



BEEF CATTLE RESEARCH UPDATE

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Use of Estrous Synchronization and Artificial insemination

Estrous synchronization and artificial insemination (AI) are management techniques available for the advancement of herd genetics by the selection of highly proven sires without the overhead cost of using natural-service sires. Research has shown that using these technologies can shorten the breeding and calving seasons, increasing the number of early births resulting in older and heavier calves at weaning and possible economic benefits.^{1,2} However, a 2007-08 USDA survey of U.S. beef cow operations (2,872 cow/calf operations from 24 states) found that only 7.6 and 7.9% of these operations utilized AI or estrous synchronization as a reproductive management tool, respectively.³ Two of the primary reasons that these operations did not use AI were “labor/time” concerns and “too difficult/complicated” to implement estrous synchronization protocols (37.7 and 16% of operations, respectively). However, during the past decade, fixed-time AI (FTAI) protocols have been developed that eliminate detecting estrus and yield satisfactory pregnancy rates. Two recently published studies have evaluated the use of estrous synchronization and FTAI. Summaries of these studies follow.

Comparison of Timed Artificial Insemination vs. Modified Estrus Detection Protocol in Beef Heifers

Estrous synchronization and AI require planning and additional time and labor. However, FTAI protocols (FTAI) eliminate estrus detection and reduce the number of times cattle are handled compared with protocols involving estrus detection. For this reason, University of Nebraska researchers recently evaluated pregnancy rates using a FTAI (no estrus detection) protocol versus a modified estrus detection with fixed time AI (MTAI).⁴ This study utilized 971 yearling, Angus-based crossbred heifers (763 lb average weight). These heifers were estrus synchronized using a melengestrol acetate (MGA) prostaglandin protocol. For the first 14 days of the study, the heifers were fed a pellet contain MGA. On day 33, they were injected with prostaglandin (PG; 25 mg, Lutalyse, Zoetis) and estrus detection patches were applied on the tail head. Each heifer was assigned a patch score (reflecting the amount of rub-off coating removed) at AI to reflect estrus status.

At 72 hours after PG injection, all FTAI heifers received a gonadotropin-releasing hormone (GnRH) injection and were artificially inseminated. Estrus was detected in the MTAI heifers at 58 and 70 hours after PG. Heifers expressing estrus were penned separately. Approximately 72 hours after PG, MTAI heifers were inseminated in the following order: heifers in estrus at 58 hours after PG, heifers in estrus at 70 hours after PG, and heifers not expressing estrus at either observation. Heifers not expressing estrus received GNRH at AI. Thirteen days following AI, bulls were placed with the heifers for a 42-day breeding season. A minimum of 51 days after AI, pregnancy was detected using ultrasound. Heifers not pregnant by AI were diagnosed for pregnancy again 45 days following bull removal.

These authors reported that in both treatments, heifers exhibiting estrus had greater AI pregnancy rates ($P < 0.01$; 71 and 66% for FTAI vs. MTAI, respectively) than heifers not expressing estrus (47 and 53% in non-estrus heifers for FTAI and MTAI, respectively). However, overall AI pregnancy rate (62%) and final pregnancy rates (97%) were similar for both treatments.

The USDA survey suggested that reproductive technologies such as estrus synchronization and AI have limited adoption in the beef industry, partially due to added labor.³ Thus, protocols that limit

labor and cattle processing have a greater potential of being adopted. In this Nebraska study, similar pregnancy rates were achieved without the added labor of estrus detection.

Effects of Breeding System (Natural Service vs. Artificial Insemination) on Reproduction in Commercial Beef Cow Herds

A 2016 North Dakota State University study compared the effects of artificial insemination and natural-service breeding systems on pregnancy rates, calving distribution and calf weaning weights of commercial beef cow-calf operations that had never previously implemented estrous synchronization or AI into their management plans.⁵ In this study, 2,399 crossbred commercial cows originating from 10 commercial beef herds were exposed to two different breeding systems. Within each herd, cows were assigned randomly to one of two breeding system treatments: 1) only exposed to natural-service herd bulls (NS; 1,122 cows) or 2) exposed to ovulation synchronization and fixed-time AI followed by natural service bulls (FTAI; 1,284 cows).

