Current and Future Estrous Synchronization Systems

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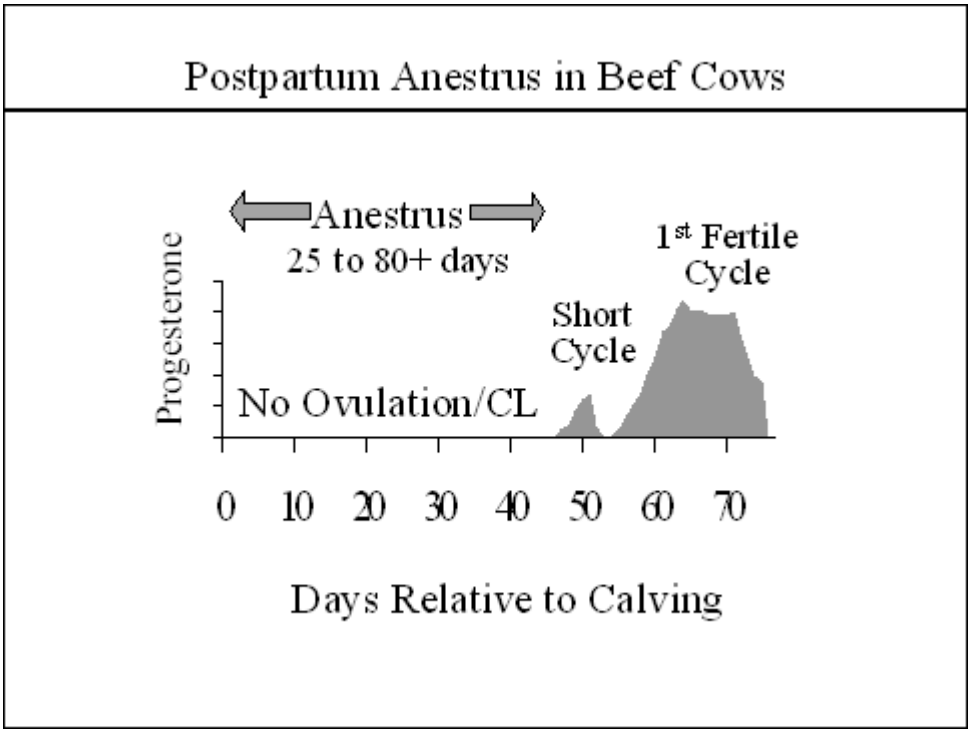
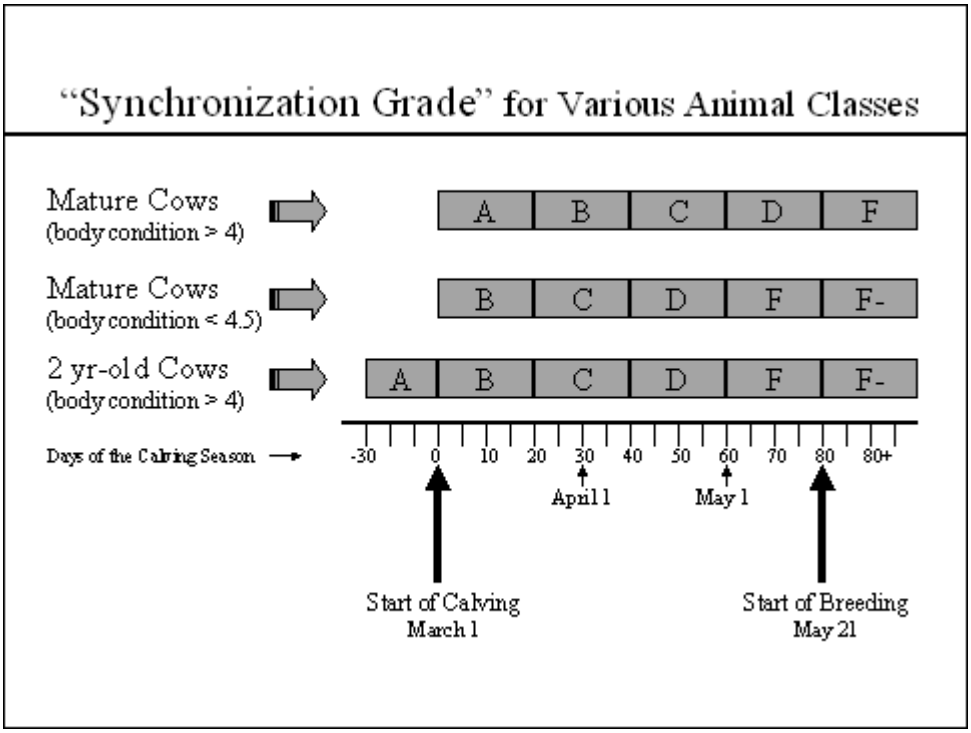


All cows have a period after calving during which they do not show heat. When cows are not coming into heat and ovulating we call them anestrous cows. When cows are showing heat every 21 days, they are called cyclic cows. If cows calve late, they have less time to recover from the stress of calving and are more likely to be anestrous. Cows in poorer body condition or that are having their first calf (2 year-old cows) are more likely to be anestrous. It is easy to synchronize estrus and AI cows that are cyclic, more difficult if they are anestrous.

