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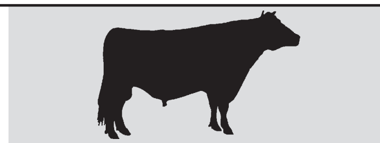

Extending Interval from Seventeen to Nineteen Days in the Melengestrol Acetate - Prostaglandin Estrous Synchronization Program for Heifers[1]

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Abstract

Two experiments were conducted to determine whether extending the interval between removal of melengestrol acetate (MGA) from feed and injection of prostaglandin $F_{2\alpha}$ (PGF) from 17 to 19 d would affect synchronization of estrus, conception, and pregnancy rates of beef heifers. In both experiments, heifers were fed MGA for 14 d, and PGF was given at either 17 or 19 d after cessation of MGA feeding. Heifers were observed for estrus and artificially inseminated for 5 d after PGF injection. In Exp. 1, 240 yearling heifers were randomly assigned to either a 17- or a 19-d treatment group according to estrous status and day of the estrous cycle. In Exp. 2, 1409 yearling heifers on a cooperating ranch were randomly assigned to the same two treatment groups without knowledge of estrous status. The PGF injection at 19 d (Exp. 1) caused a higher (P<0.05) percentage of heifers to exhibit estrus by 72 h after the injection compared with heifers receiving the injection at 17 d. A greater percentage (P<0.01) of heifers in the 19-d group were in the late luteal phase of the estrous cycle at the time of PGF injection compared with the heifers in the 17-d group, and pregnancy rates were higher for the heifers in the late luteal phase. In Exp. 2, heifers injected with PGF at 19 d after MGA had a greater (P<0.05) percentage in estrus (10%) during the 5-d breeding period, and had higher (P<0.05) pregnancy rates in 5 d (7.6%) and 50 d of breeding (5.5%), compared with heifers injected with PGF 17 d after withdrawal of MGA. These results indicate that the PGF injection given at 19 d after removal of MGA from the diet increases synchronized estrous response and results in higher pregnancy rates in heifers compared with the 17-d injection treatment.

(Key Words: Estrous Synchronization, Prostaglandin $F_{2\alpha}$, Melengestrol Acetate, Reproduction, Heifers.)

Introduction

Proper management of replacement heifers is critical for improving herd productivity and profitability. Estrous synchronization and AI programs can increase the percentage of heifers pregnant early in their first breeding season and improve overall reproductive performance (7, 13). Heifer synchronization and AI programs may be used more extensively in the future with the advent of commercially available sexed semen (12).

Estrous synchronization programs for heifers need to be practical and achieve high conception rates during a short breeding period at low costs. The MGA-PGF program has the advantages of ease of administration, induction of estrus in some prepuberal heifers, and low cost (3, 9, 10, 11). However, pregnancy rates need to be higher. Initial research on MGA-PGF (2, 8) showed no differences in conception rates when PGF was given at 17 or 18 d after the MGA feeding period. Kesler et al. (4) found

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TABLE 1. Reproductive characteristics of heifers given prostaglandin $F_{2\alpha}$ (PGF) injections at 17 or 19 d in melengestrol acetate (MGA)-PGF synchronization program — Exp. 1[a].

	PGF treatment group		
Item	**17**	**19**	**Difference**
No. of heifers	120	119	
Cycling before MGA[b], %	76.7	73.9	
Cycling after MGA feeding[c], %	94.2	94.1	
Cycling during 5-d synch., %	86.7	92.4	+5.7*
First service conception, %	56.7	61.8	+5.1
Pregnant in 5 d of AI., %	49.2	57.1	+7.9**
Pregnant in 50 d of breeding, %	88.3	93.3	+5.0**

[a] Heifers were fed MGA for 14 d then received PGF on the assigned day; heifers were observed for estrus and AI-bred with semen from one sire.

[b] Cycling status was determined by blood progesterone levels.

[c] Cycling was determined by detection of standing estrus.

* (P<0.17)

** (P<0.20)

that giving PGF to heifers at 17 d after removal of MGA from the diet resulted in higher conception rates compared with giving PGF at either 13 or 15 d. If heifers are in the late luteal phase of their estrous cycle at the time of PGF injection, a greater percentage may exhibit estrus, resulting in higher pregnancy rates. Limited research (6) indicates that extending the interval from 17 to 19 d between cessation of MGA and the PGF injection produced a tighter synchrony of estrus with slightly higher conception rates, but that overall pregnancy rates were not significantly improved. The objectives of this study were to compare the effects of delaying the PGF injection from 17 to 19 d after removal of MGA from the diet on estrous response, conception rates, and overall pregnancy rates of yearling heifers, and to determine the effect of stage of the estrous cycle at time of PGF injection on heifer conception rates.