To achieve a common breeding date, all FTAI females were exposed to ovulation synchronization (7-day CO-Synch + CIDR for cows and heifers) consisting of inserting a controlled internal drug releasing insert (CIDR, Zoetis Inc.) and intramuscular injection (i.m.) of Gonadotrophin Releasing Hormone (GnRH: Factrel, Zoetis, Inc.), followed in seven days by CIDR removal and PGF2 α i.m. (Lutalyse, Zoetis Inc.), followed in 60 to 66 hours by GnRH i.m. and FTAI. Cleanup bulls were placed in breeding pastures at least one day after FTAI and remained with females until the end of the producer-defined breeding season. The presence of a viable fetus was determined by the herd veterinarian of each operation at least 45 days after the conclusion of the breeding season. At the time of calving, birth date was recorded.

These researchers reported that no differences were observed in the proportion of females pregnant at the end of the breeding season between NS and FTAI treatments (93.1 vs. 93.2%). However, cows in the FTAI group calved 7.7 days earlier ($P < 0.001$) in the calving season than those in the NS group (27.1 vs. 34.8 days). In addition, a greater proportion ($P < 0.001$) of FTAI cows calved in the first 21 days of the calving season, compared with NS cows (45.6 vs. 24.7%). During the second and third 21-day periods, a greater proportion ($P < 0.001$) of NS-bred females calved compared to FTAI cows (41.9 vs. 27.3% and 24.7 vs. 18.6%, respectively).

Weaning weights were ~16 greater for calves born to dams in the FTAI group, compared with the NS group (549.8 vs. 534.0 lb, $P < 0.001$). They also reported that a treatment x calving group interaction was present for weaning weight. Greater ($P = 0.002$) weaning weights were observed for calves born from FTAI cows compared to NS cows in the first 21 days of the calving season (592.5 vs. 566.7 lb, $P = 0.002$). Whereas, weaning weights of calves born in the second 21 days were greater in NS calves compared with FTAI calves (542.7 vs. 527.3, $P = 0.05$). Weaning weights of calves born from day 42 to the end of the calving season were similar among treatments.

In this study, even though the use of estrous synchronization and FTAI did not affect the proportion of cows becoming pregnant; it did increase the number of calves born early in the calving season. As a result, calves born to dams in the FTAI treatment were heavier at weaning. These authors concluded that the use of estrous synchronization and FTAI could have potential benefits for producers.

Overall Summary

The North Dakota study along with other studies illustrates that estrous synchronization and FTAI can shorten the calving season, increasing the number of early births resulting in older and heavier calves at weaning and possible economic benefits. The Nebraska study suggested that one can reduce the labor/time and expense of an AI program by utilizing FTAI as compared to an estrus detection protocol followed by AI. In this study, pregnancy rates did not differ between AI protocols. Using a FTAI program allows a producer to improve their herd genetics by the selection of highly proven sires without the overhead cost of using natural-service sires.

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- ² Mercadante, V. R. G., F. M. Ciriaco, D. D. Henry, P. L. P. Fontes, N. Oosthuizen, N. DiLorenzo, and G. C. Lamb. 2015. Utilization of fixed-time artificial insemination (TAI) to reduce breeding season length and its effects on subsequent calf value: A case study. *Florida Beef Research Report*: 29-33.
- ³ USDA-APHIS. 2009. Pages 18-21 in *Beef 2007-08, Part II: Reference of Beef Cow-calf Management Practices in the United States, 2007-08*. USDA-APHIS-VS-CEAH, Fort Collins, CO. Available: https://www.aphis.usda.gov/animal_health/nahms/beefcowcalf/downloads/beef0708/Beef0708_dr_PartII.pdf.
- ⁴ Tibbitts, B. T., T. L. Meyer, D. J. Kelly, and R. N. Funston. 2017. Comparison of timed insemination versus modified estrus detection protocol in beef heifers. *Prof. Anim. Sci.* 33: 97-100.
- ⁵ Crosswhite, M. R., D. N. Black, T. L. Neville, S. R. Underdahl, and C. R. Dahlen. 2016. Effects of breeding system of origin (natural service or artificial insemination) on pregnancy rates, distribution of calving and calf weaning weights of commercial beef cow herds in North Dakota. In: *North Dakota Beef Report*. p. 62-65. Available: <https://www.ag.ndsu.edu/pubs/ansci/beef/as1815.pdf>.

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