

## **ESTRUS SYNCHRONIZATION SYSTEMS - COWS**

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### **Introduction**

Few beef producers would disagree that the genetic potential available for use in their herds via artificial insemination is greater than that of most natural service sires. However, less than 10% of the beef cows in the United States are artificially inseminated each year (NAHMS, 2000). Many reasons exist for the low rate of implementation of estrus synchronization and AI (ESAI) into beef cow-calf operations. One reason is the extensive nature of beef production. Most cows are pastured in large acreages and the labor necessary for handling the cows is too great. Additionally, many producers lack adequate facilities to enable safe and easy cattle handling. Beef production is a minor enterprise on many farms. The income from the beef enterprise in most small and medium-sized operations is secondary to other enterprises or to off-farm income. Perhaps the main limitation to incorporation of ESAI is that the first ESAI systems were variable and often the success was limited.

Many new systems for controlling the expression of a fertile estrus have been developed in recent years. Beef cow-calf producers have numerous ESAI protocols at their disposal. Many of these protocols can result in acceptable pregnancy rates but vary in cost, effectiveness, and implementation. To determine the appropriate system, producers need to consider several factors: 1) proportion of cows that are anestrus and the calving distribution, 2) available labor, skill, expertise, and facilities for accurate detection of estrus and stress-free handling of cattle, 3) cost of synchronization treatment, 4) value of semen, 5) availability of AI technician, and 6) acceptable level of success. Each of these factors will affect the choice of estrus synchronization protocol. A major consideration affecting the system of choice is labor availability for estrus detection and AI. Systems are available that require complete, limited, or no estrous detection (fixed-time inseminations or TAI).

### **ESAI Systems That Require Estrous Detection**

#### *Select Synch*

Select Synch is an outstanding protocol for synchronization of estrus in postpartum beef cows. Select Synch begins with an injection of gonadotropin-releasing hormone (GnRH; 100 µg) followed by treatment with prostaglandin<sub>F<sub>2α</sub></sub> (PG) 7 days later (Fig. 1). Estrous detection must begin 4 days prior to the injection of PG and continue for 5 days after

treatment. Cows exhibit estrus before PG treatment because GnRH does not synchronize follicle growth in cows on Day 14-16 of the cycle (Geary et al., 2000) and the CL induced by GnRH treatment may regress early in some anestrous cows (Stevenson et al., 2000). Approximately 10-15% (range 0-25%) of cows can express estrus before the PG treatment (Geary et al., 2000). A typical distribution of estrus in postpartum cows treated with Select Synch is shown in Figure 2.

Synchronization of estrus using the Select Synch Protocol results in excellent reproductive performance in postpartum beef cows (Fig. 3). Approximately 85% of cows treated will be observed in estrus (submission rate), conception rate is normal, and AI pregnancy rates typically range from 40-60% (Stevenson et al., 2000; DeJarnette et al., 2001). In large field trials (n = 4,766), Select Synch was used in well managed, multiparous cows at least 45 days postpartum and resulted in AI pregnancy rates of 77% (J. M. DeJarnette and R. A. Wallace, Select Sires, Inc., unpublished data). Obviously, Select Synch can be an effective system to synchronize a fertile estrus in postpartum beef cows. However, the effectiveness of Select Synch decreases as the proportion of cows that are anestrous at beginning of treatment increases (Stevenson et al., 2003a). Although Select Synch improves the reproductive performance of anestrous cows compared to a 2-treatment PG protocol, the AI pregnancy rates are not acceptable (20-30%; Stevenson et al., 2000).

*Select Synch should be used for ESAI if:*

1. A large proportion of the cows are cyclic before treatment. If cows are well managed (BCS > 5), the herd consists of few, if any, young cows, and the cows are at least 45 days postpartum, use of Select Synch will result in high pregnancy rates to AI.
2. Facilities and labor are available for daily estrous detection and cattle handling for at least 10 days.
3. Technician is available twice daily for 10 days.
4. Value of the semen is high. When the value of the semen is high, conception rate must be maximized. Using Select Synch, only cows that are observed in estrus are inseminated which maximizes conception rate.
5. Minimize costs of estrus synchronization treatment.