TABLE 2. Reproductive characteristics of heifers given prostaglandin $F_{2\alpha}$ (PGF) injections at 17 or 19 d in melengestrol acetate (MGA)-PGF synchronization program — Exp. 2[a].

	PGF treatment group		
Item	**17**	**19**	**Difference**
No. of heifers	723	686	
Cycling during 5-d synch., %	77.6	87.6	+ 10*
First-service conception, %	69.3	70.0	+ 0.7
Pregnant in 5 d of AI, %	53.8	61.4	+ 7.6*
Pregnant in 30 d of breeding, %	72.3	77.8	+ 5.5*

[a] Heifers were fed MGA for 14 d, then received PGF on the assigned day; heifers were observed for estrus and AI-bred with semen from one sire.

* (P<0.05).

Materials and Methods

Experiment 1 was conducted over 2 yr with 240 crossbred (British x Continental) spring-born, yearling heifers (140 in 1997 and 100 in 1998) at the West Central Research and Extension Center. Heifers were managed in drylot and fed to gain approximately 0.70 kg/d to reach a prebreeding target BW of approximately 352 kg at 13 to 14 mo of age. Animals were managed and handled according to University of Nebraska guidelines for the care and use of animals in agricultural research. Two blood samples were collected 10 d apart before initiating MGA feeding. Samples were analyzed by radioimmunoassay for concentration of progesterone. Puberty was defined as heifers having a progesterone concentration of 1.5 ng/ml in one or both of the samples. All heifers were fed MGA at 0.5 mg per head per day for 14 d in a complete mixed ration. For 8 d after the MGA feeding period,

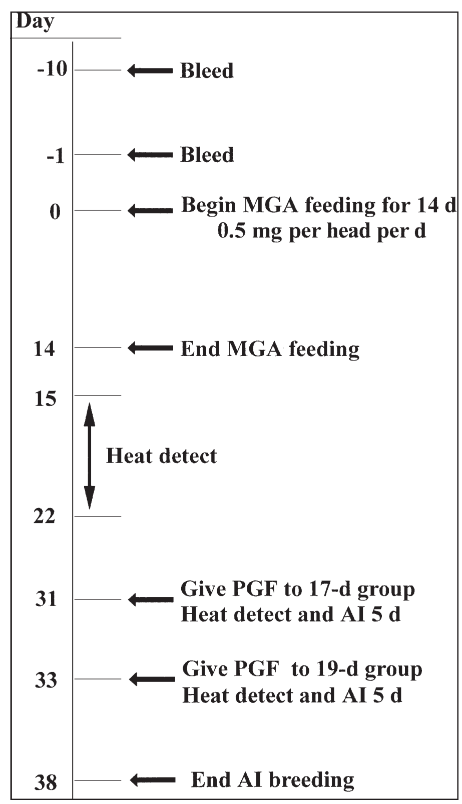

Figure 1. Diagram of experimental protocol for heifers fed MGA and followed by PGF treatment either 17 or 19 d later.

heifers were observed in early morning, midday, and late evening for standing estrus. This estrus was used to block heifers by day of estrous cycle and randomly assign them to either a 17- or a 19-d treatment group. This estrus was also used to calculate day of the estrous cycle for individual heifers at time of PGF injection. Heifers in the 17-d group were given a 25-mg PGF (Lutalyse[a], Pharmacia and Upjohn, Kalamazoo, MI 49001) i.m. injection at 17 d after the MGA feeding period, and heifers in the 19-d group received a PGF i.m. injection at 19 d (Figure 1). Heifers were placed in separate drylots at the time of the 17-d PGF injection. Both groups were observed for estrus three times per day for 5 d after their injection and artificially inseminated 12 to 16 h after first observed estrus with semen from one Angus sire within each year. Three technicians inseminated equal numbers of heifers in each treatment group.

