How to Get Cows Pregnant for the Purebred and Commercial Sectors of the Beef Industry – Using GnRH and CIDRs

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Introduction

For most artificial insemination programs in the United States, we rely heavily on the ability to synchronize estrus in cows or heifers to ensure that they are at the correct stage of the estrous cycle when we use either estrus detection followed by artificial insemination or fixed time artificial insemination (TAI) alone. Numerous factors affect the response of these recipients to hormonal regimens that we impose on them. Those factors may include weather patterns, nutrition, age or days since calving, body condition, nursing a calf, or breed composition/genetics. A second challenge is to match estrous synchronization products to ensure that we can optimize the number of females that respond to a given estrous synchronization program, and ensure that the greatest number of females are detected in estrus in a short window of time.

The premise behind synchronizing cows and heifers is to first control the timing of onset of estrus by controlling the length of the estrous cycle. The choice of approaches for controlling cycle length are: 1) to regress or "kill" the corpus luteum (CL) of the animal before the time of natural luteolysis, and thereby shorten the cycle (by administration of a prostaglandin $F_{2\alpha}$ [PGF]), or 2) to administer exogenous progestins to delay the time of estrus following natural or induced luteolysis that may extend the length of the estrous cycle. A further approach is to "select" the ovulatory follicle by an injection of GnRH, which should cause premature ovulation of that follicle. Using these concepts, researchers have made tremendous strides in developing numerous system to synchronize the estrous cycle for an artificial insemination and embryo transfer. Table 1 summarizes common products available for use in cattle estrous synchronization systems.

Initial estrous synchronization systems focused on altering the estrous cycle by regressing the CL with an injection of PGF followed by a detected estrus between 18 and 80 hours after the injection. After systems involving a single injection of PGF became successful, researchers focused on multiple injections of PGF to further reduce the days required for heat detection and AI (Lauderdale et al., 1974; Seguin et al., 1978). The next generation of estrous synchronization systems involved progestins, which (while administered) prevent estrus from occurring. Progestins were used to delay the time of estrus following a natural or induced luteolysis and extend the length of the estrous cycle. Until 2002, melengestrol acetate (MGA) was the only progestin approved by the Food and Drug Administration for estrous synchronization, but the CIDR was approved by the FDA for use in 2002. These proceedings will focus on synchronizing estrous in females using GnRH and the CIDR.

Estrus synchronization appears to becoming more complicated every year. New systems are developed and variations of older systems are used. Our goal is to

Table 1. Products, commercial names, and doses for synchronization products.

Product	Commercial name	Administration	Dose
Prostaglandins	Lutalyse®	i.m. injection	5 mL
	Estrumate®	i.m. injection	2 mL
	In-Synch®	i.m. injection	5 mL
	Prostamate®	i.m. injection	5 mL
Progestins	Melengestrol Acetate	Feed	0.5 mg/hd/d
	CIDR	Vaginal implant	1 implant
Gonadotropin Releasing Hormone	Cystorelin®	i.m. injection	2 mL
	Factrel®	i.m. injection	2 mL
	Fertagyl®	i.m. injection	2 mL
	Ovacyst™	i.m. injection	2 mL

ensure that more cows are inseminated artificial on an annual basis; therefore, a group of individuals convened in North Platte, NE in September 2004. The group consisted of veterinarians, pharmaceutical companies, AI companies, and researchers from universities. Our goals were: 1) promote wider adoption of reproductive technologies among cow-calf producers; 2) educate cow-calf producers in management considerations that will increase the likelihood of successful AI breeding; and 3) educate producers in marketing options to capture benefits that result from use of improved reproductive technologies. With these goals in mind, the group established estrus synchronization protocols that were research based and industry used that had the greatest opportunity of success for purebred and commercial producers. These protocols are listed in the back of all major AI company catalogues and are shown in these proceedings as Appendix A (for cows) or Appendix B (for heifers).

Description of the CIDR Insert

The CIDR is an intravaginal progesterone insert, used in conjunction with other hormones to synchronize estrous in beef cows and heifers and dairy heifers. The CIDR was developed in New Zealand and has been used for several years to advance the first pubertal estrus in heifers and the first postpartum estrus in cows. The CIDR is a "T" shaped device with flexible wings that collapse to form a rod that can be inserted into the vagina with an applicator. On the end opposite to the wings of the insert a tail is attached to facilitate removal with ease. The backbone of the CIDR is a nylon spine covered by progesterone (1.38g) impregnated silicone skin. Upon insertion blood progesterone concentrations rise rapidly, with maximal concentrations reached within an hour after insertion. Progesterone concentrations are maintained at a relatively constant level during the seven days the insert is in the vagina. Upon removal of the insert, progesterone concentrations are quickly eliminated.

Retention rate of the CIDR during a seven-day period exceeds 97%. In some cases, vaginal irritation occurs resulting in clear, cloudy or yellow mucus when the CIDR is removed. Cases of mucus are normal and does not have an impact on effectiveness of the CIDR. Caution should be taken when handling CIDRs. Individuals handling CIDRs should wear latex or nitrile gloves to prevent exposure to progesterone on the surface of the insert and to prevent the introduction of contaminants from the hands into the vagina of treated females. The inserts are developed for a one-time use only. Multiple use may increase the incidence of vaginal infections.

Efficacy of Different GnRH Products

The efficacy of the specific GnRH products used for follicle control in estrous synchronization systems has been discussed. The discussion was spurred by the report (Martinez et al., 2003) that Cystorelin induced a greater LH surge than Fertagyl and Factrel. Cystorelin also induced a greater ovulation rate, but all products synchronized follicular wave emergence. GnRH is a decapeptide – a linear chain of ten amino acids. The base for Cystorelin, Fertagyl and Ovacyst is diacetate, tetrahydrate. Therefore, these three products are chemically identical. Factrel has a HCL base, which should not alter bioactivity. Since the products are chemically similar, why were the differences observed by Martinez et al. (2003)? Pharmaceutical manufacturers are permitted to include a wide range of active compound in the product. Therefore, the Martinez et al. (2003) report may only be a difference in active GnRH within the product. The dose was selected based on cystic ovarian disease, the clinical claim for GnRH products. Perhaps this explains the variability in response when doses less than the recommended dose used. In a retrospective analysis between Cystorelin and Factrel we (Stevenson et al., 2000) we did not see an effect of GnRH product on AI pregnancy rates in cows treated with two different GnRH estrous synchronization protocols. Certainly, more research needs to be performed in this area.

