# PROGESTERONE CONCENTRATIONS, ESTROUS RESPONSE, AND FERTILITY IN BEEF HEIFERS AFTER ESTROUS SYNCHRONIZATION USING MELENGESTROL ACETATE® AND PROSTAGLANDIN $F_2\alpha$[1]

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## Summary

Melengestrol acetate (MGA®) and prostaglandin $F_2\alpha$ (PG; Lutalyse®) were used to synchronize estrus in 757 yearling, virgin, beef heifers on six commercial ranches. Heifers were inseminated artificially (AI) 12 h after first detected estrus; those not detected in estrus were time-inseminated 72 h post-PG injection. Heifers detected in estrus by 72 h had higher AI and overall pregnancy rates than their counterparts not detected in estrus. Heifers with serum progesterone > 1 ng/ml at PG administration were generally more fertile than those with progesterone < 1 ng/ml. Of the heifers not detected in estrus and with low progesterone ( < 1 ng/ml), 24% still conceived to the timed insemination at 72 h, but only 73% became pregnant during the entire breeding period. Overall AI conception rate, based on estrous detection and timed insemination, was 49% and varied from 24% to 69% among the six ranches. Heifers exhibiting estrus and with elevated ( > 1 ng/ml) serum progesterone showed acceptable pregnancy rates (63% AI and 94% overall).


(Key Words: Melengestrol Acetate, Prostaglandin, Beef Heifers, Fertility, Estrus, Progesterone.)

## Introduction

Estrous synchronization has been a popular and profitable tool for producers in recent years. Research at KSU has focused on combining melengestrol acetate (MGA) and prostaglandin $F_2\alpha$ (PG) to synchronize effectively estrus in virgin beef heifers. Successful synchronization reduces the length of the breeding period, shortens the calving season, and allows the effective use of AI. Along with reduced labor and older, heavier calves at weaning, selecting appropriate AI sires can minimize calving difficulty in virgin heifers and offer exceptional replacement females. However, substantial variation can occur in estrous response and fertility with MGA/PG synchronization. Our objective was to determine the relationships among estrous activity, serum concentrations of progesterone, and fertility in yearling beef heifers.

## Experimental Procedures

During the spring of 1991 at six Kansas ranches, estrus of 757 yearling beef heifers was synchronized using MGA and PG. MGA was fed at .5 mg per hd/d for 14 d in a feed supplement. Then MGA was removed and 17 d later, each heifer received an

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intramuscular injection of 25 mg PG. At the time of the PG injection, blood samples were taken for progesterone analysis. Beginning 12 h after PG, heifers were checked for behavioral estrus each morning and night and inseminated 12 h after estrus was observed. Any heifer not detected in estrus was time-inseminated at 72 h after PG. Heifers were exposed to bulls approximately 10 d following the timed insemination; bulls remained with heifers for 45 to 75 d. Heifers were palpated for pregnancy and fetal age 45 to 60 d after bulls were removed. Overall pregnancy rates to AI and natural mating were calculated and confirmed from calving data. Pregnancy data were available on 620 heifers.

## Results and Discussion

Table 1 demonstrates that more heifers bred after estrus conceived (60%) than heifers that did not show estrus and were time-inseminated 72 h after PG (32%). Pregnancy rate was 49% for all heifers bred AI (both estrus and time inseminated). Overall pregnancy rate (AI plus clean-up bulls) also favored heifers that exhibited estrus by 72 h (92%) compared to those that were time inseminated (80%).

Heifers conceiving to AI (estrus + time-insemination) had higher ($P < .001$) concentrations of serum progesterone at the time of PG injection than heifers not conceiving to AI (2.6 vs 2.0 ng/ml). Heifers pregnant at the end of the breeding period (AI + natural service) had higher ($P < .001$) serum progesterone at PG injection than nonpregnant heifers (2.4 vs 1.6 ng/ml).

Table 1 details also the effect of progesterone concentration at the time of PG injection on AI and overall pregnancy rate. More heifers conceived to AI (56 vs 33%) and were pregnant at the end of the breeding season (91 vs 77%) when they had serum progesterone > 1 ng/ml compared to heifers with serum progesterone < 1 ng/ml. Synchronization improved fertility less in heifers with serum progesterone > 2 ng/ml than in heifers with progesterone from 1 to 2 ng/ml.

