MP383

Synchronization of Estrus in Cattle

DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
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Use of products and trade names in this publication does not constitute a guarantee or warranty of the products named and does not signify that these products are approved to the exclusion of comparable products.

Synchronization of Estrus in Cattle

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Introduction

Estrous synchronization is the manipulation of the reproductive process so that females can be bred with normal fertility during a short, predefined interval. This control facilitates breeding in two important ways: it reduces, and in some cases eliminates, the labor of detecting estrus (heat), and it allows the producer to schedule the breeding. If the majority of a herd can be induced to exhibit estrus at about the same time, the producer can arrange for a few days of intensive insemination. Although the total amount of labor involved with insemination may not be reduced, it is concentrated into a shorter period. Other advantages of estrous synchronization include creating a more uniform calf crop, enabling more cows to be artificially inseminated (AI) to a genetically superior bull and reducing the length of the breeding season.

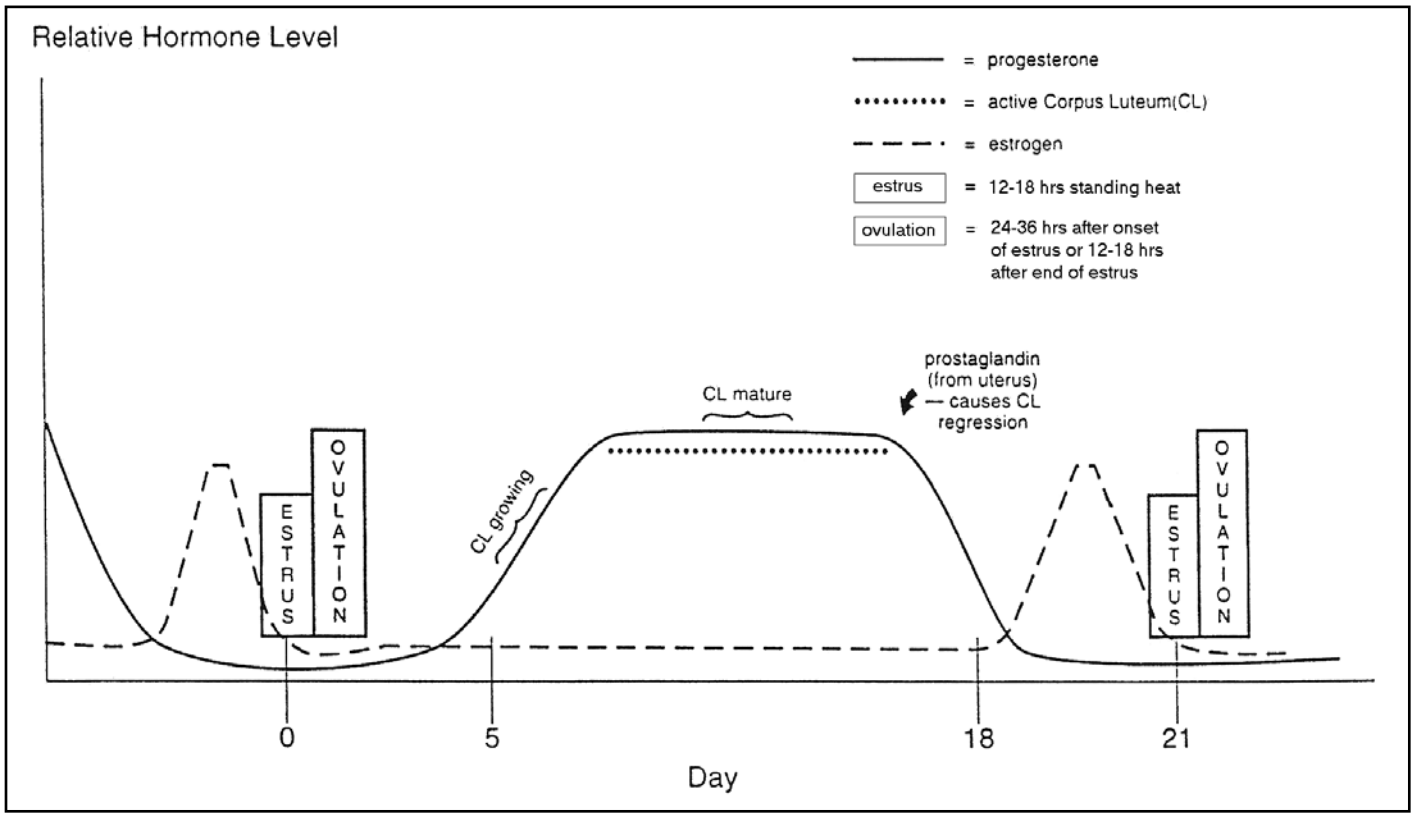
Estrous synchronization may not be for every producer. Use of this technology generally requires skilled management and adequate facilities. Cows will respond poorly if not fed properly or if body condition is less than adequate. Level of herd health is also a factor, as many diseases cause reproductive failure.