### **Problem with Anestrous Cows**

The major limitation for use of Select Synch is the proportion of cows that are anestrous at the beginning of treatment. Typically, anestrous cows make up at least 50% of the herd at the beginning of the breeding season (Stevenson et al., 2003a). Reproductive performance of anestrous cows can be improved if a progestin (progesterone-like compound) is incorporated into the Select Synch protocol (Stevenson et al., 2003b). Two progestins are available for use; melengestrol acetate (MGA) and progesterone via the EAZI-BREED™ CIDR® cattle inserts (termed CIDR; Phizer, Inc.). Progesterone delivered using a CIDR induces estrus in more anestrous cows than feeding MGA (Perry et al., 2004). Insertion of a CIDR from the day GnRH is administered to injection of PG (Fig. 1) improves reproductive performance of postpartum anestrous cows (Fig. 4; Lamb et al., 2001;

Stevenson et al., 2003b). Another benefit of insertion of a CIDR is that expression of estrus before the PG injection is inhibited.

*Select Synch + CIDR should be used for ESAI if:*

1. A large proportion of the cows are anestrous before treatment. If cows are a little thinner (BCS 4-5), the herd consists of several young cows, and many of the cows are less than 45 days postpartum use Select Synch + CIDR.
2. Facilities and labor are available for daily estrous detection and cattle handling for at least 5 days.
3. Technician is available twice daily for at least 5 days.
4. Value of the semen is moderate to high. When the value of the semen is high, conception rate must be maximized. Incorporating a CIDR with Select Synch will improve the overall submission rate. Since conception rate is unaffected, more cows conceive to AI.
5. Higher AI pregnancy rates are more important to the producer than the higher costs of the estrus synchronization protocol.

### **ESAI Systems With Limited or No Estrous Detection**

*Co Synch + CIDR and Select Synch + CIDR & TAI*

Many beef producers have neither the time nor the available labor for adequate estrous detection and the cattle handling necessary for Select Synch. Also, the availability of quality AI technician is often limited. Thus, many producers desire protocols in which estrous detection is limited (2-3 days) or cows are artificially inseminated at a fixed time (TAI). Co Synch + CIDR and Select Synch + CIDR & TAI were protocols developed to reduce the number of days of estrous detection. Both Co Synch + CIDR and Select Synch + CIDR & TAI begin with an injection of GnRH (100 µg) and insertion of a CIDR followed 7 days later by treatment with PG and removal of the CIDR insert (Fig. 5 & 6).

Producers that want to maximize AI pregnancy rates with limited estrous detection need to use Select Synch + CIDR & TAI. In this system, cows are observed for estrus for 72-84 hours after PG is administered and the CIDR is removed. Cows observed in estrus are inseminated accordingly. At 72-84 hours, all cows NOT observed in estrus are subjected to TAI and are given a second injection of GnRH. Treatment of postpartum cows with Select Synch + CIDR & TAI has several advantages: 1) only 3 days of estrous detection, 2) inclusion of the CIDR prevents early estrus (before PG) and induces estrus in more anestrous cows, 3) results in high AI pregnancy rates. The high AI pregnancy rates are the result of combining the higher conception rates to AI following accurate estrous detection and conception that occurs in some cows that would have been missed using estrous detection alone.

*Select Synch + CIDR & TAI should be used for ESAI if:*

1. A large proportion of the cows are anestrus before treatment. If cows are a little thinner (BCS 4-5), the herd consists of several young cows, and many of the cows are less than 45 days postpartum, a system that includes a CIDR is necessary.
2. Facilities and labor are available for daily estrous detection and cattle handling for at least 3 days.
3. Technician is available twice daily for at least 3 days.
4. Value of the semen is moderate to high.. When the value of the semen is high, conception rate must be maximized. Select Synch + CIDR & TAI maximizes pregnancy rates to AI but the cost is higher because all cows are inseminated. Conception rate is lower even though the AI pregnancy rate is higher.
5. Higher AI pregnancy rates are more important to the producer than the higher costs of the estrus synchronization protocol.

Producers that desire systems that require NO estrous detection should use Co Synch + CIDR (Fig. 6). In this system, all cows are subjected to a second injection of GnRH & TAI anywhere from 48-72 hours after PG is administered. When CO Synch + CIDR was first developed, cows were subjected to GnRH & TAI at 48 hours. Pregnancy rates are slightly higher if GnRH & TAI are performed around 60 hours after PG is administered (Stevenson et al., 2001; Lamb et al., 2004). Acceptable AI pregnancy rates have also been reported when GnRH & TAI occurred 72 hours after PG (M. L. Day, unpublished observations). Therefore, acceptable AI pregnancy rates can be achieved when GnRH & TAI occurs at any time from 48-72 hours after PG. The highest AI pregnancy rates appear to occur when TAI occurs near 60 hours after PG administration.

