W 1326

Estrous Synchronization for the Purpose of Natural Service

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Introduction

Increasing the number of females pregnant early in the breeding season (first 21 days) has great economic impact. Reproductive technologies have the ability to assist beef producers accomplish this goal. Estrous synchronization with artificial insemination (AI) is becoming more popular with producers; however, it may not be the best option for some beef producers where equipment, facilities or labor are limited or not appropriate for AI. Nevertheless, there are options to use estrous synchronization with natural service to achieve high conception rates early in the breeding season.

An additional time commitment is part of using an estrous synchronization protocol, and there is an increase in the labor required compared to only natural service, but there are many benefits to using this technology for the purpose of natural service. A synchronization protocol allows cows and heifers to conceive earlier in the breeding season, which results in them calving earlier in the next calving season [1]. Calving earlier in the season has great positive impacts for the producer in both the short and long term. This means the producer's calves will weigh more at weaning, resulting in greater revenue. Research by Doye and others [2] found that a controlled calving season is more profitable than a year-round calving season. Cushman and others [1] found that heifers that have their first calf during the first 21 days of the calving season on average increased their longevity in the herd by one year compared to heifers that calved in the second 21-day period or later. Using estrous synchronization to increase the number of females calving early will lead to a more uniform calf crop that will be older and heavier at weaning, which in turn reflects in greater revenue. Further, calving early in the calving season allows for the cows to have a greater post-partum interval, allowing more time to recover from calving and facilitating them to breed back sooner in the following breeding season. Also, using a synchronization protocol for the purpose of preparing cows for natural service can be a less demanding way to ease the process of synchronizing cows for AI without the extra costs of insemination. In this article we will discuss some management considerations for the success of a natural service breeding using estrous synchronization as well as two options of protocols.

Cow and Heifer Criteria

A critical requirement for cows and heifers to be able to efficiently sustain a pregnancy is their body weight and condition. When considering breeding heifers, they should weigh 55 percent to 65 percent of their predicted mature body weight, be at a body condition score of approximately 6 (on a 1 to 9 scale where 1 is emaciated and 9 is obese) and have reached puberty. A recommendation is to have a veterinarian perform a pelvic exam and assess the reproductive tract maturity of heifers to ensure that they can sustain and deliver a pregnancy. We recommend a pelvic area greater than 150 cm2 and greater than 50 percent of heifers in a group with a reproductive tract score of 4 or 5 (1 to 5 scale where 1 is infantile reproductive score and 5 is a fully mature reproductive tract) approximately 4 to 6 weeks prior to breeding. For more information about heifer development, we recommend reading UT Extension Publication No. W1089 Heifer Reproduction Starts With Nutrition.

It is important for heifers to reach puberty before or at the start of the breeding season, as this increases their chances of successfully becoming pregnant. Heifers will have reached puberty when ovulation has occurred, and ovulation typically occurs following visual signs of estrus. Although synchronization protocols can help stimulate cycling in pre-pubertal heifers, those that have already reached puberty generally show a better response and experience greater pregnancy rates [3].

Another consideration a producer should take before they synchronize their cows is how long it has been since calving. Postpartum anestrus is defined as an infertile period from when the cow calves until she resumes her fertile estrous cycle, at which time she can become pregnant again [4]. The reason for this period of infertility is that after calving, the cow's uterus must return to a state where it can support a pregnancy and the cow's hormones that control the estrous cycle must return to a normal function which allows ovulation to occur [4]. Due to this, it is recommended that cows rest for a minimum of 30 days post-caving. This allotted time allows cows to recover from parturition so uterine involution can occur properly and they can regain cyclicity; also, a longer

period can improve results. Thus, an average of greater than 40 days post calving is the recommended interval to use before breeding cows again [5]. Similarly to pre-pubertal heifers, using a synchronization protocol can "jump start" those cows that have not reached cyclicity after they have surpassed the suggested waiting period after calving; however, return to cyclicity in post-partum cows or induction of puberty in pre-pubertal heifers is dependent on the use of progestins.