The Estrous Cycle

A successful estrous synchronization program requires an understanding of the estrous cycle. Figure 1 depicts important points during the estrous cycle. Day 0 is the first day of behavioral estrus. This is when a female will stand to be mounted by another female or bull. At this time, natural breeding would occur. The hormone estrogen peaked the day before (day -1) and then declined.

Progesterone levels are low because a corpus luteum is not present. Ovulation, the release of the ova, or egg, from a follicle on the ovary occurs 12 to 18 hours after the end of "standing heat." A corpus luteum, which produces progesterone, develops at the site of ovulation

Figure 1. Relative Hormone Level



and undergoes rapid growth from day 4 to 7. This growth is concurrent with an increase in progesterone. From day 7 through day 16, a fully mature corpus luteum is present and producing high levels of progesterone. During this time, one or two follicles may become large, maintain their size for a short time and then regress. On approximately day 16, prostaglandin F2α is released from the uterus if pregnancy has not occurred, which causes regression of the corpus luteum and a subsequent drop in progesterone levels. When progesterone levels become low, estrogen levels rise as a new follicle begins rapid growth. Estrogen levels will peak on day 20, followed by behavioral estrus on day 21. At this point, the cycle repeats itself.

Products Used for Estrous Synchronization

Research has dramatically increased the number of synchronization options. A producer has many choices to pick from to tailor a synchronization protocol to his operation, his production goals and his available labor. One of the oldest ways to synchronize estrus is by using a luteolytic agent such as prostaglandin F2α or one of its analogues, which causes the regression of the corpus luteum. Prostaglandin F2α is only effective if administered after day 7 of the estrous cycle. Examples of these products are sold under the trade names of Lutylase®, Estrumate®, estroPlan®, In-Synch® and Prostamate®. Synchrony of estrus and fertility with these products is good with cyclic females, such as virgin heifers, but will not induce estrous cycles in noncycling cows following calving (postpartum anestrus). The hormone treatments used in these protocols are the least expensive; however, they often require skilled labor for estrous detection.

Another way of creating estrous synchrony is by using gonadotropin-releasing hormone (GnRH) or an analogue, which causes ovulation of a large follicle. This product is sold under the trade name Cystorelin®, Fertagyl®, OvaCyst® or Factrel®. Treatment with GnRH is combined with prostaglandin F2α, as these hormones have different functions. Synchrony of estrus and fertility with a combination of GnRH and prostaglandin F2α are good for cyclic females, and some research indicates that this combination may induce cyclicity in cows experiencing postpartum anestrus. However, protocols using only GnRH and prostaglandin F2α are not advised for use in yearling heifers due to extremely variable response.

