Beef Session III

Dr. Raymond A. Ivie, *Presiding*

MGA and $PGF_{2}\alpha$ for Estrus Synchronization

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Introduction

Our goal in studying estrous cycle control is to develop a low cost system that will elicit a highly fertile, tightly synchronized estrous response in a large percentage of the treated animals.

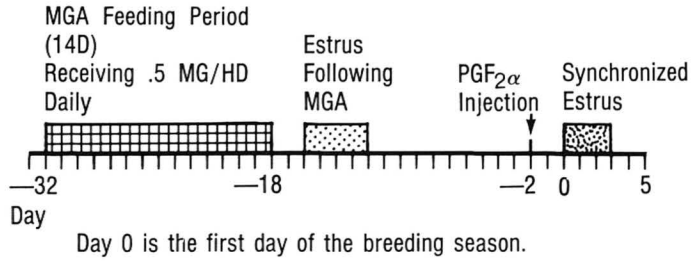
Melengestrol acetate (MGA), an inexpensive oral progestogen, is currently approved and used to suppress estrus and promote growth in feedlot heifers. Even though MGA effectively synchronizes estrus in cattle, the estrus following MGA treatment is subfertile while the fertility of subsequent estrus periods is normal (Zimbelman et al., 1966; DeBois et al., 1970). This decreased fertility has limited the use of MGA for estrous synchronization.

It is well known that prostaglandin $F_{2}\alpha$ ($PGF_{2}\alpha$) is only effective for estrous synchronization in cows between days 5 and 15 (the luteal phase) of their estrous cycle. Recent research has shown that stage of cycle within this luteal phase further affects both estrous response and the interval to estrus following $PGF_{2}\alpha$ injection, with early cycle animals (days 5-9) having a lower percentage response and showing heat sooner (a shorter interval to estrus) than late cycle animals (King et al., 1982). Another study shows that $PGF_{2}\alpha$ injected during the late stage of the cycle (days 10-15) may result in a more fertile estrus than if it were injected in the early stage of the cycle (Bearden and Fuquay, 1984). Thus, by manipulating a group of heifers to increase the percentage in the late stage of their estrous cycle when $PGF_{2}\alpha$ is injected, estrous response and degree of synchrony, as well as fertility would theoretically be improved.

Experiment 1

We conducted an experiment to test the efficacy of a system designed to increase this percentage of late cycle heifers at the time of $PGF_{2}\alpha$ injection. We use MGA to initially synchronize their estrous cycles to within a 4 to 6 day period, then allow them to reach the late stage of the resulting cycle before injecting $PGF_{2}\alpha$ for the final synchronized estrus at which we breed (Figure 1). We compared the MGA-$PGF_{2}\alpha$ treatment to the Syncro-Mate B (CEVA Laboratories Inc., Overland Park, KS) system for estrous response, conception rate, pregnancy rate and degree of synchrony.

FIGURE 1. The MGA-$PGF_{2}\alpha$ system for synchronizing estrus.



Day 0 is the first day of the breeding season.

We conducted five trials in 1984 and 1985, using 310 virgin heifers. These heifers represent a variety of purebred, crossbred and inbred beef cattle and were raised under a variety of management and environmental conditions.

Cycling status was determined by records of observed estrus and/or ovarian palpation approximately 35 days prior to the breeding season. Heifers were allotted equally to one of the two treatment groups by breed, cycling status, body condition and weight. In each trial, the two treatment groups were separated, but managed and fed identically. They were scheduled such that the synchronized breeding periods began simultaneously, except in trial 2 in which they began one day apart.

Group 1: Heifers received .5 mg MGA per head daily for 16 days (trial 1), 15 days (trial 2), or 14 days (trials 3-5). Heifers were observed and estrus was recorded following MGA removal but the heifers were not inseminated at this estrus. An injection of 25 mg $PGF_{2}\alpha$ was administered IM 17 days (trial 1) or 16 days (trials 2-5) after the final day of MGA feeding.

Group 2: Heifers received a 6 mg norgestomet implant plus an injection containing 5 mg estradiol valerate and 3 mg norgestomet 11 days before the breeding season. The implants were removed 9 days later (the Syncro-Mate B system).

Following either $PGF_{2\alpha}$ injection (Group 1) or implant removal (Group 2), heifers were observed at least four times daily for five days. They were bred by artificial insemination 12-18 hours after first being observed in estrus. In trial 5, five heifers were hand mated to a bull. They were left with the bull 12-18 hours beginning at onset of estrus.

