MISSISSIPPI STATE UNIVERSITY EXTENSION

Estrus Synchronization in Beef Cattle

Estrus synchronization is a reproductive management tool that is particularly useful in artificial insemination (AI) and embryo transfer (ET) programs. The estrous cycle is manipulated with one or more hormones, depending on the protocol, to bring females into estrus (heat) at a similar time of the producer's choosing. Therefore, estrus synchronization makes the breeding of females enrolled in AI and ET programs convenient for busy producers.

Estrus synchronization with natural or artificial breeding offers several benefits. A synchronized herd results in a larger proportion of calves on the ground earlier in the calving season; these animals will then be older and heavier at weaning and will have enhanced carcass values. These calves will also be more uniform in age and size at weaning, which is beneficial for marketing purposes. When combined with AI and the use of semen from superior sires, the calf crop also has the potential for improved genetics.

Estrus Synchronization Hormones

Several hormones can be used to effectively synchronize estrus. A basic understanding of the physiological response to the hormone will minimize errors, such as administering hormones in the wrong order or at improper times. See MSU Extension Publication 2616 The Estrous Cycle of Cattle for detailed information on the estrous cycle.

Hormones common to many synchronization protocols include prostaglandin F2α (PG), progestins, and gonadotropin-releasing hormone (GnRH). Refer to Table 1 for commercial names of the hormones used in estrus synchronization protocols. Be sure to follow product label directions for storage, dosing, and method of administration. Many estrus synchronization products require a prescription from a veterinarian, so it is important to plan ahead and acquire these products before breeding season starts.

Prostaglandin is an injectable product and is commonly used in synchronization protocols for both heifers and cows. The uterus produces prostaglandin, which is responsible for ending the estrous cycle and allowing the female to reenter a period of estrus, provided she is not pregnant. This allows females to return to heat, ovulate, and start a new cycle. Prostaglandin administration is an affordable and effective method in synchronizing estrus if females have already begun to cycle. It can be used as the sole hormone administered to cattle for synchronization purposes. However, it is not effective if given before day 5 of the estrous cycle (day 0 = estrus). Because prostaglandin only manipulates one aspect of the estrous cycle (regression of the corpus luteum, CL) females must be regularly monitored for estrus behavior and should be bred following the "AM/PM" rule. See MSU Extension Publication 2610 Estrus (Heat) Detection in Cattle for detailed information on heat detection.

Table 1. Commercial names for common bovine estrus synchronization hormones.

Hormone	Commercial Names
Gonadotropin-releasing Hormone (GnRH)	Cystorelin, Factrel, Fertagyl, OvaCyst
Prostaglandin F2α (PG)	estroPLAN, Estrumate, In-Synch, Lutalyse, ProstaMate
Progestin	MGA (melangestrol acetate), CIDR (progesterone)

Progestins are a synthetic form of progesterone, a hormone that helps prepare for and maintain pregnancy. Progestins include melengestrol acetate (MGA) and progesterone. Administration of a progestin inhibits heat and ovulation until its removal and tightens the time of estrus onset in treated females. Another benefit to using progestins in a synchronization protocol is their ability to induce cyclicity in some noncycling females, including cows that are postpartum and heifers nearing the onset of puberty.

Melengestrol acetate is used in some heifer synchronization protocols. It is administered through feed, typically for a period of 14 days. Inadequate intake can be an issue with MGA use, as heifers must consume a sufficient amount in order for it to be effective for synchronization. When using MGA, it is also important to know that the ovulation following the 14-day feeding period is not fertile, and females should not be inseminated after that estrus. It is for this reason that protocols using MGA are longer and typically recommended only for use in heifers.

Progesterone is administered via a vaginal insert of a device which contains progesterone (CIDR, Controlled Internal Drug Release; Figure 1). It is easily inserted and removed and can be left in the female for varying amounts of time, depending on the protocol. These devices can be used in both heifers and cows.

Gonadotropin-releasing hormone is an injectable hormone commonly used in synchronization protocols for both heifers and cows. During a natural estrous cycle, an increase in GnRH causes elevated pulsatile surges of follicle-stimulating hormone (FSH) and luteinizing hormone (LH), which mature the follicle and its enclosed oocyte (egg). The decline in progesterone near the end of the cycle allows the pulses of GnRH to rise, which eventually induces ovulation. Similar to progestins, administration of GnRH can induce cyclicity in some noncycling animals.

