SYNCHRONIZING ESTROUS IN BEEF CATTLE

Lesson 4

Introduction

Synchronization of estrus contributes to optimizing the use of time, labor, and financial resources by shortening the calving season, in addition to increasing the uniformity of the calf crop. The major limitation of estrus-synchronization programs is their inability to induce a potentially fertile estrus and ovulation in noncycling cattle (i.e., prepubertal heifers and anestrous suckling cattle). Because initial estrus-synchronization programs were not designed for successful treatment of noncycling cattle, their use in cow-calf operations generally has not produced results that would encourage greater A.I. use in beef cattle. Currently, less than 7% of beef cows and an estimated 8 to 10% of beef heifers are A.I.-bred in the U.S. The potential for increasing A.I. in beef cattle is great if a system can resolve successfully the problem of the noncycling female at the beginning of the breeding season.

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 $F_{2\alpha}$ [$PGF_{2\alpha}$]), 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 A.I. after a detected estrus or a timed-A.I. Table 1 summarizes common products available for use in cattle estrus synchronization systems.

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	
	Prostamate®	i.m. injection	
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

Initial estrous synchronization systems focused on altering the estrous cycle by regressing the CL with an injection of $PGF_{2\alpha}$ followed by a detected estrus between 18 and 80 hours after the injection. After systems involving a single injection of $PGF_{2\alpha}$ became successful, researchers focused on multiple injections of $PGF_{2\alpha}$ to further reduce the days required for heat detection and AI. 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. A new progestin, the CIDR, was approved by the FDA for use in 2002. These proceedings will focus on using the CIDR to synchronize estrous in postpartum suckled beef cows and replacement heifers.

Management

The single greatest reason for the failure of a synchronization program is due to poor management. In other words, use synchronization to enhance the profitability of a well-managed operation; don't use synchronization to obtain a well-managed operation!! There are several management factors to consider before deciding whether synchronization will work in your operation.

Nutrition. When focusing on any reproductive management program, nutrition is the single most important factor that could dictate the success or failure of that program. The body condition that cows calve at determines the rate at which those cows initiate their estrous cycles after calving. Therefore, it is essential to ensure that cows calve at a body condition score of 5. Waiting until after calving to feed your cows extra feed is usually too late. To give a synchronization system a chance to work for you, ensure that cows are in good condition at calving and this will give more cows an opportunity to cycle by the beginning of the breeding season. Briefly, between 25 and 70% of beef females in most herds have not yet started their estrous cycles by the start of the breeding season. A solid precalving nutrition plan can reduce the number of anestrus cows and allow synchronization to work in your favor.

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 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.

Estrous Synchronization Systems

There are many estrous synchronization systems that have been developed. These systems are diagramed on Figures 1 ($PGF_{2\alpha}$ and GnRH based protocols for cows), 2 (MGA protocols for cows), 3 (CIDR protocols for cows), and 4 (most effective protocols for heifers).

Systems utilizing $PGF_{2\alpha}$ were basically the initial systems developed and continue to be used effectively to synchronize females that have attained puberty or initiated their postpartum estrous cycles. The primary advantage of $PGF_{2\alpha}$ are cost; however, the disadvantage is that $PGF_{2\alpha}$ does not initiate estrous cycles in cows that are not cycling. Therefore, if your cows are anestrus $PGF_{2\alpha}$ in a system alone will not benefit your program.

The MGA systems continue to be the most effective synchronization system for beef heifers, especially if cost is an issue. Newer systems (7-11 Synch and MGA Select Synch) have been developed with great success in cows. If producers are prepared to detect heat, success is usually high using these systems. Of added importance is the opportunity to "kick-start" or trigger heifers to start cycling that have failed to reach puberty yet. Unfortunately, the duration of these treatments is over a long period of time (18 to 33 days); therefore, preparation needs to be initiated earlier than most systems. An additional disadvantage of is that females need to receive MGA in feed; this area of the program is often where many failures occur. Furthermore, using MGA in a timed-insemination protocol does not appear to be effective.

GnRH systems are fairly new to beef cattle estrous synchronization. However they have given us the added benefit of synchronizing follicular waves. Systems involving GnRH are shorter than MGA systems and are very effective for cows. These systems are not recommended for heifers over the MGA systems, because they tend to be less effective. However, if a producer decides to use a GnRH system with heifers, they should first consult a reproductive specialist. GnRH effectively initiates estrous cycles in postpartum cows that are not cycling. Without a progestin as many as 5-20% of cows may exhibit estrus at least three days before the $PGF_{2\alpha}$ injection so insemination of these cows will improve overall response. For cows that are inseminated before the $PGF_{2\alpha}$ injection, there is no need to inject those cows with $PGF_{2\alpha}$ on day 0.

