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The effects of resynchronization of estrus using a progestin-based system

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ABSTRACT

Improved synchronization systems facilitate fixed-time AI (FTAI) in beef heifers. However, after FTAI 30 to 50% of heifers are not pregnant. The objectives were to (1) characterize return to estrus patterns after initial FTAI, (2) determine the effectiveness of an FTAI resynchronization protocol, and (3) evaluate the economic costs of resynchronization. Estrus was synchronized in crossbred heifers (n = 176) using the 5-d CO-Synch + CIDR with FTAI at 72 h (d 0). Estrus was detected with HeatWatch (d −8 to 37). Similar numbers of heifers identified as estrus or nonestrus at initial AI were randomly assigned to resynchronization (RS) or natural service (NSV) rebreeding treatments. The RS treatment was diagnosed for pregnancy on d 29, and nonpregnant heifers were resynchronized using 5-d CO-Synch + CIDR with FTAI at 72 h. Pregnant RS heifers received no further treatment. The NSV heifers were exposed to fertile bulls from d 14 to 66. Of heifers not pregnant to initial AI, 24.7 and 48.2% were in estrus from d 5 to 11 and d 14 to 25, respectively. Total AI pregnancies tended to be greater (P = 0.07) for RS (69.7%) than NSV (56.5%) groups. Overall pregnancy rate was greater (P < 0.01) for NSV (89.4%) than for RS (69.7%). Not accounting for genetic merit of AI calves, cost per pregnancy was $24 greater for RS than NSV because of more nonpregnant RS heifers. Distribution of return estrus is highly variable. Resynchronization protocols incorporating pregnancy detection may not be biologically or economically effective in commercial beef heifers.

Key words: beef, heifer, reproduction, resynchronization, economics

INTRODUCTION

Replacement beef heifer development is one of the costliest enterprises in the beef operation. Heifers that become pregnant early in the breeding season and calve with a minimum of assistance are more productive during their lifetimes (Lesmeister et al., 1973; Bellows et al., 2002). Estrus synchronization can increase the percentage of females calving early in the calving season (Dzuik and Bellows, 1983). In addition, heifers bred to high accuracy AI sires experience less dystocia and produce offspring of greater genetic merit (Bennett and Gregory, 2001).

Typically, beef heifers that are bred AI using fixed-time AI (FTAI) systems are artificially inseminated once followed by exposure to natural service sires. Although these systems are effective in producing overall pregnancy rates of 85 to 95% (Lamb et al., 2006), they do not maximize the percentage of heifers bred AI. Resynchronization of nonpregnant heifers followed by FTAI may increase the percentage of AI sired calves while minimizing labor and cattle handling.

Whereas resynchronization of estrus and ovulation is an active area of investigation in dairy cattle (Stevenson et al., 2003; Lucy, 2012), resynchronization of estrus and ovulation in beef heifers has received less attention (Colazo et al., 2006; Sá Filho et al., 2014). Furthermore, information on the distribution of estrus in nonpregnant heifers following FTAI is lacking but may be important information when developing resynchronization protocols.

Currently, AI is only used by 7.6% of United States beef operations, and 16.3% of beef heifers are bred by AI (USDA-APHIS, 2009). The most common reasons for not adopting

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reproductive technologies include time and labor, cost, and complication (USDA-APHIS, 2009). Therefore, it is important to evaluate the effect of estrus synchronization protocols on factors such as pregnancy rate, labor, time, and economics.

Therefore, an experiment was designed to determine the effectiveness of a FTAI resynchronization protocol after synchronization with a progestin-based protocol. Specific objectives were (1) to evaluate the return to estrus distribution in beef heifers after application of a FTAI system; (2) to compare the efficacy of a resynchronization protocol to AI based on synchronized return to estrus versus natural service cleanup; and (3) to evaluate the costs of resynchronization.

MATERIALS AND METHODS

Animals and Management

Crossbred, replacement heifers (n = 176) at Southampton Correctional Center (36°43′20.2″N, 77°15′19.6″W) with a minimum reproductive tract score (**RTS**) of 3 (1 = immature, 5 = cycling; Anderson et al., 1991; Patterson et al., 1999), a minimum BW of 295 kg, and a mean age of 408 d one month before synchronization were assigned to the study.

Heifers were kept in a dry lot and fed a corn silage based diet supplemented with soybean meal. In addition, heifers had ad libitum access to Bermuda grass hay, a trace mineral mix, and water. Heifers were fed to meet NRC requirements for growing heifers with a 0.75 kg/d gain.

