

# Synchronizing Estrus in Cattle

L.R. Sprott and B.B. Carpenter\*

---

**B**eef cattle producers using artificial insemination in their herds also can synchronize estrus (heat) to breed fertile females rapidly. Estrous synchronization — which is a

---

manipulation of the reproductive process — offers several benefits. It:

- Reduces and in some cases eliminates the need to detect estrus and allows the herd manager to schedule breeding activities in a predetermined period lasting from 1 to 12 days. Artificial insemination (AI) activities are confined to a few intensive days.
- Creates a more uniform calf crop.
- Enables more cows to be bred to a superior sire.
- Shortens the breeding and calving seasons.

Cows not conceiving will return to estrus again beginning about 18 to 25 days after the synchronization period. The females will still be synchronized to a slight degree, allowing for a second chance to AI each female in the early part of the breeding season.

Without synchronization, the herd manager is faced with a 21-day period of continual estrus detection and only one opportunity for AI in most

females. This is because only 5 to 7 percent of females will display estrus more than once during the first 21 days of breeding.

For best results of an estrous synchronization program and to help ensure optimum fertility, ranchers should:

- Practice high-quality herd management.
- Provide adequate nutrition, because undernourished cows may not respond to treatment, much less conceive.
- Have vaccines administered before the breeding season to prevent reproductive diseases.
- Arrange for the services of experienced AI technicians.
- Acquire quality semen.

Beef cows with calves less than 40 days old may be anestrus (not experiencing cycles), and their response will be lower than in cows that are cyclic.

In replacement heifers, the response depends on the proportion that have reached puberty. Fifteen-month-old heifers that have reached at least 65 percent of their expected mature weight respond better than younger heifers at a lighter weight.

---

\*Professor, Extension Specialist Emeritus and Associate Professor and Extension Livestock Specialist; The Texas A&M University System.

## Estrus synchronization products and how they work

Estrus synchronization programs use the function of one or a combination of three hormones: prostaglandins, progesterone and GnRH.

**Prostaglandins** are produced naturally in the animal's body and function, in part, to affect the estrous cycle. In cyclic females, estrus occurs within 2 to 6 days after they are given intramuscular injections of prostaglandin F2 alpha (Lutalyse®) or some of its analogues (Prostamate®, Estrumate®).

Remember: Anestrous females do not respond to prostaglandin injections. Estrous-cyclic females can respond to injections between days 7 and 16 of their cycles if they have a functional *corpus luteum* (CL). The CL is a gland that develops in the ovary and secretes the hormone progesterone into the cow's blood.

Estrous-cyclic females at days 0 (estrus) to 6 and those from days 17 to 21 of their cycles are without functional CLs and do not respond to injections. However, an estrous-cyclic female without a functional CL will respond to injections if they are given in a specific sequence.

Progesterone is a naturally occurring hormone that functions to maintain the pregnancy. This hormone also "blocks" estrus and ovulation during the diestrus phase of the estrous cycle.

Two kinds of progesterone products are used to synchronize estrus:

- A controlled intra-vaginal release device (CIDR), which is an intra-vaginal progesterone insert. Using this device requires a special applicator tool for insertion. A string is attached for removal at the end of treatment.
- MGA (melengestrol acetate), which is a progestin feed additive. It acts like progesterone in the body.

Because both CIDR and MGA products function to "hold" animals out of estrus, their timed removal will synchronize estrus in responding females. When CIDRs are used in combination with GnRH or prostaglandin, 20 to 40 percent of anestrous females may be induced into estrus.

**GnRH**, or gonadotropin-releasing hormone (trade names Cystorelin®, Fertagyl®, Factrel®, Ovasync® and OvaCystv®, is a naturally occurring

hormone that causes the release of other hormones. One of these hormones affects follicle development on the ovary; another causes ovulation to occur.

Research indicates that when GnRH is given with prostaglandin to estrous cyclic and noncyclic females, the patterns of follicular development are altered, inducing ovulation. This treatment may induce estrus in 10 to 30 percent of anestrous females.

GnRH treatment is not recommended for prepubertal heifers because these young heifers have not yet established fertile estrous cycles and have no consistent response to this hormone injection.

