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Role of progesterone concentrations during early follicular development in beef cattle: II. Ovulatory follicle growth and pregnancy rates

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ABSTRACT

Two experiments were conducted to investigate the role of relatively lesser and greater progesterone (P4) concentrations during early follicular development on ovulatory follicle growth and pregnancy rate in beef cattle. In Experiment 1, time of ovulation was synchronized with the 5 d CO-Synch + CIDR (Controlled Internal Drug Release) program in multiparous cows ($n = 241$). Six days after the 2nd GnRH injection of the pre-synchronization program (d 0), ablation of follicles ≥ 5 mm in the ovaries was performed and cows were assigned to receive either a previously used CIDR and 2x-25 mg PGF2α doses 8 h apart (LoP4), or a new CIDR (HiP4). On d 5, CIDR were removed from all cows, 2x-25 mg PGF2α were administered, and estrous detection tail paint was applied. Timed artificial insemination (TAI) was performed on d 8. On d 5, P4 concentrations were greater ($P < 0.01$) in the HiP4 (4.9 ± 0.13 ng/mL) than LoP4 (1.0 ± 0.06 ng/mL) treatment group. Conversely, d 5 estradiol (E2) concentrations and follicular diameter were greater ($P < 0.01$) in the LoP4 (5.0 ± 0.23 pg/mL and 8.9 ± 0.20 mm) than HiP4 (1.5 ± 0.12 pg/mL and 7.4 ± 0.15 mm) treatment group. Follicular diameter at TAI (12.0 ± 0.12 mm, Table 1) and TAI pregnancy rate did not differ ($P > 0.10$) between treatment groups. In Experiment 2, a new follicular wave was induced with estradiol benzoate on d -7, and cows ($n = 275$) were assigned on d 0 to receive 25 mg PGF2α and either have the CIDR replaced with a new CIDR (HiP4) or the used CIDR was left in place (LoP4).Furthermore, all cows received GnRH on d 0. The CIDRs were removed from all cows on d 5 and two doses of -25 mg PGF2α were administered. Estrous detection combined with AI 12 h later (Estrus-AI) was performed for 60 h after CIDR removal with TAI coupled with GnRH administration at 72 h if estrus was not detected. The concentrations of P4 on d 5 were greater ($P < 0.01$) in the HiP4 (2.8 ± 0.10 ng/ml) than LoP4 (1.7 ± 0.05 ng/mL) treatment group. For cows that were detected in estrus after PGF2α administration, estrous response (83.5%) and interval to estrus (55.0 ± 0.5 h) did not differ between treatment groups. Pregnancy rate (combined Estrus-AI and TAI) that resulted from breeding at the time of the synchronized time of estrus was similar between treatment groups

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(HiP4: 77.1%; LoP4: 82.3%). In conclusion, differences in P4 concentrations during early follicular development do not effect pregnancy rate in beef cows when the cows are inseminated at the time of a synchronized estrus if the cows have similar intervals of proestrus.

1. Introduction

Reproductive efficiency is a major limiting factor in cattle production, and estrous synchronization programs have been used as a beneficial technique to enhance estrous detection and fertility. Luteinizing hormone (LH) pulse frequency is regulated by progesterone (P4) concentrations throughout the estrous cycle (Rahe et al., 1980; Schallenberger and Prokopp, 1985), and increasing evidence suggests that greater LH stimulation during follicular development positively effects fertility in beef cattle. Bridges et al. (2010) reported that prolonging the follicular phase when there is a relatively lesser compared with greater P4 concentration, which would increase LH stimulation, resulted in greater preovulatory estradiol (E2) concentration and increased pregnancy rate to AI. Similarly, early luteolysis in progesterone-based estrous synchronization protocols increased ovulatory follicle diameter and fertility (Carvalho et al., 2008; Dias et al., 2009; Meneghetti et al., 2009).

In *Bos indicus* influenced cattle, relatively lesser P4 concentrations during follicular growth was induced with the use of a previously used Controlled Internal Drug Release (CIDR; Dias et al., 2009; Claro et al., 2010). Heifers that received the previously used CIDR during the early follicular growth have ovulations from a larger diameter follicle and had a greater pregnancy rate to AI (Dias et al., 2009; Claro et al., 2010). In contrast, cows with three waves of ovarian follicular development during an estrous cycle have lesser P4 concentrations during late follicular growth. Some evidence suggests that cows with three waves of follicular development may be more fertile; potentially, increased LH stimulation may be one of the mechanisms involved with fertility enhancement (Bleach et al., 2004; Townson et al., 2002). The objective of the present study, therefore, was to investigate the effect of relatively lesser P4 concentrations during early follicular development on pregnancy rates. It was hypothesized that relatively lesser circulating concentrations of P4 during early follicular development would enhance pregnancy rates to AI in beef cattle.

