Getting Large Numbers of Dairy Heifers Bred AI

Lessons from the Show-Me Select Program

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Reproductive Management

Resource Knowledge → **Manager** → **Decision Action Outcome** → **Profit**

- **Economic Importance**

$$\frac{\text{Annual Cow Cost (\$)}}{\text{Avg. Wean Wt. (lbs) x \% Calf Crop}} = \text{Breakeven (\$)}$$

Heritability of Reproductive Traits

Trait	Heritability
Age at puberty	.41
Weight at puberty	.40
First service conception	.22
Conception/estrous cycle exposed	.27
Failure to conceive	.09
Calf born alive	.00
Calf alive at 2 weeks	.03
Calf alive at weaning	-.01

From Dearborn et al., 1973; Laster et al., 1979

Optimum Growth Rate for Breeding Herd Replacement Heifers

Item	Frame size				
	1	3	5	7	9
Optimum wt at 1st estrus, lb	572	669	761	858	955
Mature wt, lb	880	1,027	1,173	1,320	1,467

Adapted from Fox et al., 1988

Breed Group	Growth	Lean:Fat	Age@Puberty	Milk
Jersey	X	X	X	XXXXX
Here x Ang	XX	XX	XXX	XX
Red Poll	XX	XX	XX	XXX
Devon	XX	XX	XXX	XX
Tarentaise	XXX	XXX	XX	XXX
Brangus	XXX	XX	XXXX	XX
Brahman	XXXXX	XXX	XXXXX	XXX
Gelbvieh	XXXX	XXXX	XX	XXXX
Holstein	XXXX	XX	XX	XXXXXX
Simmental	XXXXX	XXXX	XXX	XXXX
Maine Anjou	XXXXX	XXXX	XXX	XXX
Limosin	XXX	XXXXX	XXXX	X
Charolais	XXXXX	XXXXX	XXXX	X
Chianina	XXXXX	XXXXX	XXXX	X

More X's correspond to: larger growth/mature size
more lean
later puberty and more milk

Selected Management Procedures Used on Replacement Beef Heifers

Management practice	Percent of operations
Feed separately	31.8
Pelvic measurements	3.0
Reproductive tract scores	1.2
Breed prior to mature herd	12.7
Synchronize estrus	3.0
Artificial insemination	3.3
Body condition score	4.6
Weigh	7.9
Pregnancy diagnosis	15.9

From NAHMS Survey, 1994

Reproductive Management Prior to First Breeding Season

1. Target weight
2. Reproductive tract score (RTS)
3. Pelvic measurements
4. Estrus synchronization
5. Sire selection (low BW EPD)

