Effects of Time of Fall Calving on AI Pregnancy Rate, Total Pregnancy Rate, Postpartum Anovulatory Interval, and Estrous Behavior

M.P. Davis, D.W. Kastner, I. Rubio, M. Anderson, R. Jones, R.P. Wettemann, and D.L. Lalman

Story in Brief

Pregnancy rate after artificial insemination (AI), total pregnancy rate, postpartum anovulatory interval and estrous behavior were evaluated in cows inseminated in early November (early calving) or early January (late calving). Cows were time inseminated after ovulation synchronization by treatment with gonadatropin releasing hormone (GnRH)on d 0 and insertion of a controlled internal drug releasing intravaginal insert containing progesterone (CIDR; Pfizer Inc., NY, NY), injected with prostaglandin F2α (PGF2α) on d 7 and CIDR removed, and cows were inseminated along with injection of GnRH on d 9. Cows grazed native range pastures and received a 40% crude protein supplement in winter to maintain a body condition score (BCS) of 5 at breeding, and 4.5 at weaning. Total pregnancy rate and AI pregnancy rate were not influenced by early or late calving season. Postpartum interval at synchronization was shorter in late fall breeding than early fall breeding cows in yr 3. The percentage of cows that exhibited estrous behavior was less for the late than early fall breeding season for yr 3. Late fall breeding for three years resulted in a shorter interval from calving to ovulation synchronization in year three and less cows with estrous behavior after synchronization.

Introduction

Opportunities exist for the use of AI with fall calving cows to improve genetic progress since cows usually calve in good body condition and reinitiate estrous cycles soon after calving. Fall calving cows usually require more supplemental protein during the winter than spring calving cows, but fall calving cows are better able to utilize warm season grasses to increase body energy reserves prior to calving (Bagley et al., 1987). Fall born calves tend to have greater weaning weights than spring born calves in southern states (Bagley et al., 1987). Body energy reserves at spring calving is the most important factor that influences the interval from parturition to first estrus and ovulation in beef cows (Selk et al., 1988). Body condition score at calving influence reproductive performance of fall calving cows (Rakestraw et al., 1986). Pregnancy rates using the Co-synch protocol with a controlled internal drug releasing intravaginal insert containing progesterone (CIDR; Pfizer Inc., NY, NY) for ovulation synchronization were 65% in heifers (Martinez et al., 2002), and 58% in cows (Lamb et al., 2001). Reduced pregnancy rates may occur with the Co-synch protocol without a CIDR (Geary et al., 2001; Lamb et al., 2001). Pregnancy rates of heifers that were detected in estrus prior to AI was significantly greater than for heifers bred by timed AI (Martinez et al., 2002). Metabolic signals regulate hypothalamo-hypophyseal function to control release of LH from abundant pituitary stores, which stimulate an increase in dominant follicle size, enhance estrogen secretion, and cause increased responsiveness of the pituitary to GnRH and an ovulatory surge of LH. The objective of this study was to evaluate the effects of time of fall calving and subsequent BCS on pregnancy rate after ovulation synchronization and timed AI, total pregnancy rate, postpartum interval, and estrous behavior.

Materials and Methods

Angus x Hereford cows (yr 1, n=51, yr 2, n=55, yr 3, n=59) were randomly assigned to either an early calving or late calving group and remained on the same treatment for 3 yr. Each calving group grazed one of four separate native range pastures and the groups were rotated between pastures every 2 wk. Cows received approximately 30 lbs of native grass hay per day if pastures were covered with snow or ice. Body weight and BCS were determined monthly. Cows were culled from the herd for health and reproductive problems. Each year, approximately 20% of the cows were replaced in the herd with 3 to 5 yr old pregnant cows.

The ovulation synchronization protocol consisted of Co-synch (Geary et al. 1998) in year 2 and Co-synch with a controlled internal drug releasing intravaginal insert containing progesterone (CIDR; Pfizer Inc., NY, NY) in years 1 and 3. The initiation of the ovulation synchronization protocol was on October 30, October 29, and November 4 for the early cows in yr 1, 2, and 3 respectively, and on December 29, December 31, and December 30 for the late cows in yr 1, 2, and 3 respectively. Cows were treated with gonadotropin releasing hormone (GnRH; 100 µg equivalent of gonadorelin diacetate tetrahydrate/cow im; Cystorelin Duluth, GA yr in 1 and 2, Fertagyl Intervet, Millsboro, DE in yr 3) on d 0 and a CIDR was inserted in yr 1 and 3, on d 7 the CIDR were removed and cows were treated with prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$; 25mg Lutalyse), and on d 9 cows were treated with GnRH and artificially inseminated (AI). Cows were exposed to two fertile bulls from 8 d (yr 1) or 12 d (yr 2 and 3) to 48 d after AI. Both early and late calving groups were exposed to the same two fertile bulls.

