South Dakota State University
Open PRAIRIE: Open Public Research Access Institutional Repository and Information Exchange

South Dakota Beef Report, 1996 | Animal Science Reports

1996

Effects of MGA on Prepubertal Beef Heifers

L. M. Butler
South Dakota State University

H. L. Miller
South Dakota State University

D. D. Zalesky
South Dakota State University

D. M. Marshall
South Dakota State University

K. VanderWal
South Dakota State University

See next page for additional authors

Authors
L. M. Butler, H. L. Miller, D. D. Zalesky, D. M. Marshall, K. VanderWal, and C. Moret

Effects of MGA on Prepubertal Beef Heifers

L.M. Butler,[1] H.L. Miller,[2] D.D. Zalesky,[3] D.M. Marshall,[4] K.VanderWal,[5] and C. Moret[5]
Department of Animal and Range Sciences

SDSU

CATTLE 96-6

Summary

A 2-year study (1995 and 1996) utilized prepubertal beef heifers to study the effects of feeding MGA to induce puberty. Heifers were allotted to two groups, control or treatment, based on breed, age and weight. Treatment heifers received MGA for 14 days at a rate of .4 mg/day with their diet, while control heifers received the same diet free of MGA. In year 1 (n=55; control=28, treatment=27), heifers averaged 627.7 lb and were 301.9 days of age at the start of the treatment. There was no difference in age at puberty (P=.65) with control heifers 378.5±8.3 days of age and treatment heifers 373.0±8.5 days of age. Forty-seven of 55 heifers became pregnant during the breeding season (85.5%). Of the 47 heifers, 37 heifers gave birth to a live calf (78.7%). In year 2 (control=20, treatment=21), heifers averaged 609.0 lb and were 300.4 days of age at the start of the treatment. Control heifers were 373.6±7.3 days of age and treatment heifers 382.4±7.3 days of age at puberty (P=.40). Thirty-eight of 41 heifers became pregnant during the breeding season (92.7%). Thirty-five of 41 heifers were bred AI (85.4%). Thirteen of 16 control heifers and 12 of 19 treatment heifers became pregnant to AI (P>.50). The use of MGA to induce puberty has potential, but further research is needed to determine the age at which it should be administered.

Key Words: MGA, Puberty, Heifers

Materials and Methods

A 2-year study was conducted using prepubertal crossbred (Angus, Hereford, Simmental, and Tarentaise) beef heifers maintained at the Beef Breeding Unit (BBU) at South Dakota State University (SDSU), Brookings. Prepubertal heifers were fed a diet with or without MGA for 14 days to determine if MGA alone can induce puberty.

Animals and Care

Year 1. Crossbred heifers (n=55) were weaned October 18, 1994. Fifty-two heifers were transported from the Antelope Research Station at Buffalo, SD, to the BBU in late October 1994. Three additional heifers raised at the BBU were also in the study. Heifers were on a dirt lot, received a cracked corn, alfalfa pellet ration, and had access to free choice grass hay. The final level at which the ration was fed was 6.6 lb/head/day. Heifers were subsequently weighed December 22, 1994, March 23, 1995, May 15, 1995, and August 17, 1995. Condition scores were taken at the start and end of the breeding season.

Animals were randomly allotted to one of two groups, control or treatment, based on their breed composition, age, and weight nearest the start of MGA feeding (Table 1). Treatment animals received .4 mg of MGA/head/day for 14 days. Control animals received the same diet as treatment animals only without MGA.

---

[1]Graduate Assistant.
[2]Associate Professor.
[3]Assistant Professor.
[4]Professor.
[5]Agricultural Foreman.

Table 1. Age and initial weight at the onset of treatments in 1995 and 1996

		Treatment group		
Category	Year	Control	Treatment	P value
No. of observations	1995	28	27	
Age (days)[a]		301.9 ± 1.8	301.8 ± 1.9	.97
Weight (lb)[a]		621.9 ± 13.4	633.6 ± 13.2	.54
No. of observations	1996	20	21	
Age (days)[a]		300.3 ± 2.0	300.4 ± 2.0	.96
Weight (lb)[a]		608.1 ± 14.5	609.6 ± 14.3	.94

[a]Least squares means ± standard errors.

Blood collection occurred weekly for subsequent sera removal and progesterone determination. Collection of blood started 3 weeks before the initial MGA feeding. Blood was not collected from animals receiving MGA during the 14 days on the assumption endogenous progesterone levels would be low. As heifers were determined to be cyclic, bleedings were discontinued. A level of 1 ng/ml progesterone was considered indicative of an active corpus luteum. If a pattern of two high progeseterone levels and one low progesterone level occurred, cyclic activity was determined to be occurring. Three bleedings after the AI period were taken to determine pregnancy rates to AI.