Pregnancy Rates of Heifers Bred at Pubertal or Third Estrus

	% Pregnant
Pubertal	57
Third	78

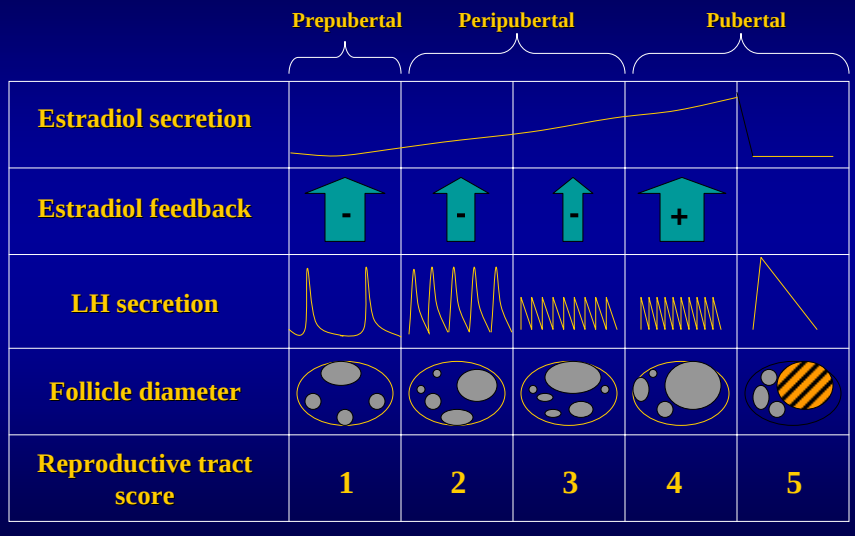
from Byerley et al., 1987

Reproductive Tract Scores

RTS	Uterine Horns	Ovarian Length (mm)	Ovarian Height (mm)	Ovarian Width (mm)	Ovarian Structures
1	Immature, <20 mm diameter, no tone	15	10	8	No palpable follicles
2	20-25 mm diameter, no tone	18	12	10	8 mm follicles
3	20-25 mm diameter, slight tone	22	15	10	8-10 mm follicles
4	30 mm diameter, good tone	30	16	12	> 10 mm follicles, CL possible
5	> 30 mm diameter	>32	20	15	Corpus luteum present

From Anderson et al., 1991

Endocrine and Ovarian Changes Associated with Puberty Onset



Adapted from Day and Anderson,1998; Anderson et al., 1991

Neonatal Exposure to Progesterone and Estradiol on Reproductive Tract in Beef Heifers

	Age at Treatment[b]			
Response[a]	Birth	Day 21	Day 45	Control
Uterocervical weight[c] (g)	113.7[d]	123.5[d]	101.3[d]	173.9[e]
Myometrial area (mm^2)	123.7[g]	141.8[g]	111.3[g]	162.8[h]
Endometrial area (mm^2)	29.9[i]	32.4[i]	37.7[i]	45.4[j]
Gland Density ($hits/mm^2$)	172.2[d]	380.3[e]	382.2[e]	486.9[f]
Uterine luminal protein (mg/flush)	2.8[d]	2.9[d]	2.3[d]	4.9[e]

From Bartol et al., 1995

Reproductive Summary

RTS	n	Weight (lb)	Pelvic height (cm)	Pelvic width (cm)	Pelvic area (cm^2)	Estrous response (%)
1	61	484[a]	13.9[a]	10.9[a]	152[a]	54[a]
2	278	620[b]	14.1[a]	11.2[a]	158[a]	66[b]
3	1103	697[c]	14.5[b]	11.4[b]	166[b]	76[c]
4	494	733[d]	14.7[c]	11.7[c]	172[c]	83[d]
5	728	755[d]	14.7[c]	11.7[c]	172[c]	86[d]

Adapted from Patterson and Bullock, 1995

Weight range of heifers by RTS (Randle and Patterson, 2005)

RTS	1	2	3	4	5
Number	58	792	4132	4550	3426
Mean wt. (lb)	644	680	708	763	777
Median	636	675	700	755	770
Mode	700	700	700	700	750
Min. wt.	375	425	410	477	515
Max. wt.	1100	1050	1150	1288	1260
Range	725	625	740	811	745

Pregnancy rates of heifers in natural service versus synchronized and AI'ed herds

	Exposed		21-d Preg rate		42-d Preg rate	
RTS	NS[1] (n)	SAI[2] (n)	NS (%)	SAI (%)	NS (%)	SAI (%)
1	8	55	38[a]	42[a]	63[c]	55[c]
2	108	661	31[a]	52[b]	54[c]	68[d]
3	336	3320	41[a]	58[b]	65[c]	74[d]
4	322	3629	48[a]	62[b]	72[c]	77[d]
5	242	2835	50[a]	64[b]	74[c]	80[d]
Total	1016	10500	44[a]	61[b]	68[c]	73[d]

[1,2]NS=natural service; SAI=synchronized and AI'ed
[a,b]P<.05; [c,d]P<.05
Adapted from Randle and Patterson, 2005

Heifer Program Requirements

- Weight and body condition
- RTS
- Pelvic measurement
- Service sire requirement
  - BW - EPD
- Estrous synchronization
- AI
- Early pregnancy diagnosis
- Ownership
- Health
  - vaccinations
  - parasite control
- Implant use

Heifer Management

- ✓ RTS: 6 to 8 weeks before breeding or 2 weeks before estrus synchronization
- ✓ Begin synchronization when ≥ 50% of the heifers have RTS of 4 or 5

Heifer Management

- ✓ Begin breeding heifers 2-3 weeks before cows
- ✓ Use proven AI sires with high accuracy EPDs for calving ease.

