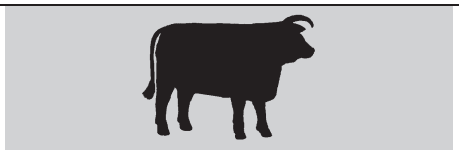
The Professional Animal Scientist 28 (2012):552–559



Effects of prostaglandin $F_{2\alpha}$ administration at CIDR insertion on artificial insemination pregnancy rates in beef heifers

B. L. Sparks,* S. L. Lake,† PAS, P. J. Gunn,* PAS, K. S. Fisher,* L. A. Horstman,‡ R. P. Lemenager,* PAS, J. Berry,† and G. A. Bridges§[1]

*Department of Animal Sciences, Purdue University, West Lafayette, IN 47907; †Department of Animal Science, University of Wyoming, Laramie, WY 82073; ‡Department of Veterinary Clinical Sciences, Purdue University, West Lafayette, IN 47907; and §North Central Research and Outreach Center, 1861 Highway 169 E, Grand Rapids, MN 55744

ABSTRACT

The objective of this experiment was to compare reproductive performance of beef heifers at 5 locations assigned to the 7-d Select Synch + a controlled intravaginal drug release insert (CIDR) and timed-AI (7dSS; n = 297), 5-d Select Synch + CIDR and timed-AI (5dSS; n = 368), or an experimental 7-d estrous synchronization protocol in which $PGF_{2\alpha}$ (PGF) was given at CIDR insertion (Mod; n = 374). On d −7, the 7dSS treatment received a CIDR and GnRH, whereas the Mod treatment received a CIDR and PGF. On d −5, the Mod treatment received GnRH and the 5dSS treatment received a CIDR and GnRH. On d 0, CIDR were removed and heifers received two 25-mg doses of PGF given 8 h apart. Estrus was detected twice daily for 60 h and heifers detected in estrus were AI by the AM/PM rule. At 72 h after CIDR removal, heifers not detected in estrus were timed-AI and received GnRH. Estrous response was greater (P < 0.05) in the 7dSS (67.1%) and Mod (69.3%) treatments than the 5dSS (56.1%) treatment. Conception rate of heifers in estrus was greater (P < 0.05) in the 5dSS (62.0%) and Mod (65.6%) treatments than the 7dSS (50.0%) treatment. Conception rate to timed-AI did not differ between treatments (mean = 45.8%). More (P < 0.05) heifers became pregnant to AI in the 5dSS (57.1%) and Mod (58.4%) treatments than the 7dSS (47.3%) treatment. In conclusion, the 5dSS and Mod protocols yielded greater AI pregnancy rates in beef heifers than the 7dSS protocol.

Key words: artificial insemination, cattle, estrous synchronization, heifer

INTRODUCTION

The goal of any estrous synchronization protocol is to induce a compact estrous response at a predetermined time with acceptable fertility following estrus or at the synchronized induced ovulation. Therefore, key targets for developing consistently effective estrous synchronization protocols for beef heifers are controlling follicular dynamics and the precise onset of estrus, maximizing preovulatory estradiol concentrations (Bridges et al., 2008), and ensuring the ovulation of a competent ovum following estrus or the GnRH-induced ovulation. In addition, protocols should control these factors regardless of endocrine status or stage of the follicle wave among females at the initiation of treatment. Increasing evidence suggests that reducing progesterone concentrations during the development of the follicular wave for a finite period of time may assist in accomplishing these aforementioned parameters and improve fertility in beef heifers (Dias et al., 2009; Peres et al., 2009; Claro et al., 2010; SáFilho and Vasconcelos, 2011). A potential approach to reduce progesterone concentrations during follicular development within a CIDR-based estrous synchronization protocol is to deliver a luteolytic dose of $PGF_{2\alpha}$ (**PGF**) at protocol initiation. Therefore, the objective of this study was to compare reproductive performance of replacement beef heifers assigned to either the 7-d Select Synch + CIDR and timed-AI

[1] Corresponding author: gbridges@umn.edu

(**7dSS**) protocol, 5-d Select Synch + CIDR and timed-AI (**5dSS**) protocol, or modified 7-d CIDR Select Synch and timed-AI (**Mod**) estrous synchronization protocol that involved PGF administration at CIDR insertion.

MATERIALS AND METHODS

All animals were handled in accordance with procedures approved by the Purdue University and University of Wyoming Animal Care and Use Committees.

