SYNCHRONIZATION OF ESTRUS IN YEARLING BEEF HEIFERS WITH THE MGA®/PROSTAGLANDIN SYSTEM: I. EFFECT ON INDUCEMENT OF PUBERTY AND CONCEPTION RATES[1,2]

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Summary

We evaluated the estrous response and fertility of yearling beef heifers after treatment with melengestrol acetate (MGA) and prostaglandin $F_2\alpha$ (PG). The 304 heifers, at three locations, were allotted to two treatments: nonsynchronized controls and those receiving .5 mg MGA per head daily for 14 days followed by a 25 mg PG injection 17 days after the end of MGA feeding (MGA/PG). Heifers in the control and MGA/PG groups were artificially inseminated 12 hours after observed estrus for 21 days or 6 days after PG, respectively. Conception rate at first service and overall pregnancy rate did not differ ($P > .10$) between MGA/PG and control heifers (64% vs. 50% and 49% vs. 38%, respectively). However, the MGA/PG system effectively induced puberty and synchronized estrus, allowing more ($P < .009$) heifers to become pregnant early in the breeding season (49%) compared with nonsynchronized controls that were inseminated on spontaneous estrus (14%).

(Key Words: Beef, Heifer, Puberty, MGA, Estrous Synchronization.)

Introduction

Numerous researchers have evaluated melengestrol acetate (MGA) as a tool to synchronize estrus in beef cattle. Early studies showed a decrease in fertility at first estrus after feeding MGA for 14 to 20 days. Subsequent studies shortened the MGA feeding period and combined PG administration after MGA feeding. Workers in Colorado successfully synchronized estrus by feeding MGA for 14 days and administering PG 16 to 17 days after MGA withdrawal, with no apparent reduction in fertility.

The objectives of this study were to: 1) determine the ability of the MGA/PG estrous

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synchronization system to induce puberty in prepuberal heifers and 2) compare the reproductive performance of yearling beef heifers exposed to the MGA/PG system and inseminated on synchronized estrus to that of untreated heifers inseminated on spontaneous estrus.

Experimental Procedures

This experiment was conducted at three locations in two states with crossbred, yearling, virgin, beef heifers. The numbers of heifers used at each location were as follows: 168 head at Hays, KS; 79 head at Manhattan, KS; and 57 head at Spickard, MO.

Treatments. Heifers at each location were blocked by age and weight and assigned randomly to one of two treatments: 153 nonsynchronized control heifers and 151 heifers that received .5 mg MGA per head daily for 14 days followed by a single injection of 25 mg PG (Lutalyse®) administered 17 days after the last day of MGA feeding (MGA/PG). After PG injection, heifers were observed twice daily for signs of behavioral estrus for the next 21 days. Control and MGA/PG heifers were exposed to AI for 21 days and 6 days, respectively. Heifers were inseminated approximately 12 hours after observed estrual behavior. No more than two technicians or two AI sires were used at each location.

Supplements. A similar supplement, with or without MGA, was fed to both treatment groups at each location. Heifers were managed as a single group at each location throughout the trial, except during the 14-day MGA feeding period.

Blood Sampling. Blood samples were collected from all heifers on 4 dates: 1) 10 days before MGA feeding, 2) on the day MGA feeding started, 3) 10 days before PG injection, and 4) on the day of PG injection. Serum progesterone concentrations greater than 1 ng/ml or sampling dates 1 or 2 and 3 or 4 were used to determine whether heifers were puberal at the beginning of the experiment or at the beginning of the breeding season, respectively. Heifers that attained puberty during the period from the start of MGA feeding until PG injection were indentified by an increase in serum progesterone to at least 1 ng/ml on sampling dates 3 or 4.

Results and Discussion

Attainment of Puberty. A greater proportion ($P < .02$) of MGA/PG heifers that were prepuberal before MGA attained puberty during the MGA feeding period and before PG injection compared to control heifers during the same period (Table 1). This suggests that MGA induced puberty in a number of nonpuberal heifers. The fertility of those attaining puberty is shown in Table 2.