The length of gestation in cattle, the duration of the preceding calving season, and the desire to produce calves on an annual schedule limit the amount of time available to implement an estrous control program and/or the proportion of the herd that can be included in the synchrony program. Furthermore, it should be evident that on a whole-herd basis, inclusion of as many females as possible in the synchrony program will usually increase the proportion of the herd that becomes pregnant during the synchrony period. If one considers that in many herds, 50% or more of the herd is anestrous at the start of the breeding season, it is requisite that anestrous females be synchronized in order to optimize pregnancy rates.

For anestrous females, the primary requirement for a successful synchronization system is to induce ovulation and initiate the first postpartum estrous cycle. In the example above of a cow with an anestrous period of 55 days, there is no progesterone in the animal's circulation from calving until about day 45. During this time she is not ovulating or forming a CL. The first ovulation after calving in this example occurred on day 45. Notice, however, that the increase in progesterone after this ovulation, and the interval to the next ovulation is not 21, but only about 10 days. This short cycle is also a normal occurrence in greater than 80% of postpartum cows. Some cows (20-30%) will show heat at the beginning of the short cycle, however, cows that are inseminated or mate with a bull at this heat will not become pregnant. The purpose of the short cycle is to provide a period of progesterone exposure before the first normal ovulation. The short period of progesterone pre-exposure is necessary for the next cycle to be a normal 21-day estrous cycle. In terms of estrous control systems designed to induce postpartum cows to ovulate, it is essential that the cow be provided with this short period of progesterone exposure before the estrus/ovulation at which insemination will occur. Conception rate of cows that do not have this period of progesterone exposure is essentially 0%.



The grading system described above ranks groups of cows on the likelihood of whether they have started to cycle again after calving (according to the start of the next breeding season).

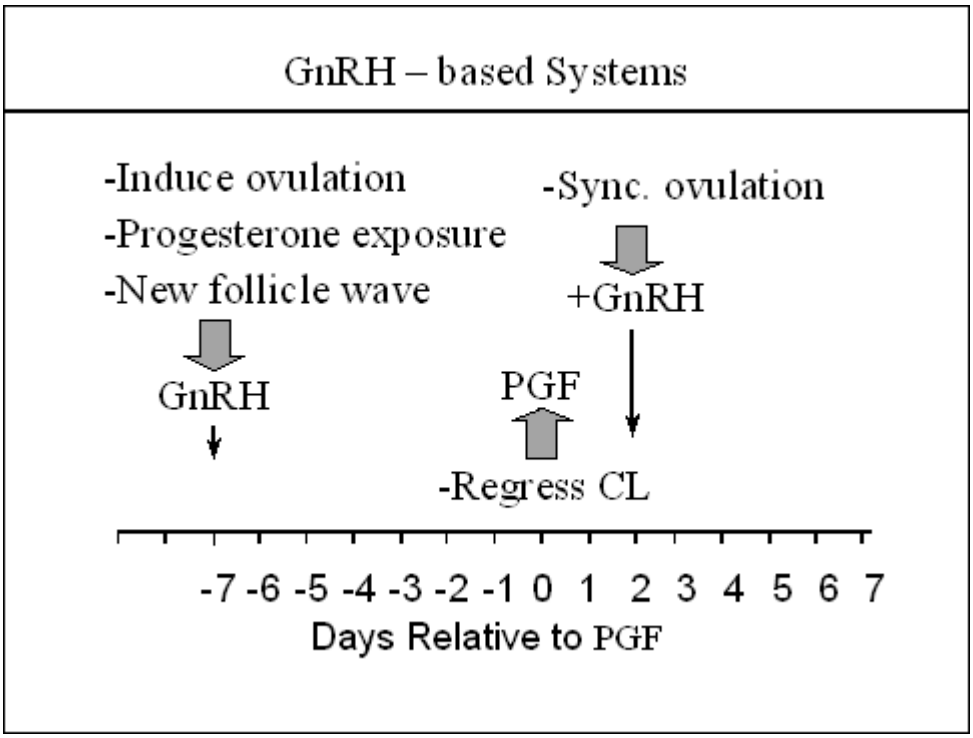
Cows with an **A** grade are probably cyclic and can be readily synchronized with high pregnancy.