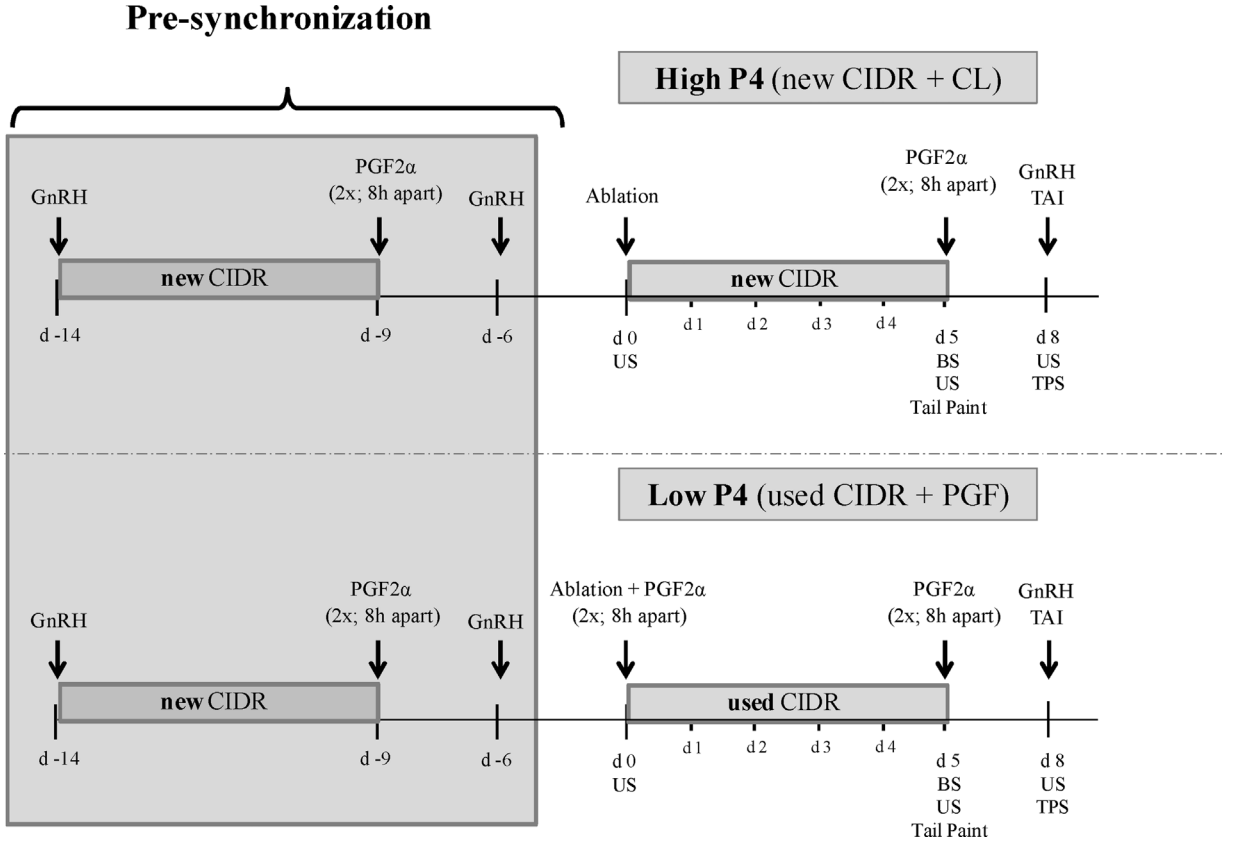

Fig. 1. Diagram of treatments performed in Experiment 1.
Treatments = High Progesterone (HiP4) and Low Progesterone (LoP4); BS = Blood Sample US = Ultrasonography. CIDR (controlled internal drug release; new = never used; used = previously used for 5 d); PGF2α = Prostaglandin F2α; TAI = Timed-AI; TPS = Tail Paint Score.