Animal Reproduction Science 168 (2016) 19–25

Contents lists available at ScienceDirect

Animal Reproduction Science

journal homepage: www.elsevier.com/locate/anireprosci

Impacts of incorporation of follicle stimulating hormone into an estrous synchronization protocol for timed artificial insemination of crossbred beef cattle

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ARTICLE INFO

Article history:
Received 8 July 2015
Received in revised form 12 January 2016
Accepted 24 February 2016
Available online 27 February 2016

Keywords:
Estrus synchronization
Follicle stimulating hormone
Pregnancy rates
Timed artificial insemination

ABSTRACT

One-hundred-eighty crossbred beef cows and 66 crossbred beef heifers across three locations were stratified by body weight (BW), body condition score (BCS), and age (within location) to evaluate administration of follicle stimulating hormone (FSH) on Day 2 using a modified 7-day CO-Synch plus CIDR® protocol (Day 0 = CIDR insertion) with timed-artificial insemination (TAI) at 72 h (cows) or 54 h (heifers) following CIDR removal. Estrous response following CIDR removal was determined using an Estrotect patch and TAI and final pregnancy rates were determined by transrectal ultrasonography 42–45 days following TAI and ≥45 days following removal of clean-up bulls. Estrous response rate, TAI and final pregnancy rates for cows were not affected ($P \geq 0.65$) by treatment. Cows that exhibited estrus had greater ($P < 0.01$) TAI pregnancy rate (66%) than cows not exhibiting estrus (38%). There was an estrous response by postpartum length interaction ($P = 0.02$) where cows exhibiting estrus and ≥55 days postpartum had greater TAI pregnancy rates (75%) compared to cows not exhibiting estrus and <55 days postpartum (39%) or ≥55 days postpartum (28%). For heifers, timed AI ($P = 0.46$) and final pregnancy rates ($P = 0.45$) were similar across treatments and estrous response had no effect ($P = 0.30$) on TAI pregnancy rates. In conclusion, the addition of FSH to the CO-Synch plus CIDR estrous synchronization protocol did not increase TAI pregnancy rates in beef cows or heifers. However, a positive estrous response to the synchronization protocol was associated with increased TAI pregnancy rates in cows.

1. Introduction

Cows subjected to estrous synchronization (ES) and become pregnant to artificial insemination (AI) calve earlier and wean calves that are heavier than their non-synchronized and non-inseminated counterparts (Schafer et al., 2001). Similarly, Rodgers et al. (2012) reported that cows exposed to ES and timed-AI (TAI) resulted in more females weaning a calf, a shift in the calving season, and produced heavier weaning weights compared with cows exposed to natural service. Regardless of these advantages, the application of these assisted reproductive technologies has not been fully embraced by the commercial cattlemen (NAHMS, 2009).

Currently, results from most TAI estrous synchronization protocols in cattle remain highly variable (Lamb et al.,

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http://dx.doi.org/10.1016/j.anireprosci.2016.02.021
0378-4320/© 2016 Published by Elsevier B.V.

2006; Larson et al., 2006; Johnson et al., 2010). Variability in the anestrous period of the beef cow (Crowe et al., 2014) and the apparent lack of control of follicular waves in cyclic cows (Bó et al., 1995, 2003; Fricke et al., 1998) contribute to this variability. Follicular waves occur in 2 or 3 distinct waves (Adams et al., 1992) with emergence on the day of ovulation and ending with a single dominant follicle ovulating from the 2nd or 3rd wave (Ginther et al., 1989a). In cattle, an endogenous increase in follicle stimulating hormone (FSH) precedes the emergence of each follicular wave (Adams et al., 1992; Sunderland et al., 1994). It has been shown that Folltropin shortened the time from treatment to emergence of the subsequent follicular wave in beef heifers (Bodensteiner et al., 1996) and hypothesized that administration of Folltropin appeared to be a viable means of follicular wave synchronization. Likewise, Gentry et al. (2013) previously reported that administration of FSH on Day 2 of the synchronization protocol resulted in an increase in pregnancy rates in crossbred beef heifers associated with TAI. In that study, heifers receiving 20 mg FSH two days following administration of estradiol benzoate and a controlled internal drug release (CIDR) device resulted in a 35% increase in pregnancy to TAI compared with controls. The success of any TAI protocol is contingent with the ability to “reset” follicular wave emergence in a group of females through initiation of follicular turnover and to control the regression of the corpus lutea (Bó et al., 1995, 2003; Fricke et al., 1998). Therefore, this experiment was conducted to test the hypothesis that incorporation of FSH into the CO-Synch plus CIDR estrous synchronization protocol would increase TAI pregnancy rates in beef cattle.