Cows with a **B** grade have at least a 50% chance of being cyclic and, even if they are anestrus, have a fairly high probability of being synchronized and pregnant with the systems discussed.

Cows in the **C** grade are mostly anestrus and represent a higher risk. If nutrition is good, and one can accept lowered conception and/or heat rates in these animals, they can be included in the program.

Cows in the **D** grade are very high risk. A small percentage (< 25%) of the cows in the D range could become pregnant if synchronized. The clean-up bull, or delaying synchronization treatments for at least 21 days (let them move to at least the C grade) are the most viable options.

F Grade Forget about it!! Wait for 30-40 days or to reduce headaches, sell the F grade cows!!



***GnRH PGF System*:** This combination represents the simplest GnRH-based system and involves the GnRH treatment followed 7 days later by the PGF treatment. A common name that is often used for the GnRH PGF system is Select Sync. Some cows (~8 %) will exhibit estrus up to 36 hours before PGF. The early heats are fertile and cows can be inseminated 12 hours after detection. The PGF treatment is not necessary in early cows that have already exhibited estrus, but will not compromise the pregnancy if given. The peak estrous response will occur 2-3 days after PGF with a range of days - 5. With this system, a minimum of 5 days of estrus detection after PGF and 2 days preceding PGF is required to detect most heats. Essentially all cyclic

females will be in estrus during this 7 - day period. This protocol will initiate estrous cycles in some anestrous cows although results can be quite unpredictable.

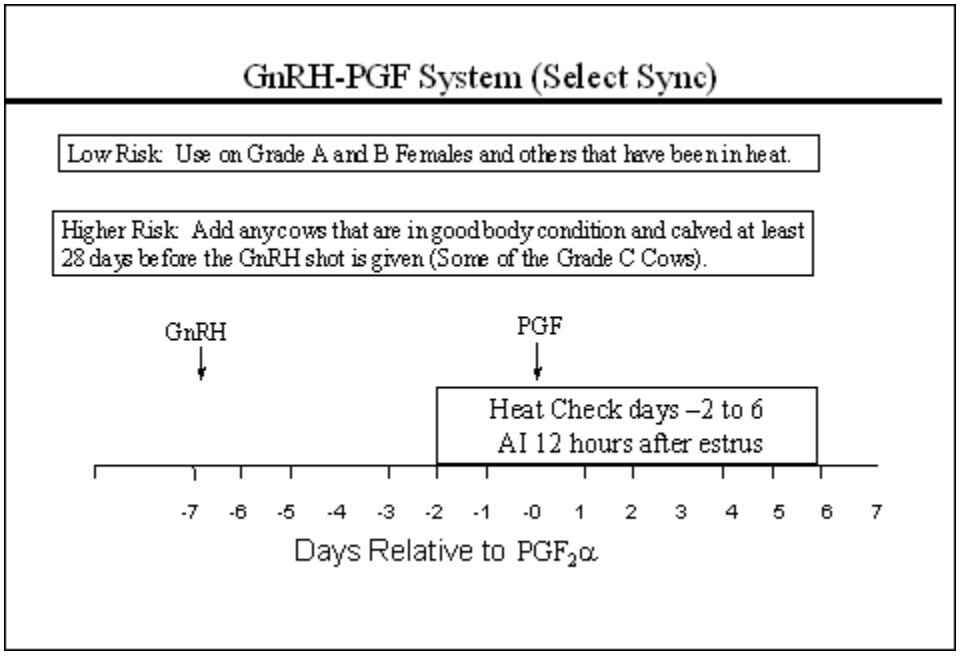
The **advantages** of this system are:

1. Simple to administer
2. Relatively low drug costs per animal
3. In animals that display estrus, fertility is excellent
4. High fertility and insemination of only cows in heat results in low semen costs/pregnancy

The **disadvantages** of this system are:

1. Involves 7 days of heat detection and AI, morning and evening.
2. In herds with a large number of non - responsive anestrous females, submission rates for AI and therefore pregnancy rates can be unacceptably low.

GnRH PGF is most effective if used on cyclic cows, or cows that would be expected to spontaneously resume estrous cycles within the first couple weeks of the breeding season. Timed AI is not recommended for this protocol.



GnRH PGF + GnRH Systems: These systems resemble a GnRH PGF system but include a second GnRH injection (+ GnRH) given to all, or some cows either between 48 and 72 hours after PGF (day 2-3), and timed AI on all or a portion of the herd.

GnRH PGF +GnRH is most effective if used on cyclic cows, or anestrous cows that would be expected to spontaneously resume estrous cycles within the first couple weeks of the breeding season. Within this sequence, several minor variations are available.

