

Estrous Synchronization for Natural Service Breeding in Beef Cattle

Lacey Quail, Ph.D., NDSU Extension Livestock Management Specialist

Introduction

The U.S. beef industry is dominated by herds that rely solely on bull breeding. The percentage of cows exposed only to bulls was 92.9%, whereas the percentage of heifers was 76.8% (Figure 1). While estrous synchronization is typically associated with artificial insemination, utilizing natural service sires to breed estrous-synchronized females may offer opportunities to get females pregnant earlier in the breeding season, have calves born earlier in the calving season and potentially increase weaning weight of calves born to synchronized females.

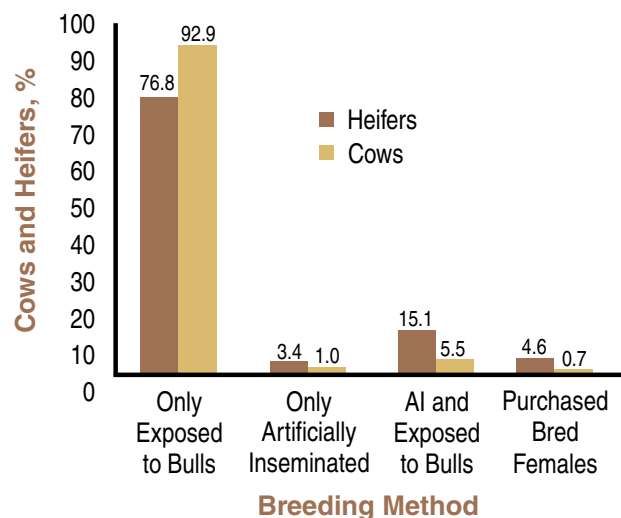
A common, yet misconceived, concern when considering using estrous synchronization in natural service breeding programs is that all females will be receptive to breeding at the same time and consequently, need additional sires. However, several estrous synchronization protocols are designed specifically to be used with natural service breeding to ensure that females come into estrus over several days.

Regardless of what protocol is chosen, careful and timely planning is critical. For a complete list of natural service synchronization protocols and timelines for each, visit www.beefrepro.org/natural-service-protocols/.

Characteristics of bulls used for breeding and characteristics of the females being synchronized contribute to the success or failure of synchronized natural service breeding. Also, knowing specific synchronization protocols will give producers flexibility as they plan to implement a synchronized natural service breeding system.



Figure 1. Percentage of heifers and cows bred by breeding method for calving in 2017. Adapted from *National Animal Health Monitoring System, 2017*.



Bull Factors That Influence Success

Not all bulls are suitable for breeding groups of synchronized females. Age, breeding soundness and libido need to be evaluated to determine whether individual bulls are suitable candidates for natural service synchronization protocols.

Age: Breeding is a learned behavior. As bulls get older, they have fewer false mounts, compared with younger bulls (Table 1); however, there are no differences in the number of successful services among bulls of different ages. More importantly, 2-year-old bulls had greater overall pregnancy rates compared with yearling bulls, and bulls that were at least 3 years old had greater overall pregnancy rates than 2-year-old bulls. Together, these results highlight the fact that experienced breeding bulls (at least 2 years old) are the best candidates for synchronized natural service breeding programs.

Breeding Soundness: A complete breeding soundness examination (BSE) is performed by a veterinarian and includes a physical evaluation, scrotal circumference measurement and semen analysis. A BSE can identify potential breeding issues that a simple semen test could not. Using bulls that passed a BSE will result in greater pregnancy rates in synchronized females compared with using bulls that failed or were classified as “deferred” (need to be retested).

Libido: High libido, or willingness to breed, is something that is certainly required of bulls stocked with synchronized females. To identify bulls with high libido, watch for bulls that aggressively seek and breed females, and keep notes for potential use in synchronized natural service systems in upcoming years. Not having the opportunity to observe yearling bulls carefully for previous breeding activity is another reason to avoid their use in synchronized programs.

Summary of minimum bull recommendations

- ✓ **Age of 2+ years with previous breeding experience**
- ✓ **Passed complete breeding soundness exam**
- ✓ **High libido**

Table 1. Breeding behavior and fertility of bulls of different ages.

	Age of Bull		
	Yearling	2	3+
Number of mounts	207 ^a	120 ^b	85.8 ^b
Number of services	54.5	37.6	40.5
Estrus females serviced, %	69.4	73.8	72.0
Pregnancy rates of serviced females, %	39.6 ^a	59.4 ^b	62.2 ^b
Overall pregnancy rate,* %	30.9 ^a	41.5 ^b	49.9 ^c

^{a,b,c} Means within row lacking common superscript differ ($P < 0.05$).

* Pregnancy rate after a five-day breeding period.

Adapted from Pexton et al., 1990.