Heifer Management

- ✓DO NOT use growth promoting implants
- ✓ Implants may disrupt or impair development of reproductive organs
- ✓ Effects of implant use are palpable at RTS

Service Sire Criteria

- Birth weight
- Calving ease
- Accuracy requirements on AI sires

Pregnancy Examination

- **Perform prior to 90 days gestation**
  - **determine fetal age**
- **Distinguish AI from natural service pregnancies**

Show-Me-Select Replacement™ Heifer Program

Accomplishments and Impacts

- First statewide, on-farm beef heifer development and marketing program in the nation
- Producers are utilizing available technologies for on-farm heifer development that are now spilling over into the cowherd
- Significant increase in interest & use of estrus synchronization and AI stemming perhaps from differential in sale prices, but more importantly from successful application
- A growing awareness, understanding and appreciation for the importance of reproductive management to the whole herd

Show-Me-Select Replacement™ Heifer Program

Accomplishments and Impacts

- Since 1997……
  - 601 farms
  - 184 veterinarians
  - 71,223 heifers
  - 10 regional extension livestock coordinators
  - 17 regional extension livestock specialists

Show-Me-Select Replacement™ Heifer Program

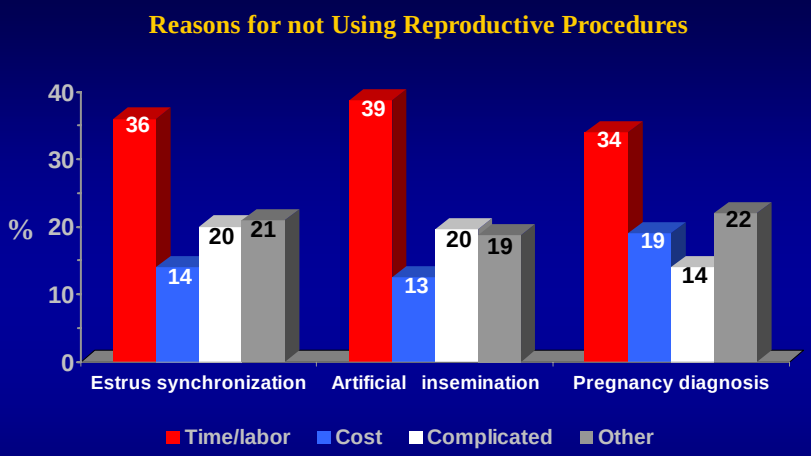
Accomplishments and Impacts

- The marketing component
  - 67 sales at 10 locations
  - 16,379 heifers sold
  - $17,295,267 in gross sales
  - 5,544 perspective buyers
    - 521 out of state
  - 1,915 successful buyers
    - 198 out of state
  - 14 states

The U.S. Beef Herd

- 69% of cow-calf enterprises are secondary income sources
- 50% of producers report an established breeding season of specific duration
- 34% of beef herds are routinely pregnancy checked
- 10% of beef cattle enterprises utilize AI

Artificial insemination and estrus synchronization are generally regarded as the most important and applicable of all available biotechnologies to the beef cattle industry (Seidel, 1995).



From NAHMS Survey, 1998

•Improvements in methods to synchronize estrus create the opportunity to significantly expand the use of AI in the U.S. cowherd …….

A unique point in time for the U.S. beef industry……

- Availability of tools and understanding of methods to control the estrous cycle in cattle
- A changing market structure that recognizes and rewards quality

- The challenge of transferring technology (estrus synchronization and AI) to the private sector exceeds the task of research and development of still newer technologies…….