Bull Management

Regardless of the breeding strategy, all bulls should undergo a breeding soundness exam (BSE) at least 30 to 60 days before each breeding season [4]. This time allows bulls that were classified as deferred to be retested (one spermatogenic cycle takes approximately 60 days) or when classified as unsatisfactory potential breeders (failed BSE), the producer has enough time to acquire new sires. In the BSE, bulls must pass a physical exam consisting of the eyes, mouth, nose, structural soundness and overall external and internal reproductive organs soundness (include rectal palpation where internal reproductive organs are evaluated). They also must meet the minimum scrotal circumference for their age (Table 1). Lastly, the semen analysis where minimum requirements include 70 percent morphologically normal sperm and 30 percent progressive motile sperm (Fig. 1.)[4]. A bull that passes a BSE is considered to be able to move freely within the pasture, visually detect sexually active groups, be able to mount females and deliver highly fertile semen into the vagina.

Table 1. Minimum scrotal circumference (SC) requirements for bull to pass a Breeding Soundness Exam based on age (Adapted from [4]).

Age	SC
< 15 mo	30 cm
15-18 mo	31 cm
18-21 mo	32 cm
21-24 mo	33 cm
> 24 mo	34 cm

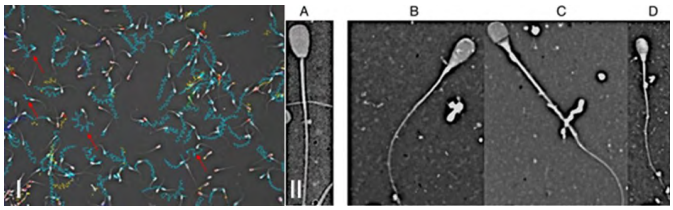

Figure 1: *Example of sperm analyses evaluation for motility and morphology. Panel I represents a frame of sperm motility analysis using a computer assisted sperm analysis where lines represent the sperm swimming trajectory (light green represents sperm with progressive motility; picture from [6]). Panel II represents different sperm characteristics during a morphology analysis where picture A represents a morphologically normal sperm and B-D represent sperm with different abnormalities (picture from [7])*

The bull-to-cow ratio is critical when using estrous synchronization with natural service. Studies have demonstrated similar results in pregnancy rates with varying bull-to-cow ratios from 1:10 to 1:60 in non-synchronized beef females [8]. When estrous synchronization is employed, several cows will come in estrus in a short period of time; however, the percentage of cows in estrus will heavily depend on the protocol used and the cyclicity status of the cows when protocol is started. In a study by Healy and co-workers [9], there was no difference in pregnancy rates in a 28-day breeding season when the bull-to-female ratio was 1:16 (84 percent) or 1:25 (83 percent); however, pregnancy rates were decreased when the ratio was 1:50 (77 percent). Thus, the recommended bull-to-cow ratio is one bull for every 25 cows, with preference to mature and experienced bulls instead of young and/or virgin bulls. Simpler protocols usually yield lower synchronization; thus, a greater bull-to-cow ratio (1-to-25 or 30) can be used where a more complex protocol that yields a greater synchrony will require a lower bull-to-cow ratio (1-to-15).

The proposed age for a bull that will be used in a synchronized herd is 2+ years old. Virgin bulls or bulls younger than 2 years old may not be fully developed and often lack the libido and siring capacity of mature bulls. These bulls tend to focus on the first cow in estrus, breeding her repeatedly, rather than covering other cows that are also in heat. This behavior can result in lower pregnancy rates. Libido is a key factor when using estrous synchronization and natural service; however, it is not evaluated during a breeding soundness exam (BSE). So, producers must closely observe the bull's behavior when introduced to the herd to ensure he has adequate libido. Additionally, monitoring bulls for injuries is essential, as injured bulls will be unable to breed cows effectively.

Estrous Synchronization Protocols for the Use of Natural Service

There are many types of synchronization protocols. Each protocol has differing levels of commitment, and they should be chosen based on the needs of the producer. A simple and inexpensive protocol is the "1 Shot PG and NS" (Fig. 2). Prostaglandin F2α (PG) is administered on day 0 or 5, and the bull is turned in on day 0 or 5. The advantage of this protocol is that animals are worked through the chute only one time. The disadvantage of this protocol is that it only works in cows and heifers that are already cycling because PG is a hormone that is used to induce luteal regression. An animal without a mature corpus luteum (CL) will not respond to PG and will not come in estrus in response to the protocol (Table 2).