Table 2. Effect of bull-to-heifer ratio on pregnancy status.

	Bull: Heifer Ratio*			
	1:50	1:50	1:25	1:16
	Nonsynchronized	Synchronized		
Number of bulls in pasture*	2	2	4	6
Pregnancy rate, %	82	77 ^a	83	84 ^b

* Each pasture had 100 heifers.

^{a,b} Means within row lacking common superscript differ ($P < 0.05$).

Adapted from Healy et al., 1993

Stocking Rate: Once bulls that meet the minimum requirements are identified, producers must make a final decision on stocking rates.

In groups of synchronized females, pregnancy rates were greater when stocking one bull per 16 heifers compared with one bull per 50 heifers. More importantly, pregnancy rates were similar when stocking one bull with 16 or 25 synchronized heifers (Table 2).

An economic analysis of the tested stocking rates concluded that a 1-to-25 stocking rate yielded the greatest economic return. Therefore, the number of synchronized females a bull can be expected to breed is not that different from the national average stocking rate of 22 females per mature (2+ years old) bull (NAHMS, 2017).

Keep in mind that the risk associated with injury or other breeding issues is concentrated when breeding synchronized females. Close observation of bulls during the synchronized period and early intervention when problems arise are critical for success. Additionally, take into account the terrain of the breeding pasture, distance to water and social dominance between bulls when setting the stocking rate.

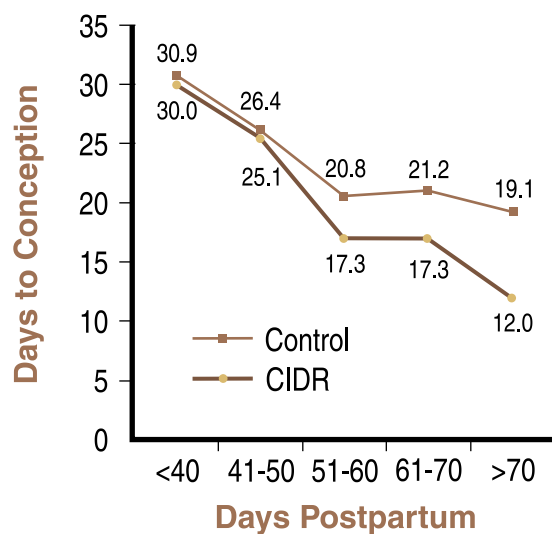
Cow Factors That Influence Success

Estrous synchronization programs for artificial insemination have concentrated on the ability of a protocol to synchronize cycling and non-cycling females. Since bulls seek out females in estrus in natural service synchronization programs, having a high proportion of females in standing heat during the synchronization period is essential to the success of the program

Cows need time to recover after calving before resuming regular estrous cycles. As days after calving (days postpartum) increase, the proportion of cows cycling increases as well. Thin cows take longer to start cycling after calving, and thin heifers take longer to reach puberty, compared with females with adequate body condition. Therefore, evaluating the days postpartum and/or body condition score can help determine whether females are good candidates for synchronization.

An easy way to evaluate the proportion of females cycling in a group is to use heat detection and closely analyze the results. If all the females in a group are cycling, we would expect to see nearly 5% of the group in heat each day (1 day ÷ 21 days in an average estrous cycle = 4.8%). For a herd of 100 females, that would mean five females in heat each day for 21 days.

Figure 2. Interval to conception from initiation of the breeding season at various days postpartum. Days postpartum × treatment ($P < 0.05$). Adapted from Lamb et al., 2008



Options for Synchronization With Natural Service

1 Shot PG: Prostaglandin F_{2a} (PG) is given on the day of bull turnout. Females that respond to the PG will be in heat for approximately the next five days. The net result would be that 76.2% of cycling females would be in heat within the first five days of the breeding season. In this scenario, the average days to conception would be day 6.8 of the estrous cycle (a 3.2-day advantage compared with no synchronization, and theoretically, calves that are 3.2 days older at weaning with 3.2 extra days to gain weight after birth).

Day 5 PG: Females are gathered five days after bull turnout and given PG. The bulls would have bred 19% to 20% of cycling females before the PG, and the remaining females that respond to PG should be in heat over the next five days. Administering PG within the first five days after bull turnout does not disrupt pregnancies from breedings that took place during the previous five days; however, giving PG after day 5 can disrupt pregnancies. Using this method, 100% of cycling females would theoretically be in heat within the first 10 days of the breeding season, with the majority of breeding activity occurring around day 8. Interestingly, the average day of conception in females responding to synchronization (day 6.8 of the breeding season) would be the same as for the 1 Shot PG protocol.

