ABSTRACT: We determined whether an ovulatory estrus could be resynchronized in previously synchronized, AI nonpregnant cows without compromising pregnancy from the previous synchronized ovulation or to those inseminated at the resynchronized estrus. Ovulation was synchronized in 937 suckled beef cows at 6 locations using a CO-Synch + progesterone insert (controlled internal drug release; CIDR) protocol [a 100-µg injection of GnRH at the time of progesterone insert, followed in 7 d by a 25-mg injection of PGF 2α at insert removal; at 60 h after PGF2α, cows received a fixed-time AI (TAI) plus a second injection of GnRH]. After initial TAI, the cows were assigned randomly to 1 of 4 treatments: 1) untreated (control; n = 237); 2) progesterone insert at 5 d after TAI and removed 14 d after TAI (CIDR5–14; n = 234); 3) progesterone insert placed at 14 d after TAI and removed 21 d after TAI (CIDR14–21; n = 232); or 4) progesterone insert at 5 d after TAI and removed 14 d after TAI and then a new CIDR inserted at 14 d and removed 21 d after TAI (CIDR5–21; n = 234). After TAI, cows were observed twice daily until 25 d after TAI for estrus and inseminated according to the AM-PM rule. Pregnancy was determined at 30 and 60 d after TAI to determine conception to the first and second AI. Pregnancy rates to TAI were similar for control (55%), CIDR5–14 (53%), CIDR14–21 (48%), and CIDR5–21 (53%). A greater (P < 0.05) proportion of nonpregnant cows was detected in estrus in the CIDR5–21 (76/110, 69%) and CIDR14–21 (77/120, 64%) treatments than in controls (44/106, 42%) and CIDR5–14 (39/109, 36%) cows. Although overall pregnancy rates after second AI service were similar, combined conception rates of treatments without a CIDR from d 14 to 21 [68.7% (57/83); control and CIDR5–14 treatments] were greater (P = 0.03) than those with a CIDR during that same interval [53.5% (82/153); CIDR5–21 and CIDR14–21 treatments]. We conclude that placement of a progesterone insert 5 d after a TAI did not compromise or enhance pregnancy rates to TAI; however, conception rates of nonpregnant cows inseminated after a detected estrus were compromised when resynchronized with a CIDR from d 5 or 14 until 21 d after TAI.

Key words: artificial insemination, controlled internal drug release, estrus synchronization, resynchronization

INTRODUCTION

Reproduction is the main factor limiting production efficiency of beef cattle (Short et al., 1990). Artificial insemination provides an economically viable technique to introduce desired genetics into a herd, whereas synchronization of estrus, ovulation, or both provides a more labor-efficient way to incorporate AI into management practices. Synchronization of AI also shortens the calving season, allowing more calves to be born near the beginning of the calving season (Larson et al., 2006). Reinsemination of nonpregnant cows at the first eligible estrus can be facilitated by resynchroni-
zation of the estrous cycle (Van Cleeff et al., 1996). With additional hormonal control of the estrous cycle, a second AI is possible. Resynchronization with a progestin increased synchronized return rates of non-pregnant females (Stevenson et al., 2003; Colazo et al., 2006), thereby increasing the number of animals that conceive to AI while maintaining efficient use of labor. Resynchronization with progesterone and estradiol cypionate or estradiol benzoate (EB), however, decreased subsequent conception rates (Stevenson et al., 2003). Supplementation with progesterone on day 5 post-AI enhanced pregnancy rates in Holstein cows (Villarroel et al., 2004), but suppressed fertility when administered within 2 days of first insemination (Van Cleeff et al., 1996). In addition, heifers that received progesterone on day 2 after AI had shorter estrous cycles than controls (Lynch et al., 1999).

The objectives of this study were to determine whether resynchronization of an ovulatory estrus could be accomplished in previously inseminated non-pregnant cows without compromising pregnancy in cows pregnant from a previous synchronized ovulation and whether insertion of a CIDR at 5 or 14 days after TAI would alter pregnancy rates.

**MATERIALS AND METHODS**

The animals utilized in this experiment were cared for by acceptable practices as outlined in the Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching (FASS, 1999), and the study was approved by the University of Minnesota Institutional Animal Use and Care Committee.