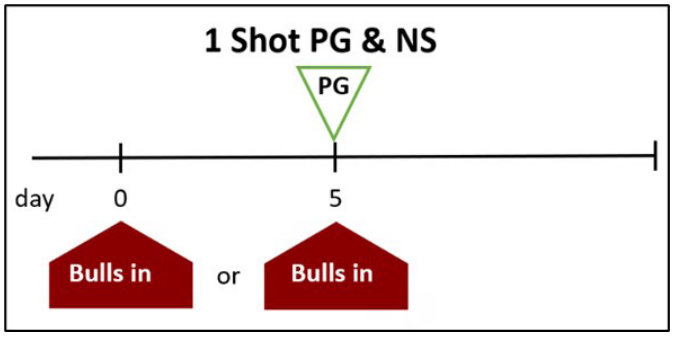

Figure 2: *Estrous synchronization with natural service (NS) using one administration of prostaglandin (PG) "1 Shot PG & NS" (image from beefrepro.org).*

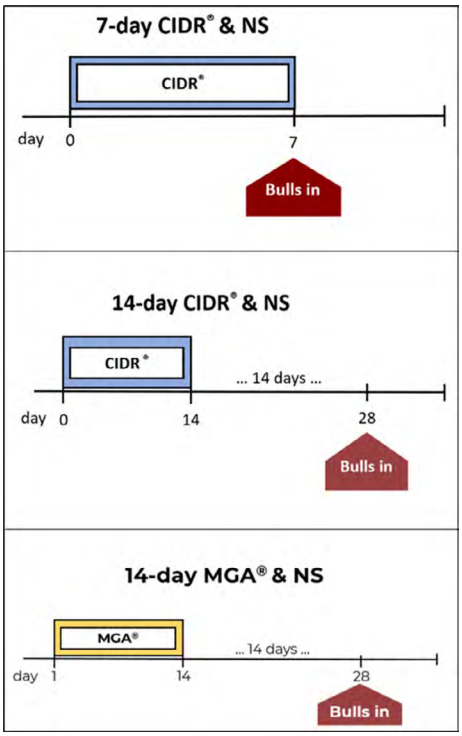

Figure 3: *Estrous synchronization protocols using progestins (CIDR or MGA) for beef cows and heifers. MGA is labeled for heifer use only (image from beefrepro.org)*

More complex and expensive protocols are also available. For example, protocols that include a CIDR or MGA (beef heifers only). A CIDR is an intravaginal progesterone-releasing insert, and MGA (beef heifers only) is a feed additive that is a synthetic progesterone (Table 2). Progesterone is the hormone that maintains gestation, and progestins are analogues of progesterone, which means it works like progesterone. Thus, while exposed to progestins, ovulation and estrus are inhibited [3]. Both have been proven to promote cyclicity in cows after calving (CIDR) and to induce puberty in heifers (CIDR and MGA). The "7-day CIDR & NS" and the "14-day CIDR & NS" protocols (Fig. 3) are options using a CIDR and can be used in both heifers and cows while the "14-day MGA & NS" protocol can only be used for beef heifers (Fig. 3).

In the "7-day CIDR and NS" protocol (Fig. 3.), a CIDR is inserted on day 0 and removed 7 days later simultaneously to bulls being turned in with females. This protocol requires the cows or heifers to be worked twice, to insert and remove the CIDR. Similarly, the "14-day CIDR and NS" protocol requires females to be worked through the chute twice. In the "14-day CIDR and NS" protocol, females receive a CIDR on day 0 and 14 days later it is removed when the cows or heifers are turned in with the bull. The "14-day MGA and NS" protocol (Fig. 3) can only be used in beef heifers complying with the product label. The heifers are fed MGA that is mixed into their feed, and after 14 days, MGA is removed from the feed mix. Similarly to the "14-day CIDR and NS" protocol, after 14 days from the last MGA feeding, the bull is turned in with the heifers. This protocol does not require the heifers to be put through a chute. An important thing to know is that there will be heat activity right after the removal of the CIDR or the MGA in the 14-day protocols, but this estrus (heat) cycle is not fertile and will not result in a successful pregnancy. This happens because an old follicle is ovulated, and old follicles have low fertility. Therefore, the bull should be turned in after 14 days of last feeding of MGA or from CIDR removal in these protocols, so we can avoid overuse of bulls in non-fertile cycles.