Angus bulls were placed with the heifers 7 d after the AI period for a total 50-d breeding season. In 1997, the heifers were palpated per rectum at 60 and 120 d after the AI period to determine day of conception by fetal age, which was confirmed by calving date. In 1998, transrectal ultrasonography was used 60 d after the AI period to determine day of AI conception, and heifers were palpated per rectum to determine the total pregnancy rate.

Experiment 2 was conducted in 1998 on a cooperating ranch in northern Nebraska, and compared the same two treatments using 1409 Angus and Hereford x Angus, spring-born, yearling heifers. All heifers were managed in drylots and fed to gain approximately 0.9 kg/d to reach a prebreeding target BW of approximately 330 kg at 12 to 14 mo of age. Heifers were fed MGA (0.5 mg per head per day) for 14 d. They were then randomly divided into two groups and received a 25-mg PGF i.m. injection at either 17 or 19 d after the MGA feeding period. Heifers were observed for estrus three times per day for 5 d and artificially inseminated at 12 to 16 h after first observed estrus with semen from one

TABLE 3. Cumulative percentages of heifers in estrus when prostaglandin $F_{2\alpha}$ (PGF) injections were given at 17 or 19 d after melengestrol acetate (MGA) feeding period - Exp. 1[a].

	PGF treatment group		
Time after injection, h	17[b]	19[b]	Difference
	(%)		
48	7	14	+7
60	38	50	+12**
72	54	70	+16*
84	73	82	+9**
96	80	88	+8**
120	87	92	+5

[a]Accumulated percentage in estrus of total group.
[b]No heifers were in estrus before injection.
*$P<0.05$.
**$P<0.10$.

TABLE 4. Effects of day of estrous cycle at prostaglandin $F_{2\alpha}$ (PGF) injection on the AI conception rate of heifers — Exp. 1[a].

	PGF treatment group		
Item	17	19	Total conception[b]
Estrous cycle day	(no. of heifers)		(%)
17	–	2	100
16	–	25	72
15	2	28	60
Late CL[c] %	(2)[d]	(53)[e]	67[f]
14	23	21	59
13	23	15	66
12	21	7	57
Medium CL[c] %	(68)[d]	(42)[e]	61[f]
11	18	3	43
10	6	1	43
7-8-9	6	1	43
Early CL[c] %	(30)[d]	(5)[e]	43[g]

[a]Number of heifers in each day of their estrous cycle when PGF was given and AI conception rates for each day of cycle.
[b]Conception percentage for each day of cycle and means for each subgroup.
[c]Estrous cycle was separated into three subgroups (CL = corpus luteum) with percentage of heifers in each subgroup.
[d,e]Subgroup percentages in rows differ by treatments ($P < 0.01$).
[f,g]Subgroup percentages in total conception column with unlike superscripts differ ($P < 0.07$).

Angus sire. Several AI technicians were used randomly across treatments during each day. Heifers were also observed for estrus and inseminated on their second cycle for a total 30-d breeding season. Day of conception was determined by ultrasonography at 30 d after the end of the breeding season.

In both experiments, heifer estrus, conception, and pregnancy data were analyzed within year by Chi-Square analyses (14) to test for treatment differences. Percentage of heifers in estrus by stage of estrous cycle was also tested for treatment differences by Chi-Square analyses. Conception rate was determined by number of heifers pregnant divided by number of heifers inseminated. Pregnancy rate was determined by total number of heifers pregnant divided by total number of heifers in the treatment group.

Results and Discussion

In Exp. 1, no year differences were found, so the data were pooled. The reproductive results of heifers in Exp. 1 are shown in Table 1. Similar percentages of heifers were cycling in both treatment groups before and after MGA feeding. A greater percentage of heifers in the 19-d group exhibited estrus during the 5-d synchronization period compared with heifers in the 17-d group (92.4 *vs* 86.7%, respectively; $P<0.17$). First-service conception rate was slightly higher (5.1%) for the 19-d group of heifers, although this difference was not statistically significant. Lamb et al. (6) also reported higher (5.5%) first-service conception rates for the heifers in the 19-d group compared with the 17-d group. In the current study, percentages of heifers pregnant during the 5-d AI period and in the 50-d breeding season were higher (7.9 and 5.0%, respectively; $P<0.20$) for heifers in the 19-d group compared with the 17-d group. These percentages were not statistically significant; however, they were confirmed statistically by the results from Exp. 2 with a larger number of heifers (Table 2).