Systems that incorporate total TAI are more variable in AI pregnancy rate than systems that use either total or partial estrous detection. The decision to use systems with complete TAI needs to involve an assessment of your or the producers comfortable level of risk. Systems that use total TAI involve higher risk. Several management factors can reduce the risk involved with systems that use complete TAI. First, cows must be in a BCS  $\geq 5$  (BCS scale 1-9; 1 = emaciated, 9 = extremely obese) both at calving and at the beginning of treatment. Also, mineral status (i.e. copper and selenium) of the cows can affect pregnancy rate to AI (L. H. Anderson, unpublished data) and many cows in the Southeast are deficient in these two minerals. Second, cows must be at least 30 days (preferably 45 days) postpartum at the beginning of treatment. Third, minimize the number of primiparous cows that are subjected to the TAI protocol. Fourth, cows must have been previously vaccinated and dewormed. Success is possible using TAI systems if the risk factors are minimized.

*Co Synch + CIDR & TAI should be used for ESAI if:*

1. Facilities and labor are NOT available for daily estrous detection and cattle handling.
2. Technician availability is very limited.

3. Value of the semen is low to moderate. When the value of the semen is high, conception rate must be maximized. Co Synch + CIDR & TAI reduces conception rates to AI and the cost is per pregnancy is higher because all cows are inseminated. Semen of high value should NOT be used.
4. Pregnancy rates of anestrous cows to this system have been acceptable but low. Reducing the proportion of anestrous cows will reduce the risk associated with TAI protocols.

### **Systems for Young Cows (suckled 2-year olds)**

Many beef cow-calf producers calve their primiparous cows 20-30 days before their mature cow herd. In this management system, the additional time postpartum allows the use of the MGA<sup>®</sup> Select protocol. The MGA<sup>®</sup> Select protocol begins with 14 days of MGA feeding (Fig. 1). Cows must receive .5 mg/hd/d of MGA. Twelve days after the end of the MGA feeding period (Day 26), cows are administered GnRH (100 µg). Seven days later PG is injected. Cows are observed for estrus for 5 days beginning the day after PG is given. Treatment of postpartum anestrous cows with MGA<sup>®</sup> Select increases the proportion of anestrous cows observed in estrus following PG treatment (Patterson et al., 1995; Stevenson et al., 2003a). If time is limited for estrous detection, then cows can be observed for estrus for 72-84 hours after PG and then those not observed in estrus administered GnRH & TAI (Fig. 5). If estrous detection is not an option, all cows can be administered GnRH & TAI 72 hours after PG (Fig. 6). Of course, pregnancy rates are more variable and can be lower when using total TAI especially in primiparous (i.e. suckled two-year old) cows.

The MGA<sup>®</sup> Select protocol has one major drawback; the length of time of treatment (38-39 days). Unless the calving season is shorter than 45 days, the MGA<sup>®</sup> Select protocol is difficult to use in most postpartum beef cow-calf herds (Fig. 7). Therefore, the best application for the MGA<sup>®</sup> Select protocol is in first-calf heifers (suckled 2-year olds) that calve before the mature cow herd.

*MGA<sup>®</sup> Select should be used for ESAI if:*

1. Primiparous cows are calved before the mature cow herd.
2. Calving season is exceptionally short (< 50 days).
3. Facilities and labor are available for daily heat detection and cattle handling for at least 5 days.
4. Technician is available twice daily for at least 5 days.
5. Value of the semen is low to moderate. The estrous response and conception rate of primiparous cows are typically lower.