Animals and Estrous Synchronization Protocols

This experiment was conducted utilizing 1,039 virgin replacement beef heifers located at 5 different locations: Animal Sciences Research and Education Center (**ASREC**; West Lafayette, IN; n = 128), Heaton Land and Livestock (**HLL**; Alton, Utah; n = 219), Turtle Creek Cattle Cooperative (**TC**; Harrodsburg, IN; n = 154), Silver Spur Ranch-Saratoga (**SS-S**; Saratoga, WY; n = 229), and Silver Spur Ranch-Wheatland (**SS-W**; Wheatland, WY; n = 307). At ASREC, HLL, and TC, heifers were randomly assigned to estrous synchronization treatment, with all heifers maintained in a similar lot/pasture during the synchronization protocol. At SS-S and SS-W, heifers were developed in commercial feedlots. Heifers were divided into 3 adjacent feedlot pens, and each pen of heifers was assigned to an estrous synchronization treatment. At SS-W, 68 heifers were removed from analysis because these females were the only purebred females at this location and only present in one treatment, whereas the remaining heifers were all crossbred heifers and randomly assigned to the 3 treatments. At each location, heifers were assigned to 1 of 3 estrous synchronization treatments (Figure 1): 1) 7dSS, 2) 5dSS, or 3) Mod protocol. The day and time of CIDR insert removal is defined as d 0 and h 0 of the experiment. On d −7, heifers in the 7dSS treatment received a CIDR (Pfizer Animal Health, New York, NY) insert and 100 μg of GnRH (i.m.; Fertagyl, Intervet Inc., Millsboro, DE), whereas heifers in the Mod treatment received a CIDR and 25 mg of PGF (i.m.; Lutalyse, Pfizer Animal Health). Prostaglandin $F_{2\alpha}$ was administered in the Mod treatment to induce luteolysis in the majority of the pubertal heifers, in an effort to reduce concentration of progesterone in the MOD treatment when compared with the 7dSS and 5dSS treatments. It is recognized that prepubertal heifers lacking a corpus luteum (**CL**) and pubertal heifers between d 0 and 5 of the estrous cycle would not respond to PGF administration (Henricks et al., 1974) in the Mod treatment. On d −5, heifers in the Mod treatment received 100 μg of GnRH to induce a new wave of follicular development. Administration of GnRH in the Mod treatment would induce ovulation and the development of a CL in a population of heifers. Whereas this CL would contribute to a circulating concentration of progesterone above that provided by the CIDR, given the 5-d duration between GnRH and PGF delivery, the progesterone contribution by this induced CL would be minimal. Heifers assigned to the 5dSS protocol received GnRH (100 μg) and a CIDR on d −5. On d 0, h 0, heifers in all 3 treatments were administered PGF (25 mg) and the CIDR inserts were removed. Approximately 8 h after CIDR removal, a second 25-mg dose of PGF was administered to all treatments.

All animals were visually detected for standing estrus twice daily for 60 h following CIDR insert removal. Heifers that were detected in estrus were AI according to the AM/PM rule. Heifers not detected in estrus within 60 h following CIDR insert removal received timed-AI concurrent with 100 μg of GnRH at 72 h following CIDR insert removal. On d 3, heifers that were observed in estrus at 60 h were inseminated first, followed by those heifers receiving timed-AI. Heifers at all locations were inseminated with semen that met the breeding objective of each individual herd and within a herd using multiple AI sires; sires were balanced between treatments. The AI technician varied between location, and within location, the AI technician was random across treatments. Between 7 and 10 d following timed-AI, clean-up bulls were placed with the heifers for the remainder of the breeding season lasting approximately 60 d. At HLL, SS-S, and SS-W, pregnancy determination was performed via transrectal ultrasonography (Sonosite MicroMaxx, Bothell, WA; equipped with a variable MHz rectal transducer) approximately 35 d following AI. At ASREC and TC, a veterinarian with 30+ years of experience in bovine theriogenology performed pregnancy diagnosis at approximately 42 d post-AI via rectal palpation. At ASREC and TC, if the initial AI pregnancy diagnosis via rectal palpation was negative or questionable, confirmation was conducted using ultrasonography. Similarly, breeding season pregnancy rates were determined approximately 35 d (ultrasonography) or 42 d (rectal palpation) following the end of the breeding season.

Data and Statistical Analysis

Estrous response was defined as the percentage of heifers exhibiting estrus by 60 h following PGF administration. The interval to estrus was defined as the average number of hours from CIDR insert removal to observed estrus. Conception rate was defined as the number of heifers exhibiting estrus within 60 h following CIDR insert removal that were inseminated and diagnosed as pregnant, divided by the number of heifers that were detected in estrus within 60 h after CIDR insert removal and inseminated. Timed-AI conception rate was defined as the number of heifers that received timed-AI and were diagnosed as pregnant, divided by the total number of heifers that were timed-AI. Overall AI pregnancy rate was defined as the percentage of treated heifers that became pregnant to AI. Breeding season pregnancy rate was defined as the number of heifers determined to be pregnant at the conclusion of the