Blood samples were collected via jugular venipuncture into vaccutainer tubes. Samples were allowed to clot for approximately 12 hours at 4°C and were centrifuged for 20 minutes at 4°C. Sera was poured into polypropylene tubes and immediately analyzed for progesterone or frozen at -20°C and analyzed at a later date.

The breeding season started May 9, 1995. Heifers were detected for estrus by visual observation for half an hour twice a day. Heifers detected in heat in the morning were bred AI the same evening. Heifers in heat in the evening were bred AI the next morning. Heifers that were not bred were given Lutalyse (UpJohn Company, Kalamazoo, MI) on day 7. Heifers were detected for estrus and bred as discussed before. A clean-up bull was placed with the heifers on pasture on day 10 of the breeding season. The bull was removed 63 days after the start of the AI period.

Heifers were ultrasounded for pregnancy 37 days after the end of the breeding season. The Aloka 500V (Corometrics Medical Systems, Inc., Wallingford, CT) with a 5.0 MHZ probe was used transrectal to determine pregnancy. Pregnancy was later confirmed by rectal palpation at approximately 90 days after the end of the breeding season and by actual calving data.

Year 2. Crossbred heifers (n=41) were weaned October 17, 1995. Animals were transported to the BBU in late October 1995 and placed on dry grass pasture. Diet consisted of a cracked corn and SBM pellet concentrate fed at a rate of 7.5 lb/head/day with access to free choice grass hay. Subsequent weights were taken December 7, 1995, January 2, 1996, February 8, 1996, March 27, 1996, May 13, 1996, and August 22, 1996.

Heifers were allotted to a control or treatment group based on the same criteria as in year 1. Feeding of MGA and blood collection and progesterone analysis were conducted as discussed in year 1.

Thirty-one days before the breeding season a synchronization program utilizing MGA and Lutalyse was initiated. Heifers were fed MGA for 14 days at .4 mg/head/day. After MGA feeding, heifers were bled weekly for 2 weeks. Seventeen days after the last feeding of MGA, Lutalyse was administered. Heifers were detected for estrus by visual observation for half an hour twice a day. Heifers that were detected in estrus were bred the next morning. Heifers were bred AI for 3 days beginning May 15, 1996. On day 4, a clean-up bull was placed with the heifers for the remaining 61 days of breeding season on grass pasture. Pregnancy determination utilized ultrasound 38 days after the end of the breeding season as in year 1.

Statistical Analysis

Statistical analysis was conducted using Procedure General Linear Model (Proc GLM) of SAS with the Least Squares Means (LSMeans) function. Treatment, breed, year, and age group were entered as independent variables into the model. Age, weights, condition scores, and age at puberty were entered into the model as dependent variables. Treatment interactions with breed, year, and age group were analyzed.

Treatment, week, and period within week were entered as independent variables with progesterone as the dependent variable. Interactions of week and period within week with treatment were also analyzed.

Reproductive data—pregnancy rates to AI and the breeding season and calving rates to AI and the breeding season—were analyzed by Chi-square analysis with one degree of freedom.

Results and Discussion

Year 1. Heifers averaged 627.7 lb and were 301.9 days of age at the start of MGA feeding (Table 1). Average daily gains prebreeding and breeding weights were similar (Table 2). Heifers averaged 715.0 lb and gained approximately .62 lb/day. Condition scores of these heifers averaged 3.4 on a 1 to 9 scale (Table 2).

Heifers improved their average daily gain from .62 lb/day prebreeding to 1.6 lb/day during the breeding season. Condition scores improved from 3.4 prebreeding to 4.7 during the breeding season (Table 3).

Control heifers were 378.5 ± 8.3 days of age and treatment heifers were 373. ± 8.5 days of age at puberty (P = .65; Table 4). One heifer in each treatment did not reach puberty by the end of the breeding season and were not included in the calculation of puberty. Conception ages were similar for treatments (P = .74; Table 4). Control heifers were 429.7 ± 3.5 days of age and treatment heifers were 428.0 ± 3.5 days of age at conception.

Conception rate, determined by ultrasound and rectal palpation, was not different for the breeding season (P > .975; Table 5). Twenty-four of 28 control heifers and 23 of 27 treatment heifers conceived for a 85.5% conception rate for the breeding season. Pregnancy rates for AI were not different (P > .975; Table 5). Nine of 13 control heifers and 11 of 16 treatment heifers became pregnant by AI.

Of the 47 pregnant heifers, 37 gave birth to live calves (Table 5). Losses included two open heifers (one from each treatment), six dead calves on arrival or died shortly after birth (three from each treatment) and two abortions (one from each treatment). Of the two open heifers, both were approximately 160 days pregnant at rectal palpation.

Heifers were housed on a dirt lot. Conditions during late winter and early spring were very wet and animals carried large amounts of mud throughout the spring. These conditions contributed to the number of incidences of foot rot. This may explain the low gains and the body condition scores at the start of the breeding season. Once on grass after the AI period, heifers had compensatory gains.

