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Abstract
The effect of MGA in mixed pens of steers and heifers was evaluated over a three-year period at the ISU Armstrong Research Farm near Lewis, Iowa. Two pens of approximately 40 head were fed diets with or without MGA in each of three replications. Estrus and riding activity was monitored using the Heat Watch® system. At slaughter, in addition to routine carcass data collection, a rib sample was collected from each carcass for tenderness evaluation. There was no effect on dry matter intake due to MGA treatment. Mixed-sex pens that were fed MGA were 4% more efficient than controls. MGA-fed steers gained similarly to control steers. MGA fed heifers gained 8% faster than control heifers. MGA highly reduced measures of estrus and riding activity throughout the feeding period. MGA feeding improved marbling and tenderness measured in both steers and heifers. These data suggest that MGA has potential to improve performance, quality grade, and tenderness in mixed pens of steers and heifers.

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Summary

The effect of MGA in mixed pens of steers and heifers was evaluated over a three-year period at the ISU Armstrong Research Farm near Lewis, Iowa. Two pens of approximately 40 head were fed diets with or without MGA in each of three replications. Estrus and riding activity was monitored using the Heat Watch® system. At slaughter, in addition to routine carcass data collection, a rib sample was collected from each carcass for tenderness evaluation. There was no effect on dry matter intake due to MGA treatment. Mixed-sex pens that were fed MGA were 4% more efficient than controls. MGA-fed steers gained similarly to control steers. MGA fed heifers gained 8% faster than control heifers. MGA highly reduced measures of estrus and riding activity throughout the feeding period. MGA feeding improved marbling and tenderness measured in both steers and heifers. These data suggest that MGA has potential to improve performance, quality grade, and tenderness in mixed pens of steers and heifers.

Introduction

In recent years the Tri-County Steer Futurity (TCSF), a popular steer testing program in Southwest Iowa, has been evaluating feedlot performance and carcass merit of heifers and steers from local producers. From this experience, it has been found that the optimum days on feed and age at slaughter are quite similar for steers and heifers from the same calf crop. This observation, coupled with the small herd size has made mixed pen feeding of steers and heifers an option that many producers are considering.

MGA is a feed additive routinely fed to feedlot heifers to suppress estrus and promote weight gain. Currently MGA is not approved for steers. The effectiveness and economics of MGA in mixed pens has not been previously evaluated.

Materials and Methods

Four hundred eighty steers and heifers were fed in mixed pens, with and without MGA. The facility contains four pens designed to accommodate 40 head each. Two pens were fed MGA and two pens served as controls in each of three replications conducted over a three-year period. Within each pen 35-36% of the cattle were heifers and 64-65% were steers. Four head were removed from the experiment over the three-year period. In year one, two cattle died of respiratory disease. In year two one male was removed as a bull. These cattle were removed during the first 28 days on feed. In year three a cycling control heifer had a broken leg on day 49. The ration used in this study averaged 16.5% crude protein, .56% Ca, .37% P, .68% K and NEg of .62 Mcal/lb on a dry matter basis. All steers were implanted with Magnum and all heifers were implanted with Ralgro. All cattle were reimplanted at 84 days on feed. For each replication cattle were marketed in two groups. The first group was marketed when 50% of the pen exceeded .4 in. external fat as measured by real-time ultrasound. The remaining cattle were marketed after an additional 35 days on feed.

Estrus and riding activity were measured using the Heat Watch® system in replications 2 and 3. Transmitters were attached to the rump of both steers and heifers in replication 2 and only heifers in replication 3. Data collected included number of mounts, number of mounts during the period between 6 p.m. and 6 a.m., estrus cycles (heifers) and the number of days the transmitters were functional for each animal.

All steers were withdrawn from MGA seven days prior to slaughter. Carcass data collected on all cattle at harvest included hot carcass weight, fat thickness, ribeye area, percent kidney heart and pelvic fat, marbling score to the nearest 10^{th}, and USDA Grader Quality and Yield Grade. Yield grade was then calculated to the nearest 10^{th} of a grade using measured carcass parameters. Estimates of carcass trim loss were also recorded. The twelfth rib was obtained from each carcass and brought to the Iowa State University Meats Laboratory to measure tenderness. Individual performance, carcass and behavioral data were analyzed using the GLM procedure of SAS.

