COOPERATIVE EXTENSION SERVICE
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Protocols for Synchronizing Estrus in Yearling Heifers

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Reproductive efficiency is the major factor affecting income and profitability in commercial beef cattle operations. Generally, the greatest reason for inefficiency is the inability of most young cows (those 2 to 3 years old) to conceive early in the breeding season.

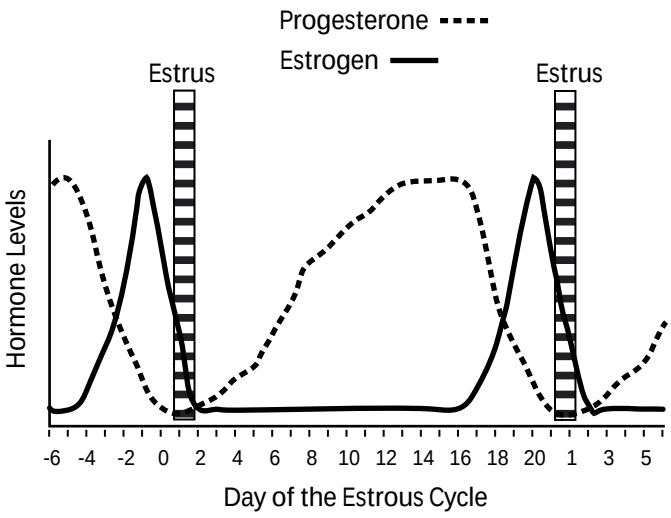
The reproductive efficiency of these cows can be improved dramatically by reducing days to conception in the first breeding season and the incidence of calving problems.

Several systems have been developed for synchronization of estrus in yearling beef heifers. Both the reproductive biology of beef females and the most common systems used to control estrus in yearling beef heifers will be discussed in this publication.

Changes in Ovarian Structures during the Estrous Cycle in Beef Females

An understanding of changing hormonal patterns and the normal growth and regression of ovarian structures is necessary to understand how to control onset of estrus. Estrus behavior in cows is stimulated by the production of estrogen in a large follicle. Follicles are the fluid-filled, balloon-like structures on the ovaries that contain the oocyte (egg). The large amount of estrogen produced by the follicle also stimulates a massive release of luteinizing hormone (LH). This LH surge generally occurs at the same time as the onset of standing estrus and stimulates the rupture of the large follicle (a process called *ovulation*) and release of the egg. Ovulation of the large follicle occurs approximately 24 to 30 hours after the onset of standing estrus (Figure 1). During ovulation, the egg is released; the follicle wall collapses and begins to form a *corpus luteum* (CL). After ovulation, the CL increases in size and increases its production of progesterone (Figure 1). Progesterone inhibits final maturation of ovarian follicles and estrus behavior. Approximately 16 to 17 days after estrus, the uterus releases prostaglandin $F_2\alpha$ (PG, which stimulates regression of the CL and a reduction in progesterone production. Declining progesterone production allows final maturation of a large follicle, which stimulates the subsequent estrus.

Figure 1. Cyclic changes in reproduction hormones.



Like the CL, follicles also grow and regress throughout the estrous cycle. Follicle growth in cattle occurs in a wavelike pattern, and females generally have either two or three waves of follicular development during an estrous cycle (Figures 2 and 3). Emergence, growth, and regression of a follicular wave generally take eight to 10 days.

Figure 2. Changes in follicle growth — 2 waves.

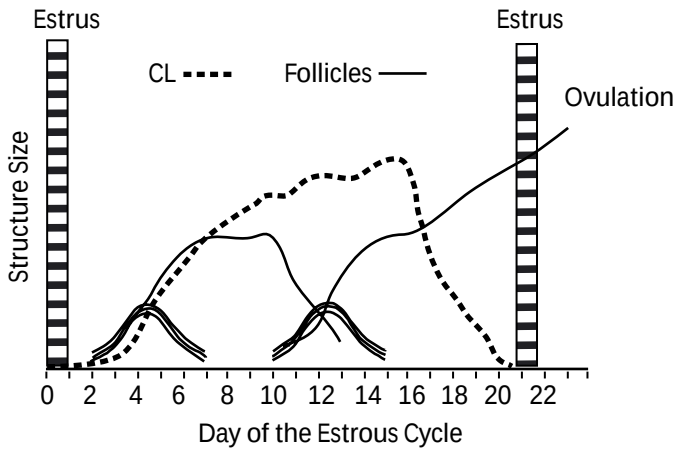
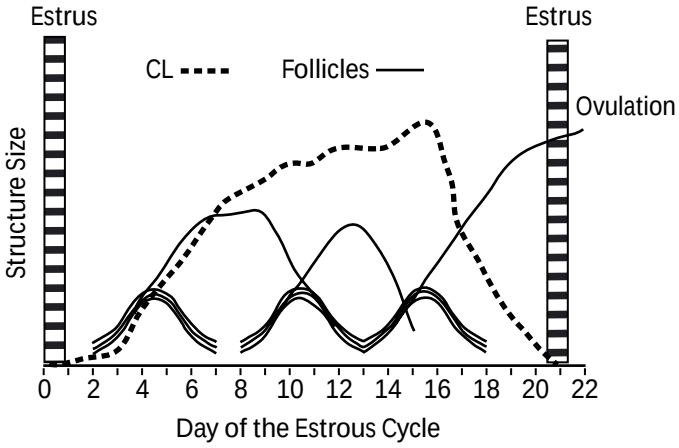


Figure 3. Changes in ovarian structures — 3 waves.