### **Implications**

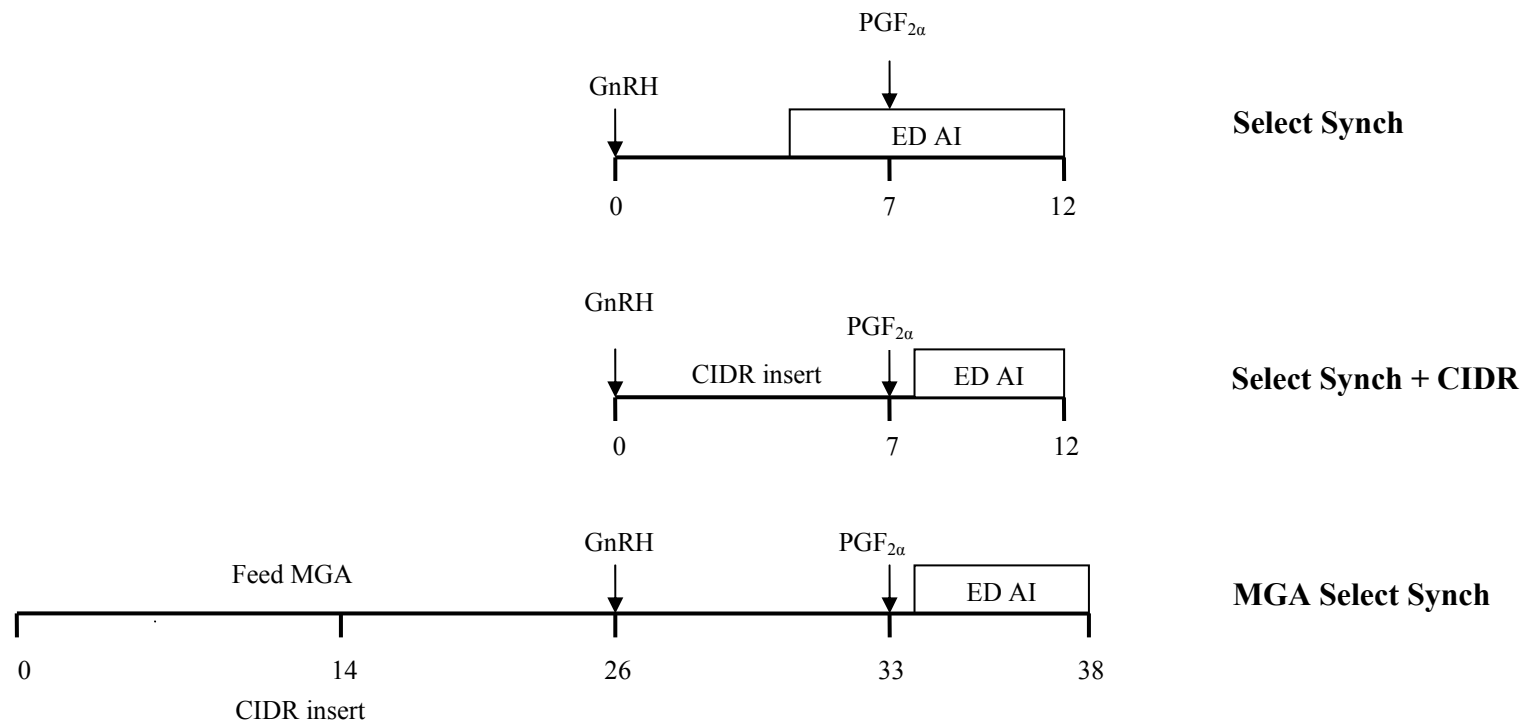
Several protocols to synchronize estrus are currently available for use by beef cow-calf producers. Determining which system to use depends upon the proportion of anestrous cows at the beginning of treatment, available labor and facilities for estrous detection,

availability of a qualified technician, value of the semen, and the goals of the producer. Certainly, incorporation of ESAI and proven genetically superior sires into beef cow calf operations will improve the productivity and profitability of any operation. Increased use of ESAI could help the United States keep its competitive global advantage in the production of quality beef.