A third method for synchronization of estrus is to use a progestin, which will maintain high levels of progesterone in the female's system even after the regression of the corpus luteum. Synchrony of estrus occurs 2 to 5 days following progestin removal. Commercial products that fall into this category are melengesterol acetate (MGA) and Controlled Internal Drug Release (CIDR)®. All other products for synchronization are delivered as injections, but available progestins are administered differently. MGA is added to the feed and has been used in the past to suppress estrus in feedlot heifers to maintain feed efficiency and feed intake. MGA is the only synchronization product that is administered orally. MGA is added to feed such that females receive 0.5 mg per head per day for 14 days. Upon removal of MGA from the feed, cyclic females will begin to show estrus. Synchrony of estrus is good for cyclic females; however, fertility is poor immediately following MGA removal. Breeding should be on the second estrus following removal. Combining MGA with prostaglandin F2α treatment improves synchrony of the second estrus following MGA removal. The CIDR® is inserted into the vagina. CIDR® protocols have become very popular synchronization options for beef cattle producers.

Other Management Considerations for Estrous Synchronization

Timed Insemination Versus Breeding on Visual Observation of Estrus

Many research studies have examined the effectiveness of breeding on a timed insemination following estrous synchronization rather than visual observation of "standing heat." Almost every type of synchronization regime has been modified to include a timed or appointment breeding option. Timed breeding is a desirable alternative to heat checking, especially when time to detect estrus is limited. While results from these studies are somewhat conflicting, generally conception rates on timed insemination are lower than for visual observation, especially in Brahman-influenced females. However, this lower conception rate may be offset by the reduction in management costs because of timed insemination. Some synchronization programs even call for a combination of visual observation and timed insemination, which may improve conception rates above either option alone.

Estrous Synchronization Programs for Beef Cows

The following is a list of estrous synchronization programs designed for mature cows. Each has advantages and disadvantages. Some estrous synchronization programs are designed for estrous (heat) detection, for timed AI or combination of estrous detection and timed AI. Careful planning is necessary to select the right estrous synchronization program for your operation.

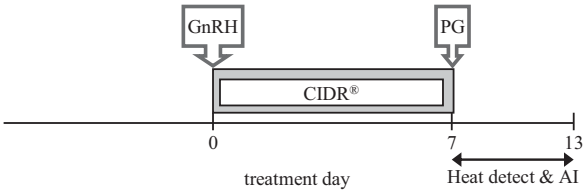
Key: GnRH = Cystorelin®, Fertagyl®, OvaCyst® or Factrel®.
PG = Lutylase®, Estrumate®, estroPlan®, In-Synch® and Prostamate®.
TAI = Fixed-Timed AI. CIDR = Controlled Internal Drug Release

BEEF COW PROTOCOLS - 2013

HEAT DETECTION

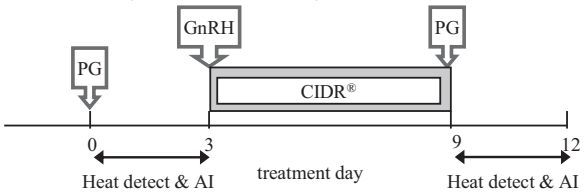
Select Synch

Select Synch + CIDR®



PG 6-day CIDR®

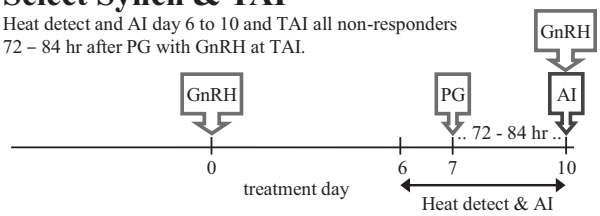
Heat detect and AI days 0 to 3. Administer CIDR to non-responders and heat detect and AI days 9 to 12. Protocol may be used in heifers.



HEAT DETECT & TIME AI (TAI)

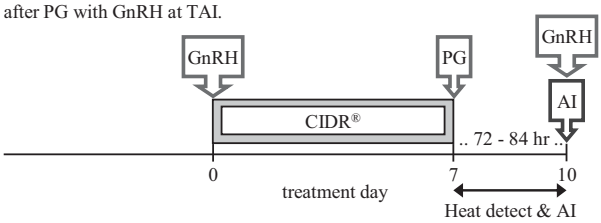
Select Synch & TAI

Heat detect and AI day 6 to 10 and TAI all non-responders 72 – 84 hr after PG with GnRH at TAI.