Estrous Response. The proportion of MGA/PG heifers that displayed estrus within 6 days after PG injection was greater ($P < .001$) than the proportion of controls that showed estrus during the same period (Table 3). The response during 6 days also was influenced ($P = .03$) by location. The percentages of heifers that displayed estrous within 6 days at each location were 53.6, 44.1, and 54.7% for Hays, Manhattan, and Spickard, respectively.

The proportions of heifers classified as puberal (based on progesterone concentration) that failed to exhibit estrus after 6 days for MGA/PG or after 21 days for control were 17.1 and 15.3%, respectively. This lack of estrous response may have resulted from poor heat detection, ovulation unaccompanied by estrus, or failure of the progesterone analyses to classify puberal status correctly. This study could not explain the high proportion of heifers not displaying estrual behavior.

Fertility Response. Estrous synchronization of heifers with the MGA/PG system did not affect ($P > .30$) first service conception rate at 6, 14, or 21 days following treatment compared to control heifers (Table 3). Pregnancy rate of MGA/PG heifers inseminated within 6 days after PG was greater ($P = .02$) than that of controls during the same period, but location effect also was significant ($P < .01$).

There was a numerical, but nonsignificant (P = .31), increase in first service conception rate of MGA/PG heifers compared to controls (Table 3). This same trend has been reported by other researchers.

Table 1. Effect of Feeding MGA for 14 Days on Attainment of Puberty in Yearling Beef Heifers

	Control[a]		MGA/PG		
Puberty status	No.	%[b]	No.	%[b]	P[c]
Cycling before MGA feeding	92/153	63.8	92/147	70.2	.74
Cycling before PG injection	111/153	74.9	123/147	86.2	.25
Attained puberty during or after MGA feeding	25/61	44.9	40/55	72.0	.02

[a]Control = heifers received no treatment, MGA/PG heifers received .5 mg MGA per head for 14 days.
[b]Least squares means.
[c]Statistical probability of a treatment effect.

Table 2. Reproductive Response of Heifers Attaining Puberty during Exposure to MGA for 14 Days

	Control[a]		MGA/PG[a]		
Response	No.	%[b]	No.	%[b]	P[c]
Displayed estrus	18/25	79.1	33/40	71.4	.60
First service conception rate	9/18	58.3	22/33	77.0	.50
Pregnancy rate	9/25	50.7	22/40	54.3	.90

[a]Control = heifers received no treatment and were exposed to AI for 21 days; MGA/PG heifers received .5 mg MGA per head for 14 days and PG 17 days after MGA and were exposed to AI for 6 days.
[b]Least squares means.
[c]Probability of a treatment effect.

Table 3. Effect of MGA/PG System on Synchronization of Behavioral Estrus and Fertility Rates in Yearling Beef Heifers

	KSU Manhattan location				All locations				
	Control[a]		MGA/PG[a]		Control		MGA/PG		
Item	No.	%	No.	%	No.	%[b]	No.	%[b]	P[c]
Observation period:			Behavioral estrus						
0 to 6 days after PG[d]	7/41	17.1	27/38	71.1	39/153	24.7	114/147	76.8	.001
0 to 21 days after PG	37/41	90.2	27/38	71.7	108/153	75.7	114/147	76.8	.92
Insemination period:			First service conception rate						
0 to 6 days after PG	4/7	57.1	22/27	81.5	22/39	58.5	76/114	64.2	.69
0 to 21 days after PG	20/37	54.1	22/27	81.5	56/108	50.0	76/114	64.2	.31
			Pregnancy rate						
0 to 6 days after PG	4/41	9.7	22/38	57.9	22/153	14.0	76/147	48.7	.009
0 to 21 days after PG	20/41	48.7	22/38	57.9	56/153	37.7	76/147	48.7	.29

[a]Control heifers received no treatment and were exposed to AI for 21 days; MGA/PG heifers received .5 mg MGA per head for 14 days and PG 17 days after MGA and were exposed to AI for 6 days.
[b]Least squares means.
[c]Statistical probability of a treatment effect.