Requirements for Control of Estrus

One of the major limitations in effectively synchronizing estrus in beef females is that most groups of heifers consist of both prepubertal and cyclic heifers. Thus, for a system to effectively control estrus in all heifers, it must induce regression of the corpus luteum, control follicular growth, and induce estrus and ovulation in prepubertal heifers. Therefore, the goal is a system that can be delivered to all heifers and result in a synchronous, fertile estrus and greater than a 50% pregnancy rate in one to four days.

Estrus Synchronization and AI

A reproductive management program for yearling heifers should have two major goals: First, heifers should have an opportunity to conceive early in their first breeding season. Second, heifers need to calve with little or no calving problems. The best management tool to accomplish both goals is to synchronize estrus and artificial insemination (AI). Using AI, producers are able to select a sire with a low birth weight EPD with an extremely high (more than 95%) accuracy. Since research has clearly demonstrated that birth weight of the calf is most highly associated with calving problems in heifers, reproductive efficiency can be greatly enhanced by incorporating AI into a management program. Following are the most often recommended systems for estrus synchronization and AI in yearling heifers.

Prostaglandin $F_2\alpha$ (PG) systems—Certainly the most used estrus control systems are those that incorporate PG, such as Lutalyse®, Estrumate®, and Prostamate®. Biologically, PG synchronizes estrus by inducing regression or death of the CL. Unfortunately, the CL is not responsive to PG for the first five days after estrus is observed and is only minimally effective for the first seven days after estrus. Additionally, PG is unable to synchronize estrus in prepubertal heifers. Therefore, in a group of heifers where only 70% are cyclic, one injection of PG induces estrus in only 40 to 50% of the heifers. If an additional injection of PG is given 11 to 14 days later, 10 to 15% more of the heifers can be synchronized. Even if fertility is optimal (80%) only 30 to 40% of all heifers given a single injection and 40 to 50% of heifers given two injections will conceive to AI. The success of the system depends entirely upon the percentage of heifers that are cyclic before treatment. If only 50% of the heifers are cyclic, only 30 to 35% of heifers that receive two injections of PG will conceive. Several different protocols using PG have been developed for both single and double injections (Figures 4 through 6).

The major limitation of any of these PG systems is that PG is ineffective in inducing estrus in prepubertal heifers. Therefore, methods for effective estrus synchronization and AI that use progestins, which have been demonstrated to induce estrus in prepubertal heifers,

Figure 4. Single Injection PG System 1.

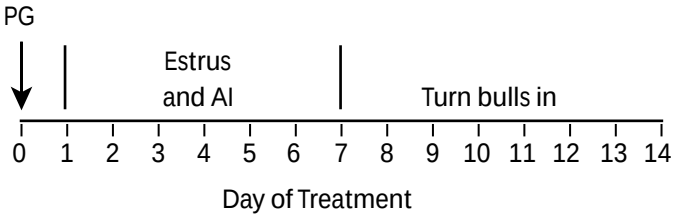


Figure 5. Single Injection PG System 2.

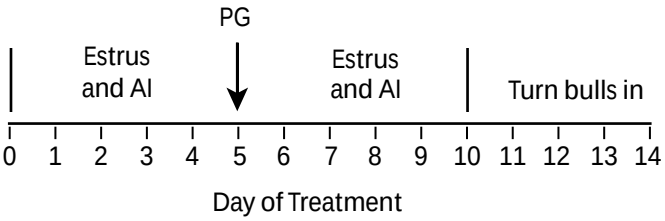
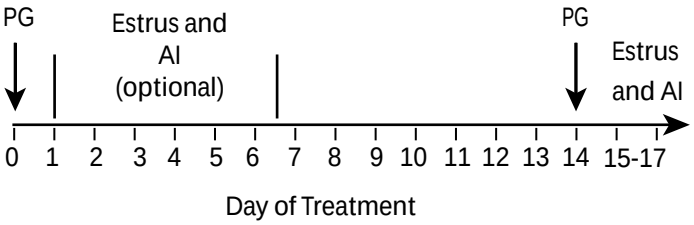


Figure 6. Prostaglandin — double injection method.

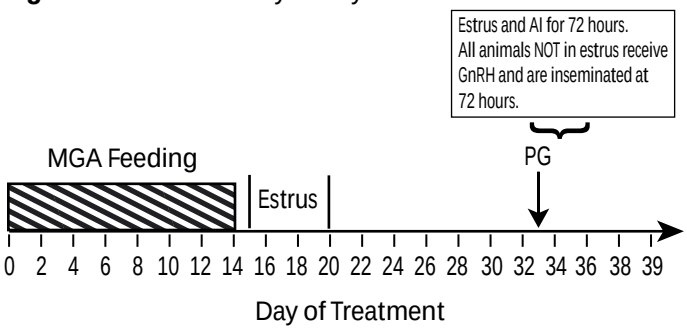


have been developed. They are effective for cyclic as well as prepubertal heifers.