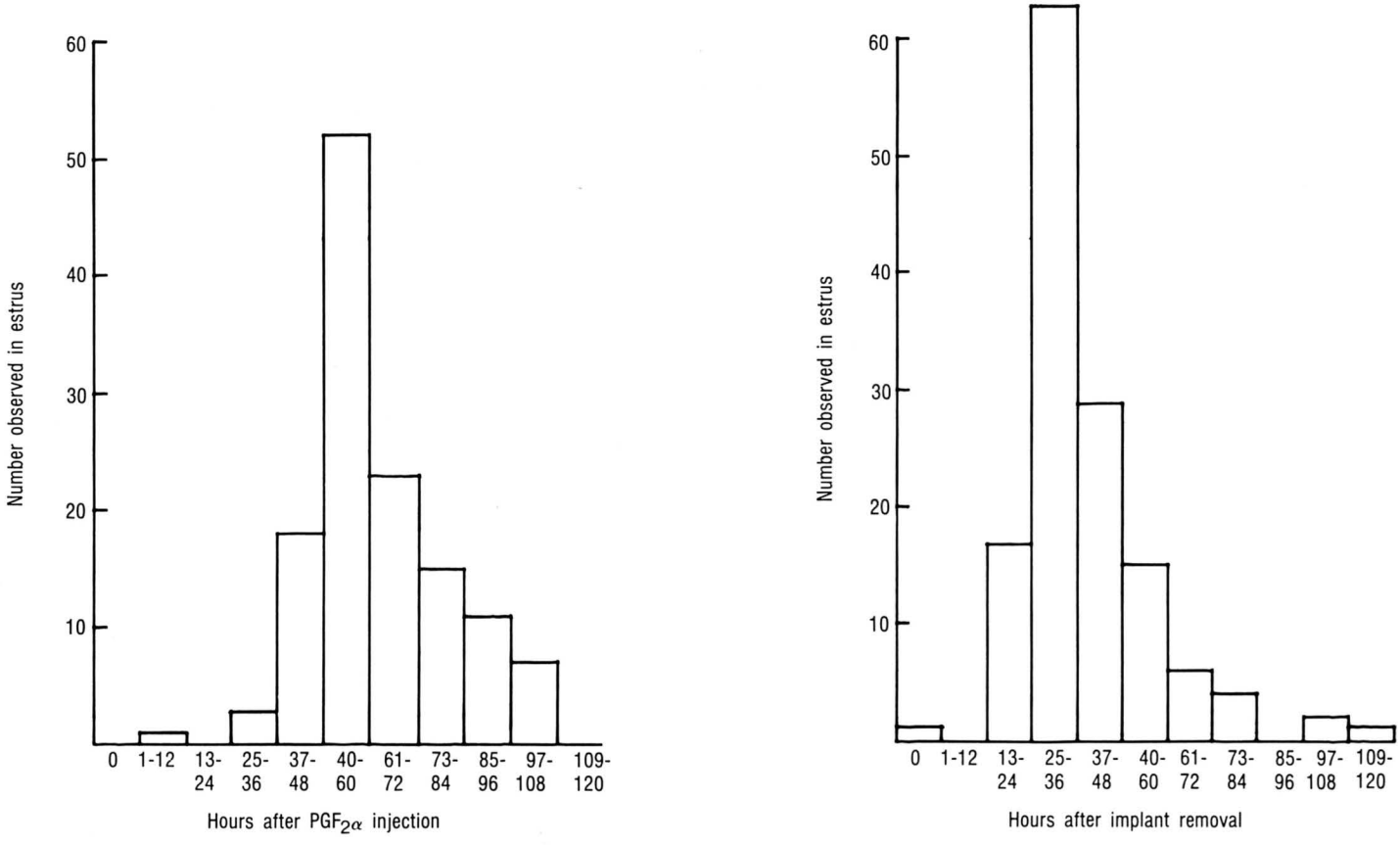
MGA was administered in a pelleted 32% protein supplement that was top dressed on silage (trials 1-4) or mixed in a ground concentrate ration consisting of oats, wheat and cottonseed meal (trial 5). All heifers were drylotted during treatment and consumption was monitored by the management.