Collectively

- Adopt common terminology regarding the various estrus synchronization protocols
- Identify and agree upon short lists of protocols
  - heifers and cows
  - heat detect and AI vs fixed-time AI
- Work to overcome the attitude of "What will this cost me?" ….to… " I'm willing to make an investment in my herd"

Effective Estrus Synchronization Programs

- 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

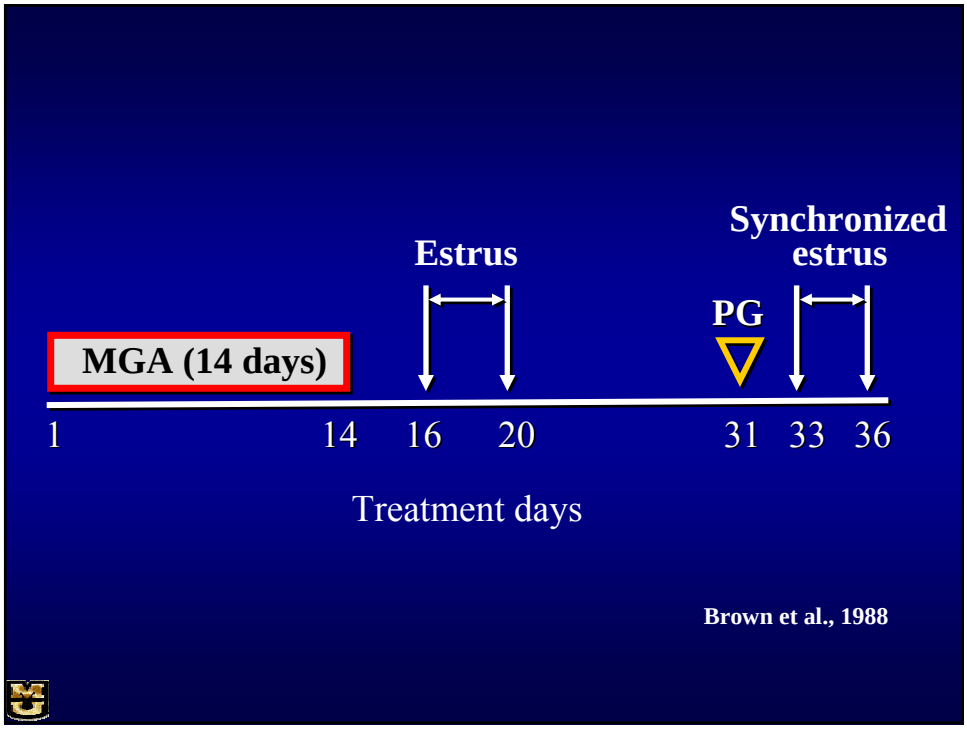
- Peripubertal heifers
- Postpartum cows
  - Anestrus and estrous cycling
- Excellent pregnancy rates

Products Currently Available

- Prostglandin
  - Lutalyse, Estrumate, ProstaMate, In Synch, estroPLAN
- GnRH
  - Cystorelin, Factrel, Fertagyl, OvaCyst
- Progestins
  - MGA
  - CIDR

What We Know About Progesterone & MGA . . .