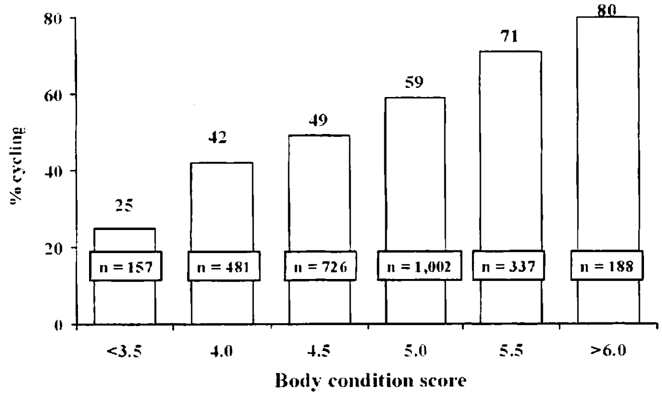
Factors Affecting The Response of Cows to Estrous Synchronization

The two primary factors that affect the response of cows to GnRH and CIDR based estrous synchronization systems are body condition, parity, and days since calving. By managing these two factors, the incidence of anestrus/anovulation can be reduced and more females will respond to be eligible to receive an embryo at the time of embryo transfer.

Body Condition

Body condition is a reflection of the immediate past and current nutritional status of the female. Gestating cows that endure varied wintering conditions with inadequate supplementation are likely to be thinner as calving approaches. Body condition is a good predictor of when the first postpartum estrus may occur. Certainly as body condition score increases at the onset of the breeding season, the proportion of cows cycling also increases by about 18% for each unit increase in body condition score (Figure 1; Stevenson et al., 2003).

Figure 1. Proportion of suckled cows that were cycling on the first day of the breeding season on the basis of body condition score assessed at that time. Cycling status was estimated by concentrations of progesterone in blood serum of cows sampled during 7 and 10 days before the breeding week (adapted from Stevenson et al., 2003).



Parity

Two-year-old (primiparous) cows require more time to initiate cycling activity than older (multiparous) cows, even when they calve before the multiparous cows. This is due to their greater energy needs and added burden to sustain lactation and their own growth, which have greater energy priority than the onset of reproductive estrous cycles. The cow's first priority is for maintenance of essential body functions to preserve life. Once that maintenance requirement is met, remaining nutrients accommodate her own growth. Finally, lactation and the initiation of estrous cycles are supported. Older cows have now growth requirement, thus the nutrients are more likely to be prioritized for milk synthesis and initiation of estrous cycles. Because of this priority system, young, growing cows generally produce less milk and are anestrus longer.

Days Since Calving/Days Postpartum

As a general rule and not unexpected, more cows begin their estrous cycles when they have longer intervals between calving and the onset of estrous synchronization. The proportion of cows cycling increases in a curvilinear fashion across days postpartum (Figure 2; Stevenson et al., 2003). For best result synchronization of estrus should not occur prior to 50 days postpartum in an embryo transfer program.

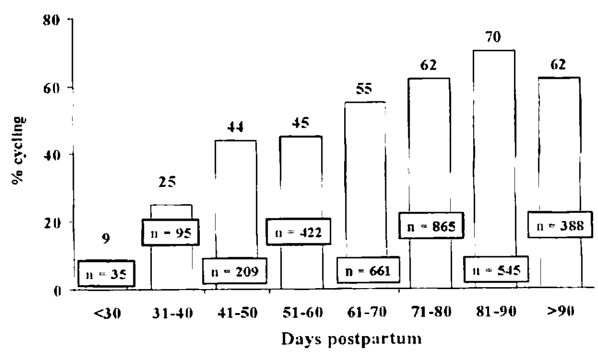
Record Keeping. Maintaining a sound recording keeping system is a key to success in any reproductive management system. For synchronization to work, producers need to know when their cows calved, whether the cow had a difficult birth, and what the birth weights of all calves were. We aim at starting a synchronization protocol when cows are greater than 45 days from calving; however, if your cow had a difficult birth or large calf, perhaps it would be wise to wait an extra few weeks. Without accurate records, these decisions can be extremely subjective.

Facilities. With synchronization, you can expect many more females to be in heat at a single time than without synchronization. Plus, females will need to be pushed through the chute for injections more frequently than usual; therefore, working facilities need to be able to accommodate the extra work. Not only should you consider reliable holding and sorting pens, but also a good solid alley and chute system. Anticipating an increase in facility use will certainly ensure a successful synchronization program.

Labor. Reliable labor is an issue that many people neglect to consider when planning a synchronization program. Detecting when cows are in heat is important for the success of a synchronization program. Any labor associated with this process needs to know exactly how cows act when they are in heat. In many cases, this is often when a program fails. A producer feels that they have more important things to do than spend time heat checking. They will often leave for the "more important" job or leave the heat checking to a less than competent individual. The end result is poor estrus response or poor conception rates.

Many more factors need to be considered, such as

Figure 2. Proportion of suckled cows that were cycling on the first day of the breeding season on the basis of days since calving. Cycling status was estimated by concentrations of progesterone in blood serum of cows sampled during 7 and 10 days before the breeding week (adapted from Stevenson et al., 2003).



using a proficient AI technician. Regardless of the system that you use, be sure to follow the directions on the drug label and don't take short cuts, believing that it will be more simple and save time. Invariably this is when results are at their poorest.