Table 2. An overview of the reproductive hormones used for estrous synchronization and natural service and their function [adapted from 5].

Hormone	Endocrine Gland	Function of Hormone	Biological Action in Estrous Synchronization	Product Name	Dosage	Route of Administration
Progesterone	Corpus Luteum	Inhibit estrus; Inhibit ovulation; Prepares animal for pregnancy; Maintenance of pregnancy	Inhibit estrus; Inhibit ovulation; Induce cyclicity	Melengestrol Acetate (MGA®) EAZI-BREED CIDR®	0.5 mg/hd/day (heifers only) 1 CIDR/animal (1.38 g progestin)	Feed Vaginal insert
Prostaglandin $F_{2\alpha}$	Uterus	Induce luteal regression	Induce premature luteal regression	Lutalyse® Lutalyse® HIghCon Estrumate® estroPLAN® ProsMate® SynchsureTM	5 ml 2 ml 2ml 2ml 2ml 2ml	im[1] injection im or sq[2] injection im injection im injection im injection im injection

[1]im= intramuscular injection
[2]sq = subcutaneous injection

The advantage of these progestin-based protocols is that the progestin exposure mimics the progesterone exposure that would naturally occur when animals are cycling, thus inducing pre-pubertal heifers and anestrus cows to start cycling. The disadvantage of these protocols is associated with elevated expenses in comparison to one single administration of prostaglandin, extra "trips" through the chute and the necessity to feed heifers (when feeding was not performed regularly).

More complex protocols, such as those used for fixed-time artificial insemination can be used for natural service as well; however, bull-to-cow ratio of one bull to fewer females is recommended as estrus would be more tightly synchronized and more females would come into estrus in a shorter period of time. In the estrous synchronization protocols discussed above, a lower synchronization is achieved (on purpose), thus a bull-to-cow ratio of 1-to-25 or even greater would suffice (especially if older mature bulls are used). However, when an estrous synchronization protocol that results in a tighter estrus response is used, a 1-to-25 or lower ratio would be advised.

Pregnancy Rates

Several studies have compared the use of estrous synchronization and natural service to natural service without estrous synchronization. Pregnancy success varied based on the type of synchronization used and whether or not females were cycling. When females were in anestrus, no difference was observed between one shot and non-synchronized, CIDR and not synchronized, 14-day CIDR or 14-day MGA [10-13]. In cycling females, there was an increase in pregnancy rates between days 5 to 9 when the "1 Shot PG and NS" protocol (Fig. 2) was used (55.7 percent) compared to no synchronization (25 percent) [10]; however, another study has demonstrated no difference in pregnancy rates between synchronized ("7-day CIDR & NS"; 86.1 percent) and not synchronized females (76.3 percent)[11]. Further, in females with unknown cyclicity status, Lamb and co-workers [11] reported an increase in pregnancy rates by day 10 in cows that received a CIDR for 7-days (43 percent) compared to females not synchronized (35 percent). In heifers synchronized with a the "14-d CIDR and NS" or a the "14-day MGA and NS" protocols (Fig 3.), there was no difference in pregnancy rates after 21 or 61 days of bull exposure between the protocols [13]. These studies demonstrated the ability of estrous synchronization to increase the number of females pregnant early in the breeding season.

Conclusion

There is great economic benefit for beef females to become pregnant early in the breeding season. Estrous synchronization with natural service is an excellent tool to improve the number of females that conceive early in the breeding season. There are many different types of protocols that producers can use to help improve their management techniques for natural service. Producers should consult with their veterinarian, Extension specialist or Extension agent if they have any questions regarding cow and heifer management, BSEs or the different types of protocols and how to best match their operation to the specific protocol that will achieve the greatest success. Up to date estrous synchronization protocols recommended for beef cows and heifers can be found on the Beef Reproduction Task Force website.

Online Resources

UT Extension Publication No. W1089 Heifer Reproduction Starts with Nutrition: **https://tiny.utk.edu/W1089**

Beef Reproduction Task Force, including up-to-date estrous synchronization protocols recommended for beef cows and heifers: **beefrepro.org**

Beef Reproduction Task Force, synchronization protocols: **beefrepro.org/protocols/**

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