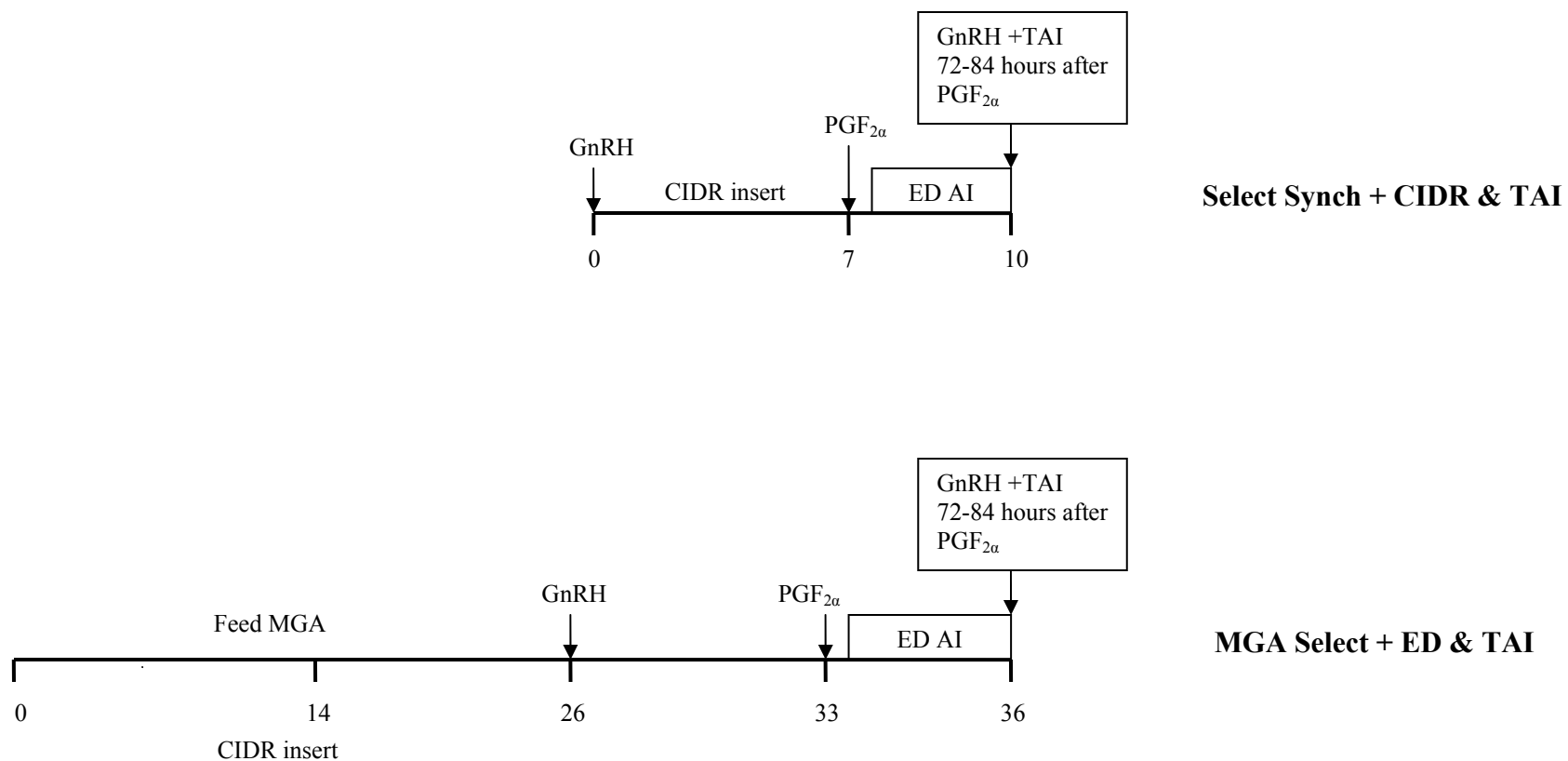
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**Figure 1.** Estrus synchronization protocols that incorporate complete estrus detection (ED)