**Locations and Cows**

During the spring breeding seasons (April 1 to June 30) of 2004 and 2005, beef cattle used in this study were managed at 6 locations, located in 3 states. Herd size ranged from 113 to 248 cows. A total of 937 suckled beef cows, consisting of British, Continental, and British × Continental breed types, were submitted for treatment. Mean days postpartum at the beginning of the breeding season (d 0) were 58 with a range of 19 to 102 d. Average parity was 3.0 ± 1.6 (mean ± SD) with a range of 1 to 10. Body condition scores (scale of 1 to 9; Whitman, 1975) were determined by an experienced, but not the same, individual at each location on day −20 relative to PGF2α (PG); mean BCS was 4.8 ± 0.6 (mean ± SD) with a range of 3 to 6.5. Individual location data are summarized in Table 1. Location abbreviations refer to each of 6 herds among 3 states.

**Treatments**

Ovulation was synchronized with the CO-Synch + progestrone insert (controlled internal drug release; CIDR) protocol (Larson et al., 2006). Cows received a CIDR insert containing 1.38 g of progesterone (Pfizer Animal Health, New York, NY) and a 100-µg injection of GnRH (OvaCyst; IVX Animal Health, St. Joseph, MO) on day −9. On day −2, the insert was removed and cows received 25 mg of PG (Lutalyse, dinoprost tromethamine, Pfizer Animal Health), followed in 60 h by a second injection of GnRH and fixed-time AI (TAI).

After the initial TAI, cows were assigned randomly (for IL1 and IL2 locations; Table 1) or stratified by BCS and days postpartum (for KS1, KS2, MN1, and MN2 locations) and then assigned to one of 4 resynchronization protocols (Figure 1): 1) untreated (control; n = 237); 2) progestrone insert at 5 days after TAI and removed 14 days after TAI (CIDR5–14; n = 234); 3) progestrone insert placed at 14 days after TAI and removed 21 days after TAI (CIDR14–21; n = 232); or 4) progestrone insert at 5 days after TAI and removed 14 days after TAI and then a new CIDR inserted at 14 days and removed 21 days after TAI (CIDR5–21; n = 234). A minimum of 2 daily visual observations (at least 45 min each) for estrus began on day 5 and continued until day 26 after TAI.

### Table 1. Characteristics of cows at each location including number of cows treated, breed composition, days postpartum, parity, BCS, and estrous cycling percentage

<table>
<thead>
<tr>
<th>Location</th>
<th>n</th>
<th>Breed origin</th>
<th>Days postpartum, mean (range)</th>
<th>Parity, mean (range)</th>
<th>BCS, mean (range)</th>
<th>Cyclicity, % (No./No.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IL1</td>
<td>120</td>
<td>British, Continental</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>IL2</td>
<td>113</td>
<td>British, Continental</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>KS1</td>
<td>248</td>
<td>British, Continental</td>
<td>61 (23–96) x</td>
<td>4.9 (1–10) x</td>
<td>5.0 (3.0–6.5) x</td>
<td>65 (161/248) x</td>
</tr>
<tr>
<td>KS2</td>
<td>143</td>
<td>British, Continental</td>
<td>49 (19–78) y</td>
<td>3.7 (1–8) y</td>
<td>4.2 (3.0–6.0) y</td>
<td>40 (57/143) y</td>
</tr>
<tr>
<td>MN1</td>
<td>160</td>
<td>British, Continental</td>
<td>59 (19–83) x</td>
<td>1.9 (1–9) x</td>
<td>5.1 (4.0–6.0) x</td>
<td>—</td>
</tr>
<tr>
<td>MN2</td>
<td>153</td>
<td>British, Continental</td>
<td>61 (22–102) x</td>
<td>—</td>
<td>5.0 (3.5–6.5) x</td>
<td>60 (92/153) x</td>
</tr>
<tr>
<td>Overall</td>
<td>937</td>
<td>—</td>
<td>58 (19–102) y</td>
<td>3.0 (1–10) y</td>
<td>4.8 (3.0–6.5) y</td>
<td>57 (310/544)</td>
</tr>
</tbody>
</table>

*Means within a column differ (P < 0.05).