Occurrence of estrus after MGA feeding was recorded for Group 1 heifers. Of those that responded, two heifers were in estrus eight days after the last MGA feeding. All others that responded were in estrus between two and six days after the last MGA feeding, and were therefore between days 10 and 15 (late stage) of their subsequent cycles when they received the $PGF_{2\alpha}$ injection. Distribution of estrus after this injection or after implant removal (Group 2) for all trials combined is shown in Figure 2. SMB elicited a higher peak response than MGA-$PGF_{2\alpha}$, as well as a shorter interval to estrus following treatment.

Estrous response (percentage of heifers showing estrus within 5 days after treatment), degree of synchrony (percentage of heifers showing estrus within the peak 24-hour period after treatment), synchronized conception rate (percentage conceiving of those inseminated), and synchronized pregnancy rate (percentage conceiving of those treated) for each of the two groups are shown in Table 1. Approximately 7% more heifers responded to Syncro-Mate B than to MGA-$PGF_{2\alpha}$ (90.2% vs 83.4%; $P<.1$). Of the heifers that responded, the same percentage for each treatment were in estrus within a 24 hour period, resulting in a similar degree of synchrony. Of the heifers inseminated, 28% more MGA-$PGF_{2\alpha}$ treated heifers conceived than did Syncro-Mate B treated heifers (68.7 vs 40.6; $P<.001$). This indicates the MGA-$PGF_{2\alpha}$ treated heifers had a more fertile synchroized estrus than those treated with Syncro-Mate B. Pregnancy rate was approximately 21% higher for MGA-$PGF_{2\alpha}$ than Syncro-Mate B treated heifers (57.3% vs 36.6%; $P<.001$).

Cycling status was determined approximately 35 days before the breeding season began by ovarian palpation and records of observed estrus. These data were also analyzed to compare the effect of each treatment by cycling status of the heifers. Estrous response, synchronized conception rate and synchronized pregnancy rate for noncycling heifers are shown in Table 2. Syncro-Mate B induced cycling in more noncycling heifers than MGA-$PGF_{2\alpha}$, resulting in a 14% increase ($P<.1$) in estrous response. However, the induced estrus appears to be subfertile, as indicated by the lower ($P<.025$) conception and pregnancy rate for Syncro-Mate B. Because cycling status was determined 35 days prior to breeding, it is likely that some of these heifers began cycling

FIGURE 2. Distribution of estrus following treatment with MGA-$PGF_{2\alpha}$ or Syncro-Mate B.



before the breeding season without treatment.

Estrous response, synchronized conception rate and synchronized pregnancy rate for cycling heifers are shown in Table 3. Heifers known to be cycling before synchronization had a similar estrous response to each treatment. There was, however, a 26% increase in conception rate and a 24% increase in pregnancy rate ($P<.001$) for the MGA-$PGF_{2\alpha}$ group over the Syncro-Mate B group, indicating that even the cycling heifers had a more fertile estrus when treated with MGA-$PGF_{2\alpha}$.

TABLE 1. Estrous response, degree of synchrony, conception and pregnancy rates in five trials comparing MGA-$PGF_{2\alpha}$ to Syncro-Mate B for Estrous Synchronization in beef heifers.

	Estrous[a] response	Degree of synchrony	Synchronized conception[b] rate	Synchronized pregnancy[b] rate
MGA-$PGF_{2\alpha}$	131/157=83.4	105/131=80.2	90/131=68.7	90/157=57.3
Syncro-Mate B	138/153=90.2	111/138=80.4	56/138=40.6	56/153=36.6

[a] $P<.1$.
[b] $P<.001$.

TABLE 2. Estrous response, conception and pregnancy rates of noncycling[a] heifers.

	Estrous[b] response	Synchronized conception[c] rate	Synchronized pregnancy[c] rate
MGA-$PGF_{2\alpha}$	44/62=71.0	25/44=56.8	25/62=40.3
Syncro-Mate B	52/61=85.2	16/52=30.8	16/61=26.2

[a] Cycling status was determined by ovarian palpation and/or observed estrus prior to the MGA feeding period.
[b] $P<.1$.
[c] $P<.025$.

TABLE 3. Estrous response, conception and pregnancy rates of cycling[a] heifers.