## "The Easy Three"

### Synchronization protocols

These three synchronization protocol options require that estrus be detected:

#### Option 1: Prostaglandin

*(12 days estrus detection required)*

Days 0 to 6 - No injections are given. Begin estrus detection and AI by the AM-PM rule (that is, females are inseminated 12 hours after the onset of estrus). Continue estrus detection and AI for 6 days. Day 0 should coincide with the usual start of the breeding season.

Day 6 - Calculate the percentage of females inseminated in the first 6 days. If it is less than 15 percent, the number of estrous cyclic females may not justify continuing the program. If it is more than 15 percent, inject all females not inseminated in the first 6 days with an intramuscular prostaglandin shot. The dosage will depend on the type of prostaglandin used. Read and follow the label or prescribed directions.

Days 6 to 12 - Continue estrus detection and AI (following the AM-PM rule).

#### Option 2: CIDR and prostaglandin

*(3 or 4 days estrus detection required)*

Day 0 - Insert a CIDR device.

Day 6 (or 7) - Remove the CIDR and inject prostaglandin (The label recommends day 6, but research suggests day 7 is acceptable.).

Day 7 (or 8) - Begin estrus detection and AI for 3 to 4 more days (AM-PM rule).

### **Option 3: CIDR, prostaglandin, GnRH**

*(No estrus detection required)*

Day 0 - Insert a CIDR device. Inject GnRH (optional).

Day 7 - Remove the CIDR device and inject prostaglandin. If you are treating lactating cows in "marginal" body condition, a 48-hour calf removal may improve the response.

Day 9 - Inject GnRH and begin timed (or mass) AI at 48 to 60 hours after CIDR removal.

Another option is AI after estrus detection.

### **Other synchronization protocols that require estrus detection**

#### **Prostaglandin only, Option 1**

Day 0 - Inject all females intramuscularly with prostaglandin. Although females able to respond to this first injection will display estrus, do not inseminate them at this time.

Day 11 - Inject all females again. Begin estrus detection, and AI by the AM-PM rule. Continue estrus detection and AI for 6 days. Day 11 should coincide with the usual start of the breeding season.

Day 17 - End estrus detection and AI.

#### **Prostaglandin only, Option 2**

Day 0 - Inject all females and begin estrus detection and AI for 6 days. Day 0 should coincide with the usual start of the breeding season.

Day 6 - Calculate the percentage of females inseminated in the first 6 days. If it is less than 45 percent, the number of estrous cyclic females may not justify continuing the program. If it is more than 45 percent, inject all females not inseminated in the first 6 days.

Days 6 to 12 - Continue estrus detection and AI.

### **MGA, with or without prostaglandin/GnRH options**

MGA is a progestin feed additive offered by feed mills that are permitted to mix medicated feeds. Although MGA is used to prevent estrus in feedlot heifers, it can also be used to synchronize estrus in breeding females.

Trials using MGA to synchronize estrus showed that females responding to treatment required up to 7 days to display estrus, and fertility was depressed. Consequently, females should not be inseminated at this time.

To avoid these problems, researchers developed an alternative that combines MGA in the feed with a prostaglandin injection. In this approach, MGA is fed in a supplement that delivers 0.5 mg of the compound per head per day. Feeding continues for 14 days and is then terminated.

After a 17-day period without MGA in the feed, the females are given a single injection of prostaglandin. The animals that respond will display estrus within 2 to 6 days. The recommended schedule for treatment follows.

#### **MGA, Option 1**

Day 0 - Begin feeding MGA (0.5 mg per head per day).

Day 14 - Withdraw MGA in the feed. Responding females may display estrus within 6 to 7 days. Because this is a subfertile estrus, do not AI.

Day 35 to 43 - Detect estrus and AI.

#### **MGA, Option 2**

Day 0 - Begin feeding MGA (0.5 mg per head per day).

Day 14 - Withdraw MGA from feed. Do not AI (see caution above).

Day 33 - Inject all females with prostaglandin. Detect estrus and AI.

#### **MGA, Option 3**

Day 0 - Begin feeding MGA (0.5 mg per head per day).

Day 14 - Withdraw MGA from feed. Do not AI (see caution above).

Day 26 - Inject with GnRH.

Day 32 - Detect estrus and AI.