1Location abbreviations refer to each of 6 herds among 3 states. Days postpartum and BCS was not recorded at IL1 and IL2 locations. Parity was not recorded at IL1, IL2, and MN2. Blood samples were not collected at IL1, IL2, and MN1 locations to determine cyclicity.

2Days postpartum at initiation of the breeding season (d 0).

3BCS on 1 to 9 scale (1 = emaciated and 9 = obese; Whitman, 1975).

4Percentage of cows cycling at initiation of treatments (d −7).
To assist in detection of estrus, cows were fitted with heatmount detectors (Kamar Inc., Steamboat Springs, CO) affixed midline to the rump of each cow between the tailhead and the tuber coxae (hook bones). Detectors were placed on all cows on d 5 after TAI. Cows detected in estrus received an AI 9 to 14 h after the first detected estrus (AM-PM rule). At 2 of the locations (KS1 and KS2), cows were visually observed for estrus between d 21 and 25 after TAI and no heatmount detectors were applied.

Pregnancy was diagnosed by transrectal ultrasonography (5- or 7.5-MHz intrarectal transducer, Aloka 500V, Corometrics, Wallingford, CT) on d 30 after AI to determine the presence of a viable embryo, thereby assessing TAI pregnancy rates. A second pregnancy diagnosis was performed at 60 d after TAI to determine pregnancy loss of cows that conceived to TAI but lost the pregnancy after d 30. Clean-up bulls were not introduced until d 26 after TAI and remained with the cows for the remainder of the breeding season.

**Blood Collection and RIA**

At the KS1, KS2, and MN2 locations, blood samples were collected in 10-mL vacutainer tubes (BD World-wide, Franklin Lakes, NJ) that did not contain additive, via tail venipuncture on d −19 and −9. Blood serum was analyzed for concentrations of progesterone in the laboratory of individual investigators, according the validation procedures of the progesterone RIA in each laboratory.

For the MN and KS locations, concentrations of progesterone in samples were analyzed by RIA using progesterone kits (Coat-A-Count, Diagnostic Products Corp., Los Angeles, CA). The assay kit was validated for bovine serum (Kirby et al., 1997) using an assay volume of 100 µL. Assay tubes for the standard curve contained 0.01, 0.025, 0.05, 0.2, 0.5, 1, 2, and 4 ng/tube. Assay sensitivity for a 100-µL sample was 0.1 ng/mL. Pooled samples revealed that the intra- and interassay CV were 5.4 and 7.2%, respectively.

Serum progesterone concentrations for samples collected on d −19 and −9, when at least 1 of 2 blood samples had concentrations of progesterone ≥1 ng/mL, the cow was considered to be cycling at the initiation of treatments (Perry et al., 1991). Serum samples collected on d 11 or 14 were used to compare differences in serum concentrations of cycling cows during diestrus or early pregnancy with or without a CIDR.
Statistical Analyses

Procedures GLM and CATMOD of SAS (SAS Inst. Inc., Cary, NC) were used to analyze all categorical data, and procedure GLM was used to analyze non-categorical data. Means were separated by using the least significant difference in procedure GLM when a protected F-test \((P \leq 0.05)\) was detected by ANOVA.

Proportions of cows cycling at the onset of treatments were analyzed for KS1, KS2, and MN2 locations with location as a fixed effect, and days postpartum and BCS as regression covariables. The model excluded the IL1, IL2, and MN1 locations because blood samples were not collected on d −19 and −9 at those 2 locations. The model used to analyze pregnancy rates to TAI, second service conception rates, cumulative pregnancies after 2 AI, and pregnancy loss included treatment and location and the treatment × location interaction, with days postpartum as a regression covariable. Because breed composition, AI sires, and AI technicians were confounded with location, they were not included in the model, but reasonable attempts were made to ensure that these variables were distributed evenly among treatments at each location.