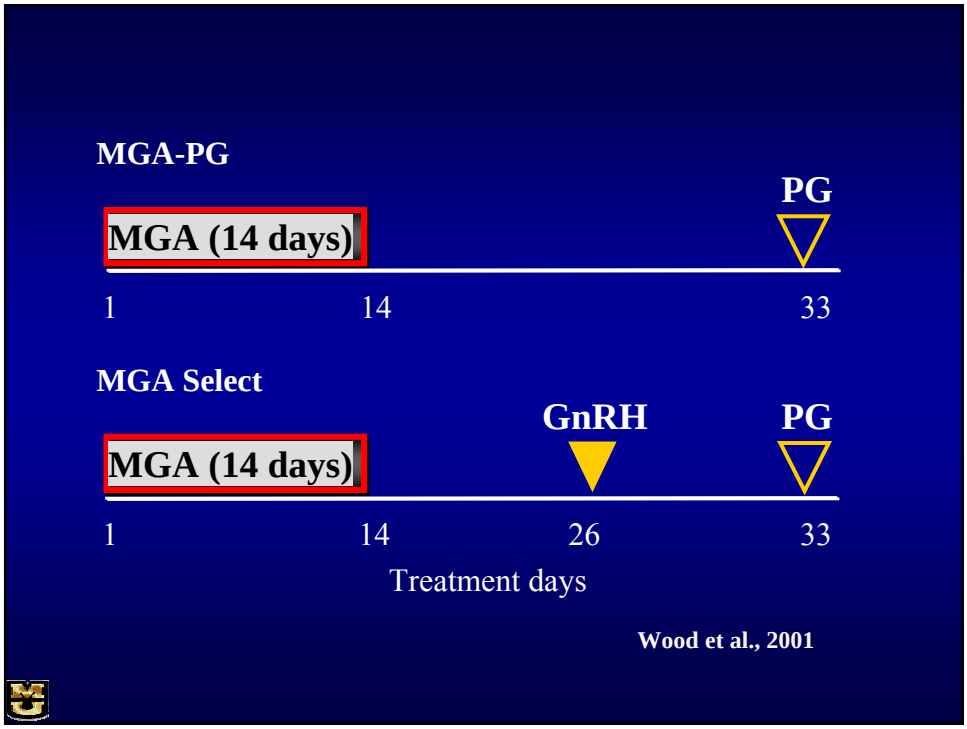
- Induces puberty in beef heifers
- Prevents expression of behavioral estrus
- Blocks the preovulatory surge of LH
- Blocks ovulation