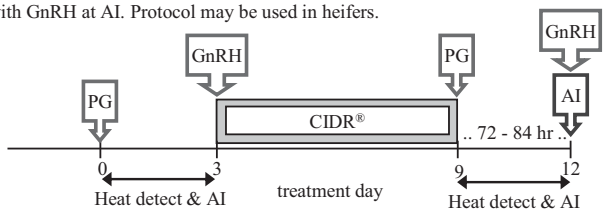
Select Synch + CIDR® & TAI

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

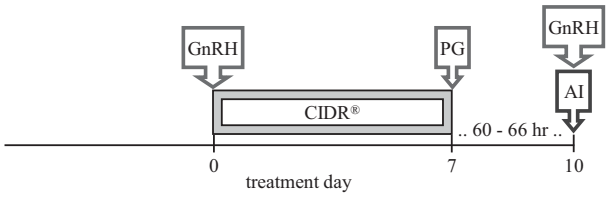
Heat detect & AI days 0 to 3. Administer CIDR to non-responders & heat detect and AI days 9 to 12. TAI non-responders 72 - 84 hr after CIDR removal with GnRH at AI. Protocol may be used in heifers.



FIXED-TIME AI (TAI)*

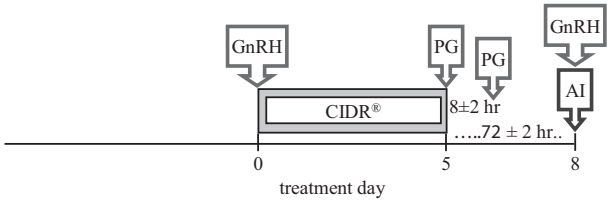
7-day CO-Synch + CIDR®

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.

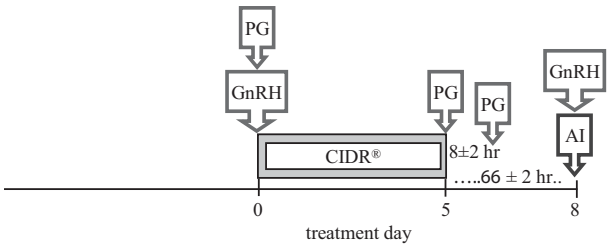


FIXED-TIME AI (TAI)*

for *Bos indicus-influenced* cows only

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.



* The time 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.

Cystorelin®, Factrel®, Fertagyl®, OvaCyst®

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

Approved 12-06-12
Beef Reproduction Task Force

Estrous Synchronization Programs for Beef Heifers

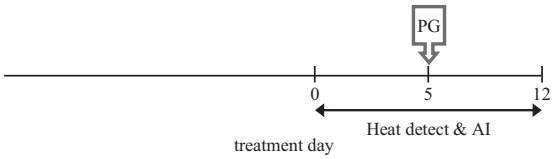
The following is a list of estrous synchronization programs designed for beef heifers. As with the estrous synchronization program for beef cows, each has advantages and disadvantages. Estrous synchronization programs can work very well with beef heifers, but planning and playing close attention to details is extremely important.

Key: GnRH = Cystorelin®, Fertagyl®, OvaCyst® or Factrel®.
PG = Lutylase®, Estrumate®, estroPlan®, In-Synch® and Prostamate®.
TAI = Fixed-Timed AI. CIDR = Controlled Internal Drug Release

