

Effects of natural service and artificial insemination breeding systems on calving characteristics and weaning weights

P.L. Steichen¹, S.I. Klein¹, Q.P. Larson¹, K.M. Bischoff², V.R.G. Mercadante², G.C. Lamb², C.S. Schauer³, B.W. Neville⁴ and C.R. Dahlen¹

A similar proportion of females exposed to estrous synchronization (ES) and artificial insemination (AI) became pregnant during the breeding season, compared with females mated during a natural service (NS) breeding system. Females in a breeding system that included ES and AI calved earlier in the calving season, compared with females mated with natural service, and a weaning weight advantage was observed in AI calves born within the first 21 days of the calving season, compared with NS calves born within the first 21 days of the calving season.

Summary

Crossbred Angus beef cows and heifers (n = 480 and 86, respectively) were used to compare the effects of two breeding systems on 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 artificial insemination (AI), followed by natural service bulls (TAI, n = 282). A greater proportion ($P < 0.05$) of TAI females (54.2 percent) gave birth in the first 21 days of the calving season, compared with the NS treat-

¹Department of Animal Sciences, NDSU

²North Florida Research and Education Center, University of Florida, Marianna

³Hettinger Research Extension Center, NDSU

⁴Central Grasslands Research Extension Center, NDSU

ment (39.5 percent). From day 22 to 42, a greater ($P < 0.05$) proportion of females in the NS treatment (34.3 percent) gave birth, compared with cattle in the TAI treatment (18.8 percent). No differences ($P > 0.05$) were present among treatment in the proportion of females that calved after day 43 or failed to have a calf. Overall, the mean calving date for females in the TAI treatment (day 17.6) was seven days earlier ($P < 0.01$) than that of females in the NS treatment (day 24.6). Calves born in the AI treatment were lighter ($P < 0.05$) at birth, compared with calves in the NS treatment. A 19.4-pound weaning weight advantage ($P < 0.05$) was observed in AI calves born within the first 21 days of the calving season, compared with NS calves born within the first 21 days of the calving season.

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 (Spratt, 2000). Experiments have used cleanup bulls after the use of ES and AI (Geary et al., 2001; Stevenson et al., 1997) but do not utilize the use of a traditional breeding system as a control. We reported that no differences in season-ending pregnancy rates existed among groups that were assigned to a natural service (NS) breeding system or a breeding system that incorporated AI (Steichen et al., 2012).

Ultrasound was used to determine the fetal age of all pregnancies in the previous study, and females in the AI treatment became pregnant earlier in the breeding season, compared with females in the NS treatment. The objectives of the current study were to compare the effects of natural service and artificial insemination

breeding systems on calving characteristics and weaning weights.

Experimental Procedures

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 seven-day CO-Synch + CIDR protocol (Beef Reproductive Task Force, 2013). Bulls were introduced to the herd on day one, and both treatments were managed as a cohort in the same pastures. The breeding season for the CGREC and HREC was 49 and 63 days, respectively.

Calving began at the CGREC on March 14, 2012, /and at the HREC on April 3, 2012. Date, calving ease, calf vigor and birth weights were recorded at calving. Calving ease and calf vigor were determined subjectively. Calving ease was rated on a 1 to 5 scale, with 1 being no assistance and 5 being caesarian. 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 (Sept. 14, 2012). For purposes of analyzing calving and weaning data, calves were grouped into 21-day intervals according to birth date within the calving season (about 21 days, 22 to 42 days and more than 42 days).

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

Results and Discussion

The pregnancy rate (overall 55 percent of TAI became pregnant to AI) and days to conception data were reported in the "2012 North Dakota Beef Report" (Steichen et al., 2012). During the calving season, a greater proportion ($P < 0.05$) of TAI cattle gave birth in the first 21 days of the calving season, compared with the NS treatment (Figure 1). From day 22 to 42, more females in the NS treatment ($P < 0.05$) gave

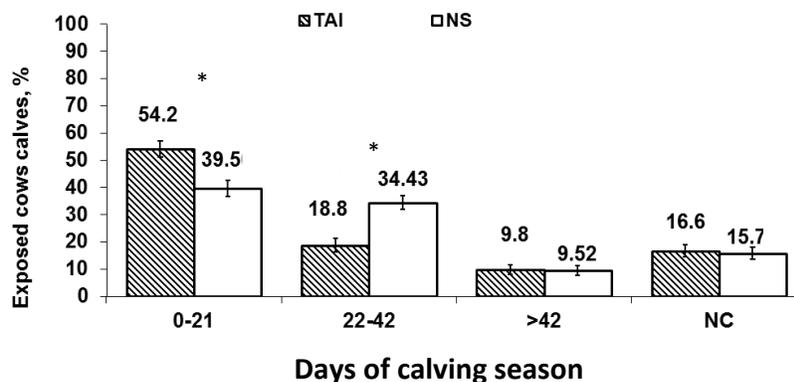


Figure 1. Effect of treatment on calving distribution.

*Means within factor lacking common superscript differ ($P < 0.05$). NC, either was called open at final pregnancy check or pregnant but did not calv.

birth, compared with cattle in the TAI treatment.