CIDR/PGF Protocols for Cows

During the seven days of CIDR insertion, progesterone diffusion from the CIDR does not affect spontaneous luteolysis. Assuming all cows have 21 day estrous cycles, there will be two populations of females after six days of CIDR treatment: females without corpora lutea and females with corpora lutea more than six days after ovulation. All females, therefore, have corpora lutea that are potentially responsive to an injection of PGF. Although most research data indicates that only about 90% of corpora lutea in cows more than six days after ovulation regress promptly to an injection PGF, only about 60% of the females will have corpora lutea at the time of PGF treatment (assuming that spontaneous corpora lutea regression beings about 18 days after ovulation). Therefore, about 95% of the females treated with the FDA approved CIDR/PGF protocol are synchronized to exhibit estrus within a few days of CIDR insert removal. However, more than 95% of the treated females will be synchronized to exhibit estrus if estrous behavior is monitored for five days after removal of the CIDR insert.

An advantage of a progestin-based estrous synchronization protocol is that administration of progestins to prepubertal heifers and postpartum anestrous cows have been demonstrated to hasten cyclicity. When suckled beef cows were assigned randomly in replicates to one of three groups (Table 2; Lucy et al., 2001): 1) untreated controls, 2) a single intramuscular (IM) injection of 25 mg PGF (PGF alone), or 3) administration of a CIDR insert for 7 d with an IM administration of PGF on day 6 of the 7 d CIDR insert administration period (CIDR + $PGF_{2\alpha}$) no differences were detected between the CIDR + PGF treatment group and either the $PGF_{2\alpha}$ alone or control groups for first-service CR for either the first 3 d of AI or the entire 31 d of AI. More cows were pregnant after either 3 d or 7 d of AI in the CIDR + PGF group than in either the PGF alone or the control group. No differences were detected in PR to first services during the 31 d AI period between the CIDR and PGF and either the PGF alone or the control group. Therefore, insertion of the CIDR increased the synchronization rates within the first 3 d following PGF, resulting in enhanced pregnancy rates. A drawback of the current protocol is that PGF was administered on d 6 after CIDR insertion (a day before CIDR removal). For beef producers this tends to be impractical, because the cows need to be handled a minimum of four times including an AI. Therefore, a more practical modification of this protocol is to inject PGF the on the day of CIDR removal.

Recent Advances in Protocols Using the CIDR for Cows

Several alterations of the basic protocol are being evaluated; however, much work is yet to be done since field trials with CIDRs were limited during the FDA approval process. Inclusion of the CIDR in the CO-Synch procedure appears to be the most researched alternative method for synchronizing beef cows. We (Lamb et al., 2001) published data in which the CIDR was included in the CO-Synch estrous synchronization procedure (Table 1). The CIDR was inserted at the time of the first injection of GnRH and removed at the time of the injection of PGF. Overall, there was a positive effect of including the CIDR in the CO-Synch protocol; however, this positive effect was not consistent across all locations. Second, the positive effect of including the CIDR was absent in the cows that were cycling and had high progesterone concentrations at the time of PGF treatment, which may explain why there was not a positive effect at each location. Along with parity, days postpartum, calf removal, and cow body condition (Table 3) our previous report (Lamb et al., 2001) also indicated that location variables, which could include differences in pasture and diet, breed composition, body condition, postpartum interval, and geographic location, may affect the success of fixed-time AI protocols.

In a more recent study involving 14 locations in seven states we (Larson et al., 2004) evaluated both fixed-time AI protocols and detection of estrus protocols with a clean-up AI. These protocols were compared to $GnRH/PGF_{2\alpha}$ protocols. Although the location accounted for the greatest variation in overall pregnancy rates the Hybrid-Synch+CIDR protocol (Figure 1) was the protocol that most consistently yielded the greatest pregnancy rates within each location. However, the CO-Synch protocol (Appendix A) was an effective Fixed-time AI protocol that yielded pregnancy rates of 54%. Additional factors that affect pregnancy rates were cycling status, parity, and days postpartum (Table 4).

Interestingly, the distribution of estrus among the CIDR/PGF, Select Synch & TAI and Select Synch+CIDR & TAI protocols was similar (Figure 3) and the average time from PGF to estrus or AI was similar to among all three treatments (Figure 4). Since the estrus response was greater in the Select Synch+CIDR & TAI protocol overall pregnancy rates were greater.

Table 2. Fertility rates in suckled beef cows treated with estrous synchronization protocols containing progestins.

Reference and treatment description	No. of cows	Conception rate[a], %	Pregnancy rate[b], %
Stevenson et al., 2000			
Exp. 1			
Select Synch	289	115/175 (66)	115/289 (38)
Select Synch + Norgestomet	289	123/208 (59)	123/289 (42)
2 × PGF	294	86/142 (61)	86/294 (28)
Dejarnette et al., 2001			
Exp. 2			
Select Synch	77	40/60 (67)	40/77 (52)
Select Synch + MGA from d -7 to -1	73	43/61 (72)	43/73 (60)
Lamb et al., 2001			
CO-Synch	287	-	138/287 (48)
CO-Synch + CIDR from d –7 to 0	273	-	160/273 (59)
Larson et al.., 2004a			
CIDR/PGF (PG on d 0) - anestrous	147	-	74/147 (50)
CIDR/PGF (PG on d 0) - cyclic	296	-	159/296 (54)
CO-Synch - anestrous	156	-	59/156 (38)
CO-Synch - cyclic	330	-	145/330 (44)
CO-Synch + CIDR - anestrous	180	-	85/180 (47)
CO-Synch + CIDR - cyclic	294	-	169/294 (57)
Select Synch & TAI - anestrous	143	-	60/143 (42)
Select Synch & TAI - cyclic	308	-	182/308 (59)
Select Synch+CIDR & TAI - anestrous	136	-	72/136 (53)
Select Synch+CIDR & TAI - cyclic	306	-	180/306 (59)
Lucy et al., 2001			
Control - anestrous	151	6/16 (38)	6/151 (4)
Control - cyclic	134	15/26 (58)	15/134 (11)
PGF - anestrous	154	17/30 (57)	17/154 (11)
PGF - cyclic	129	44/63 (70)	44/129 (34)
CIDR/PGF (PG on d –1) - anestrous	141	36/63 (57)	36/141 (26)
CIDR/PGF (PG on d –1) - cyclic	140	64/101 (63)	64/140 (46)

[a] Percentage of cows pregnant exposed to AI.
[b] Percentage of cows pregnant of all cows treated.