Results

Performance and efficiency response to MGA by pen is shown in Table 1. There were no effects on dry matter intake due to MGA treatment. Although there were apparent numerical responses in daily gain and feed efficiency within periods, these means were not significantly different. Overall feed efficiency was significantly improved 4% (7.04 vs. 7.33 lb dry matter/lb gain) by MGA feeding in mixed-sex pens.

Individual analysis of daily gain by sex is shown in Table 2. All performance factors measured were highly affected by cattle sex ($P < .01$). Heifers were lighter initially at 57 days and at slaughter. Heifers also gained slower and required slightly more days on feed than steers. MGA improved daily gains from 57 days until slaughter ($P < .05$) and overall ($P < .05$). A significant MGA by SEX interaction ($P < .01$) existed whereby MGA-fed steers performed similarly to control steers, but MGA-fed heifers gained faster. Overall MGA-fed heifers gained 8% faster than controls.

Riding activity as measured by the Heat Watch® system is summarized in Table 3. MGA reduced the number of times each heifer was mounted during the feeding period from 339 to 85 ($P < .01$). Estrus cycles were reduced from 4.5 cycles for controls to less than one for the MGA heifers ($P < .01$) during the feeding period. The number of mounts per estrus cycle was similar between MGA and control heifers. Therefore, the reduction of MGA on riding activity seems to be the direct result of reducing the number of estrus cycles. Interestingly, MGA heifers exhibiting riding activity were more likely to be visually observed because only 14% of the mounts occurred during the period from 6 p.m. to 6 a.m. This contrasts with controls in which 41% of the mounts occurred between 6 p.m. and 6 a.m. MGA fed steers actually were mounted significantly more times than control steers ($P < .01$). However this activity was minimal in steers (17.6 vs. 27.7 mounts during the feeding period).

Carcass characteristics as affected by cattle sex and MGA feeding is summarized in Table 4. Heifers had significantly lower carcass weights ($P < .01$), more kidney, heart and pelvic fat ($P < .01$), smaller ribeye area ($P < .01$), higher marbling scores ($P < .01$), more intramuscular fat and higher shear force values ($P < .01$) compared with steers. There were no effects on dressing percentage, carcass trim, fat thickness or yield grade due to cattle sex or MGA feeding. MGA fed cattle had higher marbling scores ($P < .05$) and were more tender ($P < .05$) as measured by Warner-Bratzler shear force. This effect was consistent for each replication. Intramuscular fat as measured by ether extract of the *longissimus dorsi* tended to be higher ($P < .06$) for MGA fed cattle related to controls. There were no significant sex by MGA interactions for marbling score, intramuscular fat or shear force, suggesting that the MGA effect on these measurements was similar among both steers and heifers. Also quality and yield grade distributions are shown in Table 5. Overall MGA fed cattle graded 63% USDA Choice vs. 49% for controls.

Implications

This study demonstrates the potential of MGA as a feed additive for mixed pens of steers and heifers. In addition to the performance responses shown in heifers, the improvement in quality grade may have significance for cattle marketed in a value-based system. Also, both the carcass

quality and tenderness improvements of the MGA fed treatment is important for the improvement of the quality and consistency of beef. It should be emphasized that feeding MGA to mixed pens of steers and heifers is not currently cleared by the FDA, and this study should not be considered a recommendation to do so. Rather, further research, for the purpose of seeking a clearance for such use is encouraged.

Table 1. Intake and efficiency of mixed-sex pens with and without MGA.

	Control	MGA	SE
No pens	6	6	
First period (57 days)			
Dry matter intake, lb.	22.3	21.2	0.7
ADG, lb.	3.37	3.43	.07
Feed/gain	6.68	6.23	.26
Second period			
Dry matter intake, lb.	22.4	22.4	0.5
ADG, lb.	2.87	2.93	.05
Feed/gain	7.85	7.65	.26
Overall			
Dry matter intake, lb.	22.4	21.9	.3
ADG, lb.	3.06	3.13	.03
Feed/gain[a]	7.33	7.04	.07

[a]Means differ (P < .05)

Table 2. Effect of MGA on performance of mixed pens (by sex).