Figure 1. *Controlled internal drug release (CIDR) device and applicator.*

Estrus Synchronization Protocols

The Beef Reproduction Task Force is a group of animal scientists from several land-grant universities that provides an annual list of recommended protocols based on available research and field data. Altering protocols or using alternative protocols should only be done with the advice of someone with extensive experience with synchronization protocols and should be supported by sound science. There are a variety of estrus synchronization protocols that can fit the needs of most producers. The protocols given here are effective for cows (Figures 2, 3, and 4), including a recently added protocol for Bos indicus cows (Figure 5), and heifers (Figures 6, 7, and 8). Protocols differ in the hormones used, method of hormone administration (injection, vaginal insert, or consumption through feed), number of injections, number of cattle handlings, timing of injections, and heat detection requirements. The cost of each protocol depends on the products used and labor needed. A comparison of these protocols based on labor and cost can be found in Table 2 (cows) and Table 3 (heifers).

Protocols recommended for cows and heifers can be further categorized into heat detection protocols, fixed-time protocols, and heat detection and timed protocols. Heat detection protocols manipulate fewer aspects of the estrous cycle and, therefore, may not produce a tight synchrony of estrus within the synchronized females, requiring estrus behavior to be monitored in order to know the proper time to breed. Fixed-time AI protocols eliminate the need for estrus detection. The protocols manipulate several aspects of the estrous in order to control the timing of ovulation, thus the protocol ends with all animals being bred at a predetermined time with an injection of GnRH administered at the time of breeding. Heat detection and timed AI protocols are a combination of the two previously discussed protocols. The protocol will dictate what period of time to heat detect and AI. Animals that are never observed in estrus are inseminated and given an injection of GnRH at a predetermined time, typically 72–84 hours after an injection of PG. The primary advantage of heat detection and timed AI protocols is the increased odds of conception in the early responders. This is due to insemination within the fertile window, whereas early responders enrolled in a fixed-time AI protocol may be inseminated after the fertile window.

Management Considerations

Estrus synchronization programs require good management, regardless of what protocol is used. A practical limitation of estrus synchronization protocols is the number of head that can be inseminated at one time. Cattle must be on good nutritional and herd health programs. Consider separating heifers from cows and inseminating heifers at least 2 weeks before the cows to provide them a longer postpartum interval to recover, regain body condition, and begin cycling. Adequate cattle-handling facilities must also be available to safely restrain cattle for injections, vaginal insert administration, and breeding.

Effective heat detection methods must be implemented when heat detection is required in the synchronization protocol. Detailed information on heat detection is available in MSU Extension Publication 2610 *Estrus (Heat) Detection in Cattle*.

Pay attention to safety concerns when handling estrus synchronization products. Women of child-bearing age and people with respiratory problems, such as asthma, need to be particularly cautious when handling these products and should always wear gloves. Pregnant women may want to avoid contact with these products altogether.

Injections must be administered using the proper technique, product dosage, and timing. Be sure to follow label directions for storage and use, noting any refrigeration requirements and expiration dates. Sufficient feed trough space must be provided when using MGA to ensure sufficient consumption rates amongs all cattle in the group. Some products used in estrus synchronization protocols may not be available at all local agricultural supply retailers and may instead need to be ordered in advance.

The Beef Reproduction Task Force also offers numerous resources for estrus synchronization planning at https://beefrepro.org/resources/. The Excel-based Estrus Synchronization Planner is provided free of charge, and can be customized to fit a producer's specifications. Protocols in the planner tools are updated each year. For more information on cattle reproduction or related topics, contact your local county MSU Extension office.

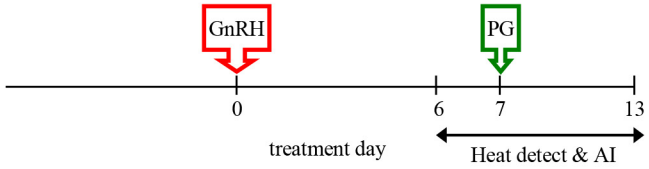
References

Beef Reproduction Task Force. December 2016. 2017 Protocols for Synchronization of Estrus and Ovulation.

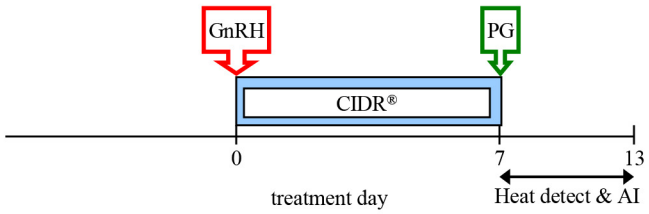
Beef Reproduction Task Force. September 2016. 2017 Estrus Synchronization Protocols for Heifers and Cows.

