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EVALUATION OF TIME TO AI WITH A MODIFIED CO-SYNCH PROTOCOL AND CALF REMOVAL IN POSTPARTUM BEEF COWS

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ABSTRACT: The objectives of this study were to evaluate optimal timing for timed AI using a modified Co-Synch protocol with or without a second injection of GnRH and calf removal. Suckling, multiparous Composite and Hereford beef cows (n=202, postpartum interval (PPI) =67 d, body condition score (BCS) =5) were synchronized for AI in two different calving seasons. Early calving cows (ECC; n=79, PPI=67 d, BCS=5.2) and late calving cows (LCC; n=123, PPI=67, BCS=4.9) were randomly assigned to one of four treatments. All cows were injected with GnRH (100 μg; i.m.) on day 0, followed by an injection of $PGF_{2\alpha}$ (25 mg; i.m.) on day 7. Calves were removed at time of PG injection and returned to nurse at time of insemination. Half of the cows were time-inseminated (TAI) 48 h post PG injection, with (48-TAI-G) or without (48-TAI) a second injection of GnRH. The second half of the cows were inseminated 72 h post PG injection, with (72-TAI-G) or without (72-TAI) a second injection of GnRH. Pregnancy rates to TAI were higher for cows inseminated at 72 h compared to cows inseminated at 48 h post PG injection ($P < 0.05$) for both ECC and LCC. Pregnancy rates at 48 and 72 h improved when GnRH was incorporated at the time of insemination ($P < 0.05$) for both ECC and LCC. However, pregnancy rate was no longer significant when sire was used as a random variable in the statistical model ($P > 0.05$). Pregnancy rates for Sire A (31.3 %) and Sire B (49.4 %) across all treatments accounted for the variability in pregnancy rates between treatments. We concluded that semen from the two sires used, affected pregnancy rates over all treatments, but delaying TAI to 72 h with a second injection of GnRH may improve pregnancy rates for mass mating programs.

Key Words: Estrous Synchronization, GnRH, AI, Calf Removal

Introduction

Estrous synchronization has become a powerful tool for timing the breeding season to fit a producers program and potential markets. Synchronization can become labor intensive if visual estrous detection is required and may allow for missed heats due to poor observation (Hixon et al., 2001). Evidence has shown that an alternative method, fixed time-insemination, can produce results comparable to those attained with other conventional estrous synchronization protocols that require detection of estrus (Perry et al., 2002; Hixon et al., 2001). Current synchronization protocols have incorporated GnRH to tighten estrous synchrony and mandate ovulation control. Incorporation of GnRH induces an LH surge leading to synchronized ovulation of large dominant follicles. Ovulation of a persistent dominant follicle often results in reduced fertility, however, induction and ovulation of a new growing dominant follicle with GnRH resulted in increased fertility (Schmitt et al., 1996).

Fixed-time insemination holds a promising future, however coordinating follicular growth and luteal regression is crucial in mediating control of the estrous cycle by controlling a precise ovulation. A modified version of the Select Synch protocol, Co-Synch (Geary and Whittier, 1998), incorporates a second injection of GnRH to induce ovulation and TAI 48 h post PG injection. Results from a recent study indicated that incorporation of TAI at 72 h post PG injection may be feasible if the 72 h estrous response is high at the time of AI, but GnRH injection with TAI at 72 h may be unnecessary (Geary et al., 2001a). However, when GnRH was added to the MGA-PG protocol, synchrony of estrus and ovulation was improved (Wood et al., 2001). Perry et al., (2002) reported improved pregnancy rates resulting from fixed-time AI with two separate injections of GnRH in the MGA-PG protocol. Though MGA was not used in this study, reports show that GnRH has an improved affect on fertility when incorporated into synchronization protocols.

In other countries, calf removal has become vital in synchronization programs for many years. As synchronization programs are being developed in herds in the US, incorporation of calf removal has generally improved conception rates in suckling beef cows to TAI. Geary et al., (2001b) suggest that 48 h calf removal with the Co-Synch protocol induces fertile ovulation in cyclic and non-cyclic cows and enhances fertility. Therefore, the objectives of this study were to determine if delaying time-insemination in a modified Co-Synch protocol to 72 h post PG injection with or without the second injection of GnRH would improve pregnancy by targeting the window of estrous synchrony.