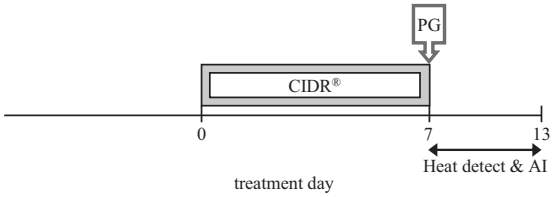
BEEF HEIFER PROTOCOLS - 2013

HEAT DETECTION

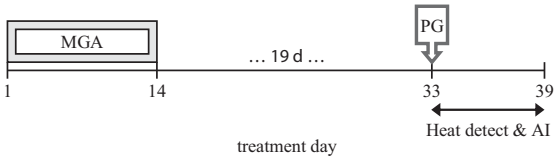
1 Shot PG



7-day CIDR®-PG



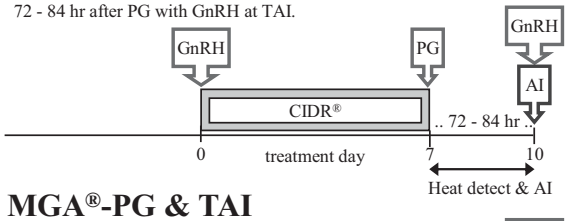
MGA®-PG



HEAT DETECT & TIME AI (TAI)

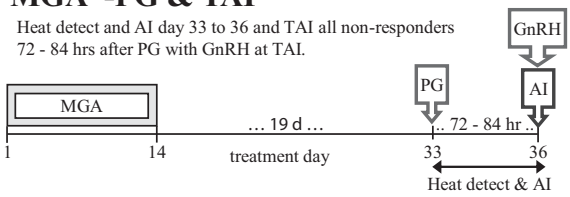
Select Synch + CIDR® & TAI

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



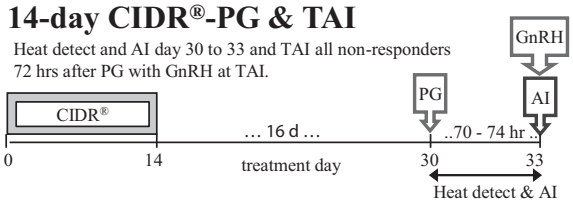
MGA®-PG & TAI

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



14-day CIDR®-PG & TAI

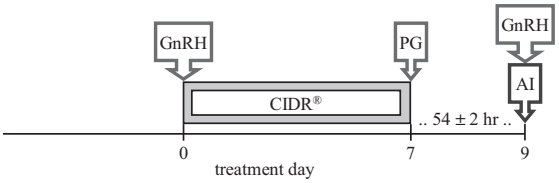
Heat detect and AI day 30 to 33 and TAI all non-responders 72 hrs after PG with GnRH at TAI.



FIXED-TIME AI (TAI)*

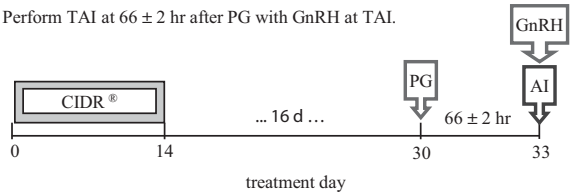
7-day CO-Synch + CIDR®

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



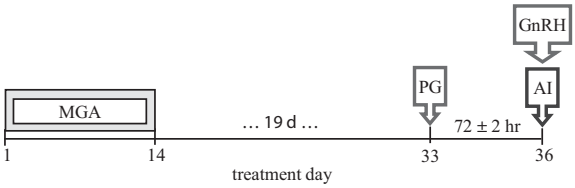
14-day CIDR®-PG

Perform TAI at 66 ± 2 hr after PG with GnRH at TAI.



MGA®-PG

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



* 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 — estroPLAN®, Estrumate®, In-Synch®, Lutalyse®, ProstaMate®

Approved 12-06-12

Beef Reproduction Task Force

Conception Rates from Estrous Synchronization and Artificial Insemination

One of the greatest concerns that producers have when implementing an estrous synchronization and artificial insemination program is the expected conception rate. Research reports for the various synchronization programs report varied results.

In 37 research papers where cows and/or heifers were synchronized and bred once or bred once at a normal estrus, the average conception rate was 49 percent with a standard deviation of 11 percent. This means that two-thirds of these studies reported conception rates within a range of 38 to 60 percent.