Year 2. At the start of the treatment, heifers were of similar weights and age. Heifers averaged 609.0 lb and were 300.4 days of age (Table 1). Heifers gained approximately 1.67 lb/day from the start of the treatment to the breeding season (Table 2). Once on pasture, heifers gained approximately 1.08 lb/day (Table 3).

Control heifers averaged 373.6 ± 3.1 days of age and treatment heifers averaged 382.4 ± 7.3 days of age at puberty (P = .40; Table 4). One heifer did not reach puberty by the end of the breeding season and was not included in the calculation of puberty. Control heifers averaged 433.7 ± 3.1 days of age and

Table 2. Condition scores, breeding weights, and average daily gain from treatment initiation to the beginning of the breeding season for 1995 and 1996 heifers

		Treatment group		
Category	Year	Control	Treatment	P value
No. of observations	1995	28	27	
Body condition score[a]		3.4 ± .1	3.4 ± .1	.88
Weight (lb)[a]		709.1 ± 15.0	721.4 ± 15.4	.57
ADG (lb/day)[a]		.62 ± .04	.62 ± .04	.94
No. of observations	1996	20	21	
Weight (lb)[a]		834.5 ± 19.6	827.4 ± 19.1	.80
ADG (lb/day)[a]		1.69 ± .07	.74 ± .07	.51

[a]Least squares means ± standard errors.

Table 3. Condition scores, end weights, and average daily gain during the breeding season for 1995 and 1996 heifers

		Treatment group		
Category	Year	Control	Treatment	P value
No. of observations	1995	28	27	
Body condition score[a]		4.7 ± .1	4.6 ± .1	.52
Weight (lb)[a]		860.4 ± 17.2	876.0 ± 17.4	.52
ADG (lb/day)[a]		1.61 ± .04	1.65 ± .07	.65
No. of observations	1996	20	21	
Weight (lb)[a]		939.8 ± 20.2	941.6 ± 19.8	.95
ADG (lb/day)[a]		1.03 ± .07	1.12 ± .07	.31

[a]Least squares means ± standard errors.

Table 4. Age at puberty and conception age for 1995 and 1996 heifers

		Treatment group		
Category	Year	Control	Treatment	P value
No. of observations	1995	27	26	
Puberty (days)[a]		378.5 ± 8.3	373.0 ± 8.5	.65
No. of observations		24	23	
Conception age (days)[a]		429.7 ± 3.5	428.0 ± 3.5	.74
No. of observations	1996	20	20	
Puberty (days)[a]		373.6 ± 7.3	382.4 ± 7.3	.40
No. of observations		19	19	
Conception age (days)[a]		433.7 ± 3.1	434.9 ± 3.1	.79

[a]Least squares means ± standard errors.

treatment heifers averaged 434.9±3.1 days of age at conception (P=.79; Table 4).

Overall conception rate was 92.7% (Table 6). Nineteen of 20 control heifers and 19 of 21 treatment heifers became pregnant to the breeding season (P>.75; Table 6). Conception rate to AI was 25 of 35 heifers (71.4%; Table 6). Thirteen of 16 control heifers and 12 of 19 treatment heifers became pregnant to the AI service (P>.50; Table 6).

The responses may be due in part to the severe sub-zero temperatures during the time when heifers were fed MGA and thereafter. All heifers but three responded favorable to the synchronization MGA.

The potential of MGA to induce puberty is still unknown. Environmental conditions, physiological maturity, and sufficient age and weight of the heifers may be key to inducing puberty. With sufficient age (less than a year) and weight, MGA should be able to induce puberty in prepubertal beef heifers.

Table 5. Pregnancy rate to AI, pregnancy rate during the breeding season and number of calves born alive for the 1995 BBU heifers

Category	Control	Treatment	P value	Total
No. pregnant to AI[a]	9/13 (69.2)[b]	11/16 (68.8)[b]	>.975	20/29 (69.0)[b]
No. pregnant to season[a]	24/28 (85.7)[b]	23/27 (85.2)[b]	>.975	47/55 (85.5)[b]
No. calves born alive[a]	18/24 (75.0)[b]	19/23 (82.6)[b]	>.75	37/47 (78.7)[b]
No. calves born to AI alive[a]	5/9 (55.6)[b]	9/11 (81.8)[b]	>.10	14/20 (70.0)[b]

[a]Chi-square analysis.
[b]( ) Percentage.

Table 6. Pregnancy rate to AI and pregnancy rate to the breeding season for the 1996 BBU heifers

Category	Control	Treatment	P value	Total
No. pregnant to AI[a]	13/16 (81.3)[b]	12/19 (63.2)[b]	>.50	25/35 (71.4)[b]
No. pregnant to season[a]	19/20 (95.0)[b]	19/21 (90.5)[b]	>.75	38/41 (92.7)[b]

[a]Chi-square analysis.
[b]( ) Percentage.