Until recently researchers primarily have focused on the timing of estrus; however, the availability of GnRH has given researchers an opportunity to aim their efforts at timing ovulation rather than the event of estrus alone. The obvious advantage is the development of time-A.I. protocols allowing cattlemen to inseminate cows that have no visible signs of estrus. These efforts should optimize the use of time, labor, and financial resources and allow more cattle to become pregnant to A.I. The most common protocol in beef cows is CO-Synch. In beef cattle operations that are fairly extensive, or would like to incorporate an AI program into their operation, and feel that labor and time associated with heat detection are limiting opportunities for AI use, then using the CO-Synch protocol is a good option. CO-Synch was modified from Ovsynch to reduce the total number of times the cows were to be processed. Even so, pregnancy rates around 50% can be consistently achieved in well-managed herds that use this system. Or a producer can use the benefits of Select Synch and CO-Synch, Hybrid Synch maximizes the opportunity for obtaining the greatest overall pregnancy rates. Detection of estrus for two to three days followed by a fixed-time A.I. should increase overall pregnancy rates. As with Select Synch, estrus detection at least three days before the $PGF_{2\alpha}$ injection and inseminating cows then will increase the heat detection rate by between 5 and 20%.

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.

During the seven days of CIDR insertion, progesterone diffusion from the CIDR does not affect spontaneous luteolysis. Assuming all beef heifers and 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 $PGF_{2\alpha}$. Although most research data indicates that only about 90% of corpora lutea in heifers and cows more than six days after ovulation regress promptly to an injection $PGF_{2\alpha}$, only about 60% of the females will have corpora lutea at the time of $PGF_{2\alpha}$ 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/$PGF_{2\alpha}$ 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 puberty and cyclicity. Table 3 reports that efficacy of the CIDR in the study conducted by Lucy et al. (2001).

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. Some of the published data will be reviewed, although it should be noted that these results are preliminary and it is unlikely that the best way to utilize CIDRs has yet to be established.

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. The CIDR was inserted at the time of the first injection of GnRH and removed at the time of the injection of $PGF_{2\alpha}$. 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 $PGF_{2\alpha}$ treatment, which may explain why there was not a positive effect at each location.