Theoretically, all heifers fed MGA for 14 d and injected with PG 17 d later should have possessed a functional corpus luteum (CL). This is documented by high concentrations of serum progesterone, generally > 1 ng/ml. Heifers with serum progesterone < 1 ng/ml would be less likely to have a functional CL and less likely to respond to PG. However, 24% of the heifers that did not exhibit estrus still conceived to AI when serum progesterone was < 1 ng/ml at the time of the PG injection. Of those with progesterone less than 1 ng/ml at the time of PG injection that were detected in estrus, 46% conceived to AI mating.

Table 1 shows the relationship of combined estrus and progesterone status on fertility. First-service AI conception rate in heifers that exhibited estrus and had an elevated serum progesterone was acceptable at 64%. Overall pregnancy rate was lowest for heifers that did not exhibit estrus and also had low serum progesterone (73%). Heifers that both exhibited estrus and had high serum progesterone had an overall pregnancy rate of 94%. These results support the importance of using AI following both heat detection and timed insemination at 72 h. Without timed insemination, 76 heifers (25% of all heifers bred AI) would not have conceived to AI. Nearly 50% of all heifers conceived to AI, an acceptable level in most cattle operations.

Table 2 shows the wide variability in pregnancy rates that can occur among different locations. Conception rate to AI varied more than twofold among different ranches, whereas overall pregnancy rate ranged from 75 to 97%. These differences in fertility could be due to differences in heifer development, management, AI technicians, or fertility of clean-up bulls.

**Table 1. Fertility in Beef Heifers Synchronized with Melengestrol Acetate and Prostaglandin $F_2\alpha$**

| | Pregnancy rate[a] | | | |
|---|---|---|---|---|
| Item | AI, % | No. | AI + bull, % | No. |
| Time to estrus | | | | |
| In estrus by 48 h post-PG[b] | 56 | 70/125 | 89 | 111/125 |
| In estrus 48 to 72 h post-PG | 63 | 156/249 | 94 | 233/249 |
| Time inseminated (72 h) | 32 | 76/239 | 80 | 191/239 |
| Serum progesterone | | | | |
| $P_4$ > 1 ng/ml[c] | 55 | 253/456 | 91 | 416/456 |
| $P_4$ > 1 ng/ml | 33 | 54/164 | 77 | 126/164 |
| $P_4$ 1 to 2 ng/ml | 50 | 66/132 | 89 | 117/132 |
| $P_4$ > 2 ng/ml | 58 | 187/324 | 92 | 299/324 |
| Estrus and progesterone level | | | | |
| No estrus, < 1 ng/ml $P_4$[d] | 24 | 23/97 | 73 | 71/97 |
| Estrus, < 1 ng/ml $P_4$ | 46 | 31/67 | 82 | 55/67 |
| No estrus, > 1 ng/ml $P_4$ | 37 | 53/142 | 84 | 120/142 |
| Estrus, > 1 ng/ml $P_4$ | 64 | 195/307 | 94 | 289/307 |

[a]AI = artificial insemination.
[b]PG = prostaglandin $F_2\alpha$.
[c]$P_4$ = serum progesterone.
[d]No estrus = heifers not detected by 72 h after prostaglandin $F_2\alpha$; Estrus = heifers detected in estrus by 72 h.

**Table 2. Variability among Ranches in Estrus Response and Fertility of Beef Heifers Synchronized with Melengestrol Acetate and Prostaglandin $F_2\alpha$**

| Item | A[a] | B | C | D | E | F |
|---|---|---|---|---|---|---|
| Total number of heifers | 74 | 189 | 202 | 77 | 92 | 123 |
| Detected in estrus by 72 h after prostaglandin injection | | | | | | |
| % | 76 | 81 | 42 | 53 | 59 | 59 |
| No. | 53/70 | 151/187 | 85/201 | 41/77 | 54/91 | 73/123 |
| Conceived to AI when detected in estrus[b] | | | | | | |
| % | 74 | 73 | 32 | 70 | 54 | NA[c] |
| No. | 39/53 | 103/142 | 27/85 | 28/40 | 29/54 | NA |
| Conceived to AI of total (estrus and time inseminated) | | | | | | |
| % | 64 | 69 | 24 | 71 | 37 | NA |
| No. | 47/74 | 125/180 | 49/202 | 53/75 | 33/89 | NA |
| Overall pregnancy rate | | | | | | |
| % | 91 | 97 | 75 | 91 | 92 | NA |
| No. | 67/74 | 174/180 | 151/202 | 68/75 | 82/89 | NA |

[a]The six ranch locations are denoted by the letters A through F.
[b]AI = artificial insemination.
[c]NA = not available.