7-day CIDR®: Using this protocol, a CIDR® is inserted for seven days prior to the start of the breeding season. Once the CIDR® is removed, the bulls are turned in. The CIDR® will stop cycling females from showing estrus during the time it is in place. It also has the potential to initiate estrus in some noncycling females. Within the first five days after the CIDR® is removed, 57% of cycling females would be expected to show heat, and the average days to conception in this scenario would be day 6 of the breeding season.

When comparing the use of a CIDR® or not, the average days to conception were three days shorter for cows receiving a CIDR® for seven days prior to the breeding season compared with cows that did not receive a CIDR®. This difference was mainly due to the effects of the CIDR® in cows that were likely cycling (calved earlier in the calving season; Figure 2).

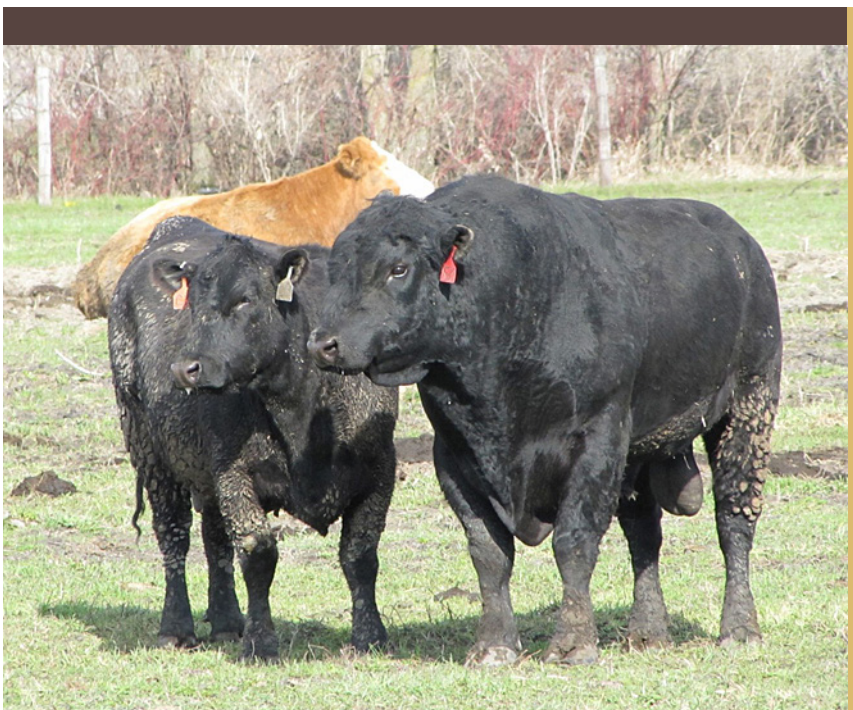
14-day CIDR®: Using this protocol, a CIDR® is inserted for 14 days. After removing the CIDR®, a period of estrus activity will occur; however, because of the long-term exposure to a progestin, these heats are subfertile, and breeding should not occur. Instead, bulls should be turned in with females approximately 14 days after CIDR® removal to breed females on the following heat of the next estrous cycle.

Other Considerations

Research focusing on modern estrous synchronization protocols has focused on making the window of time during which cattle ovulate as small as possible. This small window of ovulation time in a group of cattle is essential for optimization of fixed-time artificial insemination pregnancy rates. Many of these protocols include the hormone GnRH administered two to three days after PG to facilitate ovulation near fixed-time artificial insemination. In the case of using synchronization with natural service breeding, GnRH should not be used near breeding because cattle subsequently may not show estrus and therefore not be bred via natural service. Following established protocols is crucial to the success of a synchronization program.

Conclusions

Breeding synchronized females with natural service sires is a strategy that will work for some producers and not for others. Nevertheless, utilizing natural service synchronization programs can increase the number of females pregnant early in the breeding season, thus contributing to increases in productivity and profitability of beef herds. In either synchronized or nonsynchronized bull breeding, producers are encouraged to monitor pastures closely for breeding activity and injuries throughout the breeding season. Although not all problems will be visually noticeable (such as the case with changes in semen quality after the yearly BSE), identifying issues early in the breeding season will allow time to replace bulls that need to be replaced and salvage the remainder of the breeding season.



This publication was authored by Carl R. Dahlen, former NDSU Extension Beef Cattle Specialist, May 2014

NDSU Extension does not endorse commercial products or companies even though reference may be made to tradenames, trademarks or service names.

For more information on this and other topics, see www.ag.ndsu.edu

North Dakota State University is an equal opportunity educator and employer. NDSU Extension and the Agricultural Experiment Station's work is supported by the U.S. Department of Agriculture's National Institute of Food and Agriculture. USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity. NDSU Extension and the NDAES are committed to providing equal access. Persons with disabilities who require alternative means of communication for program information (e.g., braille, large print, audiotape, American Sign Language) or other accommodations related to disability may request them at 701-231-1865. Advance notice of two weeks is preferred to allow adequate planning.