

Synchronizing Estrus in Cattle

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Beef cattle producers using artificial insemination in their herds also can synchronize estrus (heat) to breed fertile females rapidly.

Estrus 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, which gives a second chance to artificially inseminate each female in the early part of the breeding season. Without synchronization, the herd manager is faced with a 21-day period of con-

tinual 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 with an estrus synchronization program and to ensure optimum fertility, ranchers should:

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

Beef cows with calves less than 40 days old may be anestrus (not experiencing cycles) and respond less than cows that are cyclic. The response of replacement heifers depends on whether they 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.

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Estrus synchronization products and how they work

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

Prostaglandins (PG) 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 one of its analogues (ProstaMate®, Estrumate®, estroPLAN®, In-Synch®).

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 to 6 and 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 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 insert that contains progesterone. A special applicator tool is required to insert the device. A string is attached for removal at the end of the treatment.
- MGA® (melengestrol acetate), which is a progestin feed additive. It acts like progesterone in the body.

Because both CIDR® and MGA® products "hold" animals out of estrus, their timed removal will synchronize estrus in responding females. When CIDR®s 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® and OvaCyst®), 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. 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.

Three synchronization protocols

The three protocols discussed below (and also depicted, along with others, in Figure 1) illustrate the continuum from low-cost, high-labor; to medium-cost, medium-labor; to higher cost, low-labor and fixed-time AI. The key is to select a protocol that fits your needs in regard to cost, labor, time, animal handling, experience and other factors.

One shot PG (12 days estrus detection required)

This is a low-cost, low-risk program. It requires more labor, but that also allows animals to be observed for cyclicity. Hence, the possibility of wasting semen on noncycling animals is minimized.

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).

CIDR® - PG (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).

Fixed-time AI (TAI) Co-Synch + CIDR® (No estrus detection required)

Day 0. Insert a CIDR® device. Inject GnRH.

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 54 ± 2 hours for heifers, 60 ± 6 hours for cows.

Other synchronization protocols

Many other synchronization protocols are also available (Fig. 1). Some use estrus detection, fixed-time AI, or combinations of both early estrus detection and fixed-time AI (the latter being used when it may be desirable to improve AI conception in early estrus responders rather than waiting to do fixed-time AI with the whole group).

Some protocols use an alternative progestin product called MGA®, a 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 that 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 17 days 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. MGA® protocols using estrus detection, fixed-time AI, or a combination can be seen in Figure 1.

Still other protocols may use only combinations of GnRH and prostaglandin, which helps keep costs down. These are also shown in Figure 1, along with a section showing the relative trade-offs between labor and cost for each method.

Choosing a synchrony method

The various approaches to estrous synchronization require different amounts of time to implement. Managers who have limited time and avail-

able labor should consider the methods that allow for “time mating” (TAI).

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

Well-managed beef herds that calve in 80 days or less usually respond well, so the cost of treatment is justified. 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 anestrous and respond poorly to estrus synchronization. Cows in poor to marginal body condition will likely be anestrous because of inadequate nutrition. Thus they will respond poorly to treatments.

The response in replacement heifers depends on the proportion 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 to 60 percent among females that respond to treatment. The overall pregnancy rate depends on the number of females that display estrus during the period. That is, all females must respond to treatment and display estrus if a 50 to 60 percent pregnancy rate is to be achieved in a single service. If only 50 to 60 percent of the females respond and display estrus, the pregnancy rate to single AI service would be only about 25 to 30 percent. The use of high-quality semen and experienced technicians can help ensure conception in females that respond.

Field trials indicate that, to recover the costs of the program, at least 60 percent of the females should be estrous cyclic before treatment. If the number of responding females is unknown, detect estrus for 5 to 6 days before giving any treatments. If fewer 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.

Figure 1.

