Directing the Symphony of the Reproductive System

Synching breeding females' estrous cycles for increased efficiency and productivity.

by ***Bruce Derksen***

The bovine female reproductive system and related hormones embody a symphony of finely tuned instruments. In the cattle producer's search for profitable perfection, this work of art can be safely tweaked and manipulated for increased efficiency and productivity.

Estrous synchronization (ES), heat detection and artificial insemination (AI) can help producers not only use the best bulls, but also encourage beef females to cycle sooner and breed more quickly in timed groups. Various ES protocols require different drug costs, labor and infrastructure, and by understanding the processes and the way they affect a cow herd, producers can pick the best program for their goals and resources.

The desire to improve herd capabilities through the acquisition of superior, targeted genetics is the most popular reason producers use AI, says Cliff Lamb, department head for animal science and professor in reproductive biology at Texas A&M University. A synchronization program helps capture the value of AI.

"One of the biggest advantages of using synchronization is not necessarily the benefit of using semen from a superior bull, but how it impacts reproductive performance. It's the art of the synchronization system actually stimulating noncycling females to cycle in such a way that they become pregnant sooner in the breeding season."

When this season arrives, a portion of heifers will not have reached puberty and a percentage of cows won't have reinitiated their estrous cycle after giving birth. "What estrus synchronization hormones do is stimulate those females to begin cycling again. Not only does this bunch animals up that might have been cycling, but they also stimulate noncycling animals to get pregnant at the beginning of the breeding season."

Types of synchronization hormones and protocols

Lamb outlines three major types of hormones used in synchronization, each controlling a different facet of the estrous cycle.

Prostaglandin (PGF), a hormone used in concert with other products of ES, regresses a corpus luteum (CL), or a transient gland that secretes progesterone to maintain a potential pregnancy. PGF only works to synchronize estrous cycles if a CL is present on the ovary of the female. Cows in the initial stages of their estrous cycles (one to six days), having just ovulated, will not have a CL large enough to respond to the drug. Those females at six to 16 days into their cycle will react to the PGF shot and enter heat two to six days later. The animals 16 to 18 days into their cycle will not respond but will come into heat on their own.

Gonadotropin releasing hormones (GnRH) stimulate follicles to ovulate or start a new follicular wave. "The GnRH is a precursor to the release of the luteinizing hormone (LH) which causes ovulation. By giving GnRH, we don't work on the CL, but we work on the follicle," Lamb says. These hormones are produced by the hypothalamus of the brain and cause other hormones to stimulate follicular growth and ovulation within 30 hours.

Progesterone products make up third group. Controlled intravaginal drug release (CIDR) devices or melengestrol acetate (MGA) act as progesterone and block estrus and ovulation during the diestrus (middle) phase of the cycle, essentially preventing

heat. Timed removal of these products will initiate heat and potentially induce 10% to 30% of females unable to exhibit estrus.

"Every one of the hormones used in synchronization, the cow makes herself, so the GnRH, PGF and progesterone products are exactly the same as the cow produces," Lamb says. "It doesn't matter how many times you use these protocols. There won't be any negative impacts."

Protocols using these hormones can be divided into three major categories:

- Synchronization, then heat detection and AI after an observed estrus.
- Synchronization, then AI at a fixed time without heat detection.
- Synchronization, then a period of heat detection and insemination (around two days) followed by AI of females not observed in estrus.

Lamb explains long-term protocols of up to 33 days using MGA or 14-day CIDRs not using PGF or GnRH upfront are available, but most shorter procedures use the synchronizing drugs. "Reasons for each are different. It's never a blanket motive for every single one," he adds.

Synchronization conception and pregnancy rates

Synchronizing strategies including AI do not vary conception and pregnancy rates from natural service if quality semen is used by skilled technicians. Lamb says 60% to 65% conception rates are achievable for cows cycling and observed in estrus. Those same rates are expected if the same cow was exposed to a bull.

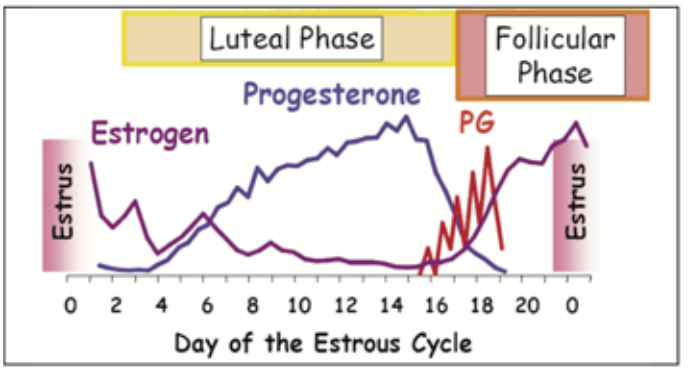
According to Lamb, math can be used to view varying approaches. If producers use an ES system involving heat detection on 100 females, only about 75% will be caught in heat and inseminated. At the 65% conception rate, this means around 50 of those 75 will get pregnant. This equates to a 50% pregnancy rate including the 25 not detected in heat.

When pairing an ES strategy forcing noncycling cows to come into heat and a timed AI without heat detection, all females are inseminated and have a chance to get pregnant. Fifty-five to 60 of those 100 will become pregnant. While more cows get pregnant in this system, the conception rate will actually be lower than the ES system with heat detection.

He notes on the average, cows that have calved will take 30 to 100 days before coming back into heat. To see the greatest pregnancy rates, waiting 45 to 50 days after calving to synchronize is a solid plan, since a higher percentage of them will be naturally cycling. Beginning the synchronization at that point will place the AI at 55 to 60 days giving the majority of females the opportunity to begin cycling again.

"My differing suggestion is that cows between 21 and 50 days after calving need synchronization the most, because they are less likely to be cycling but can be stimulated and become pregnant sooner. If producers can get over the fact they might have slightly lower pregnancy rates, possibly 45% instead of the 55% of timed AI, they will gain from accelerating them to become pregnant sooner in the breeding season. That's a sounder synchronization strategy in my opinion."

Bovine estrous cycle



Source: Parish, D. A., Larson, D. E., & Vann, D. C. (2016). The Estrous Cycle of Cattle [Pamphlet]. MS: Mississippi State University. https://extension.msstate.edu/sites/default/files/publications/publications/p2616_0.pdf

Future strategy adaptations

Lamb explains a tactic in the works is resynchronization, or an ovulation control program used for open cows which need to be re-inseminated, but care is required as the same products can't always be used due to the accidental elimination of pregnancies. Heat cycles of females not becoming pregnant in a first procedure will return 21 days later, plus or minus three or four days. This is too early to determine pregnancy; thus, PGF can't be used as it can cause abortions.

For these strategies, only progesterone products such as CIDRs or MGA can be used to resynchronize females. Other tactics include waiting for a pregnancy diagnosis using blood at 25 to 30 days, or ultrasound after 30 days. When pregnancies are determined, PGF can again be utilized, but the drawback to this system is the loss of days open and negative economic impact. The use of doppler ultrasound to identify earlier pregnancies is being researched and shows promise.

Whichever processes are employed, Lamb urges producers to follow the tried-and-true protocols. "Even though the search continues for the silver bullet to replace these strategies, it's better to use something we know works rather than trying to figure out the next best thing and get disappointed," he says.

Some manipulation of nature's handiwork in the reproductive and hormone system can bring financial rewards but mishandling of this artful symphony might not create the desired results. HW