Treatments and Reproductive Management

Heifers were synchronized using the 5-d CO Synch + CIDR protocol (Figure 1; Bridges et al., 2008). At d −8 all heifers received gonadotropin-releasing hormone (**GnRH**; 100 μg i.m. of Cystorelin, Merial, Athens, GA) and an intravaginal progesterone-releasing insert (EZ Breed **CIDR**; Zoetis, Florham Park, NJ) and were fitted with a HeatWatch Estrus Detection System (HeatWatch, Cow Chips LLC, Manalapan, NJ) transmitter. At d −3 CIDR were removed and 25 mg of dinoprost tromethamine was administered i.m. (**$PGF_{2\alpha}$**; Lutalyse, Zoetis). All heifers were administered GnRH 72 h following CIDR removal (d 0) and were inseminated. Heifers were inseminated to 1 of 2 Angus bulls by 1 of 2 trained technicians at initial AI using commercially prepared semen.

Heifers were then randomly assigned, based on detection of estrus before initial AI, to 1 of 2 return service treatments: resynchronization (**RS**) and natural service (**NSV**). Heifers were considered to be in estrus if they received a minimum of 3 mounts of 2-s duration in a 4-h period between $PGF_{2\alpha}$ and AI. Similar numbers of heifers that expressed or did not express estrus were assigned to RS or NSV treatments.

For RS heifers, ultrasonographic scanning for diagnosis of pregnancy was performed transrectally using an Aloka 500 console (Corometrics Medical Systems Inc., Wallingford, CT) and 5-MHz probe on d 29. Heifers diagnosed pregnant were returned to their lot with no further treatment. Open RS heifers were resynchronized using the 5-d CO Synch + CIDR synchronization protocol. On d 29, open heifers received GnRH (100 μg i.m.) and a new CIDR. At d 34, CIDR were removed and $PGF_{2\alpha}$ administered. All heifers were administered a dose of GnRH 72 h following CIDR removal (d 37) and were reinseminated to one Angus bull by a single trained technician (Figure 2).

Heifers in NSV (n = 85) were fitted with a HeatWatch transmitter from the time of initial CIDR insertion (d −8) until d 37 for continuous estrus detection. From d 14 to 66, cleanup bulls were turned in with NSV heifers. All heifers were continually monitored for estrus using HeatWatch from CIDR insertion until d 37.

Twice daily monitoring of the HeatWatch system allowed for the return to estrus distribution data to be collected from d −8 to 37. Estrus was defined as a minimum of 3 mounts with a minimum duration of 2 s within a 4-h period.

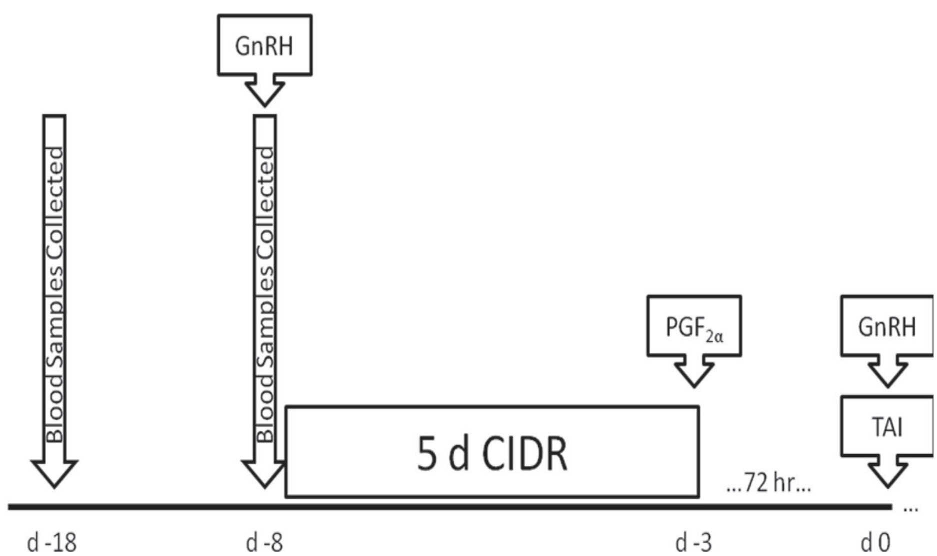

Figure 1. Initial synchronization treatment CO-Synch + CIDR (5 d). At d −8 all heifers received gonadotropin-releasing hormone (GnRH; 100 μg i.m. of Cystorelin, Merial, Athens, GA) and an intravaginal progesterone-releasing insert (CIDR, Zoetis, Florham Park, NJ). At d −3 CIDR were removed and 25 mg of dinoprost tromethamine was administered i.m. (Lutalyse, Pfizer Animal Health, New York, NY). All heifers were administered a dose of GnRH (100 μg i.m. Cystorelin) 72 h following CIDR removal (d 0) and were inseminated. $PGF_{2\alpha}$ = prostaglandin $F_{2\alpha}$; TAI = timed AI.