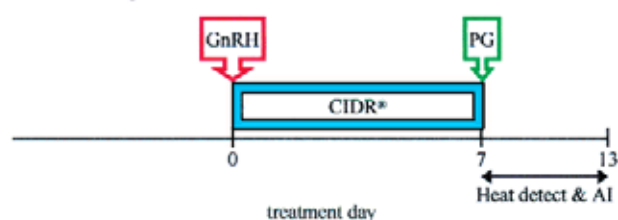
BEEF COW PROTOCOLS

HEAT DETECTION

Select Synch



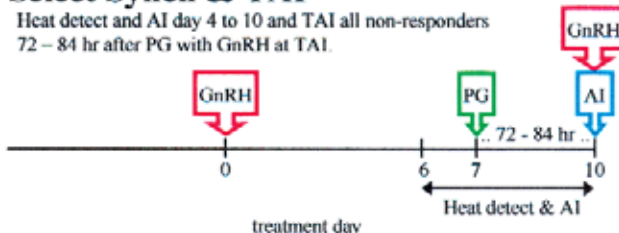
Select Synch + CIDR®



HEAT DETECT & TIME AI (TAI)

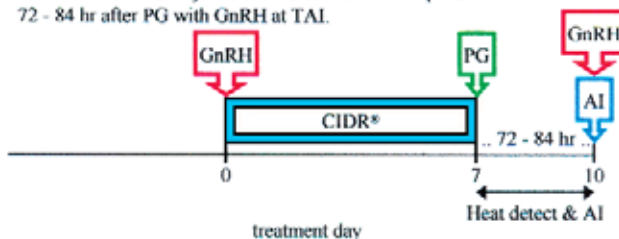
Select Synch & TAI

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

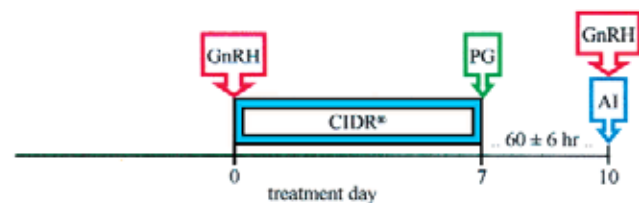
Heat detect and AI day 7 to 10 and TAI all non-responders 72 - 84 hr after PG with GnRH at TAI.



FIXED-TIME AI (TAI)*

CO-Synch + CIDR®

Perform TAI at 60 ± 6 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

HEAT DETECT & TAI	COST	LABOR
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

FIXED-TIME AI (TAI)	COST	LABOR
CO-Synch + CIDR® (TAI 60 ± 6 hr after PG with GnRH at TAI)	High	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 cows to inseminate, labor, and facilities.

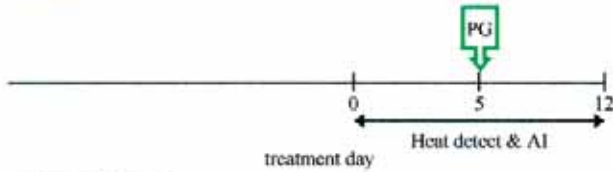
GnRH Cystorelin®, Factrel®, Fertagyl®, OvaCyst®

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

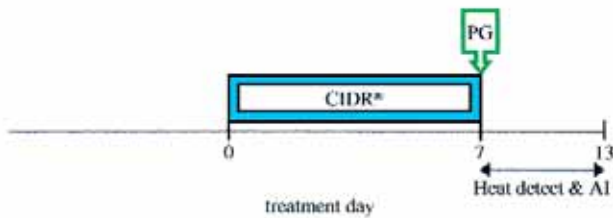
BEEF HEIFER PROTOCOLS

HEAT DETECTION

1 Shot PG



CIDR®-PG



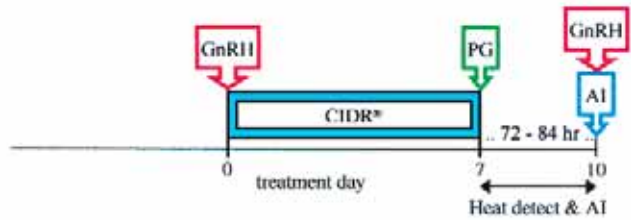
MGA®-PG



HEAT DETECT & TIME AI (TAI)

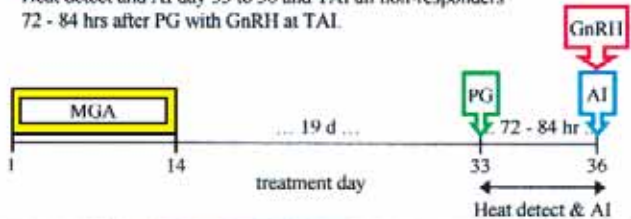
Select Synch + CIDR® & TAI

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

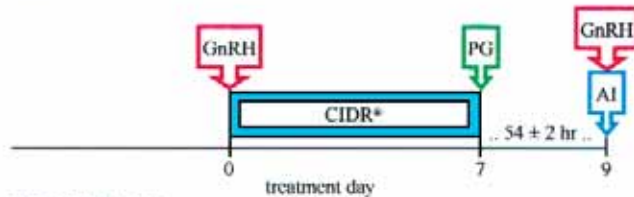
Heat detect and AI day 33 to 36 and TAI all non-responders 72 - 84 hrs after PG with GnRH at TAI.



