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ABSTRACT

Approximately 4,000 yearling heifers (initial BW = 306 ± 1.9 kg) were randomly allotted into 4 treatment groups to determine the effect of melengestrol acetate (MGA) on feedlot performance and carcass parameters. Treatments included a diet containing monensin (Rumensin) and tylosin (Tylan; RT) fed during the entire feeding period; RT plus MGA (RTM) also fed during the entire feeding period; RT withdrawn 35 d preslaughter (RTwd); and RTM withdrawn 35 d preslaughter (RTMwd). All cattle were implanted at arrival with Revalor-IH and reimplanted with Revalor-200, and were fed a standard feedlot finishing diet (that met or exceeded 1996 NRC requirements) for approximately 150 d. Final BW, ADG, hot carcass weight (HCW), DMI, and percentage of cattle grading Choice were greater (P < 0.05) for RTM than for all other treatments. Withdrawal of MGA (RTMwd) significantly (P < 0.01) decreased ADG, HCW, 12th-rib fat thickness, calculated YG, and percentage of carcasses grading Choice, but significantly increased the percentage of dark-cutting carcasses, LM area, and YG 1, 2, or 3 carcasses compared with RTM. There were no significant differences (except for dressing percentage) between RT and RTwd. Heifers continuously fed MGA increased in ADG, HCW, and carcass quality traits of economic importance compared with other treatments. Withdrawal of MGA, Rumensin, and Tylan 35 d preslaughter adversely affected carcass weight and carcass quality traits of economic importance when compared with a feeding program including MGA, Rumensin, and Tylan.

Key words: carcass, feedlot, heifer, melengestrol acetate, performance

INTRODUCTION

Melengestrol acetate (**MGA**; Pfizer Animal Health, New York, NY) is an orally active progestogen that suppresses estrus, increases BW gain, and improves feed efficiency in feedlot heifers (Bloss et al., 1966; O'Brien et al., 1968; Lauderdale, 1983). Monensin (Rumensin; Elanco Animal Health, Greenfield, IN) is an ionophore fed to feedlot cattle for improved feed efficiency and increased BW gain (Raun et al., 1976), and tylosin (Tylan; Elanco Animal Health) is an antibiotic fed for reduction of liver abscesses in feedlot cattle (Nagaraja and Chengappa, 1998). The combination of MGA, Rumensin, and Tylan is approved for estrus suppression, improved feed efficiency, increased ADG, and reduction of liver abscesses in feedlot heifers.

Perrett et al. (2008) observed improved ADG, feed efficiency, and carcass QG for feedlot heifers fed MGA, monensin, and tylosin when compared with heifers fed a control diet (monensin and tylosin, but no MGA) in a large pen commercial feedlot trial. Limited data, however, are available on the effects of this combina-

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tion on carcass traits. In addition, at the initiation of this trial, zilpaterol hydrochloride (Zilmax, Intervet Inc., Millsboro, DE) was approved for use 20 to 40 d before slaughter, but with no concomitant approval with MGA, Rumensin, Tylan, or their combination. Therefore, data were needed to evaluate the effects of a preslaughter withdrawal period of the Rumensin and Tylan or MGA, Rumensin, and Tylan combinations on performance and carcass traits of feedlot cattle.

The objectives of this study were to investigate the effects of feeding different combinations of MGA, Rumensin, and Tylan to feedlot heifers on performance and carcass traits. Effects of the withdrawal of MGA, Rumensin, and Tylan 35 d preslaughter on feedlot performance, carcass measures, and prevalence of liver abscesses were also evaluated.

MATERIALS AND METHODS

Experimental Design

The experimental design was a randomized block with a 2 × 2 factorial arrangement of treatments, with the study completed at a single location. Blocking factors included mean initial BW, source, arrival date, and location in the feedlot. A block consisted of 4 adjacent pens containing heifers as nearly alike in mean initial BW, source, and arrival date as possible. Within blocks, heifers were assigned randomly to pens and pens were assigned randomly to treatments. Cattle within a block were fed for the same number of days such that heifers within each block achieved an acceptable slaughter BW. Treatment groups were a diet containing Rumensin and Tylan fed during the entire feeding period (**RT**), RT + MGA also fed during the entire feeding period (**RTM**), RT withdrawn 35 d preslaughter (**RTwd**), and RTM withdrawn 35 d preslaughter (**RTMwd**). The experimental unit was a pen of heifers for all variables. There were 10 pens of heifers per treatment group, with 985 assigned to RT, 997 assigned to RTM, 974 assigned to RTwd, and 1,026 assigned to RTMwd.