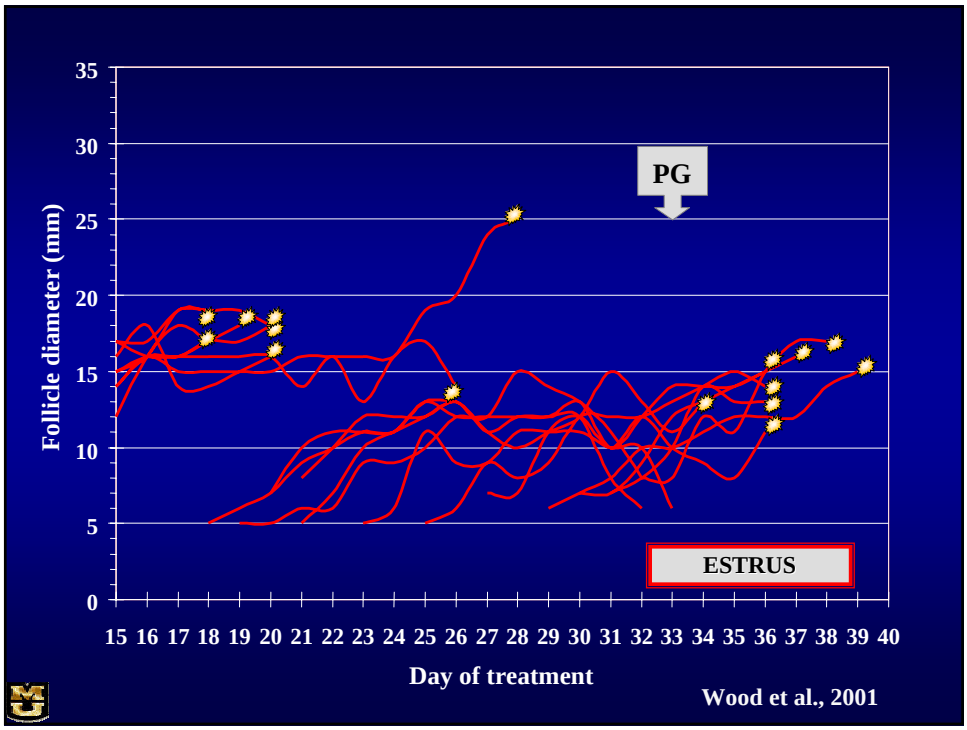


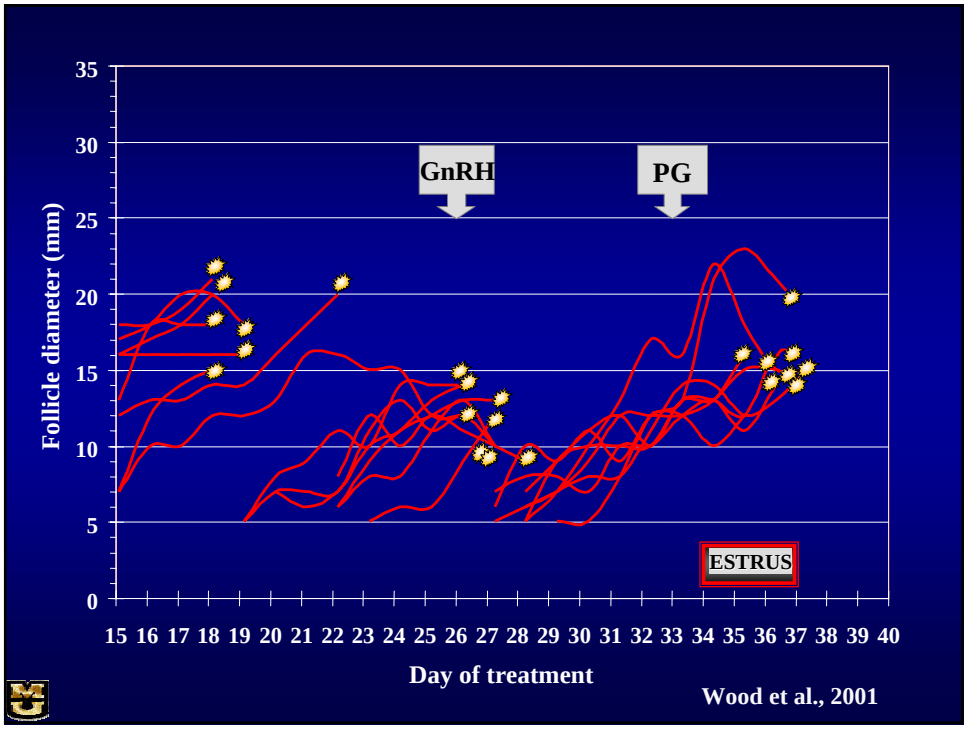
MGA-PG
14-19 d

- Improved estrous response
  - More heifers in heat
- Similar fertility
  - No change in conception or pregnancy rate
- Improved synchrony
  - More heifers in heat in a shorter time

(Deutscher et al., 2000; Lamb et al., 2000)


MGA-PG
MGA (14 days)
PG
1
14
33
MGA Select
MGA (14 days)
GnRH
PG
1
14
26
33
Treatment days
Wood et al., 2001


Follicle diameter (mm)
35
30
25
20
15
10
5
0
PG
ESTRUS
15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Day of treatment
Wood et al., 2001



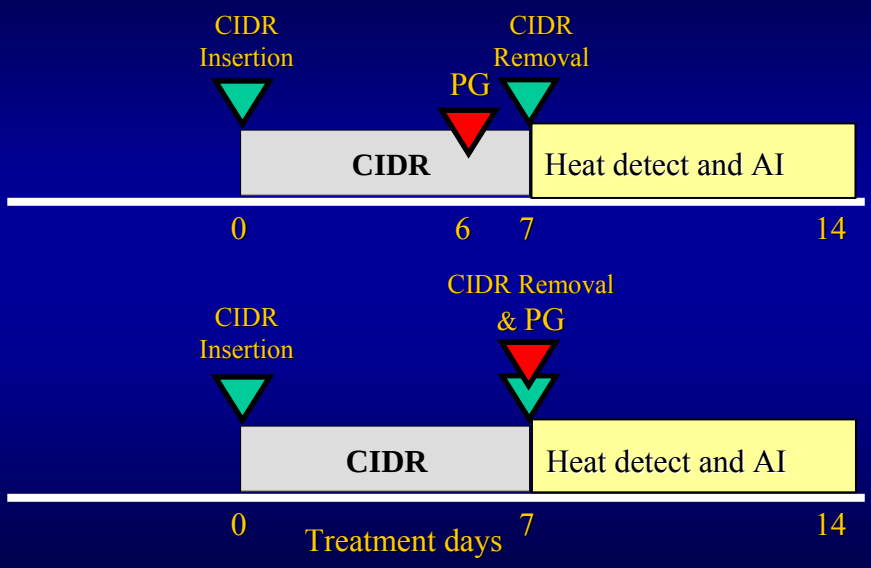
When to Add GnRH to an MGA-PG Protocol for Heifers