With healthy, cyclic heifers in good body condition, first service conception rates with skilled AI technicians may approach 75 percent. However, this is usually not the case, and a more accurate estimate is 50 to 55 percent. Conception rates are affected by the number of females that are cyclic, healthy and in good body condition due to level of nutrition. Skilled estrous detection and AI technician also affect conception rates. Inadequacy in any of these areas can spell disaster for an estrous synchronization program.

Comparing Estrous Synchronization Programs

Table 1 ranks the cost and handling needs of each estrous synchronization program. This information can be used as a guide to select the right program for each situation.

Cost of an Estrous Synchronization and Artificial Insemination Program

Like all management practices, estrous synchronization and artificial insemination come with a cost. In actuality, an artificial insemination program may be economically beneficial to one producer and not to another. It should also be noted that

Table 1

COMPARISON OF ESTROUS SYNCHRONIZATION BEEF COW PROGRAMS

Program	Cost[a]	Handling Times[b]
Heat Detection		
Select-Synch	$32.80	3
Select-Synch + CIDR®	$42.80	3
PG 6-day CIDR®	$46.60	4
Heat Detection & TAI		
Select-Synch + TAI	$32.80 to $36.80	3
Select-Synch + CIDR® & TAI	$42.80 to $46.80	3
PG 6-day CIDR® & TAI	$28.80 to $	2 to 4
Fixed-Time AI		
7-day CO-Synch + CIDR®	$46.80	3
5-day CO-Synch + CIDR®	$50.60	4
Fixed-Time AI (Bos indicus-influenced cows only)		
5-day CO-Synch + CIDR®	$54.40	4

[a]Costs are based only on the following items. GnRH = $4.00/shot; prostaglandin = $3.80/shot; CIDR = $10.00 per head; semen = $25 per straw. Cost of labor, feed, etc., were not included.
[b]Handling is considered to be processing the female through a chute or similar device.

COMPARISON OF ESTROUS SYNCHRONIZATION BEEF HEIFER PROGRAMS

Program	Cost[a]	Handling Times[b]
Heat Detection		
1 Shot PG	$28.80	2
7-day CIDR® - PG	$38.80	3
MGA® - PG	$29.22	2
Heat Detection & TAI		
Select-Synch + CIDR® & TAI	$42.80 to $46.80	3
MGA® - PG & TAI	$29.22 to $33.22	2
14-day CIDR® - PG & TAI	$38.80 to $42.80	4
Fixed-Time AI		
7-day CO-Synch + CIDR®	$46.80	3
14-day CIDR® - PG	$42.80	4
MGA® - PG	$33.22	2

[a]Costs are based only on the following items. GnRH = $4.00/shot; prostaglandin = $3.80/shot; CIDR = $10.00 per head; MGA = $0.32 per pound (does not include the cost of feed); semen = $25 per straw. Cost of labor, feed, etc., were not included.
[b]Handling is considered to be processing the female through a chute or similar device.

artificial insemination has benefits other than economic ones. Some advantages of artificial insemination include control of venereal diseases, greater genetic progress, easier calving sires used for heifers, more uniform calf crop, crossbreeding and shorter breeding season. Most of these advantages, however, have either direct or indirect economic returns. For the advantages with direct economic returns (growth traits, crossbreeding, etc.), the return on the artificial insemination investment is easy to determine. However, for the advantages with indirect economic return (control of venereal disease, value of returned breeding stock), the returns are not as easily determined. Not all ranches will experience the same cost and returns. Actual cost and returns will vary from ranch to ranch and from year to year.

Tips for a Successful Synchronization Program

Calving Distribution

The greater the proportion of cows calving in the first 21 days of the calving season, the better the response expected from a synchronization and AI program. Although some synchronization protocols can induce estrus and ovulation in some noncycling cows, cows that calved during the 30 days just before the start of the breeding season are unlikely to respond.

Using a synchronization protocol every year can gradually increase the proportion of cows that calve in the first 30 days of the calving season and subsequently increase the pregnancy rates to AI in a parallel fashion. With longer breeding seasons (more than 70 days) and less than 60 percent of the herd calving in the first 42 days of the calving season, expect much lower AI pregnancy rates. Timed AI of the entire herd would not be recommended.