A. GnRH PGF +GnRH with Timed AI of <u>All</u> Cows: This system involves giving the GnRH treatment on day 7, PGF on day 0, +GnRH on day 2 (48 hours), and inseminating all cows at the time of the + GnRH injection. No heat detection is performed. A common name for this system is CO Sync.

The **advantages** of this system are:

1. No heat detection is required

2. The herd is handled as a group and a maximum of 3 times with reduced labor costs.

3. Pregnancy rates are often similar to GnRH - PGF since submission rate is 100%.

The **disadvantages** of this system are:

1. All females receive the second GnRH injection, increasing drug costs.

2. In herds with a large number of females that are in heat early, not synchronized, or anestrus:

    a. conception rate/insemination can be very low

    b. low conception rate, with 100% of cows inseminated, results in high semen, inseminator and drug costs/pregnancy.

    c. pregnancy rates, can be unacceptably low.

A minor modification of this system is to give the +GnRH system on day 2.5 (60 hours) after PGF and mass inseminate all cows at this time. There is not sufficient evidence at this time to suggest that a large difference in pregnancy rate will occur with timed AI at either 48 or 60 hours after PGF. A second minor modification to the system is based upon findings that pregnancy rates to this system may be increased by 2-8% if cows are inseminated 8 16 hours after the +GnRH treatment. This is an approach commonly used in dairy herds, with a common name of Ov Sync. This increase in pregnancy rate must be balanced against the labor costs, stress and inconvenient time interval for moving the cows back through the chute 8 16 hours after giving the +GnRH treatment.

B.  **GnRH** **PGF +GnRH with AI of Cows in Estrus Early and Timed AI of other Cows:** This system is identical to the preceding system, with the exception that estrus detection is performed from days 2 to 1 and cows detected being inseminated 12 hours after heat. The number of early heats averages about 8% of cyclic females, with a range of 0 15 % of treated females across several research studies.

The cows inseminated early would not receive the +GnRH treatment and would not be included in the timed AI group.

The major impact that this alteration has on the previously listed advantages and disadvantages of the *GnRH PGF +GnRH* program is:

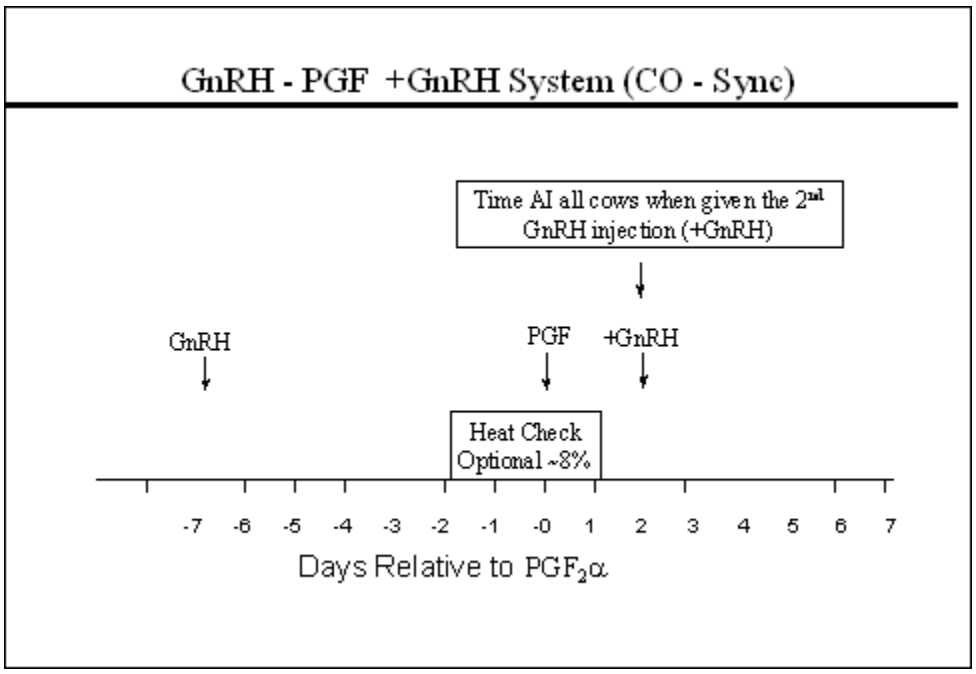
1. Establishes the need for heat detection for 3 days, resulting in increased labor costs and animal handling.