Melengestrol acetate and PG systems—The most common progestin used to synchronize estrus in beef females is melengestrol acetate (MGA). Melengestrol acetate is an orally active, synthetic progestin that effectively suppresses estrus in cyclic heifers and induces estrus in prepubertal heifers when fed at a rate of .5 milligrams/head/day. The most effective system for synchronization of estrus in beef heifers involves feeding MGA for 14 days and injecting PG 19 days after the last day of MGA feeding (Figure 7). Administration of this system, known as the MGA-PG system, synchronizes estrus in most cyclic females and can induce estrus in most prepubertal heifers. Also, on the day PG is given, females are between Days 10 and 15 of the estrous cycle, thus ensuring that PG is maximally effective in stimulating the regression of the CL. Administration of the MGA-PG system to females usually results in estrus in approximately 80 to 100% of those treated. Since fertility is normal in this system, pregnancy rates usually range from 45 to 70%. The biggest disadvantage to the use of the MGA-PG system is that it takes 33 days to administer and requires consistent intake of MGA. The MGA is normally supplied to the females as a supplement to normal prebreeding diets and should be fed at a rate of 0.5 milligrams/head/day. It is imperative that all females consume adequate levels of MGA. Therefore, at least 2 feet of bunk space is necessary to ensure that even timid females have access to MGA. Producers should also observe feeding to ensure that all females are consuming the MGA supplement. The most common failure of the MGA-PG system lies in the failure to consume an adequate amount of MGA.

Currently, no protocols suitable for mass mating are available for use with MGA-PG. However, the number of days of estrus detection can be reduced by injection of gonadotropin hormone-releasing hormone (GnRH; pharmaceutical trade names Cystorelin®, Factrel®, Fertagyl®). In this system, estrus should be detected for 72 hours after PG (Figures 8 and 9). All heifers in estrus should be inseminated approximately 12 hours after first estrus is observed. Heifers not observed in estrus by 72 hours are injected with GnRH and time inseminated 72 hours after PG.

Figure 8. The MGA-PG Hybrid System.



Another variation of the MGA-PG system is to inject GnRH (Cystorelin, Factrel, Fertagyl) 12 days after the last day of MGA feeding. This method is known as MGA Select Synch. In this system, MGA is fed for 14 days, and GnRH is injected 12 days after the last day of MGA feeding (Figure 10). Seven days later, PG is given. The current data indicate that MGA Select Synch does not improve conception rates to AI in yearling heifers. Some data indicate that the MGA Select Synch system may improve pregnancy rates in young (2- to 3-year-old) cows by 5 to 10%. The additional expense of the drug and handling does not justify use of MGA Select Synch other than perhaps with young cows (2 to 3 years old).

The MGA-PG systems are highly effective protocols for synchronizing estrus. These systems are effective because they induce estrus in prepubertal females and group most cyclic females so they are responsive to the PG.

Figure 9. The Hybrid MGA-PG System.

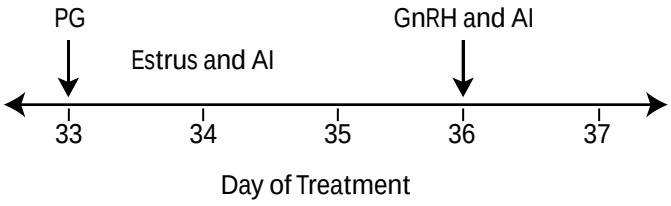


Figure 7. The MGA-PG System.

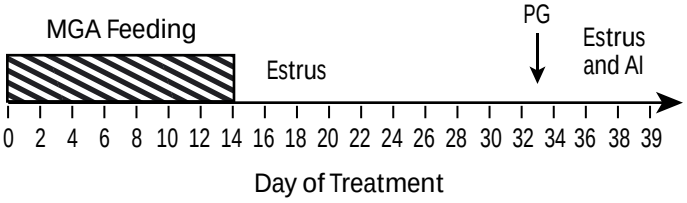
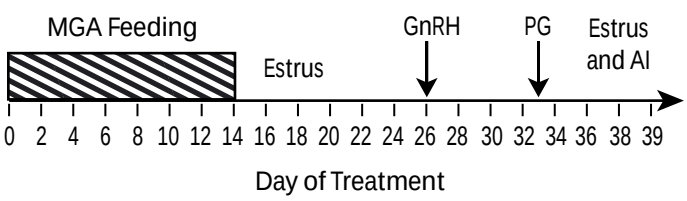


Figure 10. The MGA Select Synch System.



Conclusions

Estrus synchronization and AI are important tools beef producers can use to improve the reproductive performance of young cows. The reproductive efficiency of young cows is generally the factor that most limits production efficiency. Enhancing the reproductive performance of young cows will improve production efficiency and increase profitability of a beef cow-calf operation.
