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Comparison of melengestrol acetate and controlled internal drug-release long-term progestin-based synchronization protocols on fixed-time artificial-insemination pregnancy rate in beef heifers

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ABSTRACT

Nulliparous, predominately Angus beef heifers at a commercial ranch in the Nebraska Sandhills were randomly assigned to 1 of 2 progestin-based time AI protocols to compare pregnancy rates. Heifers assigned to melengestrol acetate (MGA; n = 688) received MGA (0.5 mg/d per heifer) from d 0 to 13 and were administered $PGF_{2\alpha}$ (25 mg, i.m.) on d 32; fixed-time AI (FTAI) occurred approximately 72 h after $PGF_{2\alpha}$. Heifers assigned to 14-d controlled internal drug-release (14-d CIDR; n = 697) received a CIDR insert (1.38 g of progesterone) from d 2 to 16, followed by administration of $PGF_{2\alpha}$ on d 32; FTAI occurred approximately 66 h after $PGF_{2\alpha}$. All heifers received GnRH (100 µg, i.m.) at FTAI on d 35. Heifers were estrus detected twice daily, d 15 to 25 following FTAI, and received AI 12 to 18 h after observed estrus. Pregnancy was determined by transrectal ultrasonography 45 d after FTAI, 50 d following second AI, and 36 d following bull removal. Heifers had similar ($P = 0.49$) FTAI pregnancy rates between MGA and 14-d CIDR (62 vs. 61 ± 2%, respectively). A similar ($P = 0.83$) proportion of MGA and 14-d CIDR heifers displayed a second estrus (26 vs. 26 ± 2%, respectively); however, heifers previously synchronized with MGA tended ($P = 0.06$) to have a greater second AI pregnancy rate (66 vs. 56 ± 2%, respectively). Overall pregnancy rate was similar ($P = 0.27$) between MGA and 14-d CIDR treatments (93 vs. 90 ± 1%, respectively). The MGA system was the more cost-effective synchronization protocol in this study.

Key words: beef heifer, estrous synchronization, fixed-time artificial insemination

INTRODUCTION

Yearling beef heifers are the future of the cowherd, and their lifetime reproductive success is dependent on conceiving early in the first and subsequent breeding seasons. Research has indicated beef females that conceive early in the breeding season and calve within the first 21 d of the calving season have increased lifetime reproductive performance and produce progeny with greater overall productivity than those born later in the calving season (Lesmeister et al., 1973; Schafer et al., 1990; Funston et al., 2012). Estrous synchronization and AI are reproductive procedures that can produce a greater proportion of pregnant beef heifers early in the breeding season. Additional benefits from estrous synchronization include, but are not limited to, a shortened calving season resulting in a more

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uniform calf crop and more rapid genetic improvement (Dziuk and Bellows, 1983). However, there has been limited adoption of estrous synchronization and AI because of time, labor, and cost to implement (NAHMS, 2008).

Implementation of fixed-time AI (**FTAI**) protocols can reduce time and labor inputs. Progestin-based estrous synchronization, such as melengestrol acetate (**MGA**) and controlled internal drug-release inserts (**CIDR**), have been documented to induce estrous cyclicity in heifers failing to reach puberty before administration (Gonzalez-Padilla et al., 1975; Patterson et al., 1990; Lucy et al., 2001). Kojima et al. (2004) reported decreased synchrony (53 vs. 69%) and AI pregnancy rate (47 vs. 63%) with MGA compared with CIDR. However, Mallory et al. (2010) found MGA and CIDR compare similarly with regard to estrous response, synchronization of estrus, and resulting pregnancy rate.

Combining progestin-based estrous synchronization with FTAI, such as CIDR and FTAI (Busch et al., 2007) or MGA versus 14-d CIDR with estrus detection and AI followed by clean-up FTAI (Tauck et al., 2007), has produced acceptable pregnancy rates. Implementation of strict FTAI can reduce time and labor by eliminating estrus detection and minimizing the number of times heifers are handled. Therefore, the objectives of this study were to evaluate the pregnancy rates and economic parameters of MGA and 14-d CIDR FTAI protocols in beef heifers.