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

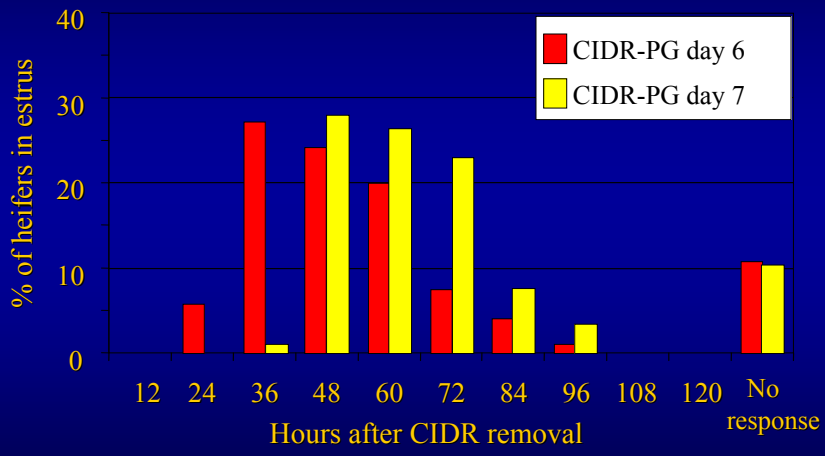
Wood et al., 2000; Kojima et al., 2001

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

CIDR-PG Protocol



CIDR-PG Protocol
Estrous Response

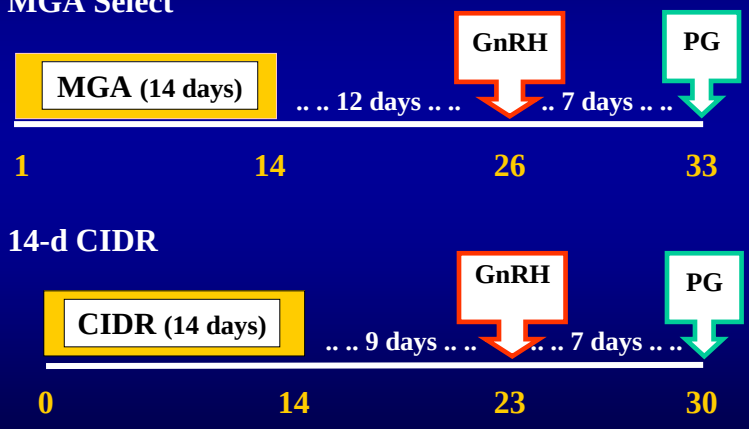


- PG injection on day 6 or 7 altered the timing of estrus after CIDR removal

Observations with MGA-based programs in yearling beef heifers . . .

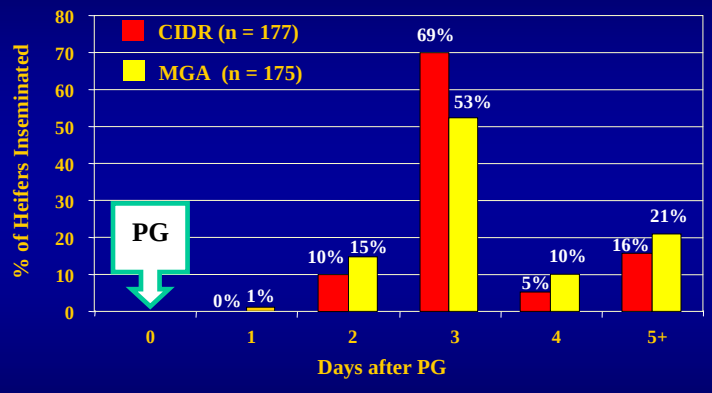
- **Increasing number of reports that pregnancy rates resulting from MGA-based estrus synchronization protocols are declining in yearling age heifers . . . . . .**
  - **Higher rates of estrous cyclicity**
  - **Heavier weight and conditioned heifers**