Larson, D. M., J. A. Musgrave, and R. N. Funston. 2010. Estrous Synchronization increases early calving frequency, which enhances steer progeny value. 2010 Beef Cattle Report. University of Nebraska. Lincoln, NE.

Select Synch



Select Synch + CIDR®



PG 6-day CIDR®

Heat detect and AI days 0 to 3. Administer CIDR to non-responders and heat detect and AI days 9 to 12. Protocol may be used in heifers.

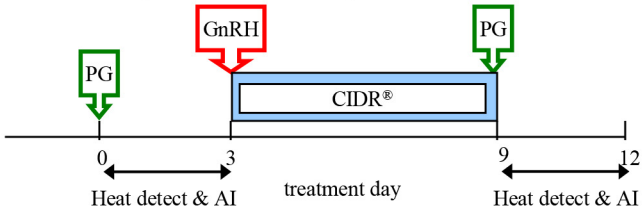
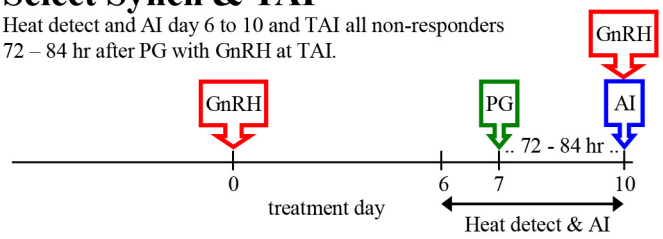


Figure 2. *Beef cow heat detection protocols.*

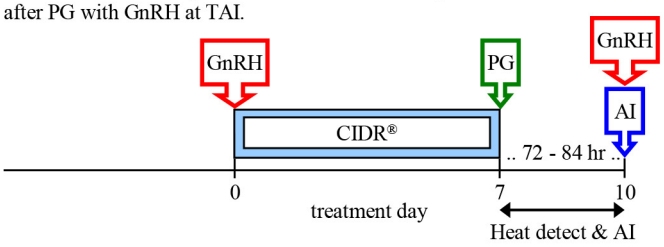
Select Synch & TAI

Heat detect and AI day 6 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.



PG 6-day CIDR® & TAI

Heat detect & AI days 0 to 3. Administer CIDR to non-responders & heat detect and AI days 9 to 12. TAI non-responders 72 - 84 hr after CIDR removal with GnRH at AI. Protocol may be used in heifers.

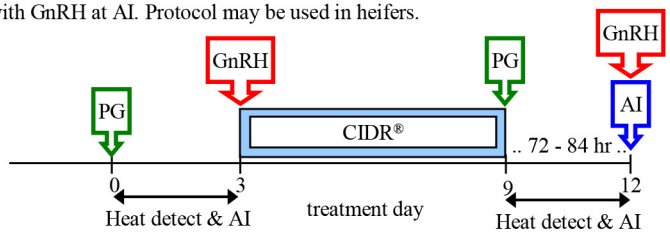


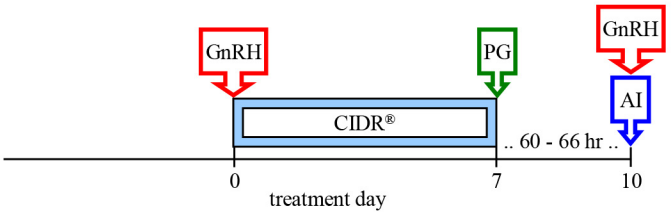
Figure 3. *Beef cow heat detection and timed AI protocols.*

Source: Beef Reproduction Task Force.

**The hours interval listed for fixed-timed artificial insemination protocols is not the time to begin inseminating, but rather the average time of insemination of all synchronized females. The start time to inseminate should be determined taking into consideration the number of females being inseminated, the workers present, and the facilities (e.g., multiple chutes and AI technicians, small holding facilities requiring several groups to be brought up one after another, etc.).*

7-day CO-Synch + CIDR®

Perform TAI at 60 to 66 hr after PG with GnRH at TAI.



5-day CO-Synch + CIDR®

Perform TAI at 72 ± 2 hr after CIDR removal with GnRH at TAI.
Two injections of PG 8 ± 2 hr apart are required for this protocol.

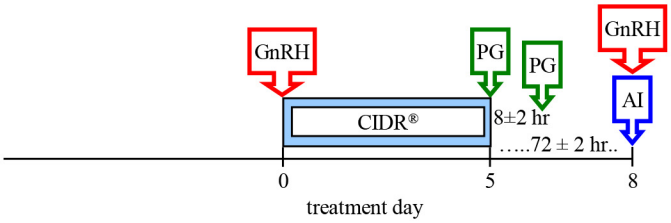


Figure 4. *Beef cow fixed-time AI protocols.**

PG 5-day CO-Synch + CIDR®

Perform TAI at 66 ± 2 hr after CIDR removal with GnRH at TAI.
Two injections of PG 8 ± 2 hr apart are required for this protocol.