2. Conception rate for cows in estrus and inseminated early would be normal.

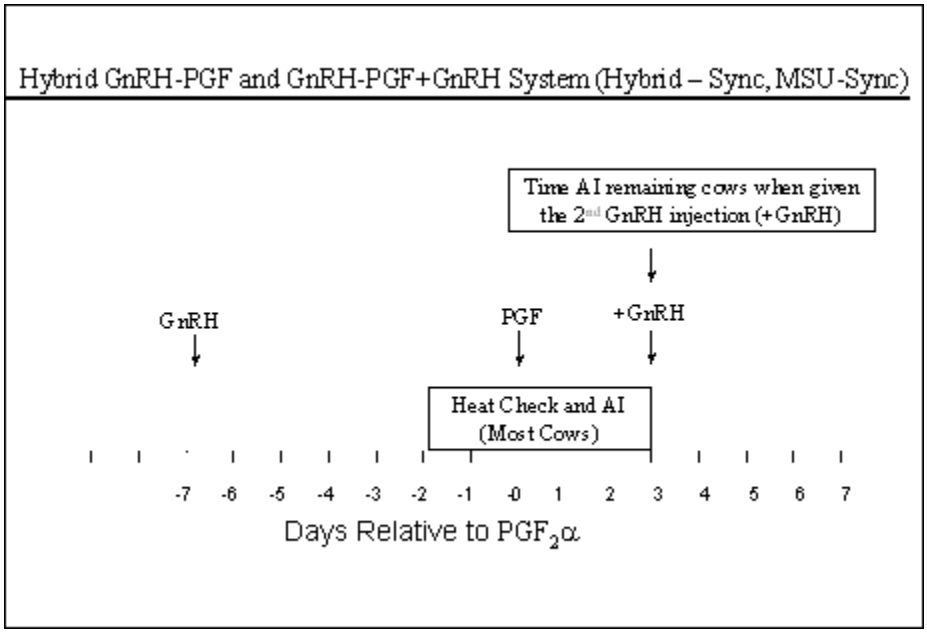
3. For the timed AI group, conception rate would increase due to removal of early females.

4. Pregnancy rate for the herd would be expected to increase.

5. Semen and drug costs would be reduced due to higher conception rates and fewer females receiving the +GnRH treatment.



C.** GnRH ** PGF +GnRH with Heat Detection Until Hour 72, Timed AI at 72 Hours:**
This approach is actually a hybrid between the *GnRH ** PGF* and the *GnRH ** PGF +GnRH* systems.** Thus, one common name for this system is **Hybrid Sync** and another is **MSU Sync**.** This approach is based upon the knowledge that in most herds, a majority of cows that are going to be in heat, will display heat by 60 ** 72 hours (Day 2.5 to 3) after PGF.** With 5 days of heat detection (Day ** 2 to Day 3) cows that will display estrus are detected and inseminated 12 hours after detection of heat.**** This time interval **permits** cows that will show estrus in a timely manner to do so, and optimizes conception rates for these animals.**



The remaining animals (not detected in estrus) receive the +GnRH treatment on Day 3 (72 hours) and are mass inseminated at this time.** This sub-group of the herd is partially made up of cows that would have been in heat after 72 hours (day 3.5 ** 6) and cows that are ovulating at an appropriate time but are not displaying a detectable estrus.** Conception rates for this portion of the timed AI group should be near that of cows inseminated after detection of standing heat.** The other portion of the cows in the timed AI group would be anestrous cows that did not respond to the earlier treatments, and cows in which synchronization of estrus was not achieved.** Very few, if any, of these females would conceive to the timed AI.** Therefore, the conception rates for the animals that are timed inseminated can vary widely.** If the +GnRH treatment were mainly grouping up animals that would be in heat within the next 2 ** 3 days, conception rate would be acceptable.** If the animals receiving the +GnRH are mainly non-responsive anestrous cows, conception rate in the timed AI group can be very low.