MATERIALS AND METHODS

Heifers and Diet

The University of Nebraska–Lincoln Institutional Animal Care and Use Committee approved the procedures and facilities used in this experiment. Nulliparous, predominately Angus, yearling beef heifers (n = 1,385) purchased from livestock auctions in Nebraska and South Dakota were used in this study, which took place on a commercial ranch in the Nebraska Sandhills. Upon arrival, heifers were vaccinated with Express 3 FP3 VL3 (Boehringer Ingelheim Vetmedica Inc., St. Joseph, MO) and dewormed (Safe-Guard, Merck Animal Health, Summit, NJ). Pelvic area was measured, and ovaries were palpated for the presence of a significant structure (follicle or corpus luteum) by a single technician. Heifers with a small pelvic area, underdeveloped reproductive tracts, and freemartins were culled (n = 15). Heifer average BW was 329 kg at enrollment. Before estrous-synchronization treatment, heifers were placed in a drylot and offered 7.1 kg/d of a diet containing wet distillers grains plus solubles (26.9% DM), mixed hay (66.9% DM), and a supplement (6.2% DM) during a 14-d adaptation period. After heifers were assigned to treatment groups, they were offered 8.6 kg/d of the same diet (Table 1).

Treatments

Heifers from varying sources were placed in one large pen and randomly subdivided into 4 groups and then randomly assigned to 1 of 2 treatments: MGA (n = 688) or 14-d CIDR (n = 697; Figure 1). Heifers assigned to MGA received melengestrol acetate (0.5 mg/d per heifer; Pfizer Animal Health, New York, NY) from d 0 through 13 and were administered $PGF_{2\alpha}$ (25 mg i.m.; Lutalyse, Pfizer Animal Health) 19 d after MGA withdrawal (d 32); heifers received AI approximately 72 h after $PGF_{2\alpha}$ (d 35). Heifers assigned to 14-d CIDR received an Eazi-Breed CIDR insert (1.38 g of progesterone; Pfizer Animal Health) from d 2 to 16 followed by administration of $PGF_{2\alpha}$ 16 d after CIDR removal (d 32); heifers received AI approximately 66 h after $PGF_{2\alpha}$ (d 35). Both treatment groups received GnRH (100 µg i.m.; Factrel, Pfizer Animal Health) at FTAI.

Table 1. Composition and nutrient analysis of drylot diet fed to heifers[1]

Item	% DM
Ingredient	
Wet distillers grain	26.9
Mixed hay	66.9
Supplement[2]	6.2
Diet nutrient analysis	
CP	15.7
TDN	65.3
Fat	4.8

[1]Nutrient analysis performed by Cattlemen's Nutrition Services LLC (Lincoln, NE).

[2]Supplement included 10.0% dried distillers grain plus solubles, 48.8% wheat middlings, 39.9% vitamins and minerals, 0.9% urea, 0.4% trace mineral premix; supplement provided 200 mg/d per heifer of Rumensin (Elanco Animal Health, Greenfield, IN).

AI, Natural Service, and Pregnancy Diagnosis

Heifers were inseminated by 1 of 10 AI technicians using semen from a single bull to reduce sire variation. Following FTAI heifers remained in the drylot and were observed twice daily for signs of estrus from d 15 to 25. Heifers observed in estrus received AI 12 to 18 h later and were placed on summer pasture. Heifers not observed in estrus remained in the drylot until pregnancy diagnosis 45 d after FTAI via transrectal ultrasonography. Bulls were placed with heifers approximately 32 d after FTAI for 50 d with a bull-to-heifer ratio of 1:25. Repeat AI heifers were examined for pregnancy approximately 50 d after second AI. Diagnosis of natural-service pregnancy occurred approximately 36 d following removal of bulls.

Economic Analysis

A partial budget analysis was conducted using the procedure by Feuz (1992). The budget analysis was evaluated for the FTAI, second AI, and overall pregnancy. Costs associated with each treatment (MGA, $PGF_{2\alpha}$, GnRH, and CIDR) were derived from the Estrus Synchroni-