Definition of Estrous Synchronization Systems

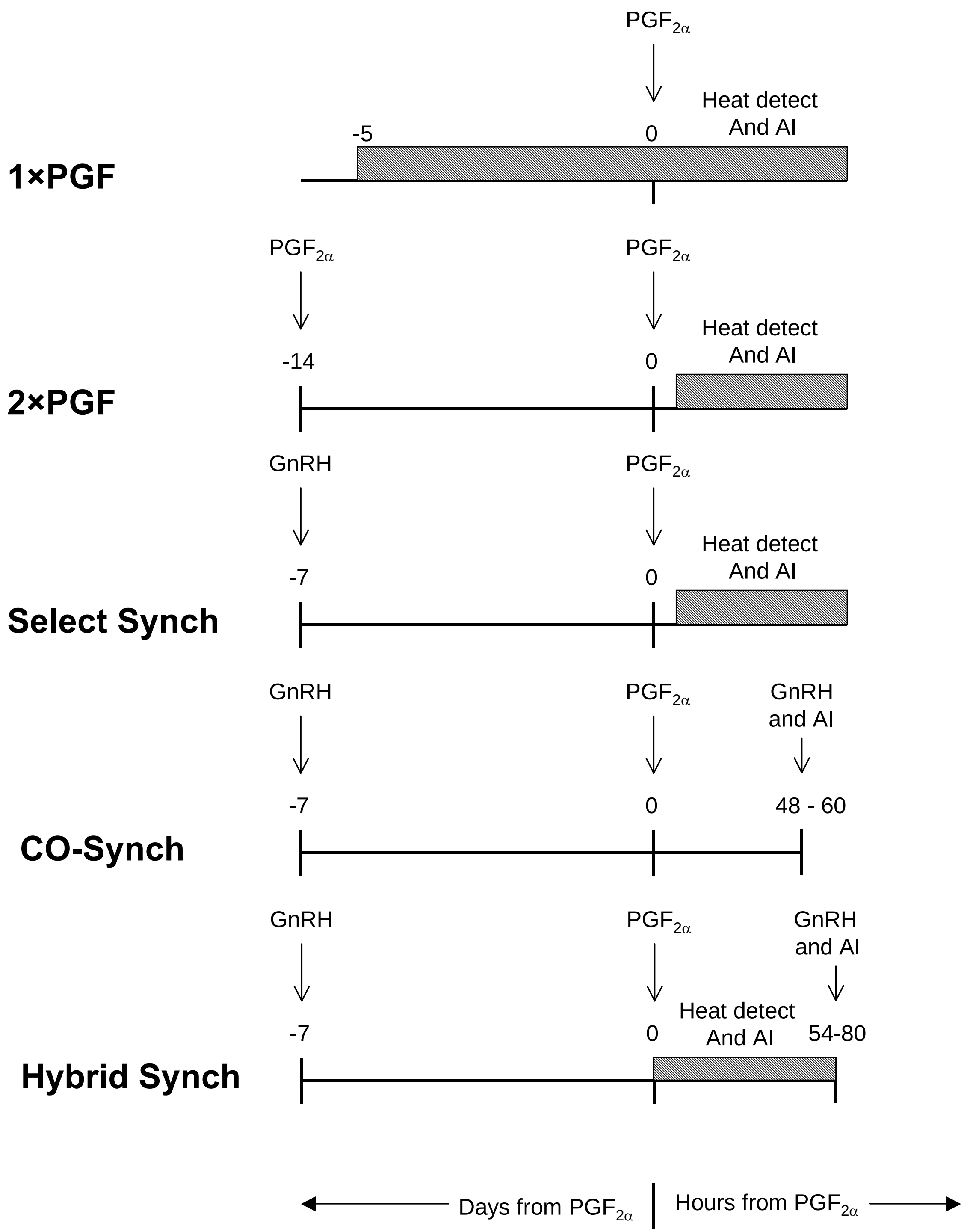

Figure 1. Estrous synchronization protocols using $PGF_{2\alpha}$ and GnRH for cows.

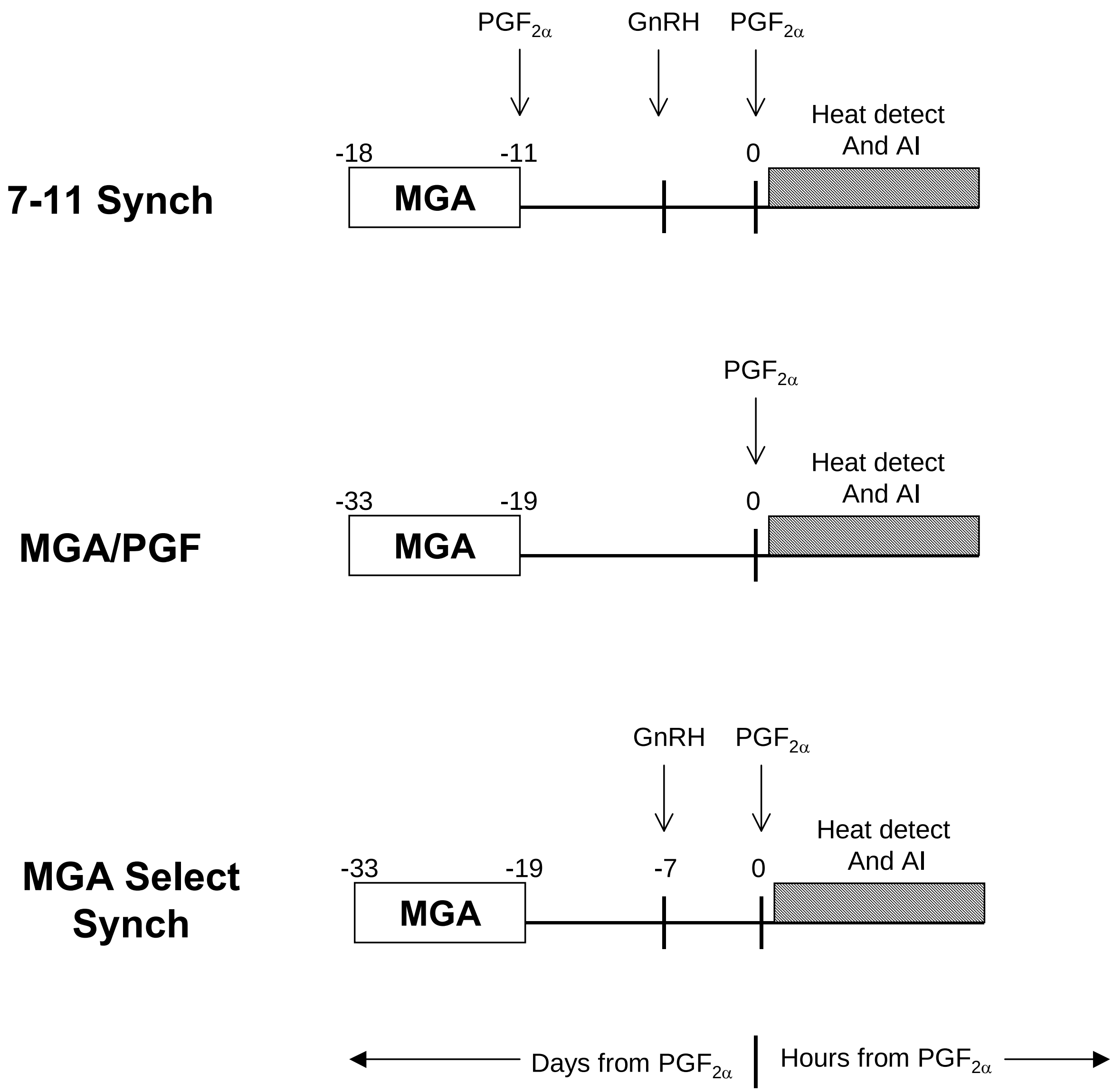

Figure 2. Estrous synchronization protocols using MGA for cows.