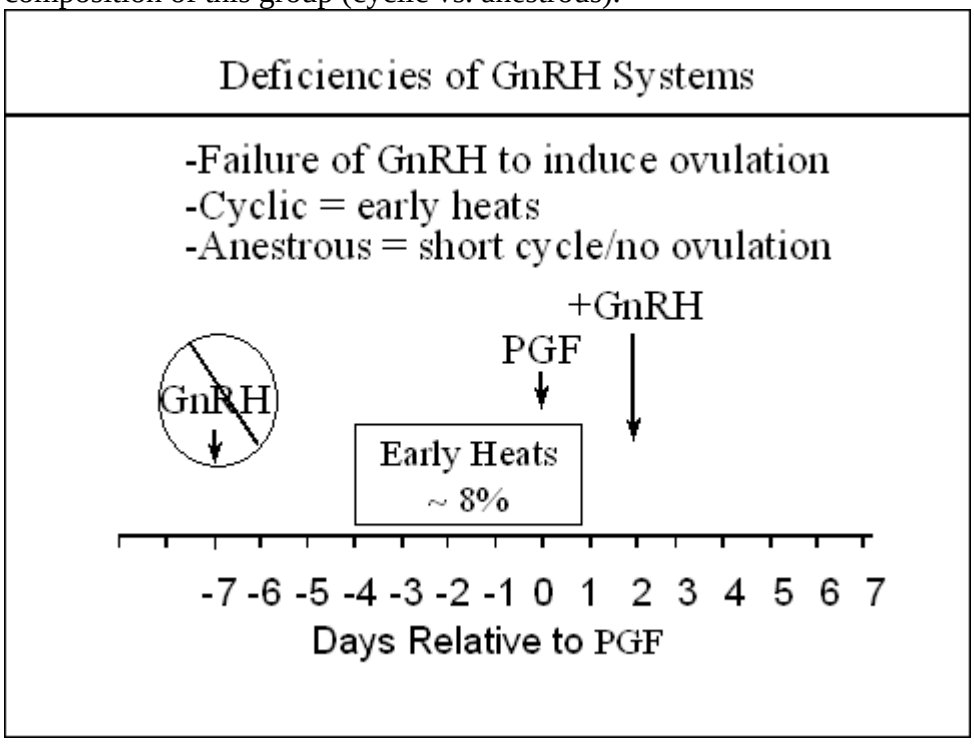
The major impact that this alteration has on the *GnRH ** PGF +GnRH* program is:

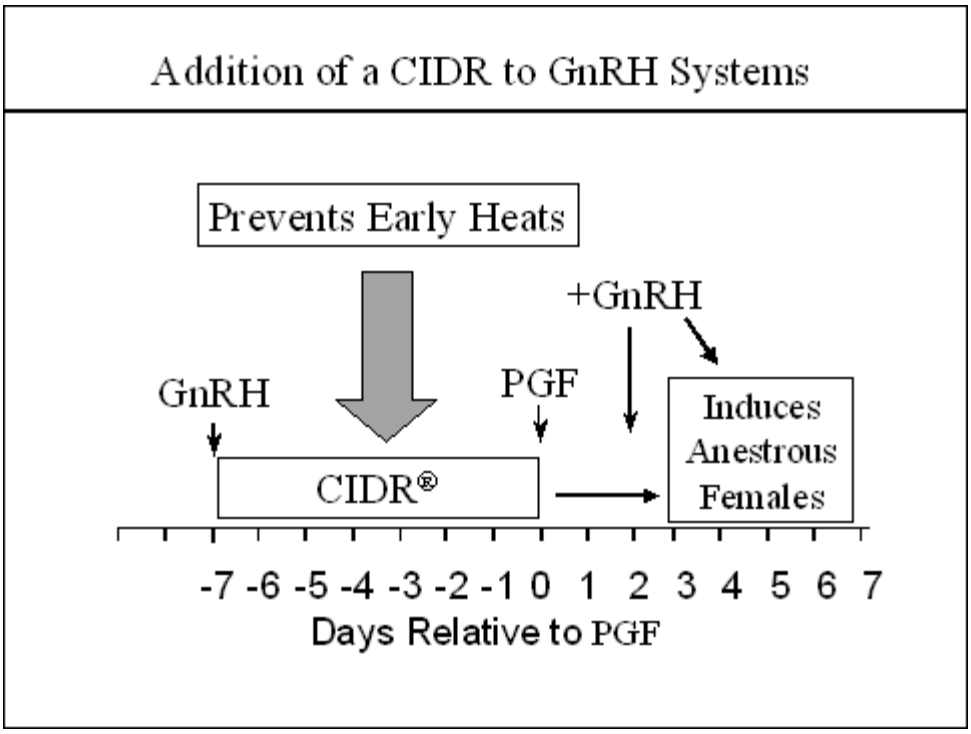
1. Includes 5 days of estrus detection and AI before the timed AI period.