Cow Age

Duration of postpartum anestrus averages 20 days longer for first-calf heifers than mature cows. Even in herds in which heifers calved ahead of cows, the proportion of primiparous cows cycling at the start of the breeding season was 9 percent less than multiparous cows.

Body Condition

Body condition influences the length of postpartum anestrus and thus the proportion of cows cycling at the start of the breeding season. Cows need to be in a positive energy balance to resume normal estrous cycles. Over a range of body condition scores (BCS) of 4 to 5.5 (1=thin to 9=fat), the proportion of cows cycling increased 18 percent for each unit increase in body condition score. This response would likely level out for cows with BCS greater than 6.5.

Mature Cows

- BCS ≥ 5 – Good candidates for synchronization and AI.
- BCS 4 to 4.5 – AI pregnancy rates will be lower. The risk of poor response may be reduced if plane of nutrition has been increasing three to four weeks before the onset of the breeding season. Timed AI is not recommended.
- BCS < 4 – Poor candidates for synchronization. Timed AI is not recommended.

First-Calf Heifers

- BCS ≥ 5.5 – Good candidates if calved three weeks ahead of mature cows.
- BCS 4.0 to 4.5 - High risk. Response to induction of ovulation with GnRH is about half of that in mature cows at similar BCS. Consider using multiple methods to induce anestrus first-calf heifers to cycle (e.g., calf removal and a progestin).

Semen

Semen should be processed at a Certified Semen Service (CSS) certified lab. Be aware that considerable sire-to-sire variation in pregnancy rates exists for bulls even when they have passed a BSE. Keep accurate records to check individual sire conception rates. Bull studs consider at least 250 inseminations before evaluating fertility. However, suspected problems observed after fewer inseminations warrant further examination. Ask the semen salesperson to identify high-fertility sires before you make final semen purchasing decisions, especially if timed breeding is to be utilized.

Technicians

Variation in conception rates between technicians can range up to 20 percent or more. When inseminating large numbers of females during timed AI, ensure you have enough technicians to complete the job. Rotating jobs between loading guns and inseminating every 15 to 25 head is recommended to minimize effects of fatigue. Size of inseminator's forearm, particularly for heifers, can be negatively related to the ability to inseminate large numbers. The pressure of the rectal sphincter on a large forearm speeds fatigue.

Treatments

Injections

- Use appropriate sizes of syringes and needles, follow label directions and Beef Quality Assurance guidelines. Accuracy is the goal, not speed.

- Do not inject in the top butt. Make sure you have the proper equipment in sufficient supplies (at least one needle per 10 to 15 cows).
- Have a specific place to discard old needles. An old milk jug works well.

CIDRs

- Follow package directions. Cleanliness is important during insertion.
- In confined situations or for heifers, you may wish to shorten the tail of the CIDR, leaving 2.5 inches exposed, so pen mates do not play with the tail and remove the CIDR early.
- Reuse of CIDRs is not recommended.

MGA

- Uniform, consistent daily consumption is increased when adequate bunk space is available (18 to 24 inches for heifers and cows, respectively).
- Make sure all animals are up to the bunk or gathered before feeding.
- Feed MGA mixed with a small amount of grain (3 to 5 pounds) that can be cleaned up in a relatively short time yet allows for everyone to get their share.
- When feeding MGA in a high volume total mixed ration, deliver half or less of the daily ration at first feeding with the entire MGA dose, delivering the remaining ration later in the day. This increases the odds that those females with lower intakes will consume the entire daily dosage.
- Cows that are just getting new-growth grass in the spring at the time MGA feeding begins may ignore the MGA feed completely. To improve consumption, remove free-choice salt from the pasture before MGA feeding and include 0.5 oz. of salt per head per day in the MGA supplement.

