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Using Estrous Synchronization in Natural-Service Breeding Situations

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Estrous synchronization is typically associated with artificial insemination (AI) programs, and is therefore often viewed as impractical or impossible to use within natural-service herds. With 92% of beef herds exclusively implementing a natural-service breeding environment (NAHMS, 2009), estrous synchronization has a place in natural-service breeding systems if implementation can be adapted into normal daily tasks. The most common reasons that estrous synchronization is avoided in natural-service situations is due to fear of overusing bulls, increased chance of injury due to amplified physical activity, and expenses associated with purchasing extra bull power due to the misconception that all cows will come into estrus at the same time. In addition, 39% of producers indicate that they do not use estrous synchronization due to shortage of labor/time resources. Other reasons cited for avoidance of estrous synchronization protocols were complexity associated with implementing protocols, cost, and lack of facilities (Figure 1; NAHMS, 2009). However, several of these reasons can be eliminated by selecting a synchronization protocol best suited for natural-service breeding. By using the correct natural-service protocol, the benefits of estrous synchronization associated with AI can be achieved in natural-service herds.

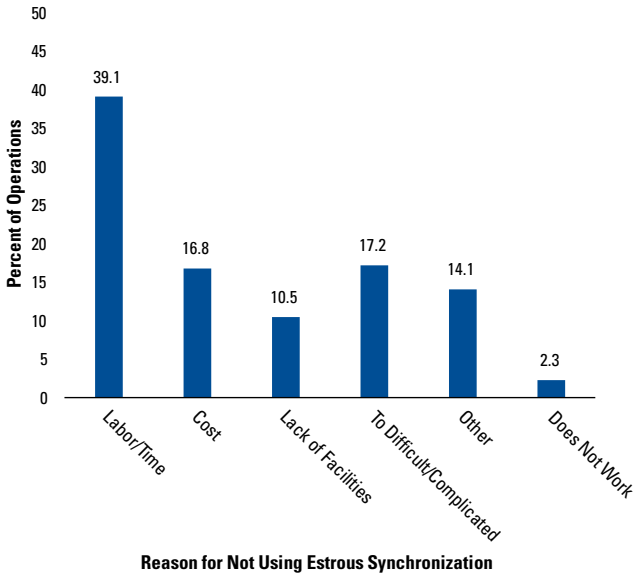

Figure 1. Reasons operations do not utilize estrous synchronization during the breeding season. Adapted from National Animal Health Monitoring System, 2009.

Benefits of Synchronization

The benefits of synchronizing estrus in natural-service herds start with increasing the number of females bred during the first 21 days of the breeding season after bull turnout. A normally cycling cow will come into estrus on average every 21 days, ranging from 17 to 24 days. Therefore, a cow only has a single chance to be bred approximately every 21 days within a traditional natural-service setting. Depending on what stage of the estrous cycle a cow is at when bulls are turned out, it could be over 20 days before she would have a chance to be bred. With natural-service synchronization, an extra opportunity to be bred is placed at the beginning of the season. This gives a majority of the herd an opportunity to be serviced twice in the first 30 days, allowing more females to become pregnant in a fixed duration breeding season. Researchers at Colorado State University and South Dakota State University have observed cows exposed to bulls following estrous synchronization conceived 13 to 14 days earlier than their non-synchronized counterparts (Schafer et al., 1990, Perry, 2005).

Increasing the number of females bred in the first cycle of the breeding season results in more females calving in the first 21 – 30 days of the calving season. Early born

calves are subsequently older at weaning time, and with age being the greatest factor affecting weaning weight, this potentially means more value on sale day. In addition, calves born during a short time period should be more uniform and have a smaller weight distribution at weaning. According to a study from USDA with over 3,700 calves, 2.5 lbs. of weaning weight is lost for every day after the first day of calving that a calf is born (R. Cushman personal communication). Thus, a difference in 100 – 150 lbs. of weaning weight is potentially given up between calves born at the beginning versus the end of a 40 – 60 day calving season. Given such ramifications, there is a clear economic advantage to having calves born early in the calving season.