No differences ($P > 0.05$) were evident among treatment in the proportion of females that calved after day 42 or failed to have a calf (NC, either were classified as nonpregnant at final pregnancy diagnosis or failed to calve between the final pregnancy diagnosis and the end of the calving season).

The mean calving date for females in the TAI treatment (day 17.6) was seven days earlier ($P < 0.01$) than that of females in the NS treatment (day 24.6). This relative difference was similar to that anticipated after our original pregnancy diagnosis and fetal aging via ultrasound (Steichen et al., 2012).

The length of the calving season was similar ($P > 0.10$) between the two treatments. Similarly, Rodgers et al. (2012) reported the mean calving date was shifted earlier by incorporating 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 the length of bull exposure and was not influenced by incorporating AI in the current study.

Calves born in the TAI treatment were lighter ($P < 0.01$) at birth (82.2 pounds), compared with calves born in the NS treatment (85.1 pounds). The anticipated reduction in birth weight because of slight expected progeny differences (EPD) of bulls among treatments would have been 0.6 pound.

The realized difference among treatments was greater, however, giving a greater advantage to calves born in the AI treatments. Even though a birth weight advantage did exist, primarily for calves that were sired by AI sires, calving ease and vigor were not different ($P > 0.10$) among treatments.

Overall, the average weaning weight of calves was 452 pounds

at an average age of 150 days (five months). Calves born in the AI treatment during the first 21 days of the calving season were 19.4 pounds heavier at weaning ($P < 0.05$) than those born during the first 21 days of the calving season in the NS treatment (Figure 2). Calves that calved later in the calving season were progressively lighter at weaning, compared with their earlier-born counterparts. However, no differences among treatments ($P > 0.10$) were present within the two remaining calving groups analyzed (22 to 42 and greater than 42 days, respectively).

Because the same bulls that sired the natural service calves were used as cleanup bulls to the AI breeding, no differences in weaning weight of later-born calves was expected. The weaning weight advantage of AI calves born during the first 21 days of the calving season highlights the potential gain producers can receive if they choose proven bulls with high growth potential.

Incorporating artificial insemination and estrous synchronization altered the calving season by having a greater proportion of cattle give birth earlier in the calving season to lighter calves. The advantage of artificial insemination also was

observed in the weaning weights of calves born within the first 21 days of the calving season. Subsequent studies will compare additional postweaning performance traits among TAI and NS treatments.

Literature Cited

- Beef Reproductive Task Force. 2013. 2013 estrus synchronization protocols for cows and heifers. Available at: <http://beefrepro.unl.edu/pdfs/Protocols%20for%20Sire%20Directories%202013.pdf>
- Geary, T.W., J.C. Whittier, D.M. Hallford and M.D. MacNeil. 2001. Calf removal improves conception rates to the Ovsynch and CO-Synch protocols. *J. Anim. Sci.* 79:1-4.
- Rodgers, J.R., S.L. Bird, J.E. Larson, N. DiLorenzo, C.R. Dahlen, A. DiCostanzo and G.C. Lamb. 2011. An economic evaluation of estrous synchronization and timed artificial insemination in suckled beef cows. *J. Anim. Sci.* 90:4055-4062.
- Sprott, L. R. 2000. Management and financial considerations affecting the decision to synchronize estrus in beef females. *J. Anim. Sci.* 77:1-10.
- Steichen, P.L., S.I. Klein, Q.P. Larson, K.M. Bischoff, V.G.R. Mercadante, G.C. Lamb, C.S. Schauer, B.W. Neville and C.R. Dahlen. 2012. Effects of natural service and artificial insemination breeding systems on pregnancy rates and days to conception. The 2012 North Dakota Beef Report. Pp. 12-15.

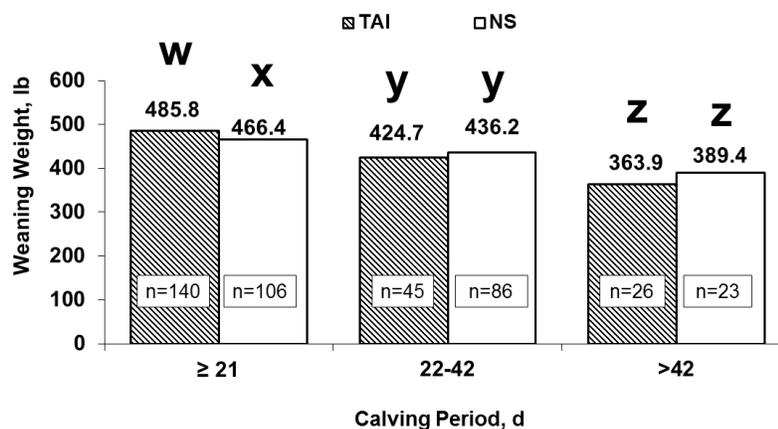


Figure 2. Effect of treatment and calving period on weaning weight of calves

Treatment × Calving period interaction ($P < 0.001$).

w,x,y,z Means lacking common superscript differ ($P < 0.05$).