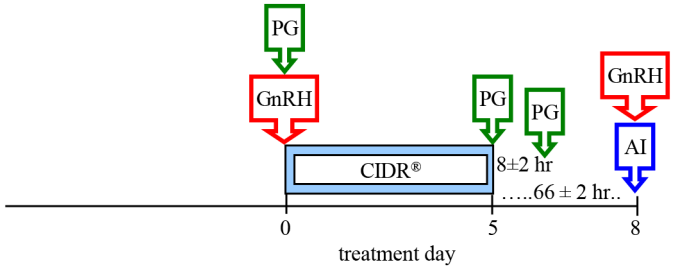
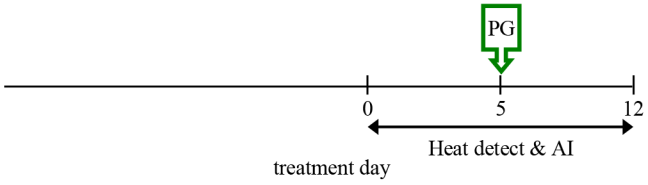
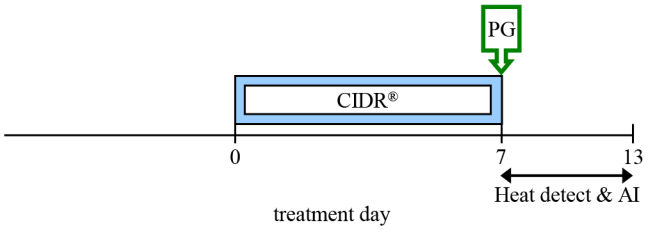


Figure 5. *Fixed-time AI protocol for Bos indicus cows only.**

1 Shot PG



7-day CIDR®-PG



MGA®-PG

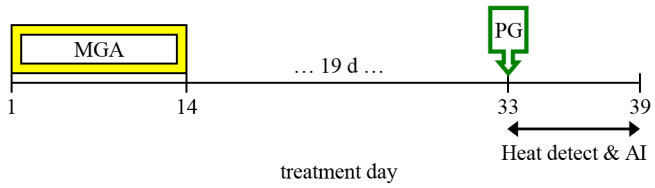
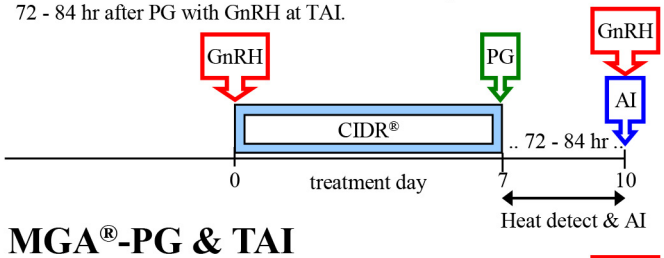


Figure 6. *Beef heifer heat detection protocols.*

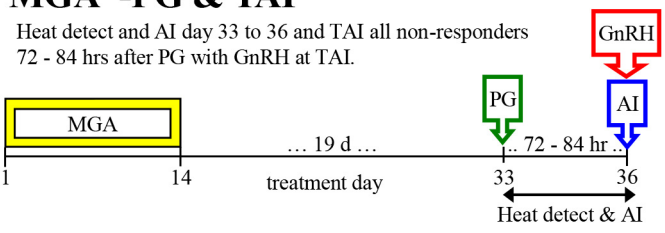
Select Synch + CIDR® & TAI

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.



14-day CIDR®-PG & TAI

Heat detect and AI day 30 to 33 and TAI all non-responders
72 hrs after PG with GnRH at TAI.

