Effects of Natural Service and Artificial Insemination Breeding Systems on Pregnancy Characteristics and Weaning Weights

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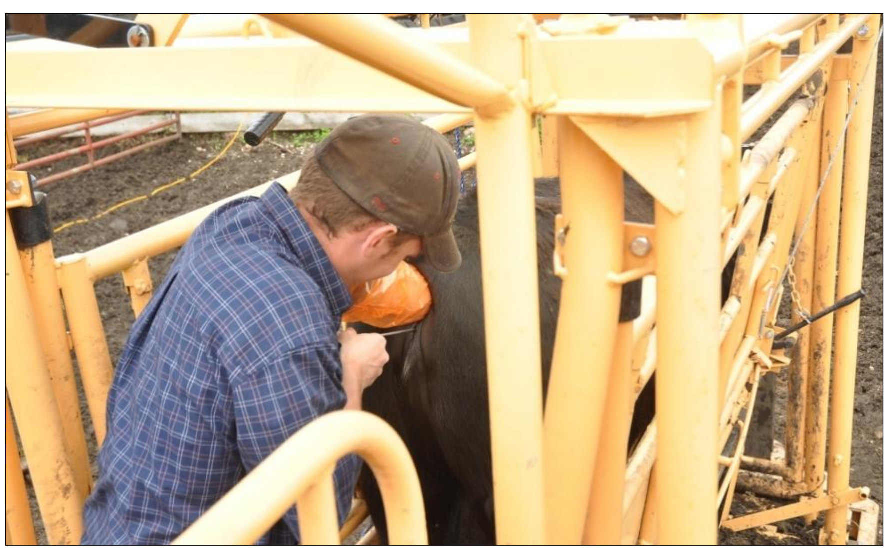
A similar proportion of beef cows and heifers exposed to estrous synchronization (ES) and artificial insemination (AI) became pregnant during the breeding season, compared with females bred via natural service breeding. Females in a breeding system that included ES and AI calved earlier in the calving season, compared with females bred with natural service, but no advantage was present for weight of calves at weaning.

Summary
Crossbred beef cows and heifers (n = 480 and 86, respectively) were used to compare the effects of two breeding systems on pregnancy rates, days to conception, calving date, calving characteristics and weaning weights. Cattle were assigned randomly to one of two treatments: 1) exposed to natural service bulls (NS; n = 284) or 2) exposed to estrous synchronization and a fixed-time AI followed by natural service bulls (TAI, n = 282). Cyclic (11.6 ± 1.4 days) and noncyclic (14.5 ± 1.4 days) cattle in the TAI treatment became pregnant earlier in the breeding season ($P < 0.05$), compared with cyclic (19.9 ± 1.4 days) and noncyclic (17.9 ± 1.4 days) cattle in the NS treatment. No differences ($P > 0.10$) were observed in the season-ending pregnancy rates among treatments. Cattle in the TAI treatment had a mean calving date six days earlier than those in the NS treatment ($P < 0.01$). No advantage ($P > 0.05$) in weaning weight was present for calves born from the TAI treatment.

Introduction
Incorporating estrous synchronization (ES) and artificial insemination **(**AI) into beef operations may result in improved reproductive performance, weaning weight, carcass quality and genetic value, along with reduced calving difficulty (Sprott, 2000). Experiments have used cleanup bulls after the use of ES and AI (Geary et al., 2001; Stevenson et al., 1997) but lacked the use of a traditional breeding system as a control. The control group many producers feel is best suited for comparison with ES and AI protocols is natural service bull breeding. When this comparison was made in *Bos indicus* cattle, greater pregnancy rates were observed when AI and ES were used compared with natural service (Sa Filho et al., 2009). In commercial *Bos taurus* herds, the calving



season distribution was shifted to have a higher proportion of females give birth earlier in the calving season and greater pounds weaned per exposed female for AI, compared with natural service cattle (Rodgers et al., 2012). However, the authors did not report on the season-ending pregnancy rates, birth weights or the impact of cyclic status.

Procedures

Animals and treatments. Crossbred Angus cows and heifers were used in two locations: 1) Central Grasslands Research Extension Center (n = 86 heifers and n = 405 cows) and 2) Hettinger Research Extension Center (n = 81 cows). Females were assigned to one of two treatments: 1) exposed to natural service bulls (NS, n = 284) or 2) exposed to ES and fixed-time AI (day 0) followed by natural service bulls (TAI, n = 282). Females in the TAI treatment were synchronized with the 7-day CO-Synch + CIDR protocol (see Larson et al., 2006). Bulls were introduced to the herd on day one, and both treatments were managed as a cohort in the same pastures. Bulls passed a breeding soundness exam and were stocked at a rate of 30 cows/bull and 15 heifers/bull. The breeding season for CGREC and HREC was 49 and 63 days, respectively.