Animals

More than 4,000 English or English × Continental crossbred heifers, 12 to 16 mo of age, weighing 270 to 340 kg, with the potential to grade approximately 45% Choice, were purchased for this study. Heifers were allocated to pens and treatments within blocks at initial processing. Before processing, heifers were appraised visually and any obvious off-type individuals and those exhibiting signs of behavioral, disease, or appetency problems or other conditions deemed unacceptable or inconsistent with the study objectives were removed from study candidacy.

Heifers were processed within 5 d (usually 2 d) after arrival at the study site. At initial processing, the ears of each heifer were palpated for previous implants (implants were not explanted if present; approximately 4% of heifers had a previous implant), and each heifer was pregnancy checked, weighed individually, identified with a uniquely numbered ear tag, implanted with Revalor-IH (80 mg of TBA and 8 mg of estradiol-17β; Intervet Inc.), dewormed, and vaccinated according to study site standard operating procedures. All products were used according to label dose and route of administration. One block of heifers was processed at a time. Within blocks, each arrival group (source and date of arrival) was processed separately and individual heifers were assigned to pens in processing order according to a predetermined randomization schedule. Heifers were excluded from the candidate pool if they were determined to be pregnant or if their BW differed from the group mean arrival BW by approximately 2 SD.

Heifers were housed outside in dirt-floored pens. Stocking density was adjusted to provide at least 23 cm of feedbunk space and 13 m^2 of pen space per head. Heifers were reimplanted with Revalor-200 (200 mg trenbolone acetate and 20 mg estradiol-17β; Intervet Inc.) at an average of 60 (58 to 64) d on feed, which was an average of 93 (76 to 106) d before slaughter. The study was conducted from January to July 2006.

Heifers were cared for in a humane manner at all times. Animals were handled at all times with due regard to well being, consistent with study site operating procedures. Heifers were observed at least once daily to ensure the animals were healthy, and, if abnormality was detected, to ensure prompt and adequate treatment by a qualified veterinarian.

Diets, Feeding, and Management

Diets were formulated to meet or exceed NRC (1996) requirements. Primary commodities used were steam-flaked corn, dried distillers grains with solubles, chopped alfalfa hay, corn silage, animal fat, and supplements. Composition of the final basal finishing diet (% of DM) was steam-flaked corn, 74.4; dried distillers grains, 8.1; alfalfa hay, 4.1; corn silage, 6.8; animal fat, 2.7; and finisher supplement, 3.9. Formulations were changed during the feeding period in response to changes in ingredient prices or availability. Heifers were stepped up to the final (finishing) diet at approximately 18 to 24 d on feed. The same step-up procedures were used for all pens within a block. Diets were sampled daily, and monthly composites of these daily samples were analyzed by Servi-Tech Laboratories (Amarillo, TX; Table 1).

Rumensin, Tylan, and MGA were added to the final ration during diet preparation by using a microingredient weigh machine (Micro Beef Technologies, Amarillo, TX). Formulated dosages in the finish diets were 30 g Rumensin/ton (90%, DM basis), 90 mg Tylan/ heifer per day, and 0.4 to 0.5 mg MGA/heifer per day.

Feed deliveries to each pen were managed to allow heifers to eat to appetite. The amount of feed offered to each pen was determined daily based on feed remaining before the first feeding of the day and the reaction of

Table 1. Analyzed nutrient content (DM basis) of experimental diets[1]

	Diet[2]	
Item, %	MGA	No MGA
DM	74.90	74.90
CP	14.00	13.60
NPN	3.40	3.40
NDF	14.70	14.20
Ether extract	6.70	6.90
Ca	0.55	0.45
P	0.32	0.32
Mg	0.19	0.17
K	0.71	0.67

[1]Diets were sampled daily, and monthly composites of these daily samples were analyzed by Servi-Tech Laboratories (Amarillo, TX).