Furthermore, another economic advantage resulting from synchronizing natural-service is fewer open cows due to the additional breeding opportunity. This is especially true with the incorporation of synchronization in prepubertal/anestrus females focused on reducing the length of the postpartum interval. By shorting the postpartum interval, studies show this also shortening the days to conception to narrow subsequent calving distribution (Lamb et al., 2008). This is done with a feed additive called melengestrol acetate (MGA) or in a controlled internal drug release (CIDR) for prepubertal heifers, but only with CIDRs for cows. Here, the progestin mimics the short luteal phase required for cows to return to cyclicity, and a fertile estrus is observed following progestin removal in a population of anestrus females. By decreasing the number of open females, fewer herd replacements will need to be retained each year also.

Estrous synchronization also benefits producers by condensing the calving season and minimizing the number of calves born late. While more calves may be born within a given week, it reduces the total amount of time producers need to spend checking and working with their herd overall, and saves producers valuable time to spend on other activities. A survey of over 4,000 producers from 23 states indicated that during calving season the frequency of which producers observe cows during a 24 hour period ranged from every 1.6 hours to once every 5.8 hours (Dargatz et al., 2004). If only 30 minutes were spent at each observation, this translates to between 48 minutes and almost 3 hours spent each day observing calving. Therefore, labor costs ($10 per hour) during the calving season can range from $8 to $30 per day and between $25 and $210 each week as the calving season progresses. In addition, checking skills tend to relax once the bulk of heifers and cows are done calving. This often results in more dystocia or death loss of calves potentially due to inadequate attention. With synchronization, fewer cows will fall into this group, but inevitably there will still be some late bred cows that require attention.

The Estrous Cycle

In order to understand how synchronization protocols can be used, it is important to have a basic understanding of the female reproductive system and hormones. When a cow is in standing estrus, or is just coming into estrus (heat), a large follicle (encases the oocyte/egg) is present on her ovaries. This follicle produces large quantities of the hormone estradiol. Estradiol causes a cascade of events resulting in ovulation (the ovary's follicle releasing of the ovum/egg from the ovary). After ovulation, the follicle is transformed into a corpus luteum (CL) that produces the hormone progesterone during the subsequent cycle or pregnancy. This is the hormone responsible for maintaining pregnancy (think pro-gestation). During the estrous cycle when estrogen levels are high, progesterone levels are low, and when progesterone levels are high, estrogen levels are low.

The CL is a functional, hormone producing structure that remains on the ovary until approximately day 18 of the estrous cycle unless the cow becomes pregnant. If the cow becomes pregnant, the CL will remain throughout gestation producing progesterone. If there is no pregnancy, a hormone called prostaglandin $F_{2\alpha}$ (PG) is released from the uterus. Prostaglandin kills the CL, thus ceasing the production of progesterone and allowing the level of estrogen to rise and the cow to ovulate the next ovum.

Natural-service Synchronization Protocols

Three estrous synchronization protocols for natural-service are described below. The 1-shot prostaglandin and MGA protocols are low cost and easy to administer. The 7-day CIDR protocol will be slightly more expensive, but will also be most effective in synchronizing all the heifers and cows in the herd no matter their cycling status.

1-Shot Prostaglandin Protocol

The 1-shot PG protocol is the least expensive, lowest input protocol available. Bulls are turned out when they normally would be without estrous synchronization (this is considered day 0 in Figure 2). From initial turn out,

bulls will breed any females that naturally come into estrus during the next 4 days. On day 4, all the females will make a single trip through the chute to be given an injection of PG. This PG will kill any functional CL on the ovary (6 – 17 days old), thus restarting each female's estrous cycle. For cows that were bred during the first 4 days, they do not have a functional CL developed yet, therefore the prostaglandin will not affect the developing pregnancy (assuming she conceived when she was bred). Therefore, there is no need to perform estrus detection and know which females were serviced during the first 4 days.

