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Altered progesterone concentrations by hormonal manipulations before a fixed-time artificial insemination CO-Synch + CIDR program in suckled beef cows

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ABSTRACT

We hypothesized that pregnancy outcomes may be improved by inducing luteal regression, ovulation, or both (i.e., altering progesterone status) before initiating a timed–artificial insemination (TAI) program in suckled beef cows. This hypothesis was tested in two experiments in which cows were treated with either $PGF_{2\alpha}$ (PG) or PG + GnRH before initiating a TAI program to increase the proportion of cows starting the program in a theoretical marginal (<1 ng/mL; experiment 1) or elevated (≥1 ng/mL; experiment 2) progesterone environment, respectively. The control was a standard CO-Synch + controlled internal drug release (CIDR) program employed in suckled beef cows (100 μg GnRH intramuscularly [IM] [GnRH-1] and insertion of a progesterone-impregnated intravaginal CIDR insert on study Day −10, 25 mg PG and CIDR insert removal on study Day −3, and 100 μg GnRH IM [GnRH-2] and TAI on study Day 0). In both experiments, blood was collected before each injection for later progesterone analyses. In experiment 1, cows at nine locations (n = 1537) were assigned to either: (1) control or (2) PrePG (same as control with a PG injection on study Day −13). The PrePG cows had larger ($P < 0.05$) follicles on study Day −10 and more ($P < 0.05$) ovulated after GnRH-1 compared with control cows (60.6% vs. 36.5%), but pregnancy per TAI was not altered (55.5% vs. 52.2%, respectively). In experiment 2, cows (n = 803) at four locations were assigned to: (1) control or (2) PrePGG (same as control with PG injection on study Day −20 and GnRH injection on study Day −17). Although pregnancy per TAI did not differ between control and PrePGG cows (44.0% vs. 44.4%, respectively), cows with body condition score greater than 5.0 or 77 or more days postpartum at TAI were more ($P < 0.05$) likely to become pregnant than thinner cows or those with fewer days postpartum. Presynchronized cows in both experiments were more ($P < 0.05$) likely than controls to have luteolysis after initial PG injections and reduced ($P < 0.05$) serum progesterone; moreover, treatments altered the proportion of cows and pregnancy per TAI of cows in various progesterone categories before the onset of the TAI protocol. In combined data from both experiments, cows classified as anestrous before the study but with elevated progesterone on Day −10 had increased ($P < 0.05$) pregnancy outcomes compared with anestrous cows with low progesterone concentrations. Progesterone concentration had no effect on pregnancy outcome of cycling cows. In summary, luteal regression and ovulation were enhanced and progesterone concentrations were altered

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by presynchronization treatments before the 7-day CO-Synch + CIDR program, but pregnancy per TAI was not improved.

1. Introduction

Widespread acceptance of AI in beef cattle partly depends on the success of programs that facilitate insemination at a predetermined time. Several ovulation synchronization protocols that use exogenous GnRH at the time of insertion of a progesterone-impregnated intravaginal controlled internal drug release (CIDR) insert have been developed [1,2]. Beef herds that have greater than 50% anestrous cows at the start of the breeding season may benefit from protocols that promote ovulation in response to GnRH before initiating a timed–artificial insemination (TAI) program. Dominant follicles are present in noncycling cows [3], and exogenous GnRH induced ovulation of a dominant follicle [4,5].

Efficacy of GnRH-induced LH secretion resulting in ovulation of ovarian follicles depended on maturity of the follicle exposed to GnRH [6]. Follicles induced to ovulate before reaching 11 mm in diameter were less likely to result in pregnancy than ovulation of larger follicles in beef cows [7]. Replacement beef heifers were more likely to become pregnant when follicles induced to ovulate with GnRH ranged from 10.7 to 15.7 mm in diameter [8]. In dairy cows, follicles greater than 10 mm in diameter ovulated in response to GnRH [9]; however, only 66% of beef cows ovulated after a single injection of GnRH because of variation in follicle size [10].