Blood samples and pregnancy determination. Blood samples for all females were taken on day -20 and -10 to determine cyclic status at the beginning of the breeding season. Cows were considered to be cyclic at the initiation of treatments if at least one of two blood samples had concentrations of progesterone of 1 nanogram/milliliter (ng/mL) (Perry et al., 1991). Transrectal ultrasonography was used to determine the presence and age of a viable fetus, using an Aloka 500 with a 5 MHz linear probe, on day 49 and again at least 40 days after the bulls were removed from breeding pastures.

Calves. Date, calving ease, calf vigor and birth weights were recorded at calving. Calving ease and calf vigor were subjectively determined. Calving ease was rated on a 1 to 5 scale, with 1 being no assistance and 5 being caesarean. Calf vigor was rated on a scale of 1 to 5, with 1 being a normal, vigorous calf and 5 being a stillbirth. All calves were managed on the same pastures as a cohort. Calf weights were collected at weaning.

Statistical analysis. All data were analyzed using the GLM procedures of SAS (SAS Ins. Inc., Cary, N.C.). The statistical model included the effects of treatment, cyclic status, location and the respective interactions. Significance was determined with an alpha of $P < 0.05$.

Results and Discussion

Overall AI pregnancy rates were 55 percent for the current study. This highlights a major difference between the two breeding systems evaluated. The AI breeding system results in pastures in which only half of the cows stocked will come into heat (other half pregnant). Thus, fewer bulls are required to breed the remaining cows. However, producers need to understand the risk of reducing bull power; in extreme cases, conception rates for AI potentially could be less than 50 percent, resulting in an inadequate bull-to-female ratio.

At the initiation of the breeding season, 42.8 percent of all cattle were cyclic. Cyclic (11.6 ± 1.4 days) and noncyclic (14.5 ± 1.4 days) cattle in the TAI treatment became pregnant earlier in the breeding season ($P < 0.05$), compared with cyclic (19.9 ± 1.4 d) and noncyclic (17.9 ± 1.4 d) cattle in the NS treatment. The decreased days to conception are due primarily to the greater proportion of cattle bred to AI on the first day of the breeding season. The reduction in days to conception potentially could alter the labor needs by having a high proportion of calves born early in the calving season (Sprott, 2000).

No differences ($P > 0.10$) in season-ending pregnancy rates were observed between treatments. Thus, the theoretical advantage of ES and AI improving reproductive performance (Sprott, 2000) was not observed. The discrepancy between our season-ending pregnancy rates and stated theory require further exploration.

When cyclic status was included in the model, fewer ($P < 0.05$) noncyclic cattle in the TAI treatment (84 percent; 136 of 162) were pregnant at the final pregnancy check, compared with cyclic cattle in the TAI treatment (94 percent; 111 of 118), whereas cyclic (88 percent; 105 of 119) and noncyclic (89 percent; 140 of 157) cattle in the NS treatment were intermediate. In contrast to our study, Stevenson et al. (1997) reported no differences in final pregnancy rates among cyclic and noncyclic cows and heifers that received an ES protocol with an injection of gonadotropin-releasing hormone.

During the calving season, the TAI treatment cattle (day 18.1) had a mean calving date six days earlier ($P < 0.01$) than the NS treatment cattle (day 24.1). This number is similar to the days to conception that was analyzed during the pregnancy diagnosis. However, with the earlier mean calving date, the length of the calving season between the two treatments was not different. Rodgers et al. (2012) reported the mean calving date was altered by ES and AI, but the length of the calving season was not different, compared with that of the natural service treatment. Calving season length is determined by length of bull exposure and was not influenced by incorporating AI in the current study.

Females in the TAI treatment had a significantly ($P < 0.01$) reduced birth weight of the calves (82.2 pounds), compared with NS treatment calves (85.1 pounds). The reduction in birth weight can be explained partially because the combined expected progeny differences of the herd bulls, compared with the AI sires with the cleanup bulls, had a reduction of 0.6 pound. Calving ease and vigor were not different ($P > 0.10$) among treatments.

No differences ($P > 0.10$) were present in weaning weights among calves born from the AI (473.3 pounds) and NS (481.7 pounds) treatments. In addition, no differences ($P > 0.10$) were observed in total weight produced from each breeding system. A study of similar design (Rogers et al., 2012) also showed no difference in weaning weight among AI and NS treatments but did show an advantage in pounds weaned per exposed female for cattle bred in a system that incorporates AI.

Artificial insemination with estrous synchronization altered the calving season by having a greater proportion of cattle give birth earlier in the calving season to lighter calves. We did not see a clear advantage in terms of weaning weight in the group bred via AI. Perhaps the long-term advantage will become clear in subsequent studies that evaluate postweaning performance and other traits that may allow the genetic potential of AI sires to be expressed.

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