2. Materials and methods

The experimental procedures used in this study were approved by the Louisiana State University Agricultural Center Animal Care and Use Committee (Protocol number: A2012-03).

2.1. Animals

Multiparous crossbred beef cows (n = 180) from the Hill Farm (HF; n = 90, body weight (BW) = 587 ± 5.9 kg, body condition score (BCS) = 5.5 ± 0.05, days postpartum (DPP) = 56 ± 1.7), Idlewild (ID; n = 49, BW = 560 ± 11.9 kg, BCS = 4.7 ± 0.08), and Red River (RR; n = 41, BW = 627 ± 11.6 kg, BCS = 6.0 ± 0.12, DPP = 56.8 ± 3.0) research stations and nulliparous beef heifers (n = 66, BW = 338 ± 2.5 kg, BCS = 5.3 ± 0.05) from the HF Research Station were used in this study. All cows and heifers were stratified by BW, BCS (1–9, 1 = emaciated, 9 = obese, (Whitman, 1975)), and DPP (HF and RR) or BW, BCS and cyclicity status (ID and for heifers) based on circulating plasma progesterone concentrations. Cyclicity status of cows from ID and heifers were determined from two plasma samples collected 10 days apart prior to the synchronization protocol initiation and analyzed for progesterone via enzyme immunoassay (Cayman Chemical Company, Ann Arbor, MI). Females were considered to be cyclic if either of the plasma progesterone samples were ≥2 ng/ml.

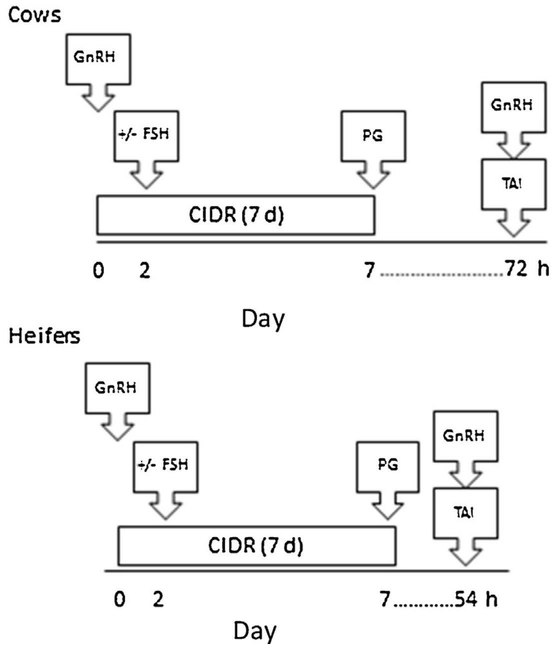

Fig. 1. Treatment schedule for females assigned to the 7-day CO-Synch + CIDR and 7-day CO-Synch + CIDR + FSH protocols.

2.2. Synchronization of estrus

All females were estrous synchronized utilizing a modified 7-day CO-Synch plus EAZI BREED CIDR® (1.38 g of progesterone; Zoetis, Florham Park, NJ) protocol to evaluate TAI pregnancy rates in females administered follicle stimulating hormone (FSH; Folltropin V, Bioniche, Ontario, Canada) on Day 2 of the synchronization protocol. On Day 0, all cows and heifers were weighed and assigned a BCS and received a CIDR insert plus 100 μg (i.m.) gonadotropin releasing hormone (Factrel; Zoetis, Florham Park, NJ). On Day 7, the CIDR was removed, followed by 25 mg (i.m.) of PGF2α (Lutalyse; Zoetis, Florham Park, NJ) and fitted with an estrous detection patch (Estrotect Inc, Spring Valley, WI). On Day 2, all females in the FSH treatment group received 20 mg FSH (i.m.) and the remaining females served as non-treated controls. Timed-AI was performed at 54 h (heifers) and 72 h (cows) following CIDR removal when all females were administered 100 μg (i.m.) GnRH and the estrous detection patch was evaluated (Fig. 1). For estrous detection patch evaluation, females with a patch ≥50% scratched were considered to have responded by exhibiting a standing estrus to the synchronization protocol, whereas females with <50% of the patch scratched were considered not to have responded. Bulls were placed with cows 14 days post TAI for natural service for the remainder of the 60 day breeding season. Pregnancy rates were determined via transrectal ultrasonography 42–45 days following TAI and at least 45 days following removal of the clean-up bulls.