Day 33 - Inject prostaglandin in those females not already inseminated and continue estrus detection and AI for 4 to 5 more days.

#### **MGA, Option 4**

Day 0 - Begin feeding MGA (0.5 mg per head per day).

Day 7 - Withdraw MGA from the feed.

Day 11 - Inject with GnRH.

Day 17 - Detect estrus and AI.

Day 18 - Inject prostaglandin in females not already inseminated and continue estrus detection for 4 to 5 more days.

## Prostaglandins and GnRH

Day 0 - Inject all females with GnRH.

Day 6 - Detect estrus and AI.

Day 7 - Inject those females not inseminated with prostaglandin and continue heat detection for 4 to 5 more days

## Other synchronization protocols that do not require estrus detection

For the following four protocols, 1 day of estrus detection and AI is recommended at 6 days after the first injection of GnRH to catch females that potentially display estrus. This may only be 6 percent or less of the entire herd.

With such a low occurrence, some producers elect not to detect estrus at all after the first GnRH injection, and instead wait to time mate (performing AI at an appointed hour on all treated females) either at or after the last GnRH injection.

### GnRH and prostaglandin, Option 1

Day 0 - Inject GnRH.

Day 6 - Detect estrus and AI (optional).

Day 7 - Inject prostaglandin in females not already inseminated.

Day 9 - At 48 to 60 hours after prostaglandin, inject GnRH and perform AI on all females not already inseminated.

### GnRH and prostaglandin, Option 2

Day 0 - Inject GnRH.

Day 6 - Detect estrus and AI (optional).

Day 7 - Inject prostaglandin.

Day 8 at 24 hours after prostaglandin, inject GnRH in females not already inseminated.

Day 9 - At 12 to 24 hours after GnRH, perform AI on all females not already inseminated.

### MGA-prostaglandin-GnRH, Option 3

Day 0 - Begin feeding MGA (0.5 mg per head per day).

Day 7 - Withdraw MGA from the feed.

Day 11 - Inject with GnRH.

Day 17 - Detect estrus and AI (optional).

Day 18 - Inject prostaglandin in females not already inseminated.

Day 20 - At 48 to 60 hours after prostaglandin, inject GnRH and perform AI on all females not already inseminated.

### MGA-prostaglandin-GnRH, Option 4

Day 0 - Begin feeding MGA (0.5 mg per head per day).

Day 14 - Withdraw MGA from the feed. Do not AI.

Day 26 - Inject GnRH.

Day 32 - Detect estrus and AI (optional).

Day 33 - Inject prostaglandin in females not already inseminated.

Day 35 - At 48 to 60 hours after prostaglandin, inject GnRH and perform AI on all females not already inseminated.

## Choosing a synchrony method

The approaches to estrus synchronization outlined above require varying amounts of time to implement. Managers who have limited time and available labor should consider the methods that allow for "time mating."

Before selecting any treatment, however, *determine the number of females that can potentially respond to treatment*. If the number of potentially responsive females is low, treatment may not be justified.

Well-managed beef herds that calve in 80 days or less usually respond well and would, therefore, justify the cost of treatment. In longer calving periods, the cows can be sorted into groups and treated according to their calves' ages. Any cow whose calf is at least 40 days old can be treated.

Beef cows with calves less than 40 days old may be anestrus and will respond poorly to estrus synchronization. Cows that are in poor to marginal body condition will likely be anestrus because of inadequate nutrition. Thus, they also will respond poorly to treatments.

The response in replacement heifers depends on the proportion of females that have reached puberty. Fifteen-month-old heifers weighing at least 65 percent of their expected mature weight will respond better than younger heifers at a lighter weight.

All treatment methods result in pregnancy rates of about 50 percent among females that respond to treatment. The overall pregnancy rate depends on the number of females that display estrus during the period.

For example, all females must respond to treatment and display estrus if a 50 percent pregnancy rate is to be achieved in a single service. If only 50 percent of the females respond and display estrus, the pregnancy rate would be only about 25 percent. The use of quality semen and experienced technicians can help ensure the chances of conception in females that respond.

Field trials indicate that, to recover costs associated with the program, at least 60 percent of the females should be estrus cyclic before treatment. If the number of responding females is unknown, detect estrus for 5 to 6 days before giving any treatments. If less than 15 percent of the females are in estrus during that time, the response to subsequent treatment will be low.