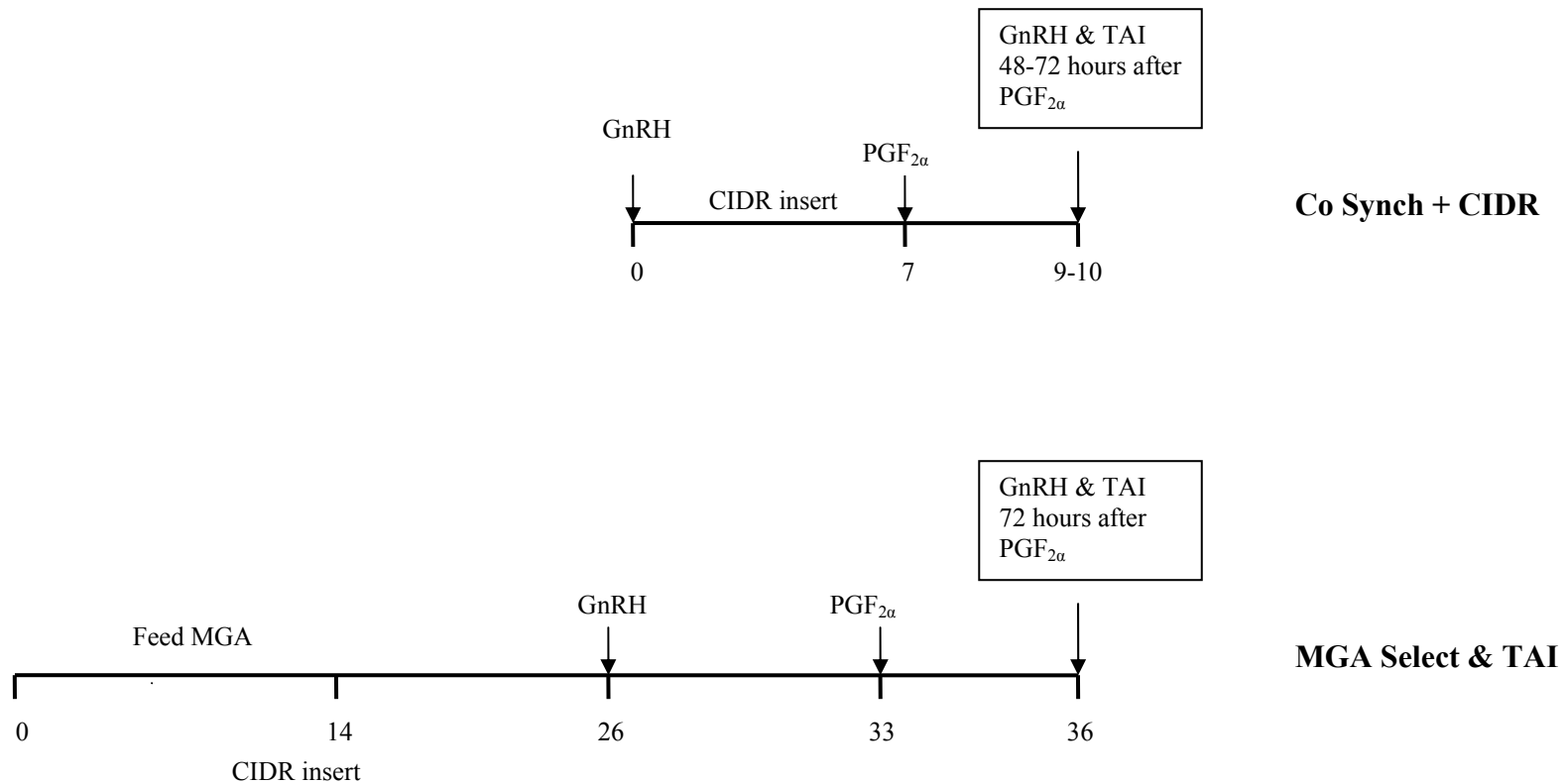


**Figure 5.** Estrus synchronization protocols that combine estrus detection (ED) and timed artificial insemination (TAI). Cows are observed for estrus and inseminated accordingly for 72-84 hours. At this time, all cows not observed in estrus are administered gonadotropin-releasing hormone (GnRH) and are inseminated.