	Estrous response	Synchronized conception[b] rate	Synchronized pregnancy[b] rate
MGA-$PGF_{2\alpha}$	87/95=91.6	65/87=74.7	65/95=68.4
Syncro-Mate B	85/92=92.4	41/85=48.2	41/92=44.6

[a] Cycling status was determined by ovarian palpation and/or observed estrus prior to the MGA feeding period.
[b] $P<.001$.

In each trial, the two treatments elicited markedly different expression of behavioral estrus from the heifers. Syncro-Mate B treated heifers showed an intense, prolonged standing heat following a short period of hyperactivity. MGA-$PGF_{2\alpha}$ heifers were sexually hyperactive often for 36 hours or more, during which time they showed additional secondary heat signs (mucus discharge, chin resting, etc.) and eventually a much less intense and shorter period of standing heat. The greater intensity of estrus in Syncro-Mate B treated heifers made heat detection somewhat easier, but it did not indicate a more fertile estrus.

Experiment 2

Other research (Beal, 1985) suggested that a short-term (7-day) MGA treatment followed by a prostaglandin may have potential as an inexpensive means of synchronizing estrus in beef cattle. We decided to directly compare the system developed at CSU (14-day MGA with $PGF_{2\alpha}$ 17 days later) with the 7-day MGA system. Three trials were conducted in 1986 using 192 yearling beef heifers. Heifers were allotted by breed, cycling status and weight to one of three groups.

Group 1: Heifers received MGA for 14 days and $PGF_{2\alpha}$ 17 days later (same as Group 1, Exp. 1).

Group 2: Heifers received .5 mg of MGA per head daily for 7 days and 25 mg of $PGF_{2\alpha}$ im on the last day of MGA feeding.

Group 3: Untreated controls.

Following $PGF_{2\alpha}$ injection, heifers were observed for estrus twice daily for seven days and bred artificially 12 hours after detected in estrus.

Results of Exp. 2 are shown in Table 4. Heifers in the 14-day MGA group had a higher ($P<.05$) estrous response than the other two groups. Synchronized conception rate, synchronized pregnancy rate and 30-day pregnancy rate were also higher ($P<.05$) for the 14-day MGA group.

TABLE 4. Effects of 14-d and 7-d feeding of MGA in conjunction with $PGF_{2\alpha}$ on estrous synchronization and subsequent reproductive performance of beef heifers.

Treatment	N	7-d estrous response (%)	7-d conception rate (%)	7-d pregnancy rate (%)	30-d pregnancy rate (%)
14- MGA+$PGF_{2\alpha}$ on d 17 post MGA	64	49(77)[a]	32(65)[a]	32(50)[a]	50(78)[a]
7-d MGA+$PGF_{2\alpha}$ on d 7 MGA	64	36(56)[b]	15(42)[b]	15(23)[b]	41(64)[ab]
Untreated controls	64	11(17)[c]	5(45)[ab]	5 (8)[c]	35(55)[b]

[a,b,c] Percentages in same columns without a common superscript differ ($<P.05$).

The synchronized conception rate for the 14-day MGA group in this experiment was similar to this group in Exp. 1, however the estrous response was lower. The lower estrous response in this experiment was probably because there were more noncycling heifers at the beginning of treatment.

The estrous response and synchronized conception rate for the 7-day MGA group were lower than expected, however, these results appear to be similar to those found by the Upjohn Company when evaluating this treatment in several trials across the country.

The results of this study suggest that the 14-day MGA treatment followed by $PGF_{2\alpha}$ 17 days later is a more effective method of synchronizing estrus in yearling beef heifers than a 7-day MGA treatment with an injection of $PGF_{2\alpha}$ on the last day of MGA feeding.

Experiment 3

Although the system developed at CSU (14-day MGA followed by $PGF_{2\alpha}$ 17 days) had looked very good in yearling heifers, it had not been evaluated in suckled cows. We conducted two trials in the spring of 1987. We used 294 spring-calving cows from the CSU resident instruction herd and the Eastern Colorado Research Center near Akron, CO. Cows were allotted by days postpartum, breed, age and condition score to either 14 days of MGA at .5 mg per head per day with an injection of 25 mg of $PGF_{2\alpha}$ 17 days after the last day of MGA feeding or to an untreated control group. At the CSU resident instruction location, MGA was administered by top dressing silage with a high energy corn based pellet containing .4 mg MGA/lb. This supplement was fed at 1¼ lb per head daily. Control cows received the same supplement without MGA. At the Eastern Colorado Research Center, .5 mg of MGA was fed in 2 lb of cake to cows on grass. Control cows received the same supplement without MGA.