A disadvantage of this protocol is its ineffectiveness in anestrous cows or prepubertal heifers due to the absence of a functional CL for PG to regress. Thus if cows are likely not having normal estrous cycles (thin body condition or short postpartum) this protocol will likely not have much benefit on these animals, and this probably is not a good use of labor or resources. Moreover, with this protocol if the herd is pastured far from working facilities, it may require extra labor to bring them back to a working facility or corral; or the females may need to remain in a dry lot until PG is administered on day 4 after bull turn out.

CIDR Protocol

CIDRs contain the hormone progesterone and is used for estrous synchronization by inserting it into the vagina to mimic a CL. The CIDR provides a continuous low dose of progesterone preventing estradiol from elevating and estrus from occurring. For the protocol in Figure 3, CIDRs are inserted on day -7 and left in place for 7 days. On day 0, the CIDR is removed and bulls are turned out. Females should exhibit estrus 1 – 10 days after CIDR removal. Those that were close to ovulating naturally will be the first to come into estrus. Those that had recently ovulated will be closer to the 10 day range. This protocol is the most expensive protocol; however, it will also be the most effective to help "jump start" females that have not yet resumed normal estrous cycles.

Adequate working facilities, permanent or portable, are necessary for this protocol. Cattle will need to be worked through the facilities twice - once to insert the CIDR and a second time to remove the CIDR. There is a slight risk of the CIDRs falling out prematurely, particularly if females are kept in dry lot where curious animals may nibble on the tail or it can get caught on something and be removed. If this happens, a new CIDR can be inserted or, depending on the remaining days of the protocol, some cows may begin to cycle before bull turn out thus reducing the synchrony of estrus expression.

Notice, there are no injections given with this 7-day CIDR protocol, unlike protocols outlined for AI. The injections are eliminated in the natural-service system as we do not desire as tight of a synchrony as in fixed-time AI. In addition, we do not want to utilize hormones that force an ovulation without exhibition of estrus, as the bulls need females to show signs of estrus in a natural-service system in order to service them on time.

MGA Protocol

MGA is a feed additive containing progestin that labeled for suppression of estrus in virgin heifers. MGA IS NOT APPROVED FOR USE IN MATURE COWS. MGA is fed at a rate of 0.50 mg/head/day for 14 days (Figure 4). When the additive is withdrawn after 14 days, heifers should exhibit estrus 2 – 6 days later. However, this is a sub-fertile estrus and heifers should not be bred during this time as very poor conception rates will be realized. On day 0 bulls should be turned out and they will begin to breed heifers on their next natural, fertile cycle.

In order for this protocol to be successful, careful bunk management must occur to ensure each female receives the required amount of MGA every day during the feeding

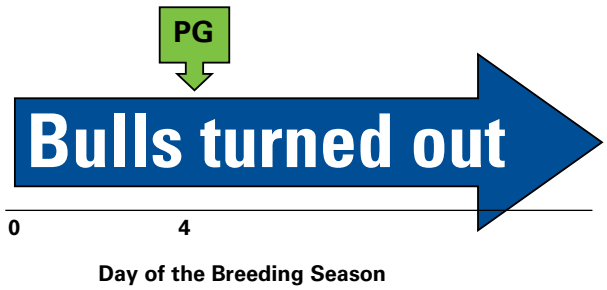

Figure 2. Bulls are turned out to perform natural-service with cows on day 0 and PG is administer 4 days later to all females.

Figure 3. A CIDR is inserted for 7 days before bulls are turned out for natural-service breeding on Day 0.