Timing

Do not combine administration of synchronization drugs with routine vaccination, especially with modified live vaccines. Most vaccinations should be completed several weeks before the breeding season begins. Make sure to give the appropriate treatment on the appropriate day. Changes by even a day may seriously harm results.

If you intend to precisely identify AI versus natural service calves, wait at least 7 to 10 days after the synchronized period to turn out bulls and employ early pregnancy detection. Pregnancy detection at 30 to 50 days after AI will minimize errors in proper identification of AI pregnancies.

Heat Detection

Synchronized Estrus

Detection for two hours morning and evening and one hour at noon identified 40 percent more cows in estrus than checking twice a day for 30 minutes. Many successful operations have someone watching cows during all daylight hours of the recommended synchronized observation period. During days of peak estrus, females that are identified in heat should be sorted off several times during the day. This allows animals that are just coming into heat to be identified more easily and increases the chances of detecting heat in timid animals.

Attempting to watch cows in large pastures is nearly impossible. Gathering cattle into a smaller pasture or moving cattle into a corner of the pasture or large pen always facilitates better heat detection. Moving and sorting stimulates heat activity. Animals need legible, clean ear tags or other forms of identification so they can be identified at a reasonable distance and accurately recorded for later sorting.

Having at least one person observing heat per 100 head during peak hours is recommended. Heat detection in very large herds may be more effective if subdivided into groups of 200 or fewer. Heat detection aids may be useful but are not as effective as visual observation.

Naturally Occurring Estrus

Detecting for 30 minutes, twice a day, is considered a minimum. The frequency of mounting activity is considerably less for naturally occurring estrus than a synchronized estrus, increasing the need for diligent observation. Gomer animals, tail chalking or heat-mount patches may be useful heat detection aids, but their effectiveness depends on examining each animal twice daily for signs of standing activity.

Timing of AI

The highest conception rate to AI has been noted 4 to 12 hours after on the onset of standing activity. So for producers using intense visual observation and thus having an accurate estimation of when standing estrus began, insemination by the AM/PM rule should produce the highest conception rates. If heat detection only occurs two times per day, an accurate estimate of the initiation of standing activity will not be achieved, and insemination once a day may provide similar results to two times per day. If animals continue to

exhibit standing estrus for long periods (12 to 14 hours) after the initial insemination, the conservative approach is to reinseminate.

Facilities

Well-designed facilities in good repair minimize stress on animals and people to optimize results. If breeding on observed estrus, areas for easy sorting and holding animals are needed. Often cows bred on observed estrus are moved immediately after AI to make heat detection and sorting on the remaining group easier. If cows can be moved to an adjacent pasture, a creep gate may work to let calves sort themselves, saving considerable time and effort.

Cows generally stand quietly in a breeding box without heads caught. Make sure to have a plan for rainy weather. Semen handling and thawing should be done out of direct sunlight. As a synchronized group of females begins to show signs of estrus, even the best fence may not deter neighboring bulls. If direct fence-line contact with bulls cannot be avoided, a hot wire set a reasonable distance from the permanent fence may prevent unplanned breedings.

Full-Time Synchronization

- Make sure animals are in adequate BCS.
- Start with a smaller group; heifers or early-calving cows.
- Consider synchronizing and using bulls natural service the first year.
- Consult an expert when selecting a synchronization system.
- Trade help with an operation that has experience with AI and synchronization to learn how they do things and to have expertise on hand when it's your turn.

Characteristics of Successful Estrous Synchronization Programs

- Good year-round nutrition program.
- Mature cows are in a minimum BCS of 5 at calving time and first-calf heifers a BCS of 6.
- Total breeding season is 60 days or less.
- Functional facilities for sorting, administration of treatments and AI.
- Skilled help.
- Good record keeping.
- Effective vaccination and health program.
- Attention to details.

Conclusion

Estrous synchronization can be a useful tool in the reproductive management of a cow herd. However, if proper levels of nutrition, body condition and health are not maintained, the program is likely to fail. Improvements in facilities and management may be necessary before implementing an estrous synchronization program.

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