Models used to analyze concentrations of progesterone on d 11 (at the IL1 location), d 14 (at MN1 location), percentage of nonpregnant cows returning to estrus, and percentage of nonpregnant cows returning to estrus during the 48-h interval from d 22 to 23 included treatment in the model. Orthogonal contrasts were used to compare concentrations of progesterone between cows that had no CIDR from d 5 to 14 (control and CIDR14–21 treatments) and cows that had a CIDR from d 5 to 14 (CIDR5–14 and CIDR5–21 treatments).

Within each model, analyses were conducted to ensure that no biases existed among treatments based on days postpartum, parity, BCS, and cycling status.

RESULTS

Cycling Status

Based on concentrations of progesterone from blood samples collected from cows at the KS1, KS2, and MN2 locations at d −19 and −9, we determined that an average of 54.4% (296 of 544) of cows were cycling before initiation of the CO-Synch + CIDR estrous synchronization protocol. Proportions of cycling cows among the 3 locations ranged from 40 to 65% and were influenced by location and BCS (Table 1). Pregnancy rates to TAI for cycling cows (48.1%; 142 of 297) did not differ \((P = 0.33)\) from noncycling cows (52.2%; 129 of 247). Similarly, cumulative pregnancies after 2 AI were similar between cycling (60.9%; 181 of 297) and noncycling (63.7%; 156 of 245) cows.

For every unit increase in BCS over the range 3.0 to 6.5, the proportion of cows cycling increased \((P < 0.01)\) by 11.9 ± 3.8%. Days postpartum did not affect cycling status at the beginning of the breeding season.

Fertility to Fixed-Time AI

Treatment with progesterone beginning on d 5 or 14 after TAI did not alter pregnancy rates to the initial TAI. Pregnancy rates determined on d 30 after TAI were 55% for control, 53% for CIDR5–14, 48% for the CIDR14–21, and 53% for the CIDR5–21 treatments (Table 2).

No location × treatment interaction was detected; however, when pregnancy rates among treatments were combined within each location, a location effect \((P < 0.01)\) on AI pregnancy rates was observed. Pregnancy rates among locations ranged from 40% (MN2 location) to 68% (IL1 location), whereas those at the remaining 4 locations were intermediate (Table 2). Pregnancy rates were greater \((P < 0.05)\) for cows that calved >50 d before the onset of the breeding season (53.3%) than for those that calved ≤50 d before the onset of the breeding season (46.0%). In addition, for every unit increase in BCS over the range 3.0 to 6.5, pregnancy rate increased \((P < 0.01)\) by 9.7 ± 3.6%. Regardless of treatment, no interaction was detected between stage postpartum at the onset of treatments or BCS and treatment.

Detection of Estrus and Fertility After Resynchronization

Pregnancy diagnosis at d 30 revealed that 106, 109, 120, and 110 cows were not pregnant for the control, CIDR5–14, CIDR14–21, and CIDR5–21 treatments, respectively. Of these nonpregnant cows, a greater \((P < 0.01)\) percentage of CIDR14–21 (64%) and CIDR5–21 (69%) were detected in estrus than control (42%) and CIDR5–14 (36%). When contrasting treatments with a CIDR from d 14 to 21 (CIDR5–21 and CIDR14–21 treatments) to those without a CIDR during that same interval (control and CIDR5–14), the return estrus for those cows treated with progesterone was more synchronous than those that were treated with progesterone during that time (Figure 2).

Conception rates to the return estrus tended \((P = 0.069)\) to be greater in the CIDR5–14 (72%) treatment than the CIDR14–21 (53%) and CIDR5–21 (54%) treatments, whereas controls (66%) were intermediate (Table 2). In contrast, combined conception rates in cows treated with progesterone from d 14 to 21 (CIDR5–21 and CIDR14–21 treatments) to those without a CIDR during that same interval (control and CIDR5–14), the return estrus for those cows treated with progesterone was more synchronous than those that were treated with progesterone during that time (Figure 2).