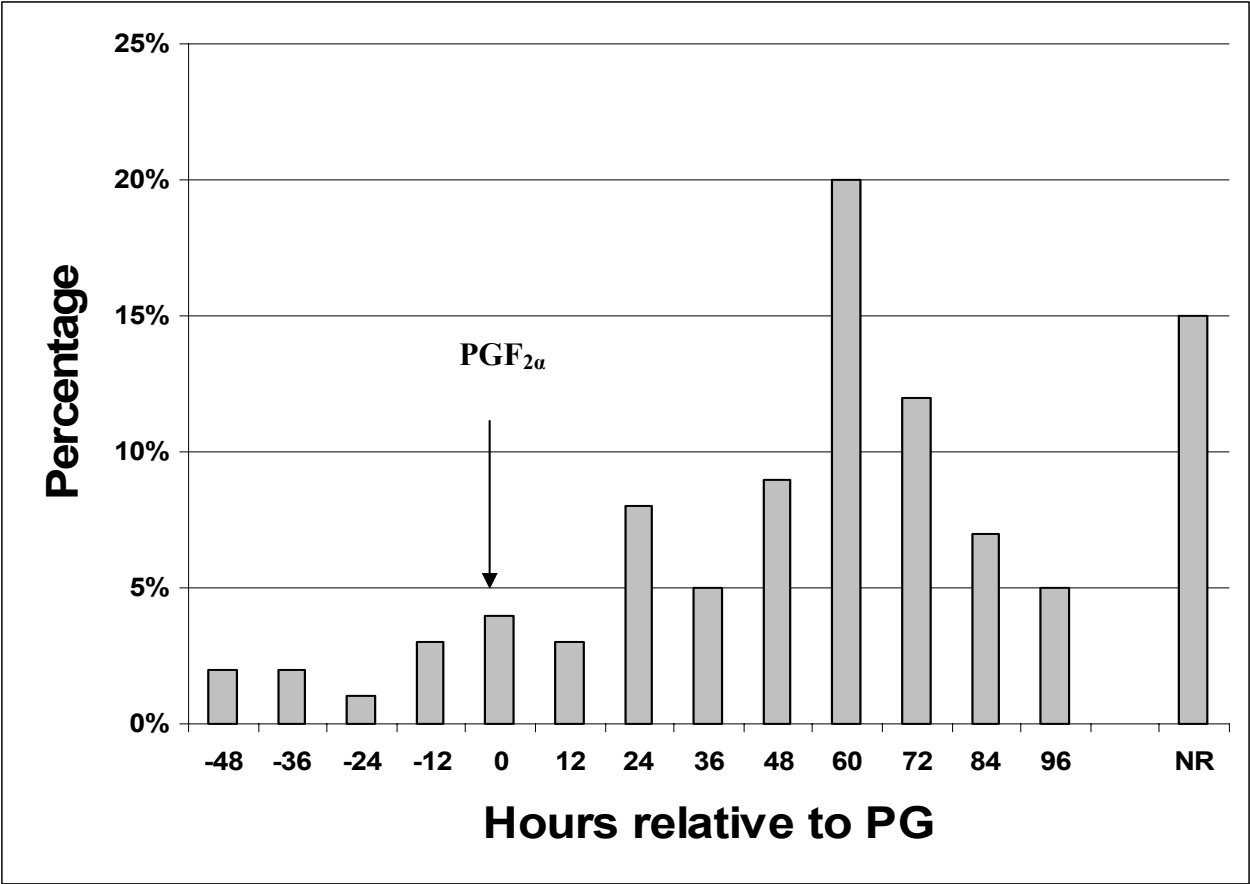




**Figure 6.** Estrus synchronization protocols for complete TAI. Cows are NOT observed for estrus and instead are injected with GnRH and inseminated at predetermined times. The TAI can occur from 48-72 hours after PG for the Co Synch + CIDR protocol and should occur at 72 hours after PG in MGA<sup>®</sup> Select & TAI.

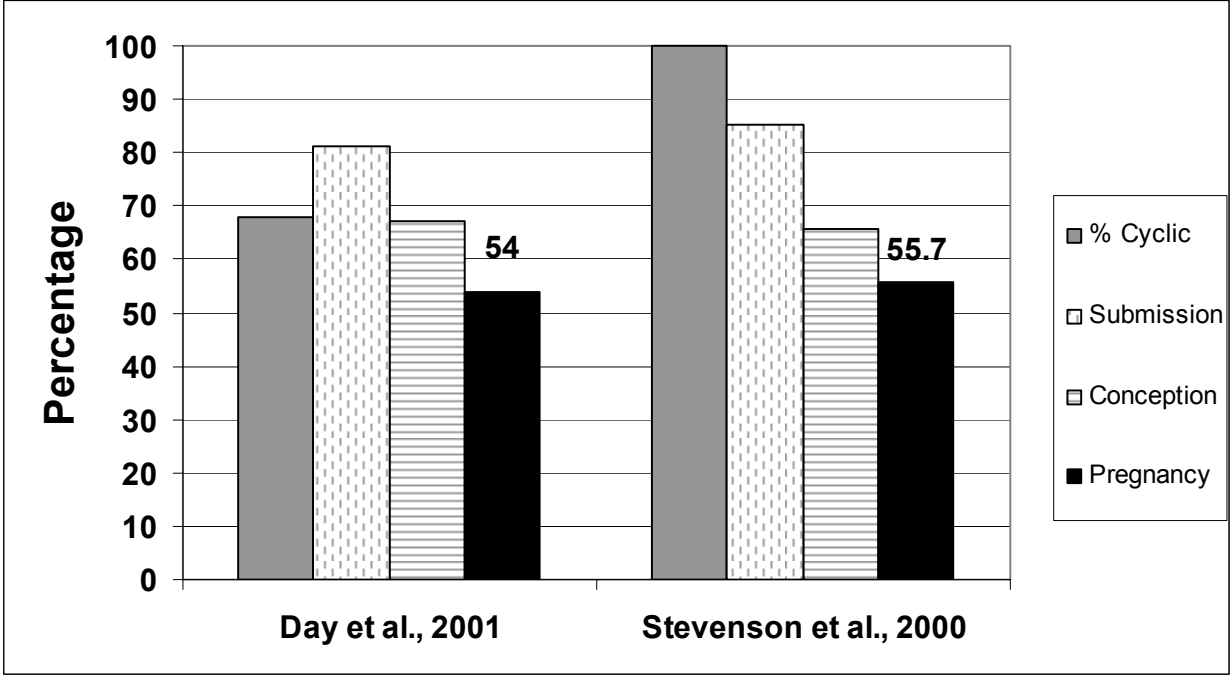


**Figure 2.** Typical estrous responses after postpartum cows are treated with Select Synch (GnRH + PG). Cows were observed for estrus twice daily.