Materials and Methods

Suckling, multiparous Composite and Hereford beef cows (n=202, postpartum interval (PPI) =67 d ± 60, body condition score (BCS) =5 ± 2) were synchronized for

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AI using a modified Co-Synch protocol while incorporating calf removal. Cows were sorted into two different calving seasons, two months apart, for other experimental reasons. Cows in both calving seasons were treated and analyzed the same. Early calving cows (ECC) (n=79, PPI=67 d ± 36, BCS=5.2 ± 1.2) and late calving cows (LCC) (n=123, PPI=67 d ± 61, BCS=4.9 ± 2.1) were injected with GnRH (100 µg; i.m.) on day 0 and PG (25 mg; i.m.) on day 7. Cows were randomly assigned to one of four treatments: 1) 48 h TAI post PG injection without GnRH (48-TAI; n=52); 2) 48 h TAI post PG injection with GnRH (48-TAI-G; n=51); 3) 72 h TAI post PG injection without GnRH (72-TAI; n=48); 4) 72 h TAI post PG injection with GnRH (72-TAI-G; n=51). Cows were artificially inseminated by three experienced AI technicians. Calves were removed at PG injection and returned to their dams the day of AI. Cleanup bulls were turned out on pasture 14 d post 72 h AI and left in with all the cows for 60 d. All cows were diagnosed for pregnancy to AI via transrectal ultrasonography 33 d following 72-TAI by an experienced technician. Cow BCS (1 to 9; 1 = emaciated and 9 = obese) were assessed on all cows at start of estrous synchronization to determine nutritional status of each cow.

Preliminary analysis revealed no significant differences in pregnancy rates between treatments for both calving seasons (ECC and LCC) or AI technician, therefore data from both ECC and LCC were pooled and AI technician was not included in the final model. Differences in pregnancy rates between treatments (TAI and GnRH) were analyzed with least squares means using the GENMOD procedure in SAS (1990). Data were analyzed to identify differences in pregnancy rates due to BCS, PPI, and treatment (TAI x GnRH) interaction with sire analyzed as a random effect. Significance was determined using Chi-Square at $P < 0.05$.

Results and Discussion

Timed AI pregnancy rates, for both breeding seasons, in all four treatment groups was 39.1% (79/202). There was no treatment (TAI x GnRH) by BCS and PPI interaction ($P > 0.05$), therefore data was pooled together to analyze for main effects. Effect of BCS ($P > 0.80$) and PPI ($P > 0.30$) on TAI pregnancy rates did not differ among treatments. Effect of TAI on pregnancy rate differed ($P < 0.05$) for cows inseminated at 72 h compared to those inseminated at 48 h. This increase in fertility may have been due to more cows exhibiting a delayed response to PG injection (average interval to estrus with the Select Synch protocol is 70 h; Geary et al., 2000). Cows receiving a second injection of GnRH at both 48 and 72 h post PG had improved pregnancy rates to TAI ($P < 0.05$; Figure 1). The delayed response to PG injection could have allowed the second injection of GnRH to initiate a preovulatory LH surge (Twagiramungu et al., 1995) that induced ovulation in cows with an ouvulatory dominant follicle present at the time of injection (Thompson et al., 1999; Wood et al., 2001).

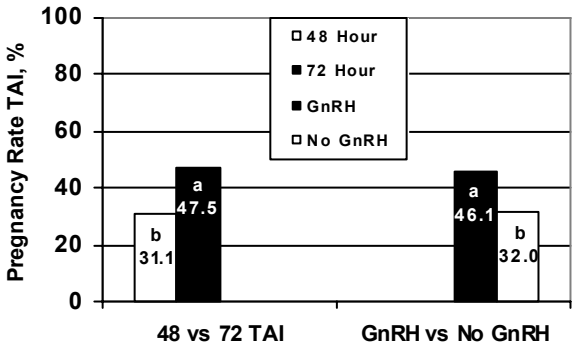

Figure 1: Main effect of time to AI and GnRH on pregnancy rate to fixed time AI (TAI). Means without a common letter for each main effect (a, b) differ ($P < 0.05$).