	Control		MGA		MGA Effect	Sex Effect
	Steers	Heifers	Steers	Heifers		
Number of head	151	88	148	89		
Days on feed[a]	149 ± 1	159 ± 2	151 ± 1	153 ± 2	NS	< .001
Initial weight	732 ± 6	620 ± 8	734 ± 6	618 ± 8	NS	< .001
57 - day weight	939 ± 7	783 ± 9	940 ± 7	792 ± 9	NS	< .001
57 - day ADG[a]	3.65 ± .05	2.89 ± .07	3.65 ± .05	3.06 ± .07	NS	< .001
Final weight	1216 ± 7	1037 ± 10	1220 ± 7	1050 ± 9	NS	< .001
ADG, day 57 to slaughter[a]	3.07 ± .04	2.51 ± .055	3.05 ± .04	2.72 ± .05	< .05	< .001
Overall ADG[a]	3.31 ± .04	2.65 ± .05	3.29 ± .04	2.86 ± .05	< .05	< .001

[a]MGA by Sex interaction (P < .05)

Table 3. Effect of MGA on estrus and riding activity.

Heifers (Years 2 and 3)	Control	MGA	Probability
Number of times mounted	339 ± 20	85 ± 20	< .01
Number of estrus cycles	4.5 ± .2	.7 ± .2	< .01
Number of times mounted during estrus	303 ± 19	43 ± 19	< .01
Number of mounts 6 pm to 6 am	150 ± 11	22 ± 10	< .01
Number of days with transmitter on	109 ± 2	104 ± 2	NS
Mounts per day transmitter on	3.2 ± .2	.80 ± .2	< .01
Estrus cycles per 21 days transmitter on	.44 ± .06	.20 ± .06	< .01
Mounts per day (6 pm to 6 am transmitter on)	1.43 ± .10	.21 ± .10	< .01
Mounts per estrus cycle	66 ± 5	54 ± 8	NS
Percent of mounts 6 pm to 6 am	41 ± 2	14 ± 2	< .01
Steers (Year 2 only)			
Number of times mounted	17.6 ± 1.5	27.7 ± 1.5	< .01

Table 4. Effect of MGA on carcass characteristics of mixed pens.

	Control		MGA		MGA Effect	Sex Effect	Sex X MGA Effect
	Steers	Heifers	Steers	Heifers			
Hot carcass wt.	755 ± 4	649 ± 6	761 ± 5	652 ± 6	NS	< .01	NS
Dressing %	62.1 ± .2	62.6 ± .2	62.4 ± .2	62.1 ± .2	NS	NS	< .05
Carcass trim	.8 ± .3	.1 ± .3	.4 ± .3	1.1 ± .3	NS	NS	< .05
Fat thickness	.48 ± .01	.49 ± .02	.48 ± .01	.52 ± .02	NS	NS	NS
KPH, %	2.12 ± .04	2.25 ± .05	2.09 ± .04	2.29 ± .05	NS	< .01	NS
REA	13.4 ± .1	12.1 ± .1	13.1 ± .1	11.8 ± .1	NS	< .01	NS
Marbling score[a]	982 ± 5	1039 ± 7	994 ± 6	1056 ± 7	< .05	< .01	NS
Ribeye intramuscular fat, %	4.13 ± .13	5.39 ± .17	4.45 ± .13	5.63 ± .17	< .06	< .01	NS
Yield grade	2.71 ± .05	2.78 ± .07	2.79 ± .05	2.93 ± .07	NS	NS	NS
Shear force, lb.	6.63 ± .10	6.95 ± .13	6.27 ± .10	6.73 ± .13	< .05	< .01	NS
Quality grade distribution							
Prime	0	1.2	0	3.4			
Upper 2/3 Choice	3.4	17.2	3.4	22.5			
Low Choice	31.5	56.3	50.0	53.9			
Select	60.4	22.9	43.9	19.1			
Standard	4.0	1.2	2.0	1.1			
Dark cutters	0.7	1.2	0.7	0			
Yield grade distribution							
1	10	10	5	6			
2	58	56	30	52			
3	31	33	12	38			
4	1	1	3	4			

[a]900 = slight[00], 1000 = small[00]