2. Conception rates for cows detected in estrus would be normal.

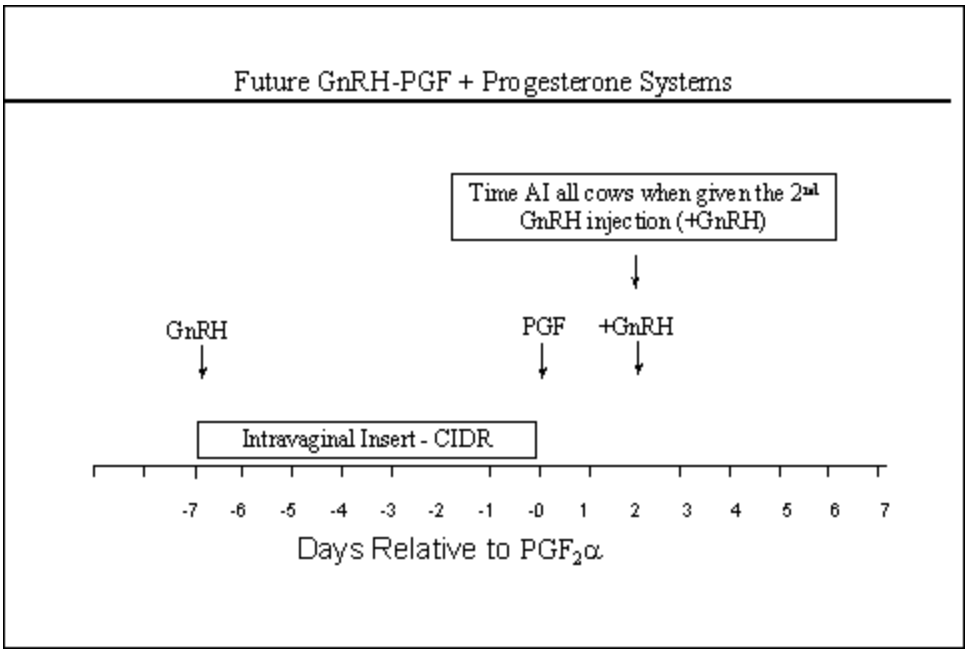
3. Drug costs would decrease with increasing proportions of cows being detected in estrus before 72 hours.

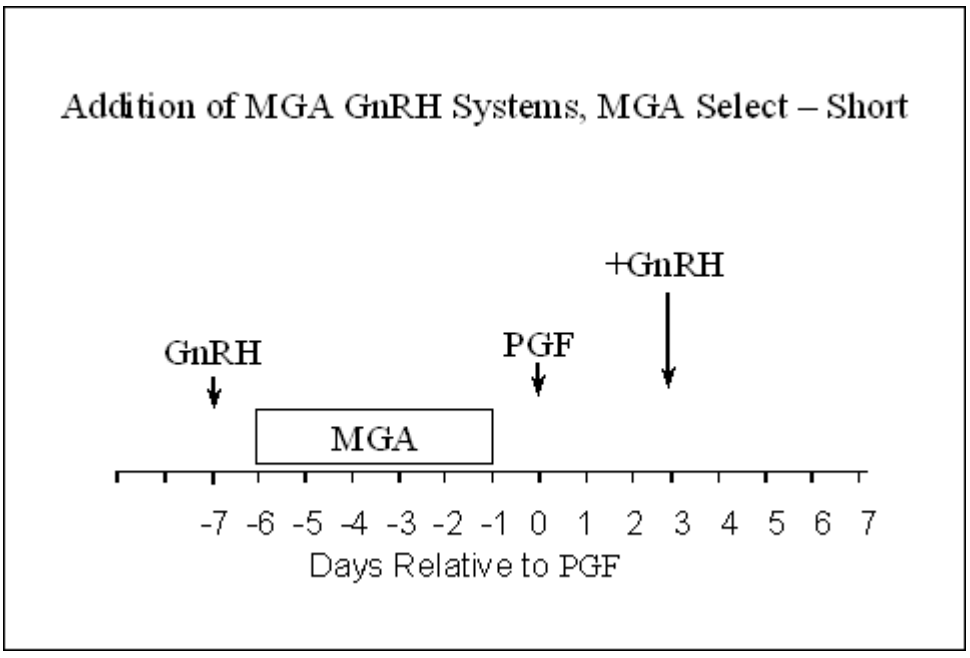
4. Conception rate for the timed AI group can vary widely, depending upon the composition of this group (cyclic vs. anestrous).





D. Future Systems with Intravaginal Progesterone Insert and GnRH PGF: The CIDR is an intravaginal device that should be available by breeding season next year. It releases progesterone into the cow′s bloodstream, and substantially increases the ability to synchronize anestrous cows. With the addition of the CIDR, a greater number of the Grade C cows can be included, and the risk of failed responses lessened substantially. With this system, most Grade C cows would be excellent candidates. Some of the grade D cows could be used, particularly those that have calved at least 28 days earlier, but are in the D Grade because of age (2 yr-old) or nutrition (body condition < 4.5).