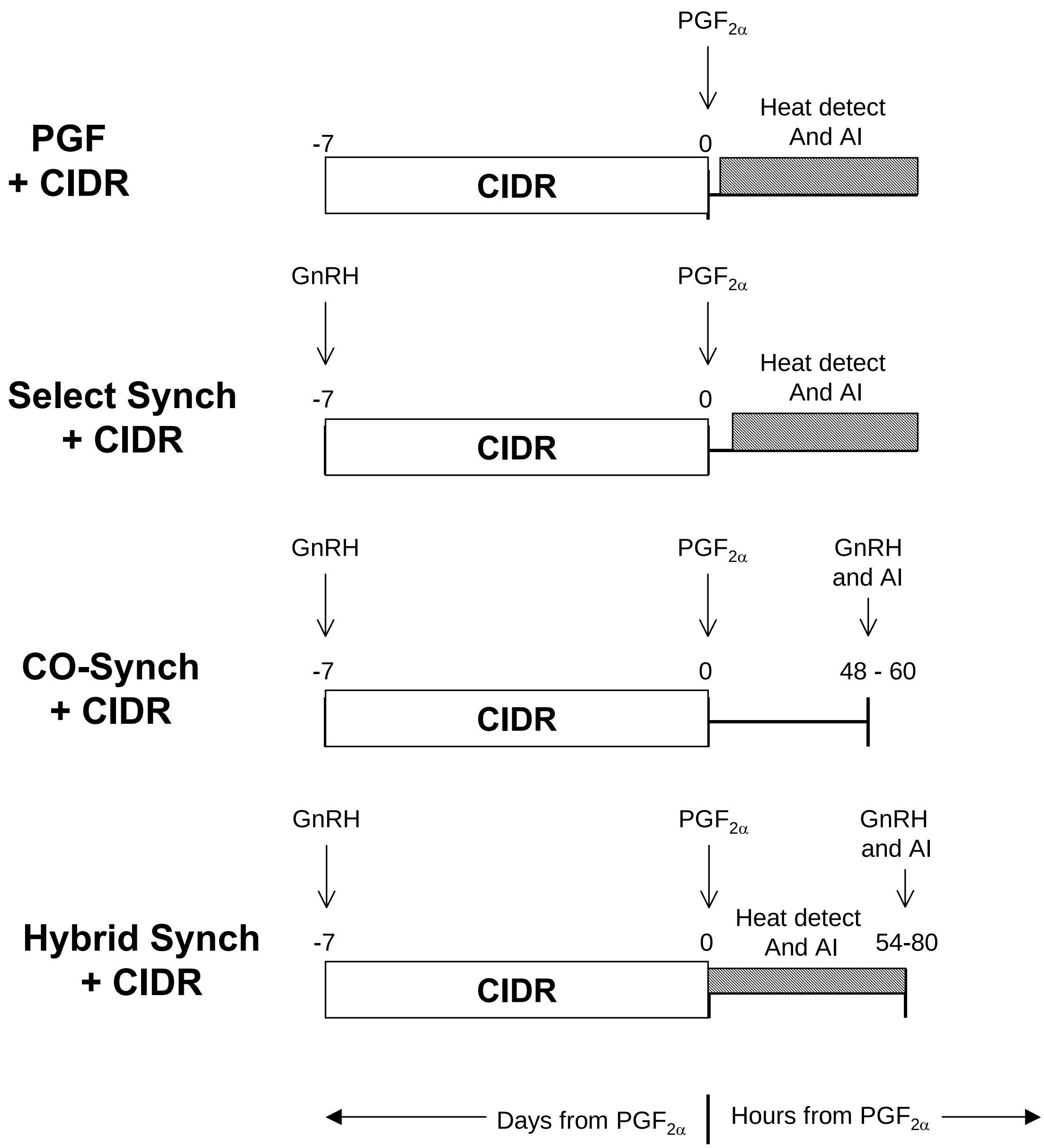

Figure 3. Estrous synchronization protocols using the CIDR for cows.