An alternative is to detect estrus after any treatment. Both approaches allow managers to see the degree of response and decide if the program should be continued.

The return on investment is affected by pregnancy rates, rate of growth of AI offspring and market prices per pound. The maximum affordable costs of AI/estrous synchronization per female in commercial beef herds are shown in Table 1.

There are other reasons to use AI/estrous synchronization that are not based solely on the potential pregnancy and performance responses:

- The advent of expected progeny difference (EPD) values for bulls of various breeds allows producers to tailor their breeding program for specific characteristics.
- Replacement heifers can be inseminated to calving-ease bulls, thereby reducing or eliminating calving problems. Field trials show that this can reduce the costs associated with calving problems by as much as \$57 to \$65 per head.
- AI and estrous synchronization also can be used to create heifers with improved maternal

**Table 1. Maximum affordable cash costs of AI and estrous synchronization in a commercial beef herd as affected by pregnancy rate, offspring performance and market price\***

Percent of females in estrus	Percent of herd pregnant to AI <sup>1</sup>	Average weight increase of AI calves <sup>2</sup> (pounds)	Market prices per pound				
			\$.60	\$.70	\$.80	\$.90	\$1.00
40-50	20	50	\$6.00	\$7.00	\$8.00	\$9.00	\$10.00
		70	\$8.40	\$9.80	\$11.20	\$12.60	\$14.00
		90	\$10.80	\$12.60	\$14.40	\$16.20	\$18.00
60-70	30	50	\$9.00	\$10.50	\$12.00	\$13.50	\$15.00
		70	\$12.60	\$14.70	\$16.80	\$18.90	\$21.00
		90	\$16.20	\$18.90	\$21.60	\$24.30	\$27.00
80-90	40	50	\$12.00	\$14.00	\$16.00	\$18.00	\$20.00
		70	\$16.80	\$19.60	\$22.40	\$25.20	\$28.00
		90	\$21.60	\$25.20	\$28.80	\$32.40	\$36.00
90 or more	50	50	\$15.00	\$17.50	\$20.00	\$22.50	\$25.00
		70	\$21.00	\$24.50	\$28.00	\$31.50	\$35.00
		90	\$27.00	\$31.50	\$36.00	\$40.50	\$45.00
90 or more	60	50	\$18.00	\$21.00	\$24.00	\$27.00	\$30.00
		70	\$25.20	\$29.40	\$33.60	\$37.80	\$42.00
		90	\$32.40	\$37.80	\$43.20	\$48.60	\$54.00

\*Does not include the potential increase in herd performance (growth and milk) by superior female AI offspring saved as future replacements.

<sup>1</sup>Assumes that about half the females in estrus conceived to a single AI service.

<sup>2</sup>Average weight advantage of AI offspring compared to non-AI offspring in pounds.

characteristics, the value of which is realized when they give birth.

- Insemination to sires with improved marbling ability and growth in their offspring has been shown to improve feedlot performance and carcass value by as much as \$40 per head. Club calf production from estrus synchronization/AI treatments in commercial cows can increase income by as much as \$300 to \$600 per pregnant female. Clearly, registered breeders should consider AI as an economic way to access their breed's most popular sires.

If the semen is very expensive, estrus detection is recommended after any treatment. This results in the financially efficient use of semen and cost savings. Although treatment compounds and their specific uses result in varied costs (\$5 to \$15) per treated female, trials in beef females using a \$7 per head product showed a positive return on investment.

These trials also demonstrated that the degree of estrus response, pregnancy rate, performance of AI offspring and market prices affected returns more than did semen and product costs. In these trials, the pregnancy rate was only 30 percent of 800 inseminations, yet the return on investment of product was still positive.

### Special considerations

Using MGA in combination with prostaglandins requires specific consideration. This method is typically the most cost effective in situations where a drylot or semi-confinement period is a normal part of management, such as in overwintering cow or heifer development programs.

Ranchers should make sure that each animal takes in an adequate amount of the MGA feed supplement so that each one gets the proper dosage and has an acceptable estrus response. Although intake varies among individual animals, the dosage rate is designed to overcome some of the variation.