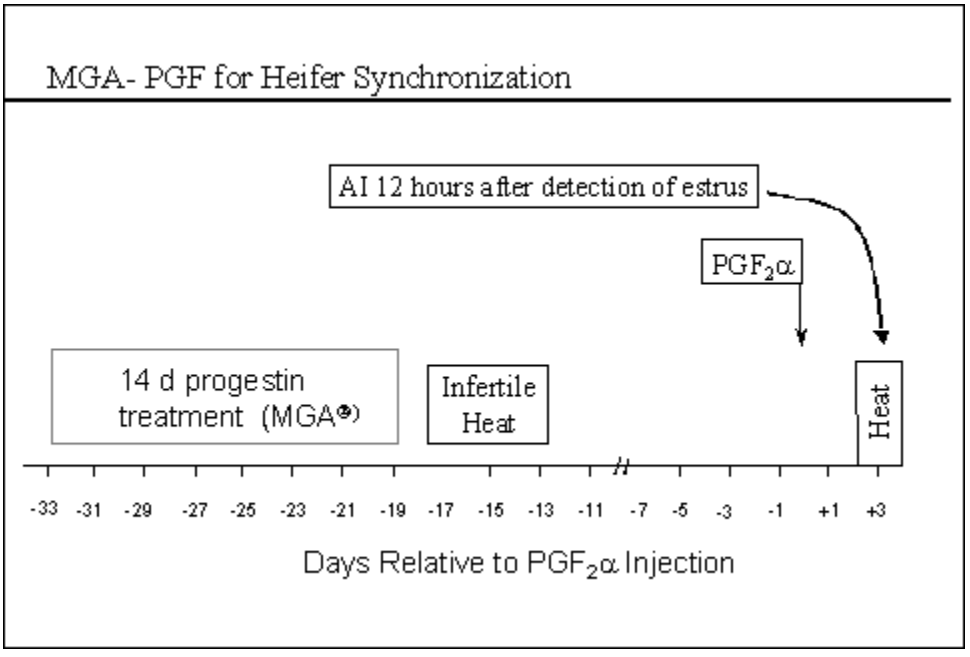

Future GnRH-PGF + Progesterone Systems
Time AI all cows when given the 2nd GnRH injection (+GnRH)
GnRH
PGF
+GnRH
Intravaginal Insert - CIDR
-7 -6 -5 -4 -3 -2 -1 -0 1 2 3 4 5 6 7
Days Relative to PGF2α


Addition of MGA GnRH Systems, MGA Select – Short
+GnRH
GnRH
PGF
MGA
-7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7
Days Relative to PGF

Heifer Synchronization

Melengestrol Acetate (MGA) and PGF: The best system in heifers is synchronization using MGA and PGF. In this system, MGA is fed at .5 mg/head/day for 14 days. Feeding MGA for 14 days prevents cyclic cows from showing heat even if their CL regresses, until the MGA is removed from their feed. Essentially all cyclic females, and some anestrous females will exhibit estrus within a week after withdrawal of the MGA. This is a **subfertile** heat, with many females ovulating a persistent follicle. They should not be inseminated at this estrus. A single injection of PGF, administered 17 - 19 days after the MGA has been withdrawn will regress the CL that developed following the infertile heat. Most females will show estrus 48 to 72 hours after PGF and can be inseminated 12 hours after detection of estrus. The most common approach is to check heat for 5-7 days and inseminate upon detection. Alternatively, timed AI of all females, or just those that have not yet displayed heat by 72 hours after PGF can often result in acceptable pregnancy rates.

There are two major reasons that this is a highly effective system; particularly with heifers. First, the 14 - day feeding period of MGA will group the cyclic females, and induce onset of cycles in some prepubertal heifers. Variable proportions of the anestrous females will be induced to ovulate; probably dependent upon their distribution between peri estrous and anestrous status. The 17-19 day waiting period was carefully chosen, in order to ensure that most females would be in the latter stages of the estrous cycle (after day 12) when PGF was given. The effectiveness of PGF to cause regression of the CL is highest at this time. It is not uncommon for estrus response rates to exceed 80%, and conception rates to be 70% or greater when using this system on heifers. The 19 - day interval between the last day of feeding MGA and PGF yield a more precise estrous response.



An important consideration of this system is to ensure that all females consume MGA on a daily basis. If consumption is variable, females will show estrus during the MGA feeding period, and the initial synchronizing effect of the MGA will be lost. A disadvantage of this system is the length of time between initiation of feeding of MGA and the breeding season (- 33 days). With yearling heifers, this can be accommodated with careful planning. In postpartum cows, with an annual calving interval, there are not typically 31-33 days available between calving, and the start of the next breeding system to implement this system. A second concern is that with postpartum cows, there is some evidence of an increased incidence of twinning with this system.

A specialized adaptation of this system can be used with 2 year-old cows or cows calving approximately 60 days before the start of breeding. Since some producers calve 2 year-olds up to a month before the cows, there are sufficient days between the end of calving and onset of breeding for this 33-day system. This system would be effective in most females that have calved 30 days before the onset of the MGA feeding (63 days before onset of the breeding season).