Pregnancy rates were higher ($P < 0.05$) for 72-TAI-G (54.9 %) compared to all other treatments. There was no difference ($P > 0.05$) in pregnancy rates for 48-TAI-G vs 72-TAI, however cows bred at 48-TAI had lower ($P < 0.05$) pregnancy rates than 48-TAI-G, but did not differ ($P > 0.05$) compared to 72-TAI, (Table 1). The addition of a second injection of GnRH may have induced ovulation in cows that did not responded to PG because of low progesterone levels (regressing or developing CL), or cows that were anestrous. The first injection of GnRH likely induced ovulation of the present dominant follicle and development of a new growing dominant follicle (Schmitt et al., 1996) in all treatments, but cows receiving the second injection of GnRH had increased pregnancy rates that were likely complimented with the second injection of GnRH that induced ovulation in cows not responding to PG.

Table 1. Characteristics of cattle bred TAI for each treatment.

Characteristic	48 GnRH	48 - No GnRH	72 GnRH	72 - No GnRH
No. Head	51	52	51	48
Mean BCS	5.0 ± 2.0	5.1 ± 1.4	5.1 ± 0.9	5.0 ± 1.5
Mean PPI, d	68 ± 37	68 ± 60	66 ± 55	68 ± 55
Pregnancy rate, %	37.3[b]	25.0[c]	54.9[a]	39.6[b,c]

Means without a common letter (a, b, c) differ ($P < 0.05$).

Pregnancy rates were different for 72-TAI-G vs 72-TAI, 48-TAI-G, with 48-TAI having fewer cows conceiving to AI. These results would suggest that delaying TAI to 72 h post PG injection may improve pregnancy rates (Perry et al., 2002; Geary et al., 2001a), and incorporation of a second injection of GnRH at TAI may be feasible (Wood et al., 2001).

Pregnancy rates for cows inseminated to sire B in all four treatments were higher (49.4 %; $P < 0.05$) as compared to cows inseminated to sire A (31.3 %; Figure 2). The variation in pregnancy rates for the different treatment

groups is likely explained by poor semen quality for Sire A. Although sire A had lower fertility in all four treatments, there was a pattern of improved fertility for both sires if TAI occurs at 72 h post PG injection, with the incorporation of a second injection of GnRH.

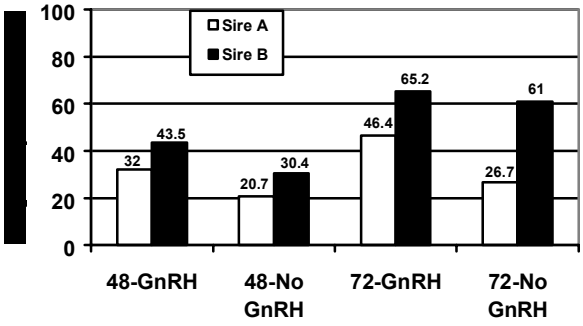

Figure 2: Random effect of sire on pregnancy rate to fixed time AI for all four treatment groups.

Calf removal has shown to improve conception rates in a 48 h calf removal with TAI (Geary et al., 2001b). In the 72-TAI-G cows, 72 h calf removal may have caused a tighter, more fertile synchrony due to increased GnRH and LH pulse frequency in cows that ovulated a dominant follicle at 72-TAI. Calf removal coupled with GnRH may have accounted for increased pregnancy rates due to a larger LH surge that may have improved synchrony of ovulation.

Implications

The current data suggest that synchrony of ovulation may be tighter and that improved pregnancy rates are feasible if TAI is delayed until 72 h post PG injection with a second injection of GnRH. Semen with low sperm fertility in an AI synchronization program can greatly affect pregnancy rates, however pregnancy rates were still improved for cows bred at 72 h and administered a second injection of GnRH, with respect to both sires. This study warrants further research to investigate why cows that were TAI at 72 h, with GnRH, had higher pregnancy rates, and to determine if a second injection of GnRH is economically beneficial with or without incorporation of calf removal.

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