Nevertheless, animals should be forced to consume the supplement, which can be accomplished in a confined or semi-confined feedlot. Using MGA feed supplements to synchronize females grazing open range or pasture is not recommended because adequate intake cannot be assured. This is especially true in the South during springtime, when females may have enough quality grazing and, consequently, no appetite for supplemental feeds.

Intake cannot be assured unless animals are confined for the required 14-day feeding period. Females unaccustomed to eating daily, hand-fed supplements may require a 7- to 14- day "training" period in which they are fed the supplement without MGA. This helps ensure adequate consumption. After this time, MGA can be added to the supplement to begin treatment.

### Precautions and planning

Before initiating any treatments, herd managers should read and follow product labels or prescribed directions. Incorrect use results in disappointment, low treatment response and low pregnancy rates. Some products cannot be used in lactating dairy cows.

Use prostaglandins with extreme caution. They cause abortions in animals and humans. They are readily absorbed through the skin and cause breathing difficulties. Avoid any contact with the skin. Wash accidental spills from the skin immediately.

After selecting the synchronization product, enter on a calendar the work schedule associated with that protocol. The first day or days of insemination should coincide with the usual start of the breeding season.

Once the program for a particular approach is begun, do not alter the schedule. The timing of injections and insemination days are critical to their success. On injection and insemination days, additional people may be needed to move cattle through the chute, administer injections, read ear tags, thaw semen and inseminate cattle.

Remember, estrus detection in synchronization programs can be confusing because of the high degree of mounting activity. It is recommended that at least two or three observers be used during each detection period (lasting from about 1 hour, two to three times each day).

Applying heat mount patches (Kmar<sup>®</sup>) also may help improve the efficiency of finding estrus cows. To reduce the confusion from repetitive mounting, females confirmed in estrus should be sorted from the others about midway through each observation period. The remaining females should be observed for the latter half of the hour and additional estrus females should be sorted out of the pen.

Whether using "time mating" or estrus detection followed by AI, there is potential for many females

to be inseminated in a concentrated period of time. Depending on the herd size and insemination schedules, as many as four technicians may be needed.

Use only experienced technicians and allow them to alternate after every 10 to 15 inseminations to avoid exhaustion. Tired technicians are less effective in their procedures. If “time mating” is used, AI technicians should either thaw semen or perform inseminations and not be asked to perform other duties.

Contact the AI technicians several weeks before beginning the program. Professional technicians usually have a full schedule during spring and autumn, and they will need to coordinate their work schedules.

Buy all the necessary products, semen and equipment at least 10 days before treatment. Make sure the working facilities is in good order. Most programs require that females be put through the chute at least three times to implement the treatments and to perform inseminations.

Keep accurate records of all activities. Use ear tag numbers to identify which sire was used on each female and to record her date and time of observed estrus.

It also may be necessary to record which AI technician performed each insemination in order to assess technician efficiency. On insemination days, do not ask the record keeper to perform other duties. The record keeper must be alert and free from distractions because of the speed at which experienced technicians perform inseminations.

Handle cattle in a manner that reduces stress. Work them quietly, avoid excessive prodding and refrain from using dogs at or near the chutes. Stress has been shown to affect production of certain hormones that can impair reproduction.

Reducing cattle stress reduction may also improve the efficiency and attitudes of AI technicians, because most technicians prefer to inseminate cattle that are calm over those that are overly excited. Although these may seem to be insignificant details, they too are important to the program’s success.

The information given herein is for educational purposes only. Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement by Texas Cooperative Extension is implied.

Produced by Agricultural Communications, The Texas A&M University System  
Extension publications can be found on the Web at: <http://tcebookstore.org>  
Visit Texas Cooperative Extension at: <http://texasextension.tamu.edu>

*Educational programs of Texas Cooperative Extension are open to all people without regard to race, color, sex, disability, religion, age or national origin.*

Issued in furtherance of Cooperative Extension Work in Agriculture and Home Economics, Acts of Congress of May 8, 1914, as amended, and June 30, 1914, in cooperation with the United States Department of Agriculture. Chester P. Fehlis, Deputy Director, Texas Cooperative Extension, The Texas A&M University System.

3M, Revision



