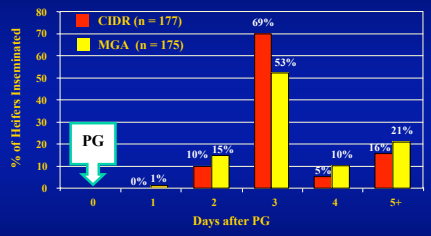
Wood et al., 2000; Kojima et al., 2001

MGA Select vs. CIDR Select



Kojima et al., 2004

Summary for Timing of AI



- Distribution of AI dates were different between MGA- and CIDR-treated heifers (P < 0.02)

Kojima et al., 2004

Estrous Response, AI Pregnancy, and Final Pregnancy Rates

	Estrous Response	AI Pregnancy	Final Pregnancy
CIDR	154/177 (87 %)	112/177 (63 %)[a]	164/177 (93 %)
MGA	147/175 (84 %)	83/175 (47 %)[b]	159/175 (91 %)
Total	301/352 (86 %)	195/352 (55 %)	323/352 (92 %)
Diff.	+ 3 %	[a, b] P = 0.01 + 16 %	+ 2 %

Kojima et al., 2004

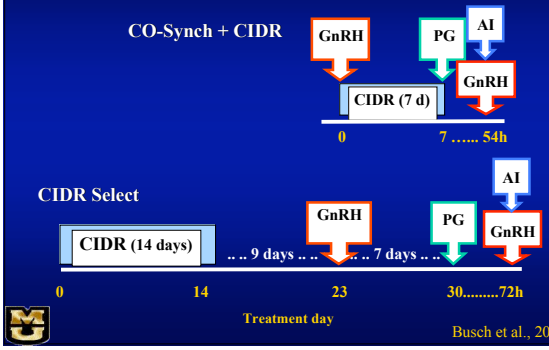
CIDR Select vs MGA Select

- No difference in estrous response during the synchronized period
- Improved synchrony of estrus
- Improved conception & pregnancy rates during the synchronized period
- No difference in final pregnancy rate at the end of the breeding period

Kojima et al., 2004

How do long-term and short-term CIDR-based protocols compare in heifers?

CO-Synch + CIDR w/ TAI at 54h vs CIDR Select w/ TAI at 72h



Busch et al., 2007

AI pregnancy

	Fixed-time AI pregnancy rate		
	Pre/peri-pubertal	Estrous cycling	Combined
CIDR Select	13/21 (62%)	54/87 (62%)^{x}	67/108 (62%)^{x}
CO-Synch + CIDR	11/23 (48%)	40/86 (47%)^{y}	51/109 (47%)^{y}
Total	24/44 (55%)	94/173 (54%)	118/217 (54%)
Diff.	+ 14 %	+ 15 % ^{x,y} P= 0.03	+ 15 % ^{x,y} P= 0.02

Busch et al., 2007

CIDR Select vs CO-Synch + CIDR

- Synchronizing beef heifers with the CIDR Select protocol resulted in:
  - Increased response to GnRH (*P = 0.01*)
  - Higher estrous response (*P* = 0.06)
  - Reduced variance associated with the interval from PG to estrus and ovulation (*P* < 0.01)
  - Significantly higher FTAI pregnancy rates (*P* = 0.02)
    - CIDR Select = 62%
    - CO-Synch + CIDR = 47%
  - Reduced variance associated with the interval from FTAI to the subsequent return to estrus (*P* < 0.05)

Busch et al., 2007; Leitman et al., 2008

How do the CIDR Select and 14-day CIDR-PG protocols compare?

- Estrous response
- Interval to and synchrony of estrus
- Synchronized pregnancy rate

Leitman et al., 2009

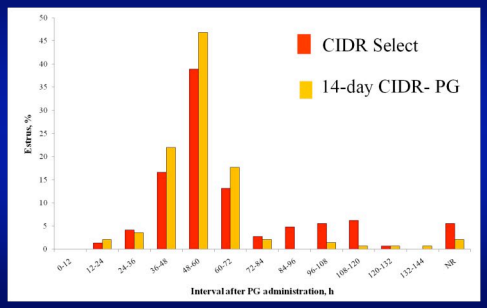
Treatments

CIDR Select

14-day CIDR-PG

Leitman et al., 2009

Distribution of estrus after PG



Leitman et al., 2009

14-day CIDR-PG vs. CIDR Select

- Estrous response was similar between treatments (98% , 14-day CIDR-PG; 94%, CIDR Select; *P* = 0.43)
- Mean interval to estrus was 7 h earlier (*P* = 0.01) for 14-day CIDR-PG treated heifers compared to CIDR Select treated heifers
- Heifers assigned to 14-day CIDR-PG had a greater (*P* < 0.01) synchrony of estrus compared to heifers assigned to CIDR Select