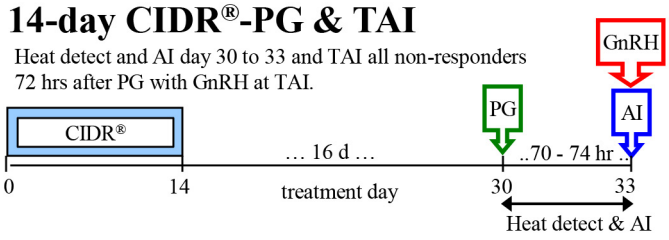


Figure 7. *Beef heifer heat detection and timed AI protocols.*

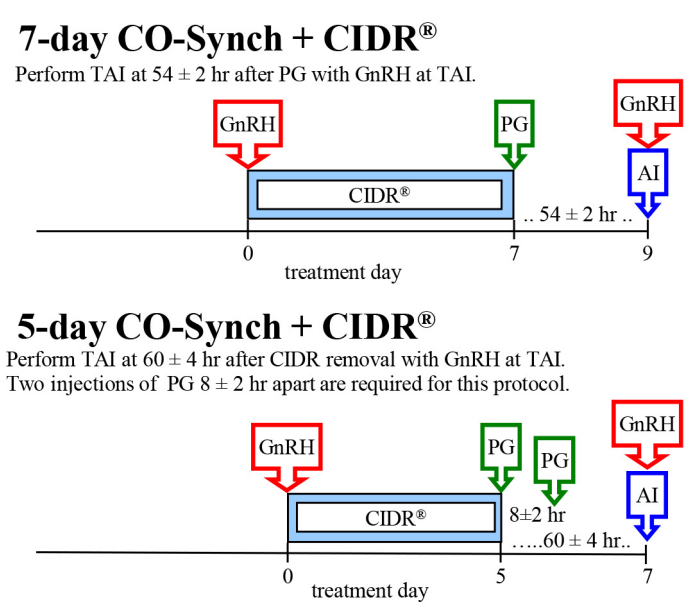


Figure 8. *Beef heifer short-term fixed-time AI protocols.**

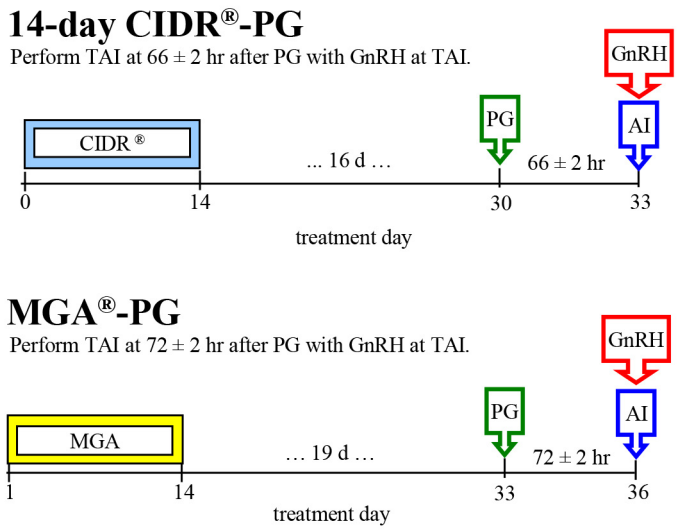


Figure 9. *Beef heifer long-term fixed-time AI protocols.**

Source: Beef Reproduction Task Force.

**The hours interval listed for fixed-timed artificial insemination protocols is not the time to begin inseminating, but rather the average time of insemination of all synchronized females. The start time to inseminate should be determined taking into consideration the number of females being inseminated, the workers present, and the facilities (e.g., multiple chutes and AI technicians, small holding facilities requiring several groups to be brought up one after another, etc.).*

Table 2. Comparison of beef cow estrus synchronization protocols.

Protocol	Labor	Cost
Heat Detection		
Select Synch	medium/high	low
Select Synch + CIDR	medium	high
PG 6-day CIDR	medium/high	high
Heat Detection and Timed Artificial Insemination (TAI)		
Select Synch & TAI	medium/high	low
Select Synch + CIDR & TAI	medium	high
PG 6-day CIDR & TAI	medium/high	medium
Fixed-time Artificial Insemination		
7-day CO-Synch + CIDR	medium	high
5-day CO-Synch + CIDR	medium	high
PG 5-day CO-Synch + CIDR (Bos indicus cows only)	high	high

Source: Adapted from Beef Reproduction Task Force, Beef Cow Protocols, 2016.

Table 3. Comparison of beef heifer estrus synchronization protocols.

Protocol	Labor	Cost
Heat Detection		
1 Shot PG	high	low
7-day CIDR-PG	medium	medium
MGA-PG	low/medium	low
Heat Detection and Timed Artificial Insemination (TAI)		
Select Synch + CIDR & TAI	medium	high
MGA-PG & TAI	medium	medium
14-day CIDR-PG & TAI	medium	medium
Fixed-time Artificial Insemination (Short-term Protocols)		
7-day CO-Synch + CIDR	medium	high
5-day CO-Synch + CIDR	medium	high
Fixed-time Artificial Insemination (Long-term Protocols)		
14-day CIDR-PG	medium	medium
MGA-PG	medium	medium

Source: Adapted from Beef Reproduction Task Force, Beef Cow Protocols, 2016.

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