Effect of MGA vs CIDR Estrus Synchronization on Estrus Response and Pregnancy Rates in 311 d Old Beef Heifers

Hazy R. Nielson, Rosemary V. Anderson, and Rick N. Funston

Summary

A study compared the effect of melengestrol acetate (MGA)-prostaglandin (PG) and 14-day controlled internal drug release (CIDR)-PG estrus synchronization protocols on estrus response and pregnancy rates of 311 d old heifers (n = 153). Pre-breeding BW was 50.1% of predicted mature BW. Percentage of heifers demonstrating signs of estrus was similar between synchronization treatments (CIDR vs MGA, 71.5 vs 77.4 ± 1.0%). Pregnancy rates to AI of heifers expressing estrus (n = 115) and final pregnancy rate were similar between CIDR and MGA synchronization treatments. Approximately half of these 311 d old heifers exposed to AI and bulls became pregnant.

Introduction

For optimum lifetime productivity a beef heifer should give birth to her first calf at approximately 2 yr of age (*Journal of Animal Science*, 1973, 36(1): 1–6). However, incidence of precocious puberty has been found to be higher than anticipated in several cases. In beef cattle, precocious puberty is defined as attainment of puberty before 300 d of age (*1996 Nebraska Beef Cattle Report*, pp 21–23). The heifers utilized in the current study were younger than 300 d at the initiation of the estrus synchronization protocols.

This study sought to evaluate the outcome of exposing heifers at a young age and determine if young heifers attain and maintain a pregnancy. If a pregnancy can be carried to term, will these heifers have the maturity to raise a calf? This study evaluated estrous response, reproductive performance, and subsequent calving performance of heifers exposed at 311 d of age synchronized with melengestrol acetate (MGA) or 14-d controlled internal drug release (CIDR) estrus synchronization protocols.

....

Procedure

Angus-based, crossbred, fall-born heifers (n = 153) from 2 locations were utilized in this study. Heifers were weaned at approximately 193 d of age (Feb 18). After weaning heifers received, on a DM basis, 8 lb of hay, 3.19 lb of dry distillers grain, 1.32 lb of cracked corn and 0.05 lb of mineral mixed in the ration (2.9% of BW) with amount increasing as heifer BW increased. At approximately 10 mo of age, group pre-breeding BW was measured and heifers were randomly assigned to 1 of 2 estrus synchronization protocols in the spring.

Estrus synchronization treatments are presented in Figure 1. Heifers in the MGA protocol received MGA for 14 d fed through the diet beginning on d 0 of the synchronization treatment period. Heifers in the CIDR treatment received the same diet as MGA heifers, on a DM basis, 10.6 lb of hay, 4.6 lb of dry distillers grain, 1.8 lb cracked corn and 0.05 lb of mineral mixed in the ration (2.8% of BW), and were implanted with a CIDR (Eazi-breed CIDR, Zoetis, Florham Park, NJ) on d 2 of the treatment period and removed on d 16. Following estrus synchronization,

heifers from both treatments were combined and received a single PG (Lutalyse, Zoetis, Florham Park, NJ) injection on d 32. Heifers with activated heat detection aids (Estrotect, Rockway Inc, Spring Valley, WI) were AI 12 h following observation for 3 d. Heifers not expressing signs of estrus were not given an opportunity to become pregnant. Heifers exposed to AI (n = 115) were placed with bulls at a 1:50 bull to heifer ratio 4 d after the last d of AI for 35 d. Sixty-three d following bull removal heifers were diagnosed for pregnancy by a veterinarian. Over the winter heifers grazed deferred upland Sandhills range with supplementation of dry distillers grain beginning at 2.3 lb (DM) and increasing as heifer demand increased. Hay was provided in times of deep snow.

At calving the following data was collected (n = 58): birth date, sex of calf, calf birth BW, calving ease score, and mothering score. Calving ease was scored according to the BIF 9th Edition Guidelines (1 = no difficulty, no assistance, 2 = minor difficulty, some assistance, 3 = major difficulty 4 = ceasarian or very hard pull, 5 = abnormal presentation). A mothering
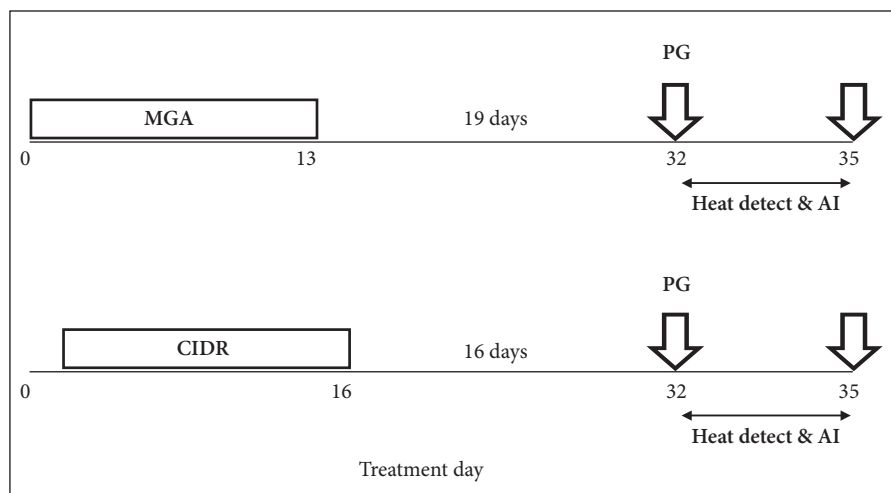