When $PGF_{2\alpha}$ was given and the CIDR was removed the tail heads of cows were marked. This was used to determine if cows were mounted and the mark was rubbed. Cows were classified as in estrus if they were observed standing to be mounted or if the livestock marker had been rubbed during 3 d after PGF2α treatment.

Concentrations of progesterone in plasma were quantified by radioimmunioassay on d -7, 0, 7, 9, and 16 of treatment. Blood was collected, placed on ice, centrifuged at 2500 RPM for 20 min, and plasma was decanted. Concentrations of progesterone greater than 1 ng/ml on d (-7, 0, 9, or 16) were considered as luteal activity and ovarian function.

Calving date was used to determine if pregnancy was from AI or natural service. If a calf was born greater than d 291 after AI then the calf was classified to be from natural service. Concentration of progesterone in plasma was also used to determine sire of calf (AI or natural service). If progesterone was less than 2 ng/ml at d 16 (7 d after AI) or greater than 2 ng/ml on d 9 (d of insemination) of treatment then the calf was classified as from a natural service sire. To determine total pregnancy rate, pregnancy was diagnosed rectally 3 to 4 mo after the end of the natural breeding season.

Effects of treatment, year, and the interaction were analyzed in a completely randomized design using PROC GLM (SAS Institute Inc., Gary, NC). When there was a significant effect, means were compared using Least Significant difference. Ovarian luteal activity, estrous behavior, total pregnancy rate, and pregnancy rate to AI were analyzed using PROC GLM (SAS Institute Inc., Gary, NC).

Results and Discussion

Luteal activity and pregnancy rates to timed AI were not influenced by time of AI or year (Table 1). There were significant differences (P<.05) in postpartum intervals between early and late breeding in yr 1 and 3 (Table 1). In yr 1, the postpartum interval to synchronization for the early cows was shorter (P<.05) than for the late cows. This was due to the allocation of the cows to early and late fall calving herds. The shorter postpartum interval for cows in the late than early breeding season in yr 3 was due to less AI pregnancies and more natural service calves. This shortened postpartum interval combined with environmental differences, such as lower ambient temperatures, resulted in decreased estrous behavior in the late breeding season vs the early breeding season in yr 2 and 3. Less late cows in estrus after synchronization in yr 2 and 3 vs yr 1 may be associated with a reduced interval from calving to synchronization in the latter 2 yr.

Table 1. Reproductive performance data of early and late fall calving beef cows

Year/Season	PP interval, days	Cyclic with ovarian luteal activity, %	Estrus during 3 days after PGF2α, %	Pregnancy Rate, %	Pregnancy Rate to Timed AI, %
Year 1 Early N=24	59.2^{a}	91	59^{a}	89	38
Year 1 Late N=27	112.7^{d}	100	42^{a}	89	52
Year 2 Early N=29	75.6^{c}	100	40^{a}	92	40
Year 2 Late N=26	77.2^{c}	100	15^{a}	85	54
Year 3 Early N=33	79.1%^{c}	97	39^{a}	90	47
Year 3 Late N=26	67.7^{b}	100	12^{b}	96	48

Means in columns without a common subscript differ (P<.05)

After 3 yr of early and late breeding, pregnancy rates of two herds were not significantly different. A shorter interval after calving to synchronization of late cows in yr 3, and fewer cows pregnant after AI, indicates a possible cumulative effect on reproductive performance. The effect of calving time on future reproductive performance will be evaluated.

Implications

Fewer cows in estrus after ovulation synchronization in late vs early cows could cause a decreased pregnancy rates. Environmental factors such as ambient temperature and nutrient availability may influence the response of time AI in fall calving cows and should be evaluated.

Literature Cited

Bagley C. P. et al. 1987. J Anim. Sci. 64: 687-694

Geary T. W. et al. 1998. J. Anim Sci. 76: 1523-1527

Geary T. W. et al. 2001. J. Anim. Sci. 79: 2536-2541

Lamb G. C. et al. 2001. J. Anim. Sci. 79: 2536-2541

Martinez M. F. et al. 2002. J. Anim. Sci. 80: 1746-1751

Rakestraw J. et al. 1986. Therio. 26: 461-473

Selk et al. 1988. J. Anim. Sci. 66: 3153-3159

Acknowledgments

The authors would like to thank Pfizer for the donation of the Lutalyse, and EZ Breed CIDR. Also thank you to InterVet for donation of Fertagyl.

Authors

Davis, M. P.-Graduate Student

Kastner, D. W.-Graduate Student

Rubio, I.-Graduate Student

Wettemann, R. P.-Regents Professor

Lalman, D. L.-Associate Professor