[2]MGA = melengestrol acetate (Pfizer Animal Health, New York, NY).

cattle to that feeding. Daily feed issue was recorded electronically at the time of delivery on a per-pen basis. Excess feed for each pen was weighed as needed, consistent with the study site standard operating procedures, and the DM content was determined. Feed consumed by heifers moved to a hospital pen was estimated as the prorated share of feed fed to the hospital, according to study site standard operating procedures. Feed deliveries were converted to DM delivered using standard DM percentages for diet ingredients. Diet samples were oven-dried daily as a check on calculated DM content. Average daily DMI was determined by dividing the total DM credited to the pen less DM weighed back by the total head days in the period or trial. Animals had ad libitum access to water via a float-controlled water tank located in the fence line between pens.

Feedlot performance data were calculated with dead animals and animals removed from the study considered in the analyses ("deads in"). Date was recorded for days on feed for heifers that died or were removed. The BW was recorded on the day a heifer was removed. The number of total days on feed was calculated as (days for heifers slaughtered + days for heifers removed + days for heifers died)/(number of heifers placed). Final BW was calculated as (total BW of slaughtered heifers + total BW of heifers removed)/(number of heifers placed). Total BW gain was calculated as (total BW of slaughtered heifers + total BW of heifers removed) − (total BW of heifers placed). Average BW gain was calculated as (total BW gain)/(number heifers placed), and ADG was calculated as (total BW gain)/(total days on feed for slaughtered heifers + total days on feed for dead and removed heifers). Feed efficiency (G:F) was calculated as (total gain)/(total feed). The DMI was calculated as (total DMI)/(total days on feed for slaughtered heifers + total days on feed for dead and removed heifers).

Heifers were observed daily for abnormal conditions (morbidity, mortality, and adverse reactions). Animals that either died or were killed underwent necropsy by a qualified veterinarian to ascertain the cause of death. For heifers removed from the study, a qualified veterinarian diagnosed the cause for removal. No treatment-related deaths or removals were documented.

Initial BW was the scale weight. A 4% shrink was not applied because transit shrink was assumed not to have been recovered. All BW sub-

Table 2. Effects of different combinations of melengestrol acetate (MGA), Rumensin, and Tylan on the performance and carcass-adjusted performance of feedlot heifers

	Treatment[1]				
Item	RT	RTM	RTwd	RTMwd	SE
Pens, no.	10	10	10	10	
Placed, no.	985	997	974	1,026	
Died, no.	13	16	14	16	
Removed, no.	19	16	24	12	
Live performance[2]					
Initial BW, kg	305	307	306	306	1.9
Days on feed	150.4	150.5	150.2	150.8	2.8
DMI, kg	7.81[a]	8.08[b]	7.90[a]	8.08[b]	0.09
Final BW, kg[3]	512[a]	524[b]	511[a]	516[ab]	3.1
Total BW gain, kg	207[a]	217[ab]	205[a]	210[a]	3.7
ADG, kg	1.39[a]	1.45[b]	1.38[a]	1.40[a]	0.02
G:F	0.177	0.178	0.173	0.172	0.002
Carcass-adjusted performance[4]					
Final BW, kg	511[a]	523[b]	512[a]	517[ab]	3.24
Total BW gain, kg	206[a]	216[b]	206[a]	211[b]	4.1
ADG, kg	1.38[a]	1.45[b]	1.39[a]	1.41[ab]	0.02
G:F	0.176	0.177	0.174	0.173	0.002

[a,b]Numbers within a row without the same superscript differed at $P < 0.05$.

[1]RT = Rumensin and Tylan fed continuously; RTM = Rumensin (Elanco Animal Health, Greenfield, IN), Tylan (Elanco Animal Health), and MGA (Pfizer Animal Health, New York, NY) fed continuously; RTwd = Rumensin and Tylan fed until 35 d before slaughter; RTMwd = Rumensin, Tylan, and MGA fed until 35 d before slaughter.

[2]Estimates of heifer BW gain and DMI included dead and removed calves.

[3]Final shrunk BW was estimated as [(final pen weight × 0.96) + total weight of removals)/initial pen head.