CIDR/PGF Protocols for Heifers

As with cows, beef heifers have 21-day estrous cycles and respond to the CIDR in a similar fashion to cows, resulting in a majority of heifers that should be synchronized using the FDA approved CIDR/PGF protocol. Heifers tend to be an easier population of females to synchronize for estrus, because they are not nursing calves, tend to express estrus well, and most of the heifers usually are cycling, and can be maintained in areas where they can be fed allowing them to respond well to the MGA/PGF system (Wood et al., 2001; Brown et al., 1988; Lamb, et al., 2000). In addition, MGA delivered in feed has the ability to induce puberty in some peripubertal heifers (Patterson et al., 1992). However, the length of time to apply this system (31 to 33 d) is a drawback. During a late spring/early summer breeding season, MGA must be delivered in a grain carrier when cattle tend to be grazing forage pastures. Thus, the challenge is to

Table 3. Pregnancy rates in suckled beef cows after treatment with Cosynch or Cosynch+CIDR (Lamb et al., 2001)

	Treatment[a]		
Item	Cosynch	Cosynch+P	Overall
	---------------- no. (%) ----------------		
Body condition[b]			
≤ 4.5	12/40 (30)	11/36 (31)	23/76[x] (30)
4.5 to 5.5	30/74 (41)	40/80 (50)	70/154[y] (45)
≥ 5.5	19/32 (59)	11/13 (85)	31/45[z] (69)
Days postpartum			
≤ 50	23/60 (38)	27/58 (47)	50/118[x] (42)
51-60	25/62 (47)	36/54 (67)	61/116[y] (53)
61-70	28/49 (62)	25/44 (57)	53/93[y] (57)
71-80	18/41 (44)	30/45 (67)	48/86[y] (56)
> 80	44/75 (59)	42/72 (58)	86/147[y] (59)
Parity[c]			
Multiparous	61/138 (44)	79/132 (60)	140/270 (52)
Primiparous	25/50 (50)	20/45 (44)	45/95 (47)

[a] See experimental design for treatments in Figure 1.
[b] Body condition scores from IL and MN only.
[c] Parity data from KS and MN only.
[xyz]Percentages within an item and column lacking a common superscript letter differ (P < .05).

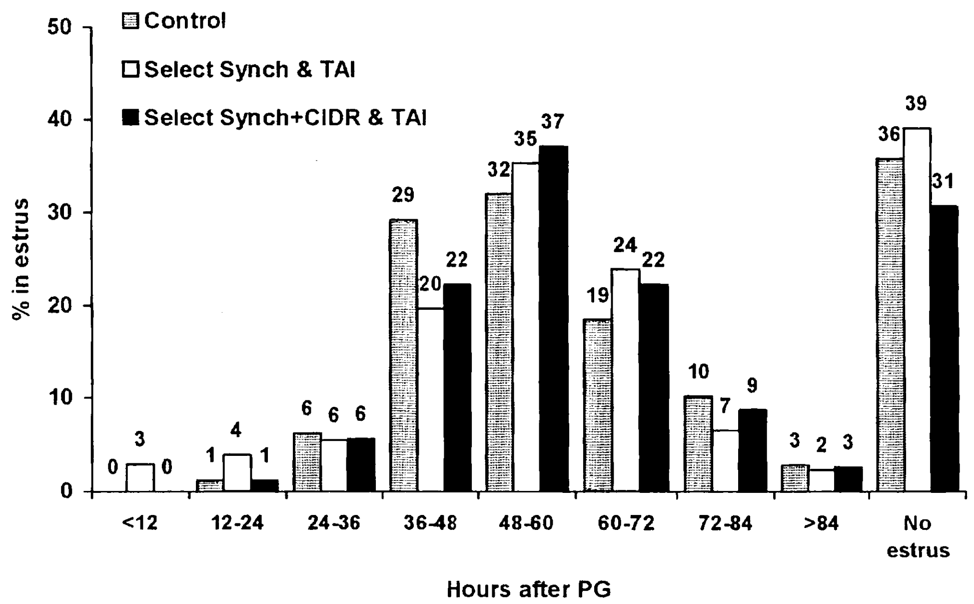


Figure 3. Percentage of cows treated with CIDR/ PGF, Select Synch & TAI, or Select Synch+CIDR & TAI that were observed in estrus, separated by hours from PG injection to AI (Larson et al., 2004a)

Table 4. First-service pregnancy rates in suckled beef cows after estrus synchronization with PG, GnRH, and/or a CIDR.

Item	Treatments[a]					
	Control	CO-Synch	CO-Synch+CIDR	Select Synch & TAI	Select Synch+CIDR & TAI	Overall
			--------------------no. (%) --------------------			
Pregnancy rates[b]	266/506^x (53)	238/548^y (43)	290/539^x (54)	269/507^x (53)	289/498^x (58)	1352/2598 (52)
Cycling Status[c]						
Cycling	154/282 (55)	142/316 (45)	165/278 (59)	175/291(60)	170/288 (59)	806/1455 (55)
Noncycling	74/147 (51)	57/155 (37)	84/178 (47)	59/141 (42)	73/136 (54)	347/757 (46)
Parity[d]						
Primiparous	38/84 (45.2)	33/84 (39.3)	49/89 (55.1)	37/86 (43.0)	48/85 (56.5)	205/428^x (47.9)
Multiparous	196/365 (53.7)	178/400 (44.5)	222/394 (56.3)	205/362 (56.6)	207/355 (58.3)	1007/1876^y (53.7)
Body Condition Score						
< 5	43/85 (51)	39/100 (39)	54/96 (56)	42/79 (50)	34/67 (51)	212/427 (50)
5-6	115/231 (50)	114/252 (45)	140/268 (52)	114/231 (49)	137/237 (58)	620/1219 (51)
≥ 6	105/183 (57)	80/182 (44)	93/163 (57)	108/182 (59)	110/181 (61)	496/891 (56)
Days Postpartum						
≤ 50	36/85 (42)	29/90 (32)	46/89 (52)	42/91 (46)	53/93 (57)	206/448^x (46)
51-60	52/83 (63)	42/91 (46)	52/88 (59)	34/79 (43)	40/66 (61)	220/407^y (54)
61-70	50/100 (50)	45/108 (42)	57/107 (53)	56/98 (57)	60/104 (58)	268/517^y (52)
71-80	63/116 (54)	73/149 (50)	76/134 (57)	75/120 (63)	63/115 (55)	350/631^y (55)
> 80	65/122 (53)	49/113 (43)	59/121 (49)	62/119 (52)	73/120 (61)	308/595^y (52)