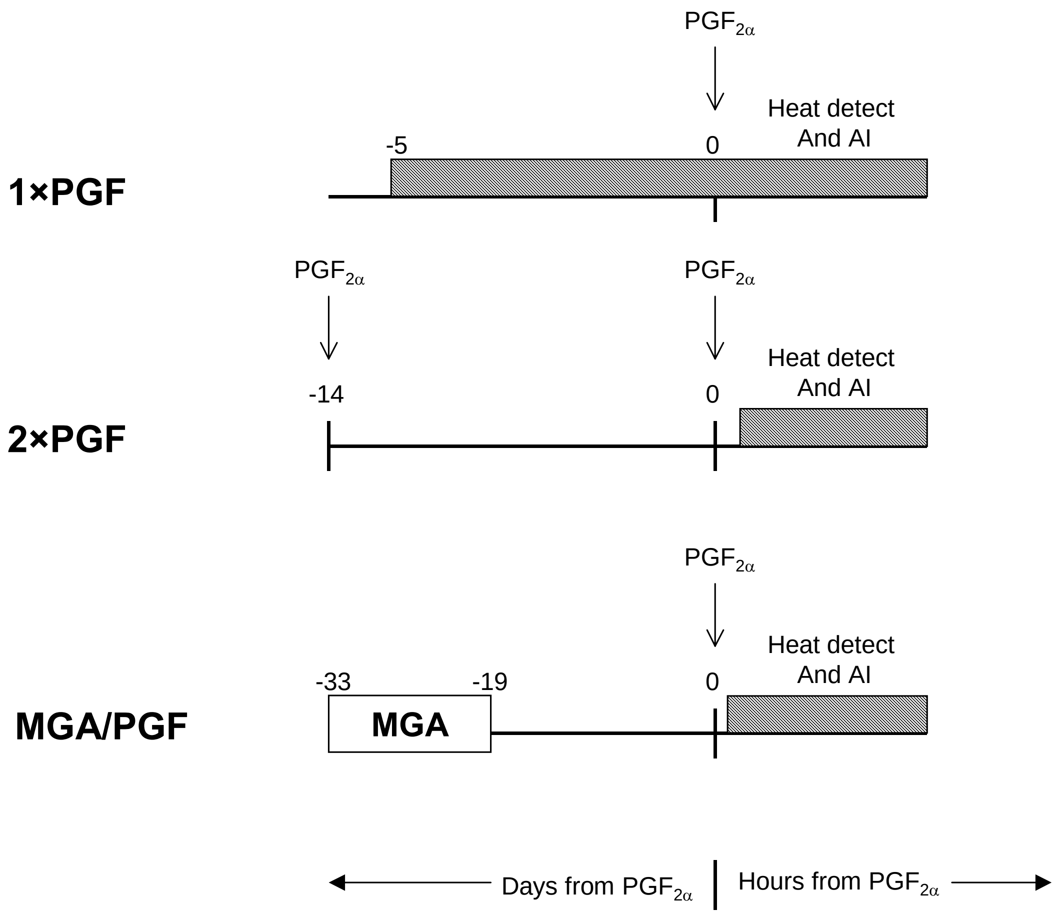

Figure 4. Estrous synchronization protocols for heifers.

Focus on Beef Cows

Table 2 summarizes the conception and pregnancy rates of numerous reports evaluating GnRH based synchronization systems. Thompson et al. (1999) scanned the ovaries of 40 early postpartum, suckled beef cows before, during, and after treatments of GnRH and (or) norgestomet and reported that luteal structures were induced from dominant follicles in 75% of the noncycling cows treated, resulting in elevated progesterone after 7 d. In contrast, Stevenson et al. (2000) reported that the rates of induced ovulation for noncycling cows treated with Select Synch were 38% and 49% in two experiments.

Table 2. Fertility rates in suckled beef cows treated with GnRH protocols

Reference and treatment description	No. of cows	Conception rate[a], %	Pregnancy rate[b], %
Geary et al., 1998			
Ovsynch + calf removal	220	-	119/220 (54)
Syncromate-B	216	-	91/216 (42)
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 × $PGF_{2\alpha}$	294	86/142 (61)	86/294 (28)
Exp. 3			
Select Synch	184	80/115 (70)	80/184 (44)
CO-Synch	175	-	58/175 (33)
Hybrid Synch	177	60/177 (34)	60/184 (34)
Dejarnette et al., 2001			
Exp. 1			
Select Synch (6 day interval)	24	17/22 (77)	17/24 (71)
Select Synch (7 day interval)	27	19/25 (76)	19/27 (70)
Dejarnette et al., 2001			
Exp. 1			
Hybrid Synch (72h)	45	15/20 (75)	20/45 (71)
Hybrid Synch (72h)+ GnRH on d-16	42	19/24 (79)	23/42 (55)
Exp. 2			
Hybrid Synch (72h)	638	278/467 (60)	299/632 (47)
Hybrid Synch (72h)+ GnRH on d-16	638	287/447 (64)	333/634 (53)
Greiger et al., 2001			
Select Synch + horn bred	118	47/64 (73)	47/118 (40)
Select Synch + body bred	119	46/66 (70)	46/119 (39)
CO-Synch + horn bred	108	-	45/108 (42)
CO-Synch + body bred	115	-	61/115 (53)
Geary et al., 2001			
Ovsynch	123	-	64/123 (52)
Ovsynch + calf removal	114	-	70/114 (61)
CO-Synch	117	-	63/117 (54)
CO-Synch + calf removal	119	-	75/119 (63)
Geary et al., 2001			
CO-Synch (GnRH)	117	-	57/117 (49)
CO-Synch (GnRH) + calf removal	121	-	56/121 (46)
CO-Synch (hCG)	114	-	39/114 (34)
CO-Synch (hCG) + calf removal	115	-	40/115 (35)

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

Response of ovaries to GnRH is dependent on the stage of follicular growth that GnRH is administered (Geary et al., 2000). A high percentage of cows during the later stages of their estrous cycle (d 15 to 17) failed to ovulate a follicle after administration of GnRH and exhibited estrus prior to an injection of $PGF_{2\alpha}$ (Geary et al., 2000). In addition, Moreira et al. (2000) observed that day of the estrous cycle in which the Ovsynch protocol was initiated in dairy heifers affected dynamics of follicular development, plasma progesterone profiles, and occurrence of premature ovulation. We (Lamb et al., 2001) determined that when treatments were initiated (d -7), 99 of 333 cows (29.7%) considered to be cycling subsequently had low concentrations of progesterone on d 0. In this class of cows treated by Cosynch, 43.3% (26/60) were pregnant after AI.