Figure 1. Treatment schedule for heifers in CIDR (n = 76) or MGA (n = 77) treatments. MGA = melengestrol acetate, CIDR = controlled internal drug release, PG = prostaglandin, GnRH = gonadotropin releasing hormone.

score was assigned to each heifer at calving. Mothering score was similar to Behavioral Pen Scores described in the BIF 9th Edition Guidelines, but takes into consideration the heifer's ability to care for her calf. The mothering score ranged from 1 to 5 wherein 1 = calm, attentive, keeps her calf with her; 2 = unremarkable, but presents no problems when moving the pair; 3 = slightly nervous or distracted; 4 = very nervous or confused, required extra time to move the pair; 5 = "crazy" or completely disinterested in the calf.

Economic Analysis

Due to the unique prices in the actual yr of this study (2014), average 5-yr price was used to conduct an economic analysis. Value of heifers was obtained from the Nebraska Weekly Cattle Auction Summary available through the USDA Agriculture Marketing Service (AMS) for the wk heifers were weaned. Feed expenses, including dry distillers grain, corn, and hay were also obtained from the AMS of USDA. Pasture rates were calculated as one half the pasture rental rates of a cow-calf pair, values obtained from the Nebraska Farm Real Estate Summary. Other expenses include interest calculated at 6.5% of the opportunity cost of the heifer, management expense valued at $0.50·hd^{-1}·d^{-1}, vaccinations and other miscellaneous health expenses, and breeding expenses calculated using EstruSynch estrus synchronization planner (estrussynch.com). Total cost included value of heifer, feed cost, and other expenses. Cull heifer value at the time of pregnancy diagnosis was determined via AMS and calculated by multiplying the value of a single cull heifer by 1 minus pregnancy rate (*Journal of the American Society of Farm Management and Rural Appraisers*, 1992, 56(1):61–66). The net cost of 1 pregnant heifer was calculated as the difference between total heifer cost and cull value, divided by pregnancy rate.

Statistical Analysis

All data were analyzed using the GLIMMIX procedure of SAS (SAS Institute, Inc., Cary, N.C.), accounting for origin as a random variable. Estrous response, pregnancy rate, and calf sex were analyzed using an odds ratio. Least squared means and SE of the proportion

of pregnant heifers by treatment were obtained using the ILINK function.

Results

Group BW were measured at weaning and prior to breeding and are presented in Table 1. Pre-breeding BW was 50.1% of predicted mature BW. Heifer ages and estrous response are presented in Table 2. Heifer age at breeding was not different (*P* = 0.12) between MGA and CIDR treatment groups. Percentage of heifers demonstrating signs of estrus was similar (*P* = 0.42) between synchronization treatments (CIDR vs MGA, 71.5 vs 77.4 ± 1.0%). Heifers not expressing estrus were not given an opportunity to become pregnant and removed from the herd. Pregnancy

results are presented in Table 3. Pregnancy rates to AI were similar (*P* = 0.27) between CIDR and MGA synchronized heifers (46.3 vs 36.1 ± 6.8%). Final pregnancy rate was also similar (*P* = 0.96) between CIDR and MGA treatments (51.0 vs 51.5 ± 7.4%). Heifer BW at pregnancy diagnosis was not different (*P* = 0.45) between CIDR and MGA treatment groups (715 vs 708 ± 7.6 lb). Calving rate was similar (*P* = 0.72) between CIDR and MGA treatments (50.9 vs 47.5 ± 6.7).

Calving data is presented in Table 4. Julian calf birth date did not differ (*P* = 0.30) between CIDR and MGA groups. Calf BW at birth was similar (*P* = 0.69) between groups as well. Calving ease score was similar (*P* = 0.68; 1.3 ± 0.2 vs 1.2 ± 0.2, CIDR vs MGA). Mothering score was also

Table 1. Measures of BW on heifers AI at 311 d of age[a]

Item	All Heifers
n	153
Weaning BW, lb	437
Pre-breeding BW, lb	602
Development ADG,[b] lb	1.40
Percent of mature BW, %	50.1

[a]Group BW of all heifers were taken and weaning and pre-breeding; group BW averages are presented here.
[b]118 d (Feb 18 to June 16).