No treatment differences were detected for cumulative pregnancies after 2 AI, but number of pregnancies were different among locations with MN1 (83%) experiencing the greatest proportion and KS2 (51%) the poorest. In addition, pregnancy loss for cows diagnosed pregnant to the initial TAI on d 30 but diagnosed non-
### Table 2. Fertility of previously inseminated suckled beef cows whose first eligible estrus was resynchronized with or without progesterone via a controlled internal drug release (CIDR) insert after an initial fixed-time AI (TAI)

<table>
<thead>
<tr>
<th>Item</th>
<th>Treatment</th>
<th>Control</th>
<th>CIDR5–14</th>
<th>CIDR14–21</th>
<th>CIDR5–21</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IL1</td>
<td>Control</td>
<td>20/30 (67)</td>
<td>24/30 (80)</td>
<td>18/30 (60)</td>
<td>20/30 (67)</td>
</tr>
<tr>
<td>IL2</td>
<td>CIDR5–14</td>
<td>10/29 (34)</td>
<td>13/28 (46)</td>
<td>11/26 (42)</td>
<td>15/30 (50)</td>
</tr>
<tr>
<td>KS1</td>
<td>CIDR14–21</td>
<td>36/62 (58)</td>
<td>38/63 (60)</td>
<td>32/62 (52)</td>
<td>34/61 (56)</td>
</tr>
<tr>
<td>KS2</td>
<td>CIDR5–21</td>
<td>22/35 (63)</td>
<td>18/30 (46)</td>
<td>21/40 (53)</td>
<td>26/40 (65)</td>
</tr>
<tr>
<td>MN1</td>
<td>Overall</td>
<td>17/40 (43)</td>
<td>16/38 (42)</td>
<td>13/37 (35)</td>
<td>15/38 (39)</td>
</tr>
<tr>
<td>MN2</td>
<td></td>
<td>131/237 (55)</td>
<td>125/234 (53)</td>
<td>112/232 (48)</td>
<td>124/234 (53)</td>
</tr>
<tr>
<td></td>
<td>Return to estrus</td>
<td>44/106 (42)</td>
<td>39/109 (36)</td>
<td>77/120 (64)</td>
<td>76/110 (69)</td>
</tr>
<tr>
<td></td>
<td>Conception rates</td>
<td>29/44 (66)</td>
<td>28/39 (72)</td>
<td>41/77 (53)</td>
<td>41/76 (54)</td>
</tr>
<tr>
<td></td>
<td>Cumulative pregnancy rates</td>
<td>23/30 (76)</td>
<td>24/30 (80)</td>
<td>25/30 (83)</td>
<td>23/30 (77)</td>
</tr>
<tr>
<td></td>
<td>IL1</td>
<td>16/29 (55)</td>
<td>18/28 (64)</td>
<td>12/26 (46)</td>
<td>18/30 (60)</td>
</tr>
<tr>
<td></td>
<td>IL2</td>
<td>38/62 (58)</td>
<td>36/63 (60)</td>
<td>40/62 (65)</td>
<td>47/61 (77)</td>
</tr>
<tr>
<td></td>
<td>KS1</td>
<td>22/35 (63)</td>
<td>18/36 (50)</td>
<td>22/36 (61)</td>
<td>14/35 (40)</td>
</tr>
<tr>
<td></td>
<td>KS2</td>
<td>32/41 (78)</td>
<td>34/39 (87)</td>
<td>32/40 (80)</td>
<td>34/40 (85)</td>
</tr>
<tr>
<td></td>
<td>MN1</td>
<td>29/40 (73)</td>
<td>26/38 (68)</td>
<td>23/37 (62)</td>
<td>25/37 (68)</td>
</tr>
<tr>
<td></td>
<td>MN2</td>
<td>158/237 (67)</td>
<td>158/234 (68)</td>
<td>154/231 (67)</td>
<td>161/233 (69)</td>
</tr>
<tr>
<td></td>
<td>Overall</td>
<td>9/130 (7)</td>
<td>6/126 (5)</td>
<td>6/111 (5)</td>
<td>6/124 (5)</td>
</tr>
</tbody>
</table>

*Means within a row differ (P < 0.05).
**Means within a row differ (P < 0.10).