Of the estrus or ovulation synchronization protocols currently used for suckled beef cows, CO-Synch tends to be more cost effective and less labor intensive than other timed-AI synchronization protocols (Twagiramungu et al., 1995; Geary et al., 2001; Kojima et al., 2000). A disadvantage of this protocol is that approximately 10 to 20% of suckled beef cows exhibit estrus prior to and immediately after the $PGF_{2\alpha}$ injection. Unless these cows are detected in estrus and inseminated, they will fail to become pregnant after the CO-Synch protocol.

Table 3. Fertility rates in suckled beef cows treated with CIDR protocols

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 × $PGF_{2\alpha}$	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)
Lucy et al., 2001			
Control - anestrous	151	6/16 (38)	6/151 (4)
Control - cyclic	134	15/26 (58)	15/134 (11)
$PGF_{2\alpha}$ **- anestrous**	154	17/30 (57)	17/154 (11)
$PGF_{2\alpha}$ **- cyclic**	129	44/63 (70)	44/129 (34)
$PGF_{2\alpha}$ **+CIDR - anestrous**	141	36/63 (57)	36/141 (26)
$PGF_{2\alpha}$ **+CIDR - 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.

When suckled beef cows were assigned randomly in replicates to one of three groups (Table 3; Lucy et al., 2001): 1) untreated controls, 2) a single intramuscular (IM) injection of 25 mg $PGF_{2\alpha}$ ($PGF_{2\alpha}$ alone), or 3) administration of a CIDR insert for 7 d with an IM administration of $PGF_{2\alpha}$ on day 6 of the 7 d CIDR insert administration period (CIDR + $PGF_{2\alpha}$) no differences were detected between the CIDR + $PGF_{2\alpha}$ 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 + $PGF_{2\alpha}$ group than in either the $PGF_{2\alpha}$ alone or the control group. No differences were detected in PR to first services during the 31 d AI period between the CIDR + $PGF_{2\alpha}$ and either the $PGF_{2\alpha}$ alone or the control group. Among the 298 cows administered CIDR inserts, 12 (4.0%) cows lost their insert before the scheduled day of removal. No adverse health events were noted for cows administered CIDR inserts.

Comparison of the CO-Synch and CO-Synch with a CIDR insert from day –7 to day 0 treatments indicated that addition of a CIDR for progesterone supplementation improved pregnancy rates after a fixed time AI (Table 3; Lamb et al., 2001). But progesterone did not seem to improve pregnancy rates in suckled beef cows cycling at the initiation of treatments. Progesterone seemed to be more effective by enhancing pregnancy rates in cows that were cycling but in the later stages of the estrous cycle or anestrous cows at first injection of GnRH and subsequently no luteal structure at the $PGF_{2\alpha}$ injection or in noncycling cows. Along with parity, days postpartum, calf removal, and cow condition 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. Therefore, a sound strategy for utilizing a GnRH protocol in the absence of progesterone may be to select cows that calved earlier in the calving season that tend to be in good body condition. A high percentage of these cows should be cycling, resulting in acceptable fertility rates. Cows that calved late in the calving season that have poor body condition and may be first calving cows may be good candidates for a CIDR (Table 4).

Table 4. Pregnancy rates in suckled beef cows after treatment with Cosynch or Cosynch+P

Item	Treatment[a] 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 ($P < .05$).

Focus on Beef Heifers

Heifers are an easier group of females to synchronize within a beef herd. Because heifers are not nursing calves and can be maintained in areas where they can be fed they have responded extremely well to the MGA/$PGF_{2\alpha}$ 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 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.

Table 5. Occurrence of Estrus Before, During, and After the Target Breeding Week (days 0 to 7; day 0 = $PGF_{2\alpha}$; Stevenson et al., 1999).

	Treatment		
Item	$2\times PGF_{2\alpha}$	$MGA+PGF_{2\alpha}$	Select Synch
No. of heifers	139	289	160
	------------ % (no.) -------------		
Before: days -5 to -1	8.6 (12)	5.9 (17)	12.5 (20)
During: days 0 to 7	74.8 (104)	82.0 (237)	72.5 (116)
(Average days to estrus)	(3.0 ± .1)	(3.2 ± .1)	(2.3 ± .1)
After: >day 7	8.6 (12)	8.3 (24)	8.7 (14)
No estrus	7.9 (11)	3.8 (11)	6.2 (10)