Pregnancy results

	Treatment	
	CIDR Select	14- day CIDR-PG
AI conception rate	78/135 (58)[x]	92/137 (67)[y]
AI pregnancy rate	78/143 (55)[a]	92/140 (66)[b]
Final pregnancy rate	116/143 (81)	113/140 (81)

[x,y] Means within rows with different superscripts tend to differ ($P = 0.09$)
[a,b] Means within rows with different superscripts differ ($P = 0.05$)

Leitman et al., 2009

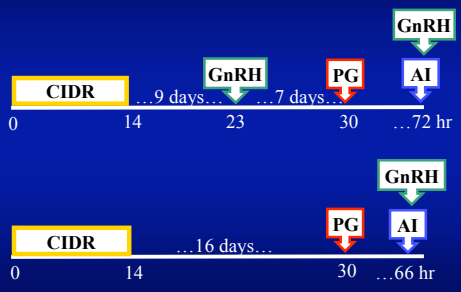
Conclusion

- The administration of GnRH following CIDR removal in the CIDR Select protocol is not required to facilitate an improvement in the synchrony of estrus in beef heifers.

How do the CIDR Select and 14-day CIDR-PG protocols compare on the basis of pregnancy rates resulting from fixed-time AI?

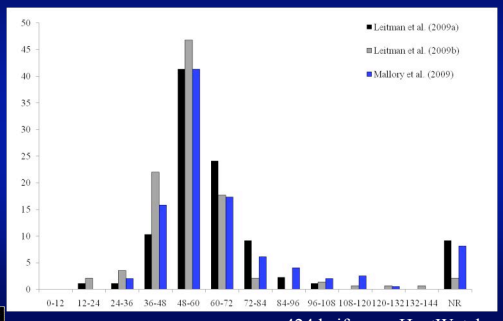
Mallory, 2009

Treatments



Mallory, 2009

Combined Estrus Distribution



n = 424 heifers on HeatWatch

Timing of AI

- Interval to estrus following PG from HeatWatch:

	# head	Mean (h)
Mallory et al. (2009)	180	56.2
Leitman et al. (2009b)	138	54.4
Leitman et al. (2009a)	79	59.3
Total	**397**	**56.2**

- Mean interval from PG to AI
  - CIDR Select 72.4 h
  - 14-day CIDR-PG 66.5 h

Mallory, 2009

AI pregnancy rates

	Treatment	
	CIDR Select	14-day CIDR-PG
AI pregnancy rate	98/192 51[a]	124/200 62[b]
Estrous cycling	83/158 53[c]	102/162 63[d]
Prepubertal	15/34 44	22/38 58

[a,b] Means within rows with different superscripts tend to differ ($P = 0.07$)

[c,d] Means within rows with different superscripts tend to differ ($P = 0.06$)

Mallory, 2009

Summary

- Pregnancy rates tended to be higher (P = 0.07) for 14-day CIDR-PG compared to CIDR Select treated heifers.
- Final pregnancy rates did not differ between treatments.

Mallory, 2009

Conclusion

- 14-day CIDR-PG is effective in synchronizing estrus prior to FTAI at 66 hours in beef heifers.

	Heat detection	Fixed-time AI
Leitman et al. (2009a,b) Mallory et al. (2009a)	241/422 57%	---
Mallory et al. (2009b)	---	124/200 62%
Cooperating herds	---	339/534 63%
Totals	241/422 57%	463/734 63%

Comparison of estrous response and fertility in beef heifers after treatment with various estrus synchronization protocols.

Treatment	Estrous response		Synchronized pregnancy rate	
AI based on detected estrus				
MGA-PG 14-19 d	1129/1302	87%	768/1302	59%
MGA® Select	433/499	87%	280/499	56%
CIDR-PG (d6)	200/285	70%	112/830	39%
CIDR Select	896/974	92%	577/974	59%
14-day CIDR-PG	394/422	93%	241/422	57%
Heat detect & fixed-time AI				
7-day CIDR-PG: 84 hr			282/517	55%
Select Synch + CIDR: 84 hr			289/504	57%
14 d CIDR-PG: 72 hr			48/77	62%
14 d MGA + PG: 72hr			52/79	66%
AI performed at predetermined fixed times with no estrus detection				
7-day CIDR-PG	Fixed-time AI @ 60 hr		258/525	49%
CO-Synch + CIDR	Fixed-time AI @ 60 hr		282/531	53%
CO-Synch + CIDR	Fixed-time AI @ 54 hr		51/109	47%
CIDR Select	Fixed-time AI @ 72 hr		616/1051	58%
14-day CIDR-PG	Fixed-time AI @ 66 hr		463/734	63%

Take Home Points

- Long-term CIDR-based protocols enhance synchrony of estrus compared to short-term CIDR-based or MGA-based protocols.
- Pregnancy rates resulting from fixed-time AI in beef heifers are expected to be higher following treatment with long-term CIDR-based protocols because of improvements in synchrony of estrus following treatment.

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