1Location abbreviations refer to each of 6 herds among 3 states.
2Treatments were untreated (control), progesterone insert at 5 d after timed AI and removed 14 d after TAI (CIDR5–14), progesterone insert placed at 14 d after timed AI and removed 21 d after timed AI (CIDR14–21), and progesterone insert at 5 d after timed AI and then a new CIDR inserted at 14 d and removed 21 d after timed AI (CIDR5–21).
3Timed AI = fixed-time AI; pregnancy rates were determined on d 30.
4Percentage of nonpregnant females returning to estrus d 21 to 26 after timed AI.
5Percentage of cows pregnant after AI for cows returning to estrus.
6Overall pregnancy rates after 2 AI as determined on d 60.
7Pregnancy loss of TAI pregnancies between d 30 and 60.
pregnant on d 60 was similar among treatments, demonstrating that treatment with progesterone beginning 5 d after TAI failed to enhance conception rates.

**Concentrations of Progesterone**

There was a tendency \((P = 0.11)\) for concentrations of progesterone to be greater in CIDR5–14 cows \((4.28 \pm 0.24 \text{ ng/mL})\) than in controls \((3.50 \pm 0.23 \text{ ng/mL})\) on d 11 after TAI. The CIDR5–21 \((4.08 \pm 0.23 \text{ ng/mL})\) and CIDR14–21 \((3.81 \pm 0.25 \text{ ng/mL})\) treatments were intermediate. Differences \((P = 0.03)\) were noted in progesterone concentrations when contrasting treatments that received progesterone from d 5 to 14 (CIDR5–14 and CIDR5–21) and those that did not receive progesterone (control and CIDR14–21; Figure 3).

Similarly, on d 14 after TAI, concentrations of progesterone were greater \((P = 0.03)\) for the CIDR5–14 \((7.21 \pm 0.41 \text{ ng/mL})\) and CIDR5–21 \((7.19 \pm 0.39 \text{ ng/mL})\) treatments than controls \((5.99 \pm 0.38 \text{ ng/mL})\) and tended \((P = 0.07)\) to be greater than the CIDR 14–21 \((6.21 \pm 0.39 \text{ ng/mL})\) treatment. When contrasting treatments that received progesterone from d 5 to 14 (CIDR5–14 and CIDR5–21) and those that did not (control and CIDR14–21), progesterone-treated cows had greater \((P < 0.01)\) concentrations of progesterone than those not receiving progesterone (Figure 3).

**DISCUSSION**

When managing reproduction in beef cattle to improve the genetic base of the calf crop efficiently, the percentage of cows conceiving to AI must be increased. The 2-fold purpose of this study was to determine 1) whether increasing progesterone in early diestrus (d 5 after TAI) would reduce pregnancy loss and increase pregnancy rates to TAI; and 2) whether the interval required for detection of the first eligible estrus of previously inseminated nonpregnant cows could be reduced and effectively resynchronized without interfering with established pregnancies resulting from an earlier TAI. Early progesterone supplementation via a CIDR insert failed to enhance pregnancy rates to TAI, and we found no evidence that implementation of the resynchronization protocols was disruptive to established pregnancies. In contrast, resynchronization of estrus with progesterone between d 14 and 21 after TAI effectively resynchronized nonpregnant cows, but conception rates to the resynchronized estrus were compromised resulting in no benefit to overall pregnancy rates.

In dairy cows, providing supplemental progesterone by CIDR (containing 1.9 g progesterone) increased or tended to increase pregnancy rates when treatments were initiated no earlier than d 3 after AI (Robinson et al., 1989; Van Cleeff et al., 1996; Stevenson et al., 2007), but not consistently (Stevenson and Mee, 1991). Supplemental progesterin during the luteal phase tended to increase conception rates (Wilmut et al., 1986) or calving rates of beef heifers (Favero et al., 1993). In addition, supplementing exogenous progesterone may preclude low concentrations of progesterone from occurring in the maternal circulation and prevent pregnancy losses in dairy cows (Stevenson and Mee, 1991; El-Zarkouny and Stevenson, 2004; Stevenson et al.,...
2007) and dairy heifers (Van Cleeff et al., 1996). In contrast, treatment with progesterone beginning on d 5 after TAI in the present study failed to enhance pregnancy rates to TAI.