Experimental Protocols



Kojima et al., 2004

Summary for Timing of AI



- No treatment x location effect (P > 0.10); therefore, data were pooled
- 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

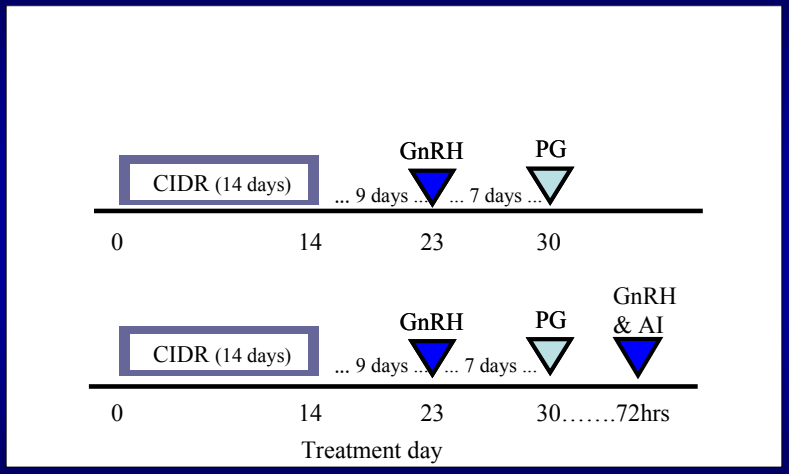
Summary

- In yearling beef heifers:
  - CIDR-GnRH-PG improved synchrony of estrus compared with MGA Select
  - CIDR-GnRH-PG improved AI pregnancy rate over MGA Select

Kojima et al., 2004

Estrous Response and Fertility in Beef Heifers After Treatment with Various Estrus Synchronization Protocols

Treatment	Estrous response		Pregnancy rate	
Heat Detect	No.	%	No.	%
MGA-PG 14-19	1129/1302	87	768/1302	59
MGA Select	433/499	87	280/499	56
CIDR-PG(d6)	200/285	70	112/285	39
14d CIDR	713/830	86	499/830	60
Heat Detect & Time AI				
CIDR-PG(d7): 84hr			282/517	55
Select Synch +CIDR: 84 hr			289/504	57
Fixed-Time AI				
CIDR-PG: 60hr			258/525	49
CO-Synch CIDR: 60 hr			282/531	53
14d CIDR: 72 hr			518/853	61



Pregnancy rates after administration of the 14-d CIDR protocol in field trials involving AI performed after observed estrus.

Herd	No. pregnant	No. inseminated	Preg. rate (%)
1	50	79	63
2	27	42	64
3	35	56	63
4	26	48	54
5	49	79	62
6	38	50	76
7	31	46	67
8	24	44	55
9	29	41	71
10	42	81	52
11	20	39	51
12	9	16	56
13	10	16	63
14	8	10	80
15	41	81	51
16	25	33	76
17	12	18	67
18	23	51	45
Totals	**499**	**830**	**60**

Pregnancy rates after administration of the 14-dCIDR protocol in field trials involving AI performed 72 hours after PG.

Herd	No. pregnant	No. inseminated	Preg. rate (%)
1	71	117	61
2	44	67	66
3	7	9	78
4	42	82	51
5	58	85	68
6	25	48	52
7	8	12	67
8	52	77	68
8	31	58	53
8	7	27	26
9	50	81	62
10	23	39	59
11	44	69	64
12	32	50	64
13	24	32	75
Totals	**518**	**853**	**61**