Table 2. Effect of CIDR or MGA estrus synchronization on estrus response of 311 d old heifers

	CIDR[a]	MGA[b]	SEM	*P*-value
n	76	77		
Estrus Response, %	71.5	77.4	1.0	0.42
Age at weaning, Julian d	196	190	5	0.12
Age at breeding, Julian d	317	311	5	0.12

[a]Heifers synchronized using the 14-day CIDR-PG protocol.
[b]Heifers synchronized using the MGA-PG protocol.

Table 3. Effect of CIDR or MGA estrus synchronization on reproductive performance of 311 d old heifers

	CIDR[a]	MGA[b]	SEM	*P*-value
n	51	53		
AI pregnancy rate, %	46.3	36.1	6.8	0.27
Total pregnancy rate, %	51.0	51.5	7.4	0.96
Pregnancy diagnosis BW, lb	715	708	7.6	0.45
Calving rate,[c] %	50.9	47.5	6.7	0.72

[a]Heifers synchronized using the 14-day CIDR-PG protocol.
[b]Heifers synchronized using the MGA-PG protocol.
[c]Number of live calves born divided by number of heifers exposed to AI and bulls.

Table 4. Calving performance of heifers' exposed at 311 d old

	CIDR[a]	MGA[b]	SEM	P-value
n	28	30		
Birth Date, Julian d	82.8	86.0	2.2	0.30
Birth Weight, lb	74.2	74.9	1.2	0.69
Calf Sex[c]	0.43	0.45	0.09	0.88
Calving Ease Score[d]	1.3	1.2	0.2	0.68
Mothering Score[e]	2.1	2.0	0.2	0.79

[a]Heifers synchronized using the 14-day CIDR-PG protocol.
[b]Heifers synchronized using the MGA-PG protocol.
[c]Calf Sex: bull = 1; heifer = 0.
[d]1 = no difficulty, no assistance; 2 = minor difficulty, some assistance; 3 = major difficulty 4 = ceasarian or very hard pull; 5 = abnormal presentation.
[e]1 = calm, attentive, keeps her calf with her; 2 = unremarkable, but presents no problems when moving the pair; 3 = slightly nervous or distracted; 4 = very nervous or confused, required extra time to move the pair; 5 = "crazy" or completely disinterested in the calf.

Table 5. Economic Analyses using average 5-yr price for heifer development from weaning to pregnancy diagnosis

	CIDR[a]	MGA[b]	SEM	P-value
Value of heifer, Feb. 18, $/hd	833.50	833.50	73.54	1.00
Feed Cost, $/hd	233.46	233.46	23.15	1.00
Other expenses,[c] $/hd	260.01	248.58	4.78	0.13
Total Expenses, $/hd	1,326.97	1,315.54	91.40	0.93
Less: Value of cull heifers,[d] $/hd	532.29	526.86	70.62	0.96
Net Cost, $/hd	794.68	788.68	53.41	0.94
Net cost per pregnant heifer, $/hd	1,558.20	1,531.42	104.21	0.86

[a]Heifers synchronized using the 14-day CIDR-PG protocol.
[b]Heifers synchronized using the MGA-PG protocol.
[c]Includes interest at 6.5%, management expense, vaccine, and other miscellaneous health expenses, and breeding expense.
[d]The value of non-pregnant heifers the week of pregnancy diagnosis multiplied by (1 minus pregnancy rate).

similar (P = 0.79) with CIDR heifers scoring 2.1 ± 0.2 and MGA heifers scoring 2.0 ± 0.2. The heifers had little trouble calving at 1.6 yr of age and demonstrated adequate mothering skills.

Economic Analysis

Table 5 presents the economic analysis conducted using prices from the last 5 yr. Heifers began development at the same value and were developed as a single group, thus feed costs were also the same. Other expenses were numerically different due to the difference in cost associated with the less expensive MGA-PG synchronization protocol compared with the more expensive 14-day CIDR-PG protocol. Given that final pregnancy rates were not different (P = 0.96), value of cull heifers was also not different (P = 0.96). The net cost per pregnant heifer was similar (P = 0.86) between CIDR and MGA heifers.

Although not statistically significant, there was a numerical 10 percentage unit decrease in AI pregnancy rate in MGA compared with CIDR synchronization. Approximately half of these 311 d old heifers exposed to AI and bulls became pregnant. They went on to demonstrate adequate calving ease and mothering ability.

Hazy R. Nielson, graduate student

Rosemary V. Anderson, Anderson Ranch, Whitman, Neb.

Rick N. Funston, professor, University of Nebraska, West Central Research and Extension Center, North Platte, Neb.