In lactating dairy cattle, studies have demonstrated that steroid metabolism reduces the concentration of circulating progesterone compared with nonlactating cows or heifers (Sangsritavong et al., 2002; Sartori et al., 2002). Therefore, lactating dairy cows may benefit from treatments that enhance progesterone after AI. In contrast, in beef cows, the concentration of circulating progesterone shortly after TAI is likely sufficient for pregnancy establishment and maintenance. Mean concentrations of progesterone on d 11 after TAI were 3.93 ng/mL and addition of the CIDR treatment provided 4.66 ng/mL of progesterone, only a 0.62 ng/mL increase in serum progesterone compared with cows without a CIDR. Furthermore, mean concentrations of progesterone on d 14 after TAI were 6.10 ng/mL and addition of a CIDR provided 7.20 ng/mL of progesterone, only a 1.10 ng/mL increase in serum progesterone compared with cows without a CIDR. In addition, there was no difference in concentrations of progesterone between cows that became pregnant and those that failed to become pregnant.

Previous studies demonstrated that pregnancy rates in cows established after TAI were unaffected by resynchronization treatments. Pregnancies were unaffected when EB was administered on d 12, 13, or 14 after AI (Macmillan et al., 1999), or when EB or estradiol cypionate was administered at insertion and removal of a used progesterone CIDR insert on d 11 to 18 or 13 to 20 after TAI (Stevenson et al., 2003). Our results indicate that administering progesterone via a CIDR insert also was effective in preventing the occurrence of spontaneous estrus before its removal.

Concentrating the distribution of estrus into a short, predictable time frame provides advantages for an AI program. Detection of estrus is time consuming and labor intensive, especially for repeat periods of estrus after a failed AI, because interval to estrus is more variable compared with noninseminated females (Van Cleeff et al., 1996). Therefore, another purpose of these studies was to determine whether the protocols employed effectively increased percentages of nonpregnant females returning to estrus. When a CIDR was present between d 14 and 21, percentages of eligible nonpregnant females returning to estrus increased, which concurs with our previous report (Stevenson et al., 2003). In addition, distribution patterns of estrus for our cattle receiving a CIDR between d 14 and 21 after TAI were consistent with previous studies in which beef cows were given a single injection of EB on d 13 (CIDR insertion) and on d 20 at CIDR removal (Stevenson et al., 2003), or dairy cattle (Macmillan et al., 1999) in which 43% were in estrus on d 1 and 42% on d 2 after CIDR removal.

Despite a greater proportion of cows resynchronized with a CIDR insert expressing estrus, conception rates were compromised resulting in similar overall pregnancy rates after 2 AI relative to cows that were not resynchronized. These results agree with our previous report (Stevenson et al., 2003) in which the use of progesterone or melengestrol acetate (MGA) plus estradiol cypionate either tended to reduce, or reduced, fertility at the resynchronized estrus, respectively. Other research (Purvis and Whittier, 1997) has shown that conception rate of beef heifers after resynchronization with MGA did not differ from controls. Reduced conception rates in MGA-treated (Chenault et al., 1990) or CIDR-treated females (Macmillan and Peterson, 1993) indicated that some persistent follicles might have developed in heifers assigned to those treatments. This very likely could be the reason for the reduction in fertility in our study because no treatment was used to initiate a new follicular wave at CIDR insertion. When EB was administered at CIDR insertion for resynchronization of estrus, fertility increased in dairy cows as a consequence of promoting a third follicular wave (Macmillan et al., 1999). This was evident when conception rates were less in cows in which fertilized oocytes were derived from the second (58%) compared with the third (95%) follicular wave of the estrous cycle in beef (Ahmad et al., 1997) and dairy cows (30 vs. 68%; Townsend et al., 2002).

Enhancing fertility of estrus- or ovulation-synchronization protocols facilitates a potential increase in the use of AI. We demonstrated that supplementation of progesterone via a CIDR insert to postpartum suckled beef cows on d 5 after TAI failed to enhance fertility. In addition, resynchronization of estrus in nonpregnant cows with a CIDR enhanced synchrony of estrus and increased the proportion of cows detected in estrus, but had a negative impact on pregnancy rates. Therefore, further research is required to seek a protocol that successfully resynchronizes previously inseminated nonpregnant females while maintaining satisfactory conception rates after detected estrus.

LITERATURE CITED


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