FIXED-TIME AI (TAI)*

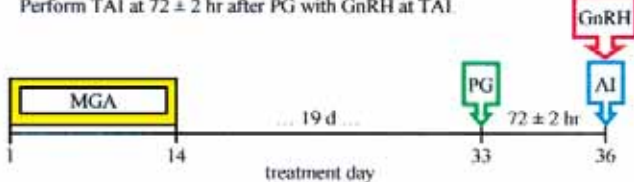
CO-Synch + CIDR®

Perform TAI at 54 ± 2 hr after PG with GnRH at TAI.



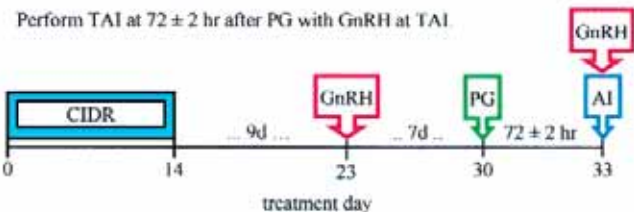
MGA®-PG

Perform TAI at 72 ± 2 hr after PG with GnRH at TAI.



CIDR® Select

Perform TAI at 72 ± 2 hr after PG with GnRH at TAI.



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 54 ± 2 hr after PG with GnRH at TAI)	High	Medium
MGA®-PG (TAI 72 ± 2 hr after PG with GnRH at TAI)	Medium	Medium
CIDR® Select (TAI 72 ± 2 hr after PG with GnRH at TAI)	High	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 heifers to inseminate, labor, and facilities.

GnRH	Cystorelin®, Factrel®, Fertagyl®, OvaCyst®
PG	Estrumate®, In-Synch®, Lutalyse®, ProstaMate®, estroPLAN®

Table 1. Maximum affordable cash costs of AI and estrus 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 ¹	Average weight increase of AI calves ² (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.

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

²Average weight advantage of AI offspring compared to non-AI offspring in pounds.

There are other reasons to use AI/estrus 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 programs 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 estrus synchronization also can be used to create heifers with improved maternal characteristics, the value of which is realized when they give birth.
- Insemination to sires with improved marbling 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 economical way to access their breed's most popular sires.

If the semen is very expensive, estrus should be detected after any treatment. This results in the financially efficient use of semen and lowers costs. Although treatment protocols have 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

There are special considerations when using MGA in combination with prostaglandins. This method is typically the most cost-effective when 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 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. The dosage rate is designed to overcome some of the variation in intake among individual animals. 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 ensured. This is especially true in the South during springtime, when females may have enough good grazing and, consequently, no appetite for supplemental feeds. Intake cannot be ensured 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

Herd managers should read and follow product labels or prescribed directions before beginning any treatment. If products are used incorrectly there will be low treatment response and low pregnancy rates. Some products cannot be used in lactating dairy cows.

Use prostaglandins with extreme caution because 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 a 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 has begun, do not alter the schedule. The timing of injections and insemination days is critical to success.

On injection and insemination days, additional people may be needed to move cattle through the chute, give injections, read ear tags, thaw semen and inseminate cattle.

Remember, estrus detection in synchronization programs can be confusing because of the frequent mounting activity. At least two or three observers should be used during each detection period. Detection periods should last about 1 hour and occur two to three times each day. Applying heat mount patches (Kmar[®] or Estrus Alert[®]) may make finding estrous cows more efficient. 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 other estrous females sorted out of the pen.

Whether using “time mating” or estrus detection followed by AI, it is possible to inseminate many females in a concentrated period of time. But, 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. 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 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 are in good order. Most programs require that females be put through the chute at least three times.

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 to assess

the technicians' 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 near the chutes. Stress has

been shown to produce certain hormones that can impair reproduction. Reducing stress may also improve the efficiency and attitudes of AI technicians, because most technicians prefer to inseminate cattle that are calm rather than those that are overly excited. Although these may seem to be insignificant details, they are important to the program's success.

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