[a] See experimental design or treatments in Figure 1.
[b] Pregnancy rates = percentage of cows pregnant compared to all cows estrus synchronized and inseminated artificially.
[c] Cycling status excludes locations OH-1 and OH-2.
[d] Parity data excludes MN-1, MN-3, and OH-1.
[xy] Percentages within an item and column lacking a common superscript letter differ ($P < .05$).

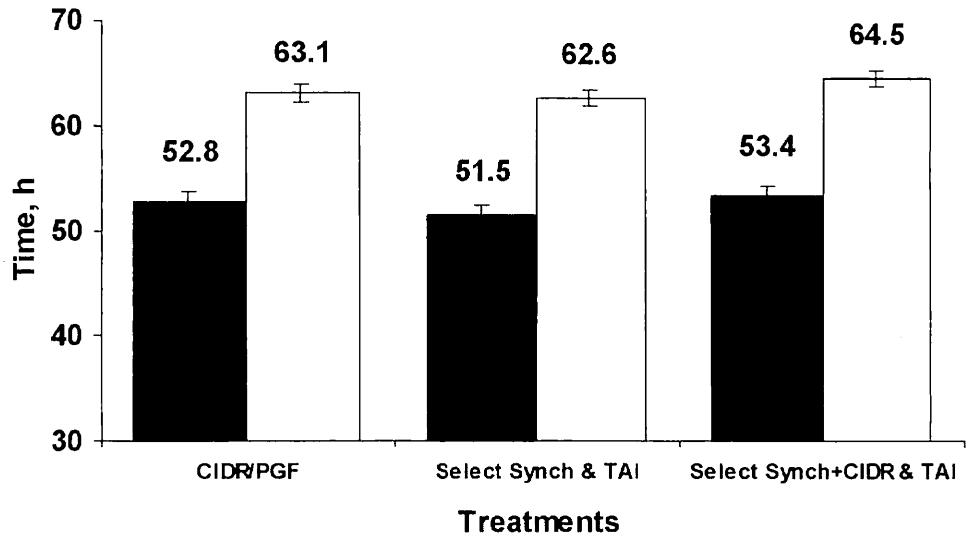


Figure 4. Time from PG injection to estrus (black bar) and time from PG injection to AI (white bar) for those cows exhibiting estrus in Control. Select Synch & TAI, and Select Synch+CIDR & TAI treatments (Larson et al., 2004a).

ensure that each heifer receives the required MGA dose. Therefore, producers could benefit from an alternative estrous synchronization system that eliminates the use of MGA.

First attempts focused at synchronizing estrus in heifers with a CIDR and PGF. The study by Lucy et al., (2001; Table 5) demonstrates the pregnancy rates of heifers synchronized with the FDA approved CIDR/ PGF protocol. As in cows, the CIDR/PGF protocol yielded greater pregnancy rates in heifers than for heifers that were untreated or for heifers treated with PGF alone. Therefore, insertion of the CIDR increased the synchronization rates within the first 3 d following PGF, resulting in enhanced pregnancy rates. Again, the drawback of the current protocol is that PGF was administered on d 6 after CIDR insertion, which requires an additional day of handling the heifers. Therefore, consideration should be to inject PGF the on the day of CIDR removal.

The CIDR + PGF treatment reduced the interval to first estrus (2 d) compared with either the control (15 d) or PGF alone (16 d) treatments (Table 4). Similarly, for heifers that were prepubertal when the study was initiated the CIDR + PGF shortened the interval to first estrus (14 d) compared to control (27 d) and PGF alone (31 d). The CIDR + PGF treatment improved the synchrony of estrus compared with the PGF alone, with 60% vs. 25%, of heifers in estrus over 3 d after CIDR inserts were removed.

Recent Advances in Protocols Using the CIDR for Heifers

Although excellent pregnancy rates can be achieved with the MGA/PGF protocol and acceptable pregnancy rates can be achieved with the CIDR/PGF protocol, no system short duration system has managed to successfully synchronize estrus in replacement beef heifers that consistently yields pregnancy rates that match the MGA/PGF protocol. In addition, there has not been a no reliable fixed-time AI protocol exists for synchronizing estrus in beef heifers. Therefore, in a more recent study involving 12 locations in 8 states we (Larson et al., 2004b) focused on developing a study to determine whether: 1) a TAI protocol could yield fertility similar to a protocol requiring detection of estrus; and 2) an injection of GnRH at CIDR insertion enhances pregnancy rates.

To evaluate our objectives, estrus in beef heifers was synchronized and artificial insemination occurred after four treatments (Figure 1): 1) CIDR/PGF & TAI; 2) Select Synch+CIDR & TAI; 3) CO-Synch+CIDR; and 4) CIDR/PGF/TAI. The percentage of heifers cycling at the initiation of estrous synchronization was 91.0%. Percentages of cycling heifers among locations ranged from 78 to 100%. Overall pregnancy rates were at days 30 to 35 after AI ranged from 38 to 74%. Although no differences in pregnancy rates were detected among treatments, heifers that were

Table 5. Interval to estrus, synchrony of estrus and fertility of beef heifers following treatment with PGF or CIDR and an injection of PGF (Lucy et al., 2001).