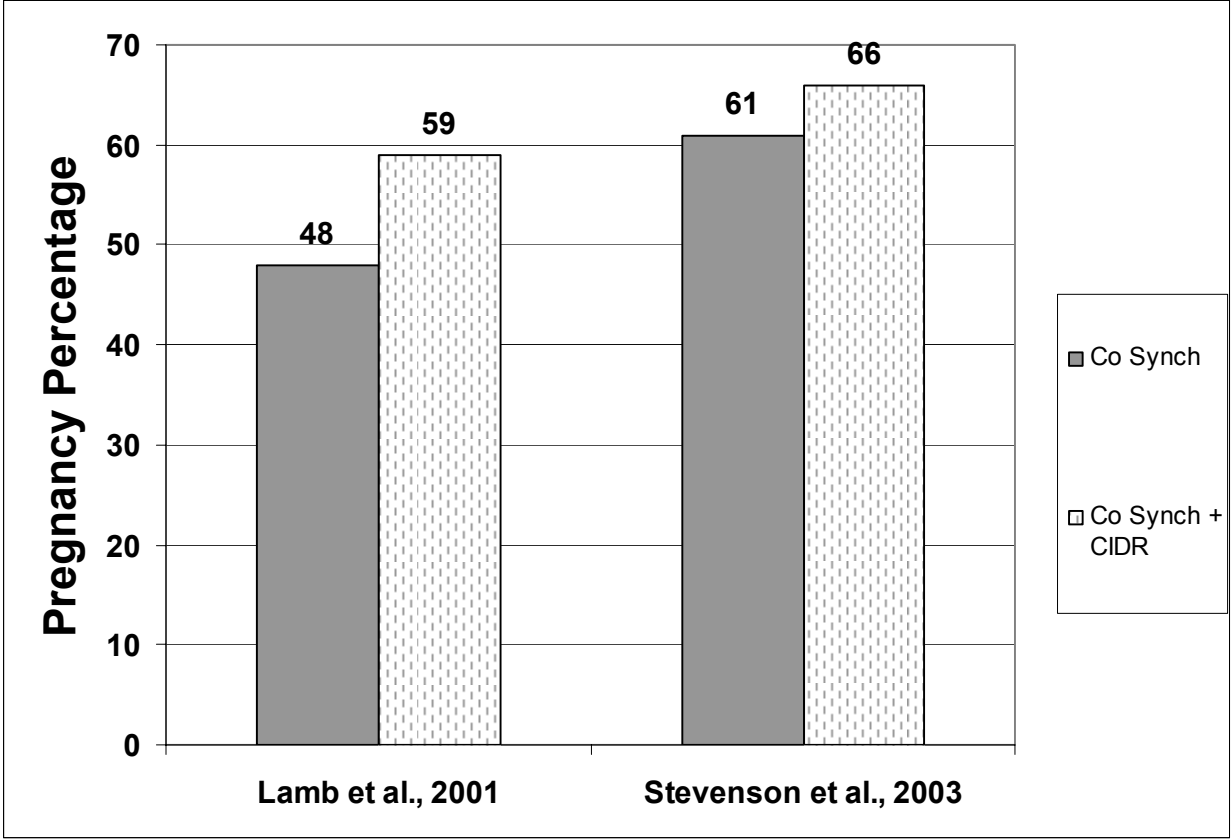


L. H. Anderson, unpublished data

**Figure 3.** Reproductive response of postpartum cows treated with Select Synch (GnRH followed 7 days later by PG). Reproductive responses include the percentage of cows that had initiated estrous cycles prior to treatment, the percentage of cows submitted to AI (submission rate), the conception rate to AI, and the overall pregnancy rate to AI.



**Figure 4.** Pregnancy rate of postpartum suckled beef cows treated either with Co Synch (GnRH + PG + GnRH & TAI) or with Co Synch + CIDR. The CIDR device was inserted on the day of GnRH treatment and removed 7 days later.



**Figure 7.** Production cycle of a beef cow-calf operation. In herds with a short ( $\leq 60$  days) calving season, only 20-30 days separate the end of the calving and the beginning of the breeding season thereby limiting the use of MGA<sup>®</sup> Select systems.

