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Abstract

Fixed-time artificial insemination is an effective management tool that reduces the labor associated with more conventional artificial insemination programs requiring detection of estrus. The 7-day CO-Synch + controlled internal drug release (CIDR) insert protocol has been shown to effectively initiate estrus and ovulation in cycling and non-cycling suckled beef cows, producing pregnancy rates at or greater than 50% in beef cows. The gonadotropin-releasing hormone (GnRH) injection that begins the CO-Synch + CIDR program initiates ovulation in a large proportion of cows, particularly anestrous cows. The CIDR, which releases progesterone intravaginally, prevents short estrous cycles that usually follow the first postpartum ovulation in beef cows. Our hypothesis was that inducing estrus with a prostaglandin injection followed 3 days later with a GnRH injection, 7 days before applying the 7-day CO-Synch + CIDR protocol, might increase the percentage of cycling cows that would exhibit synchronous follicular waves after the onset of the CO-Synch + CIDR protocol. We also hypothesized that the additional GnRH injection would increase the percentage of anestrous cows that would ovulate, thereby increasing pregnancy outcomes.

Keywords

Kansas Agricultural Experiment Station contribution; no. 13-162-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 1083; Cattle; CIDR; GnRH; Timed artificial insemination; PGF2α; 7-day CO-Synch

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Presynchronizing $PGF_{2\alpha}$ and GnRH Injections Before Timed Artificial Insemination CO-Synch + CIDR Program

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Introduction

Fixed-time artificial insemination is an effective management tool that reduces the labor associated with more conventional artificial insemination programs requiring detection of estrus. The 7-day CO-Synch + controlled internal drug release (CIDR) insert protocol has been shown to effectively initiate estrus and ovulation in cycling and non-cycling suckled beef cows, producing pregnancy rates at or greater than 50% in beef cows. The gonadotropin-releasing hormone (GnRH) injection that begins the CO-Synch + CIDR program initiates ovulation in a large proportion of cows, particularly anestrous cows. The CIDR, which releases progesterone intravaginally, prevents short estrous cycles that usually follow the first postpartum ovulation in beef cows. Our hypothesis was that inducing estrus with a prostaglandin injection followed 3 days later with a GnRH injection, 7 days before applying the 7-day CO-Synch + CIDR protocol, might increase the percentage of cycling cows that would exhibit synchronous follicular waves after the onset of the CO-Synch + CIDR protocol. We also hypothesized that the additional GnRH injection would increase the percentage of anestrous cows that would ovulate, thereby increasing pregnancy outcomes.

Experimental Procedures

A total of 809 primiparous and multiparous cows in 11 pastures at 4 operations in Florida and Kansas were enrolled in this study. Characteristics of suckled beef cows enrolled by location are summarized in Table 1. Cows were stratified by breed, days postpartum, and parity, and then assigned randomly to 1 of 2 treatments. Control cows received the standard CO-Synch + CIDR program (100 μg GnRH; 2 mL Factrel, Pfizer Animal Health, Whitehouse Station, NJ) 7 days before and 72 hours after receiving 25 mg prostaglandin F_{2a} (PG; 5 mL Lutalyse; Pfizer Animal Health). A new CIDR insert (Pfizer Animal Health) containing 1.38 g progesterone was placed intravaginally at the time of the first GnRH injection (day −10). Treated cows (Figure 1; PG-3-G) received 25 mg PG 10 days before (day −20) followed by 2 mL Factrel 7 days before the CO-Synch + CIDR program began.

Body condition scores (1 = thin; 9 = very fat) were assigned at the time PG was administered to all cows on day −20. Estrus-detection patches (Estrotect, Rockway, Inc., Spring Valley, WI) were affixed to all cows. Estrus-detection patches were removed on day −17 if completely colored; otherwise, they were removed on day −10 and scored (0 = not colored, 1 = partially colored, and 2 = completely colored). On day −3, CIDR inserts were removed, a second estrus-detection patch was applied, and PG was administered to all cows in both treatments.