More recently researchers have incorporated gonadotropin-releasing hormone into (GnRH) estrus synchronization systems, which can induce preovulatory LH surges in prepubertal heifers (Skaggs et al., 1986) and consistently induce ovulation of large follicles (≥ 10 mm) present at the time of injection (Thompson et al., 1999; Wood et al., 2001). The majority of these systems have relied on visual detection of estrus for suitable results (Cassady et al., 1999; Stevenson et al., 1999). In most cases heifers have failed to achieve the fertility rates in a GnRH protocol that equals the fertility of the standard MGA/PGF system. In addition, synchrony of estrus after $PGF_{2\alpha}$ in an MGA system tends to be tighter with more heifers being artificially inseminated during a shorter period of time than when using a GnRH protocol (Table 5; Stevenson et al., 1999; Funston et al., 2002). Nonetheless, fertility in heifers that are estrus detected and inseminated after a detected estrus does not appear to be compromised over a normal $2 \times PGF_{2\alpha}$ system (Table 6), whereas heifers inseminated after a fixed time with or without an additional injection of GnRH before the CO-Synch protocol appears to have improved fertility over a $2 \times PGF_{2\alpha}$ system, especially in heifers with poorly developed reproductive tracts (Table 7; Dahlen et al., 2001).

Table 6. Rates of Estrus, Conception, and Pregnancy for Heifers Detected during the Target Breeding Week (days 0 to 7; day 0 = $PGF_{2\alpha}$; Stevenson, et al., 1999).

Item	Treatment[1]		
	$2 \times PGF_{2\alpha}$	$MGA+PGF_{2\alpha}$	Select Synch
No. of heifers	139	289	160
Estrus detection[2], %	74.8	82.0	72.5
Conception rate[3], %	69.2	68.2	63.8
Pregnancy rate[4], %	51.8	56.0	46.2

[1] Percent of heifers expressing estrus of all heifers synchronized
[2] Percent of heifers conceiving of heifers inseminated
[3] Percent of heifers pregnant of all heifers synchronized

Table 7. Synchronized Pregnancy rates of heifers synchronized with prostaglandin $F_{2\alpha}$ and GnRH (Dahlen et al., 2001)

Reproductive tract score	Treatment						Overall	
	2 × $PGF_{2\alpha}$ (d –12 and 0)		**CO-Synch (GnRH on d –6)**		**CO-Synch (GnRH on d –12 and –6)**			
	------------------------------no. (%)--------------------------------							
2	0/53	(0)	6/55	**(11)**	**9/53**	**(17)**	**15/161**	$(9)^{p}$
3	12/72	(17)	12/71	(17)	**21/73**	**(29)**	**45/216**	$(21)^{q}$
4	6/38	(16)	17/38	(45)	**12/35**	**(34)**	**35/111**	$(32)^{q}$
5	4/10	(40)	3/8	(38)	**1/8**	**(13)**	8/26	$(31)^{pq}$
Total	22/173	$(13)^{x}$	38/172	$(22)^{y}$	43/169	$(25)^{y}$	103/514	(20)

[a] RTS = Reproductive tract scores.
[p,q] Percentages within a item and column lacking a common superscript differ ($P < 0.01$).
[x,y] Percentages within a row lacking a common superscript differ ($P < 0.05$).

Between 130 and 177 purebred or crossbred European breeds or Brangus peripubertal beef heifers were enrolled at each of five sites (FL, IL, NE, MO, and MT; n = 763; Lucy et al., 2001). The heifers were approximately 1 yr old and were managed in accordance with normal practices at each location. Heifers were randomly assigned to the three treatment groups: 1) untreated controls, 2) a single intramuscular (IM) injection of 25 mg $PGF_{2\alpha}$ ($PGF_{2\alpha}$ alone), or 3) administration of a CIDR insert for 7 d with an IM administration of $PGF_{2\alpha}$ on day 6 of the 7 d CIDR insert administration period (CIDR + $PGF_{2\alpha}$).

The CIDR + $PGF_{2\alpha}$ treatment reduced the interval to first estrus (2 d) compared with either the control (15 d) or $PGF_{2\alpha}$ alone (16 d) treatments (Table 8). Similarly, for heifers that were prepubertal when the study was initiated the CIDR + $PGF_{2\alpha}$ shortened the interval to first estrus (14 d) compared to control (27 d) and $PGF_{2\alpha}$ alone (31 d). The CIDR + $PGF_{2\alpha}$ treatment improved the synchrony of estrus compared with the $PGF_{2\alpha}$ alone, with 60% vs. 25%, of heifers in estrus over 3 d after CIDR inserts were removed.

No differences were detected between the CIDR + $PGF_{2\alpha}$ group and either the $PGF_{2\alpha}$ or control groups for first-service CR during the first 3 d of AI or the entire 31 d AI period (52 to 60%). Significantly more heifers in the CIDR + $PGF_{2\alpha}$ group were pregnant after either 3 d or 7 d of AI than in either the $PGF_{2\alpha}$ alone or control groups. Pregnancy rate to first services during 31 d of AI of heifers administered CIDR + $PGF_{2\alpha}$ was higher than in heifers administered $PGF_{2\alpha}$ alone (47 vs 36%), but did not differ from that of controls (42%). Among the 250 heifers administered CIDR inserts, 27 (10.8%) inserts were lost before the scheduled day of removal, with 17 of the 27 inserts lost at two sites. No adverse health events were noted for heifers administered CIDR inserts.