Criterion	Untreated controls	PGF[1]	CIDR/PGF[2]
Interval[3] to estrus, d (n)			
All heifers	15*	16*	2
Anestrous heifers[5]	27**	31**	14
Estrus d 1-3, %	12**	25**	60
FSCR[4], % (n)			
D 1-3	57	52	60
D 1-31	58	52	58
FSPR[5], % (n)			
D 1-3	7**	14**	36
D 1-7	14**	18**	38
D 1-31	42	36*	47

[1]25 mg PGF.
[2]CIDR insert administered intravaginally for 7 days with PGF administered on day 6.
[3] Median interval in days from removal of CIDR inserts.
[4] First-service conception rate (number of heifers).
[5] First-service pregnancy rate (number of heifers).
* Different from CIDR/PGF, $P < 0.05$.
** Different from CIDR/PGF, $P \leq 0.01$.

inseminated in the estrus-detection treatments had greater pregnancy rates than heifers in the fixed-time AI treatments (56 vs. 51%, respectively). However, the the CO-Synch+CIDR treatment provides a reliable fixed-time AI protocol for beef producers (Figure 5).

For the two estrus-detection protocols, CIDR/PGF and Select Synch+CIDR & TAI, pregnancy rates for heifers detected in estrus before 84 hr were 44.6 and 45.0%, respectively. Therefore, the clean-up TAI at 84 hr enhanced pregnancy rates by 9.9 and 12.3 percentage points for CIDR/PGF and Select Synch+CIDR & TAI protocols, respectively. These results indicate that TAI after a period of estrus detection enhances the potential for improving pregnancy rates to exceed those of estrus detection alone (Figure 6).

The time from PG injection to detection of estrus and AI for those heifers exhibiting estrus was similar among CIDR/PGF & TAI (49.9 and 61.7 hr, respectively) and Select Synch+CIDR & TAI (49.8 and 61.3 h, respectively). These results demonstrate that estrus in heifers can be synchronized effectively with GnRH, PG, and a CIDR. The Select Synch+CIDR & TAI treatment most frequently produced the greatest pregnancy rates and provided a reliable alternative to an MGA/PGF protocol.

Summary

To achieve optimal pregnancy rates with CIDR based estrous synchronization protocol, cows should be in good body condition (BCS ≥5) and treatments should be initiated only when cows are at least 50 days postpartum. Treatment of suckled cows and replacement beef heifers with a CIDR and GnRH will yield industry accepted pregnancy rates. Results of the most recent CIDR based studies indicate that for a fixed-timed AI protocol the CO-Synch+CIDR protocol yields the most impressive pregnancy rates for a fixed-time AI protocol, whereas the Select Synch+CIDR & TAI treatment yields the best overall pregnancy rates. Similarly, heifers can be synchronized effectively with GnRH, PG, and a CIDR. The Select Synch+CIDR protocol most frequently yields the greatest pregnancy rates and provides a reliable alternative to an MGA/PGF. In addition, a fixed-time AI CIDR-based estrus synchronization protocol has been developed to inseminate both suckled beef cows and replacement heifers with acceptable pregnancy rates.

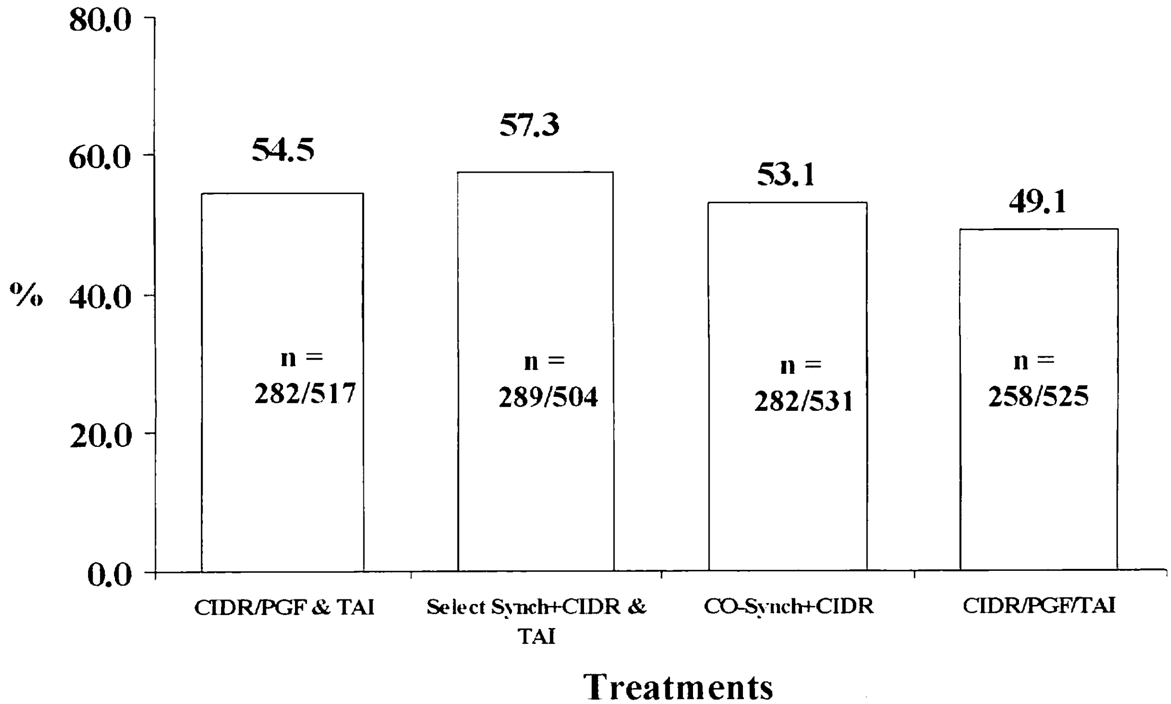


Figure 5. First service pregnancy rates in heifers after receiving one of four CIDR treatments (Larson et al., 2004).