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Blood samples were collected via caudal vessel puncture at days −20, −17, −10, −3, and 0. Samples were assayed for progesterone by using radioimmunoassay. Cows with blood progesterone >0.95 ng/mL on days −20, −17, or −10 or with a completely colored estrus-detection patch by day -10 were assumed to have reestablished estrous cycles and were classified as cycling. The sample collected at day −3 reflected progesterone concentrations resulting from the CIDR insert, a functional corpus luteum, or both.

Artificial insemination was performed 68 to 70 hours after CIDR insert removal on day 0, and estrus-detection patches were removed and scored. Cows were either exposed to cleanup bulls 10 to 12 days later or reinseminated at subsequent estrus. At 35 days after artificial insemination, pregnancy was confirmed by transrectal ultrasonography (Aloka 500V, 5MHz transrectal transducer, Wallingford, CT). A positive pregnancy outcome required the presence of a corpus luteum and uterine fluid or uterine fluid and an embryo with a heartbeat. A final pregnancy diagnosis was determined 35 days after the end of the breeding season via transrectal ultrasonography. Embryonic losses in cows that conceived to the timed artificial insemination were determined at that time.

Results and Discussion

Cyclicity in the cows averaged 49.9% across the 4 locations at the beginning of the protocol (Table 1). The percentage of primiparous cows varied by location (62.8 to 83.4%). Average body condition score ranged from 4.9 to 5.6. Unusually hot and dry conditions affected all locations, and a total of 11 cows either died or were sold before the final pregnancy diagnosis. Considerable variation in pregnancy outcomes was observed among locations; however, pregnancy rates did not differ between treatments (Figure 1). Cyclicity and the cyclicity-treatment combinations also did not affect pregnancy outcomes (Table 2). In contrast, cows that had calved more than 77 days before timed artificial insemination had better ($P = 0.002$) pregnancy outcomes than those that calved less than 77 days before artificial insemination. Cows with greater body condition scores (≥5.5) than thinner cows also had greater pregnancy rates.

Implications

Results indicate that the PG-3-G treatment and control were equally effective fixed-time artificial insemination protocols, even in herds with a large percentage of anestrous cows. Both of these protocols were more effective for cows that were at least 77 days since calving and had a minimum body condition score of 5.5.

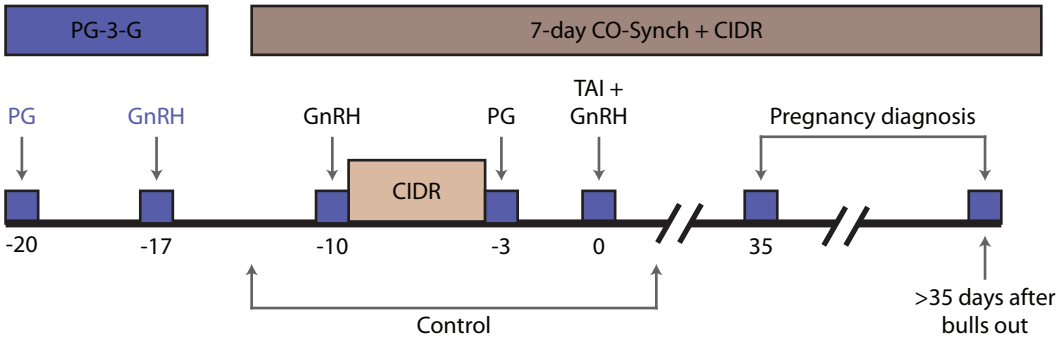
Table 1. Location characteristics of suckled beef cows enrolled in the study

Location	Breed	Number of cows	2-year-olds, %	Days postpartum at artificial insemination[1]	Body condition score[1]	Cyclicity, %[2]
Florida	Angus, Charolais, Brangus	169	16.6	69 ± 0.7	5.6 ± .04	56.2
Kansas						
K-State Agricultural Research Center–Hays	Angus × Hereford	195	37.4	80 ± 1.0	5.5 ± .04	32.3
K-State Commercial Cow-Calf Unit	Angus × Hereford	261	16.9	71 ± 0.7	5.5 ± .04	50.6
K-State Purebred Beef Unit	Angus, Hereford, Simmental	184	24.5	69 ± 1.2	4.9 ± .05	62.0

[1] Mean ± Standard Error.
[2] Percentage cyclicity at the onset of the CO-Synch + CIDR (controlled internal drug release) program.