Cows averaged 47 days postpartum (range 5-82) at the start of MGA treatment (33 days before start of breeding season) at the CSU resident instruction location and 41 days postpartum (range 6-76) at the start of MGA treatment at the Eastern Colorado Research Center.

Results are shown in Table 5. Cows in the MGA group at the CSU resident instruction herd had a 64.1% estrous response, somewhat lower than what we have seen with heifers. The fertility of the cows showing estrus was excellent (86.0% synchronized conception rate) resulting in a synchronized pregnancy rate of 55.1%. At ECRC, estrous response (31.6%) was poor. The synchronized conception rate of those that came in estrus was good (64.0%). The poor estrous response was probably due primarily to the poor condition of the cows (average condition score 4). There was some difficulty in getting uniform consumption of the MGA cake and this may have also contributed to the poor estrous response.

These data suggest the CSU MGA-$PGF_{2\alpha}$ synchronization may be effective in lactating cows; however, success may be limited by cows in poor condition or inability to get uniform consumption of MGA.

MGA-$PGF_{2\alpha}$ combinations are not currently approved by FDA for estrous synchronization in beef cattle, however, the Upjohn Co. is seeking approval.

TABLE 5. Effect of 14-day MGA feeding followed by $PGF_{2\alpha}$ 17 days later for estrous synchronization in suckled beef cows.

Location	TRT	Condition score[a] (%)	Estrous response[b] (%)	Synchronized conception rate[c] (%)	Synchronized pregnancy rate[d] (%)	25-d pregnancy rate[e] (%)
CSU-RI	MGA-PGF2α	5.81	50/78=64.1*	53/50=86.0	43/78=55.1*	66/78=84.6
	Control	5.75	2/36=5.5	0/2=0.0	0/36=0.0	25/36=69.4
ECRC	MGA-PGF2α	3.98	38/120=31.6*	25/38=65.7	25/118=21.2	82/121=67.7
	Control	4.00	7/60=11.6	5/7=71.4	5/60=8.3	43/60=71.6

[a] Conditions score (1-very thin; 5-average; 9-very fat).
[b] Number in estrus in 120 h (synchronized period) after treatment divided by number in group.
[c] Number pregnant in synchronized period divided by number bred
[d] Number pregnant in synchronized period divided by number in group.
[e] Number pregnant during first 25 days of breeding season divided by number in group.
* $P<.05$.

References

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Questions & Answers:

Question: What advise can you give us if you try to use this program on 200 cows where heat detection is a bit of a hassle?

Answer: If you cannot heat detect, I would not recommend this system. I would be more comfortable with Synchromate B, especially in cows, if I were time breeding. With cows, compared to heifers, we have a wider spread in when they come in heat, compared to heifers.

Question: What is the optimum herd size for using this program in cows?

Answer: We have used it in programs even with heat detection. With Kamar pads placed on all the cows at the time we give the prostaglandin we run all the cows through on the second day. Any with activated Kamas or lost pads we inseminate. Again on the third day and maybe the fourth day. This gets away from pulling out all the "heats". You still have to run all the cows through and inseminate them. I am not totally comfortable with this program with cows as far as running them all through and breeding them all at one time.

Question: In the lactating cows where you put the drug in cubes and feed on pasture, you stated there was a consumption problem. The drug cost is not prohibitive but can you over feed the drug?

Answer: If we go to a higher dose, we may influence when they come in heat after MGA treatment and we may delay this perhaps. Maybe we should give the injection of prostaglandin later, based on our design. I don't know if it would work.

Question: The consumption problem is not related to palatability, is it?'

Answer: We have some people who are feeding cattle on grass in early April, before the green grass comes up. In our situation, we had a fair amount of green grass and we had some cows that were not hungry when we put the cubes out.

Question: Have you done any calf removal?

Answer: No, If we did, I would remove them about a day after we stopped feeding MGA. If we are going to have some effect on initiating cycling, I would try to get more cows in heat at that time, hopefully have a normal length luteal phase and regress the C. L. with prostaglandin during the late luteal phase of that particular cycle and have a fairly fertile estrus after that. One of the reasons I have tried to stay away from calf removal in this program is that it is not very labor intensive. If we add calf removal to it we add a lot of labor and time, but it is something that we need to look into experimentally to see if there is enough value there to justify it.