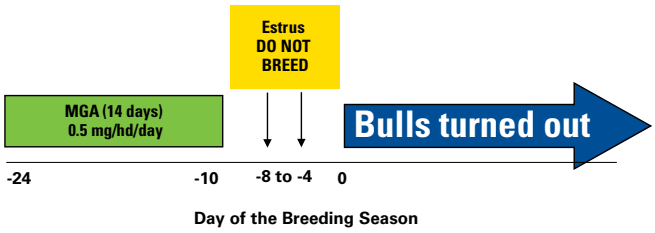

Figure 4. MGA is fed for 14 days and bull turn out is delayed 10 days until day 0 , so to start natural-service breeding heifers on their first normal estrus.

period. Inconsistent feeding, poorly mixed rations and shortage of bunk space will limit the success of this protocol. The entire dose of MGA should be provided to heifers in one feeding that will be consumed in a short period of time. Allowing 18 – 24 inches of bunk space per head will make sure that every heifer has equal opportunity to consume the correct dose. If enough MGA is not provided, heifers may show premature estrus. The opposite response is observed when MGA is offered in excess amounts, as this will affect how fast the progesterone clears a heifer's system and may result in delayed estrous expression.

Estrus Response and Pregnancy Rate

Each natural-service synchronization protocol will yield different estrus responses based on the number of females that have a functional CL and are undergoing normal estrous cycles. Pregnancy rates should be comparable to those of an AI estrous synchronization system. Expectations of 60 – 70 % pregnancy rates during the first 21 days of the breeding season may be observed in all females that are cycling and if bulls are fertile and successfully servicing all females in estrus. However, it is more likely than not that some females will not have resumed normal estrous cycles at time of estrous synchronization; therefore, lower pregnancy rate than previously mentioned may occur. The use of a progestin protocol (CIDR or MGA) will improve pregnancy rates among animals that have not initiated normal estrous cycles yet. However, if cows are in thin body condition and/or short postpartum; even the progestin protocols will not result in all cows responding to the synchronization protocol.

Bull to Cow Ratio

When synchronizing estrus in a natural-service setting, one should take into consideration the amount of bull power that will be needed to service the cow herd. Depending on the operation, there will be different bull to cow ratios used. For example, factors such as experience of bulls, libido, pasture size, and terrain of pastures need to be evaluated in order to attain successful pregnancy rates during the breeding season. Estrous synchronization is not recommended for use with yearling bulls due to inexperience. In addition, mixing yearling and mature bulls together is not recommended as the mature bulls will establish social dominance leaving the yearling bull to potentially avoid breeding and never gain the experience needed. Therefore, experienced mature bulls that have passed their annual breeding soundness exam (BSE) are the best candidates for use with natural-service synchronization protocols. Bull to female ratios when using estrous synchronization should range from 1:15 to 1:25 depending on the experience of the sire. Research conducted by Healy and colleagues in 1993 reported that pregnancy rates were similar when heifers were synchronized are exposed to bulls at a 1:16 ration or a 1:25 ration. Thus, the economic analysis of this study reveals an optimal mating ratio of 1:20 or 1:25 for synchronized females.

More bulls may be required if the breeding pastures are very large. Taking into consideration the stocking density of pastures, terrain and the synchronization protocol used, bulls should be stocked to be able to service the cows without becoming overworked and potentially injured. With a natural-service synchronization protocol, bulls may be expected to breed twice as many cows as they would in a non-synchronized herd over a 7 – 10 day period. Bulls should have a Breeding Soundness Examination and be in good health and body condition score before turn out. Their health and condition status need to be closely monitored at least weekly to ensure bulls are successfully mating cows and to asses if replacement bulls are needed. This is especially important in small groups where only 1 sire is present because if a bull becomes injured and or goes sterile, the result will be a large group of open cows. Therefore, rotating sires may be one a way to avoid the consequences of an injury, and in addition allow incorporation of more genetic lines into each breeding season.

Conclusion

In conclusion there are several estrous synchronization protocols that are designed to be utilized specifically with natural-service. Therefore, when correctly implemented, the benefits and profitability of estrous synchronization

including attaining more cows bred early, shorter calving season, greater pounds of calf weaned per cow exposed, and better utilization of labor can be achieved without using AI. Aside from following the natural-service protocol correctly, management considerations of nutrition, health and days postpartum of herd females should be evaluated in order for a successful breeding season to be realized, no matter if estrous synchronization is used or not. Visit with an expert in these fields to develop a breeding plan that will deliver desired results year after year.

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