Percentage of heifers in estrus after PGF injections for Exp. 1 is shown in Table 3. A greater ($P<0.05$) percentage of heifers in the 19-d group were in estrus by 72 h after PGF than heifers in the 17-d group (70 *vs* 54%); also, 12, 9, and 8% more heifers were in estrus by 60, 84, and 96 h, respectively, after PGF ($P<0.10$) injection. No heifers in the 19-d group were detected in estrus before the PGF injection, although two heifers did have a standing estrus by 12 h after the injection, and both conceived by AI. These results indicate that heifers in the 19-d group exhibited estrus sooner after PGF injection, so estrous detection should begin at time of PGF injection. Heifers in estrus at time of injection or shortly after were fertile, and should be inseminated. Previous research (6) indicated that heifers receiving PGF at 19 d had shorter intervals to estrus, and a greater proportion were inseminated by 72 h after PGF injection compared with the 17-d treatment.

In general, heifers in the later stages of their estrous cycles had higher conception rates (Table 4). Day of cycle was grouped into late corpus luteum (CL) (d 15 to 17), medium CL (d 12 to 14), and early CL (d 7 to 11) subgroups. Fifty-three percent of the heifers in the 19-d group were in the late CL subgroup, compared with only 2% of the 17-d group ($P<0.01$). The late CL subgroup had the highest AI conception rate (67%), which may explain why the heifers in the 19-d group had higher conception and pregnancy rates. The early CL subgroup had 30% of the heifers in the 17-d group, and only 5% of the heifers in the 19-d group. This subgroup had the lowest ($P<0.07$) conception rate (43%). These data support the higher pregnancy rates for the heifers in the 19-d group. A high percentage (53%) of these heifers were in the late CL stage of the estrous cycle at the time of PGF injection, and may have had a spontaneous estrus during the early synchronization period.

Numerous studies (5, 15, 16, 17) have reported that cattle administered PGF before d 10 of the estrous cycle had lower estrous response than those given PGF later in the cycle. A Virginia study (1) showed that heifers given PGF after d 12 of the estrous cycle had higher (91%) estrous response rates than heifers given PGF between d 9 and 12 (77%). However, no results were reported on the effects of day of cycle on pregnancy rates.

The reproductive results of the heifers in Exp. 2 are reported in Table 2. During the 5-d synchronization period, 10% more heifers in the 19-d group exhibited estrus, with a 7.6% higher pregnancy rate for this group ($P<0.05$), compared with the 17-d group. Also, the pregnancy rate after 30 d of breeding was 5.5% higher ($P<0.05$) for the 19-d group. These results are similar to those of Exp. 1. Lamb et al. (6) also showed a slight increase in 5-d pregnancy rates for the 19-d PGF injection compared with the 17-d injection, but the data were not significantly different.

The heifers in Exp. 2 also responded to the PGF injections with a significantly higher percentage of the 19-d group in estrus by 84 h after PGF compared with the 17-d group (82% *vs* 67%, respectively; $P<0.05$). This indicates an earlier and tighter synchronization period, probably because more heifers were in the late luteal phase of the estrous cycle at PGF treatment. However, a few heifers (1.5%) were in estrus within 12 h after the PGF injection, so early heat detection is needed.

Implications

The results of these experiments indicate the following advantages for the 19- over the 17-d PGF injection procedure: 1) a higher percentage (6 to 10%) of heifers exhibited estrus during the 5-d synchronization period; 2) a higher percentage of heifers (16%) were in estrus by 72 h after PGF; 3) first-service conception rates were similar; 4) a greater percentage of heifers were pregnant in 5 d, and total pregnancy rates were higher (5 to 8%); and 5) considerably more heifers (50%) were in the late

CL stage of their estrous cycle at PGF and had high fertility.

The 19-d PGF injection will improve pregnancy rates of synchronized heifers, which may encourage more beef producers to initiate an estrous synchronization and AI program. Also, the 19-d procedure could be used in combination with the 17-d procedure, if necessary due to weather conditions, labor availability, or large groups of heifers, to allow more flexibility in the AI work schedule. Additional research is needed on the effects of day of the heifer's estrous cycle at time of PGF injection on first-service conception rates.

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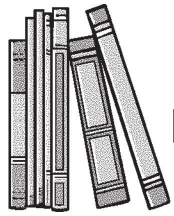

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