Table 8. Interval to estrus, synchrony of estrus and fertility of beef heifers following treatment with prostaglandin $F_{2\alpha}$ **($PGF_{2\alpha}$)** or an intravaginal progesterone insert **(CIDR insert)** and an injection of $PGF_{2\alpha}$.

Criterion	Untreated controls (n = 255)[3]	$PGF_{2\alpha}$[1] (n = 257[a])	CIDR insert + $PGF_{2\alpha}$[2] (n=251[a])
Interval[4] to estrus, d (n)			
All heifers	15.0*	16.0*	2.0
Anestrous heifers[5]	27.0** (107)	>31** (101)	14.0 (119)
Estrus d 1-3, %	12**	25**	60
FSCR[6], % (n)			
D 1-3	57 (30)	52 (64)	60 (149)
D 1-31	58 (178)	52 (170)	58 (202)
Pregnancy rate[7], % (n)			
D 1-3	7** (246)	14** (244)	36 (247)
D 1-7	14** (246)	18** (244)	38 (247)
D 1-31	42 (246)	36* (244)	47 (247)

[1]25 mg prostaglandin $F_{2\alpha}$
[2]CIDR insert administered intravaginally for 7 days with $PGF_{2\alpha}$ administered on day 6.
[3] Number initially assigned.
[4] Median interval in days from removal of CIDR inserts.
[5] Anestrous cows (number of heifers).
[6] First-service conception rate (number of heifers).
[7] First-service pregnancy rate (number of heifers).
* Different from CIDR + $PGF_{2\alpha}$, $P < 0.05$.
** Different from CIDR + $PGF_{2\alpha}$, $P \leq 0.01$.

Summary and Implications

Most beef herds in the mid-western United States initiate the breeding season with between 25 and 70% of their cows in an anestrus state. For most AI programs to work, a sound nutrition program is essential to ensure a high percentage of cows are cycling. Synchronization does decrease the labor associated with AI programs; additional benefits include a shorter breeding season and consequently a shorter calving season. In essence, the value of progeny is greater due to a more uniform calf crop and more older calves at weaning. To achieve optimal pregnancy rates with any synchronization protocol, cows should be in good body condition (BCS $\geq$5) and treatments should be initiated only when cows are at least 50 days postpartum.

Synchronization can be an effective tool for enhancing beef cattle reproductive management techniques. For producers interested in utilizing synchronization in their operations, be sure to understand the pros and cons of each system and consult with a reproductive specialist who can specifically answer questions that you may have.

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Lesson 4 Quiz Synchronizing Estrous In Beef Cattle

1. For estrous synchronization to be effective, what four areas of management should a producer focus on prior to synchronizing their cows?

2. What are two product names for prostaglandins ($PGF_{2\alpha}$)?

3. What are to product names for GnRH?

4. What is an advantage and a disadvantage of feeding MGA?

   Advantage –

   Disadvantage –

5. What is an advantage and a disadvantage of using a CIDR?

   Advantage –

   Disadvantage –

6. Which is the best estrous synchronization system for synchronizing heifers?

7. True or False Removing calves for 48 hrs improves pregnancy rates in a CO-Synch system?

8. True or False A fixed-time AI results in better pregnancy rates that an estrous detection system?

9. True or False The CIDR is a better progestin for synchronizing heifers?

10. True or False Body condition score and days postpartum do not play a role in response to estrous synchronization?

Please list any questions you may have that weren't answered in this lesson:

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Name ____Phone__________________________

Address____

(Optional) Fax_________________________E-mail______________________________________

Lesson 4 Quiz Answers Synchronizing Estrous In Beef Cattle

1. For estrous synchronization to be effective, what four areas of management should a producer focus on prior to synchronizing their cows?

   Nutrition, Records, Facilities, Labor

2. What are two product names for prostaglandins ($PGF_{2\alpha}$)?

   Lutalyse, Prostamate, Estrumate

3. What are to product names for GnRH?

   Cystorelin, Fertagyl, Factrel

4. What is an advantage and a disadvantage of feeding MGA?

   Advantage – cost, kick-starts cows and heifers
   Disadvantage – feeding the MGA, length of the system, not great for timed-AI

5. What is an advantage and a disadvantage of using a CIDR?

   Advantage – works for timed-AI, easy to apply, kick-starts cows
   Disadvantage – cost, need facilities, vaginal infections, not great for heifers

6. Which is the best estrous synchronization system for synchronizing heifers?

   MGA/PGF

7. ***<u>True</u>*** or False Removing calves for 48 hrs improves pregnancy rates in a CO-Synch system? ***True***

8. ***<u>True</u>*** or False A fixed-time AI results in better pregnancy rates that an estrous detection system? ***True***

9. True or ***<u>False</u>*** The CIDR is a better progestin for synchronizing heifers? ***False***

10. True or ***<u>False</u>*** Body condition score and days postpartum do not play a role in response to estrous synchronization? ***False***