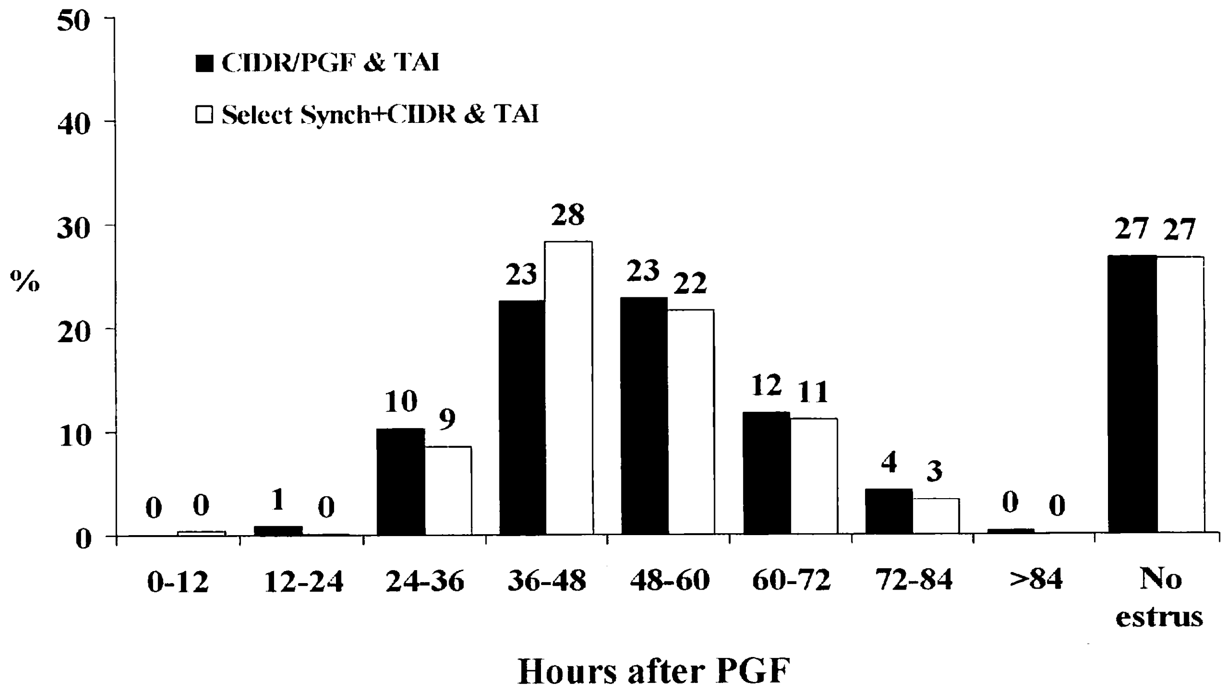


Figure 6. Percentage of heifers treated with CIDR/ PGF or Select Synch+CIDR & TAI that were observed in estrus, separated by hours from PG injection to AI (Larson et al., 2004b).

Literature Cited

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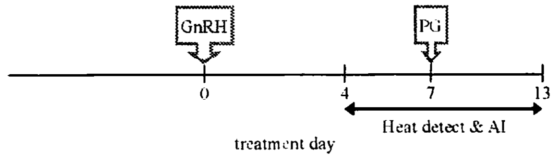
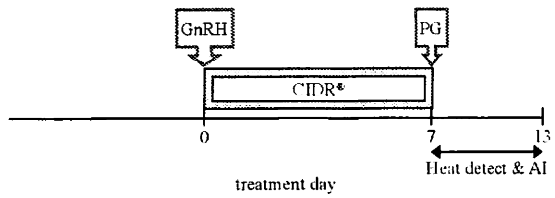
BEEF COW PROTOCOLS

HEAT DETECTION

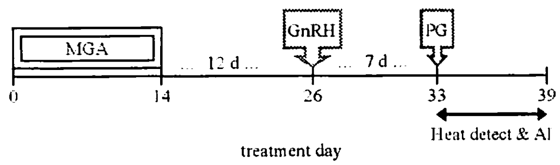
Select Synch



Select Synch + CIDR®



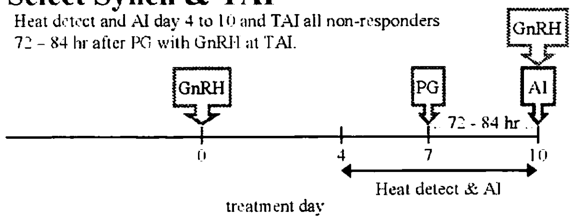
MGA® Select



HEAT DETECT & TIME AI (TAI)

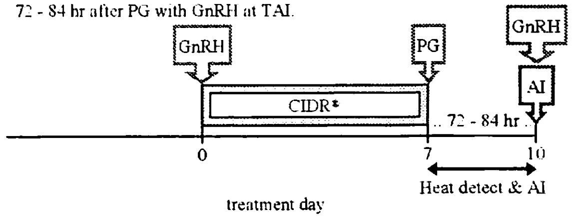
Select Synch & TAI

Heat detect and AI day 4 to 10 and TAI all non-responders 72 - 84 hr after PG with GnRH at TAI.



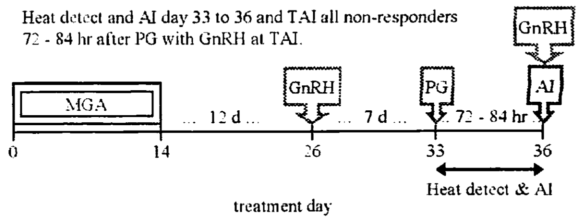
Select Synch + CIDR® & TAI

Heat detect and AI day 7 to 10 and TAI all non-responders 72 - 84 hr after PG with GnRH at TAI.



MGA® Select & TAI

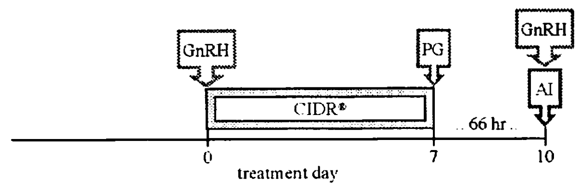
Heat detect and AI day 33 to 36 and TAI all non-responders 72 - 84 hr after PG with GnRH at TAI.