Table 2. Pregnancy rates in suckled beef cows after presynchronization with PG-3-G before CO-Synch-CIDR (controlled internal drug release)

Item	%	n	*P*-value
Treatment			0.336
PG-3-G	49.0	399	
Control	45.1	399	
Cycling status			0.415
No	45.4	405	
Yes	48.6	393	
Treatment × cycling status			0.721
PG-3-G (not cycling)	48.0	192	
PG-3-G (cycling)	49.9	207	
Control (not cycling)	42.9	213	
Control (cycling)	47.4	186	
Days postpartum at artificial insemination			0.002
<77	39.6	386	
≥77	54.6	412	
Body condition score			0.065
<5.5	43.3	415	
≥5.5	50.9	383	



GnRH = gonadotropin-releasing hormone (Factrel; Pfizer Animal Health, Whitehouse Station, NJ); PG = prostaglandin $F_{2\alpha}$ (Lutalyse; Pfizer Animal Health); CIDR = controlled internal drug release containing progesterone; TAI = timed artificial insemination.

Figure 1. Experimental protocol illustrates the sequence of treatments and measurements. The PG-3-G treatment included the control standard 7-day CO-Synch + CIDR timed artificial insemination program.

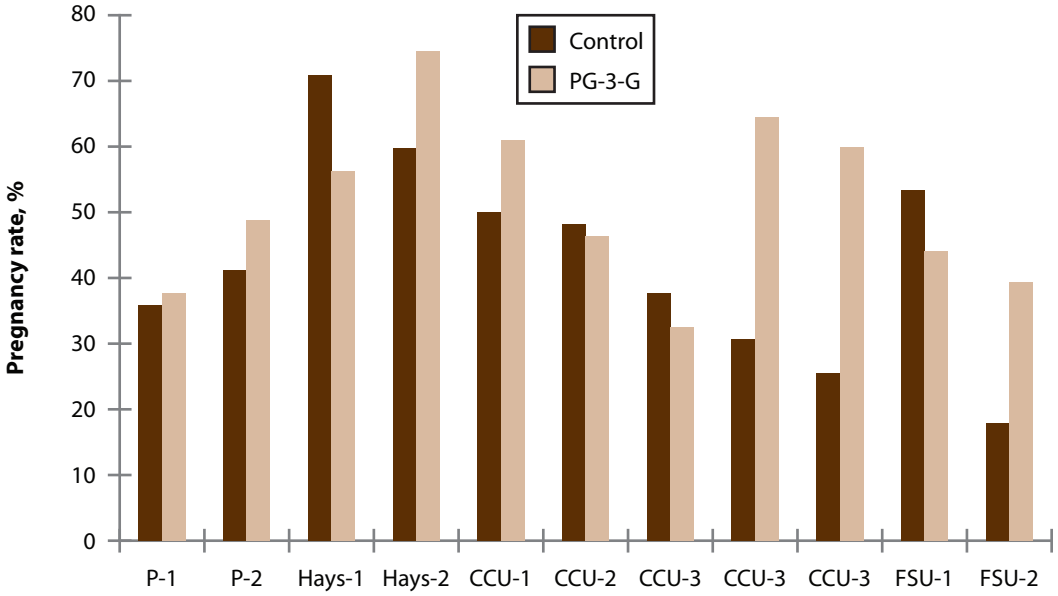


Figure 2. Timed artificial insemination pregnancy rates achieved at each pasture location. There were 2 pastures in Florida (FSU), 2 pastures at the Kansas State University Agricultural Research Center–Hays (Hays), 5 pastures at the K-State Commercial Cow-Calf Unit (CCU), and 2 pastures at the K-State Purebred Beef Unit (P).