Using $PGF_{2\alpha}$ (PG) to synchronize a follicular wave before the start of a 6-day CO-Synch TAI protocol improved pregnancy outcomes in beef cows compared with a 5-day CO-Synch (GnRH injection 5 days before and 66–70 hours after PG, with GnRH-2 injection given at TAI) + CIDR insertion concurrent with the GnRH-1 injection [11]. Likewise, a larger proportion of heifers exhibited a new follicular wave at the start of a TAI protocol when they were injected with PG 3 days before the initiation of the protocol [12]. Lactating dairy cows had better pregnancy outcomes during the summer when they were treated with PG and GnRH (3 days after PG and 7 days before the start of the Ovsynch protocol) than cows whose estrous cycles were presynchronized with two PG injections 14 days apart, with the second PG injection administered 10 days before Ovsynch [13].

We hypothesized that treatment with PG or PG followed by GnRH before the start of the 7-day CO-Synch + CIDR protocol would improve pregnancy outcomes by altering concentrations of progesterone at the onset of the TAI protocol. Our objectives were to determine if presynchronization treatments would increase the proportion of cows beginning a 7-day CO-Synch + CIDR protocol either at a low (experiment 1) or high (experiment 2) progesterone environment and consequently improve pregnancy outcomes compared with the 7-day CO-Synch + CIDR control.

2. Materials and methods

2.1. Experiment 1: Experimental design

A total of 1537 primiparous and multiparous cows at nine locations in four states (Florida, Georgia, Kansas, and South Dakota, USA) were enrolled. Characteristics of suckled beef cows enrolled by location are summarized in Table 1. Cows were stratified by breed, days postpartum, and parity and assigned randomly to two treatments (Fig. 1). Control cows received the standard CO-Synch + CIDR program (100 μg GnRH [2 mL Factrel; Pfizer Animal Health, Whitehouse Station, NJ, USA] 7 days before and 72 hours after 25 mg PG [5 mL Lutalyse; Pfizer Animal

Table 1
Selected characteristics of suckled beef cows enrolled in experiments 1 and 2[a].

Location[a]	Breed	No. of cows	2-y- old cows, %	Mean days postpartum at AI	Mean BCS[b]	Mean cyclicity, %
Experiment 1						
FL-1	Angus, Charolais, Brangus	228	10.5	69	5.0	30.3[c]
FL-2	Angus, Brangus	146	8.2	54	5.3	20.5[c]
GA-1	Angus	126	21.4	75	5.0	65.1[d]
KS-H	Angus × Hereford	195	25.1	80	5.7	53.3[d]
KS-C	Angus × Hereford	205	27.8	71	6.0	50.2[d]
KS-P	Angus, Hereford, Simmental	167	27.0	69	5.2	69.5[d]
SD-A	Angus × Hereford	222	37.8	74	4.4	22.7[d]
SD-C	Angus × Hereford	104	31.1	75	4.9	36.5[d]
SD-CT	Angus × Hereford	144	0.7	67	4.3	16.4[d]
Experiment 2						
FL	Angus, Brangus	169	16.6	69	5.6	56.2[e]
KS-H	Angus × Hereford	195	37.4	80	5.5	32.3[e]
KS-C	Angus × Hereford	261	16.9	71	5.5	50.6[e]
KS-P	Angus, Hereford, Simmental	184	24.5	69	4.9	62.0[e]

Abbreviations: AI, artificial insemination; BCS, body condition score.
[a] In experiment 1, cows located at nine locations in four states were enrolled, and in experiment 2, cows at four locations in two states were enrolled.
[b] Body condition score.
[c] Cyclicity determined from estrus-detection patches.
[d] Cyclicity determined by serum progesterone concentrations and estrus-detection patches.
[e] Cyclicity determined by serum progesterone concentrations only.