FIXED-TIME AI (TAI)

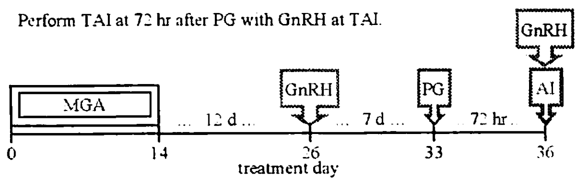
CO-Synch + CIDR®

Perform TAI at 66 hr after PG with GnRH at TAI.



MGA® Select

Perform TAI at 72 hr after PG with GnRH at TAI.



COMPARISON OF PROTOCOLS FOR BEEF COWS		
HEAT DETECTION	**COST**	**LABOR**
Select Synch	Low	Medium/High
Select Synch + CIDR®	High	Medium
MGA® Select	Medium	Medium/High
HEAT DETECT & TAI		
Select Synch (TAI non-responders 72-84 hr after PG)	Low	Medium/High
Select Synch + CIDR® (TAI non-responders 72-84 hr after PG)	High	Medium
MGA® Select (TAI non-responders 72-84 hr after PG)	Medium	Medium/High
FIXED-TIME AI (TAI)		
CO-Synch + CIDR® (TAI at 66 hr after PG with GnRH at TAI)	High	Medium
MGA® Select (TAI at 72 hr after PG with GnRH at TAI)	Medium	High

• The times listed for "Fixed-time AI" should be considered as the approximate average time of insemination. This should be based on the number of cows to inseminate, labor, and facilities.

Cystorelin®, Factrel®, Fertagyl®, OvaCyst®

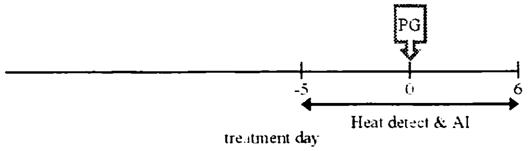
Estrumate®, In-Synch®, Lutalyse®, ProstaMate®

D.J. Schafer and D.J. Patterson
Division of Animal Sciences - University of Missouri - Columbia
These protocols are recommended by the North Central Region Bovine Reproduction Task Force.

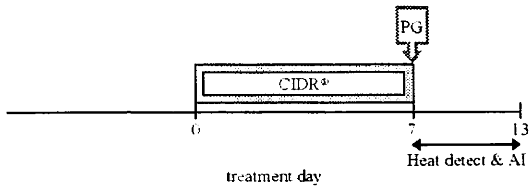
BEEF HEIFER PROTOCOLS

HEAT DETECTION

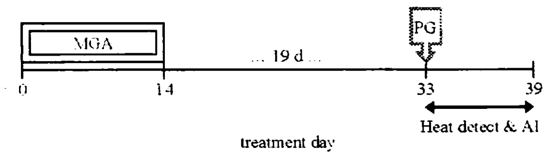
1 Shot PG



CIDR®-PG



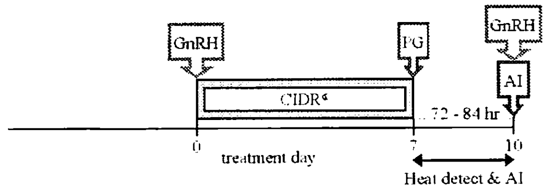
MGA®-PG



HEAT DETECT & TIME AI (TAI)

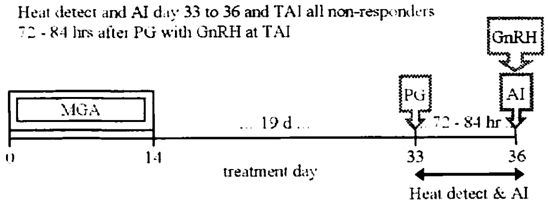
Select Synch + CIDR® & TAI

Heat detect and AI day 7 to 10 and TAI all non-responders 72 - 84 hr after PG with GnRH at TAI.



MGA®-PG & TAI

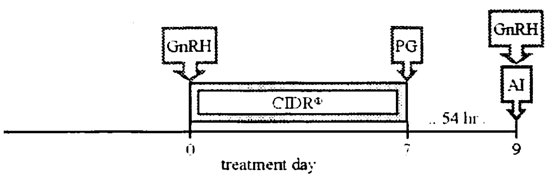
Heat detect and AI day 33 to 36 and TAI all non-responders 72 - 84 hrs after PG with GnRH at TAI



FIXED-TIME AI (TAI)

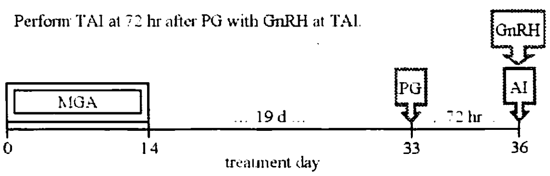
CO-Synch + CIDR®

Perform TAI at 54 hr after PG with GnRH at TAI.



MGA®-PG

Perform TAI at 72 hr after PG with GnRH at TAI.



D.J. Schafer and D.J. Patterson
Division of Animal Sciences - University of Missouri – Columbia
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COMPARISON OF PROTOCOLS FOR BEEF HEIFERS

HEAT DETECTION	COST	LABOR
1 Shot PG	Low	High
CIDR®-PG	Medium	Medium
MGA®-PG	Low	Low/Medium
HEAT DETECT & TAI		
Select Synch + CIDR® (TAI non-responders 72-84 hr after PG)	High	Medium
MGA®-PG (TAI non-responders 72-84 hr after PG)	Medium	Medium
FIXED-TIME AI (TAI)		
CO-Synch + CIDR® (TAI at 54 hr after PG with GnRH at TAI)	High	Medium
MGA®-PG (TAI at 72 hr after PG with GnRH at TAI)	Medium	Medium

• The times listed for "Fixed-time AI" should be considered as the approximate average time of insemination. This should be based on the number of heifers to inseminate, labor, and facilities.

Cystorelin®, Factrel®, Fertagyl®, OvaCyst®

Estrumate®, In-Synch®, Lutalyse®, ProstaMate®