[4]Carcass-adjusted final shrunk BW was estimated as (final shrunk BW) × (pen dressing percentage/trial mean dressing percentage).

sequent to the initial BW were pen weights shrunk 4% (scale weight × 0.96) to account for gastrointestinal fill. Carcass-adjusted final BW were calculated as (pen shrunk BW × pen dressing percentage)/(trial average dressing percentage). Carcass data were collected by personnel from the Beef Carcass Research Center, West Texas A&M University (Canyon, TX). Carcass measurements included marbling score, lean color score, USDA QG, hot carcass weight (**HCW**), LM area, 12th-rib fat thickness (calculated from the adjusted preliminary USDA YG), KPH, USDA YG, dressing percentage, and liver abscesses.

Statistical Analyses

The response variables of interest were initial and final BW, ADG, total BW gain, DMI, G:F, and carcass variables. Pen was the experimental unit for all variables. Mixed model procedures (SAS Institute Inc., Cary, NC) were used and these included the fixed effect of treatment and the random effects of block and treatment by block (as the error term). Tests of treatment differences were based on estimates of least squares means and SE calculated from the model for each treatment group. Carcass measures that were categorically expressed included USDA QG and YG, liver abscesses, and identification of a color score greater than 6.0. The response variables for categorically expressed carcass measures were evaluated as proportional carcass measures within pen. Proportional carcass measures were recorded as the percentage of heifers within a pen with USDA Choice or better QG, USDA YG less than 4, having a liver abscess, and having a color score >6 for QG, YG, liver abscesses, and color score evaluations, respectively. Proportional carcass measures were analyzed in a generalized mixed model procedure (SAS Institute Inc.) and assumed a logit link function and a binomial distribution. Estimates of least squares means and SE were back transformed to their observed scale.

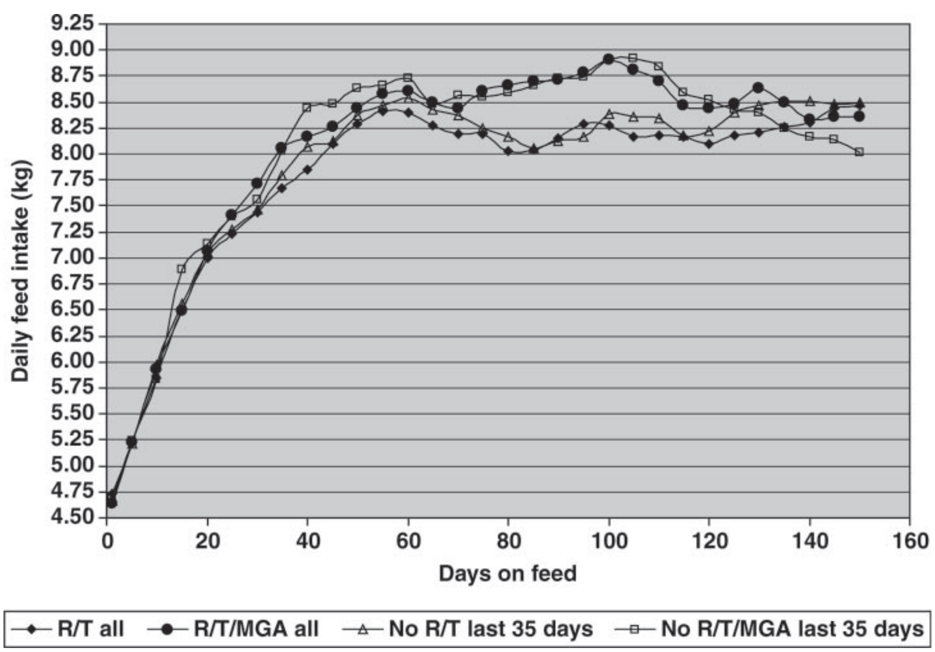

Figure 1. Average DMI by day on feed for cattle fed different combinations of melengestrol acetate (MGA; Pfizer Animal Health, New York, NY), Rumensin (Elanco Animal Health, Greenfield, IN), and Tylan (Elanco Animal Health). R/T = Rumensin and Tylan fed continuously; RTM = Rumensin, Tylan, and MGA fed continuously; RTwd = Rumensin and Tylan fed until 35 d before slaughter; RTMwd = Rumensin, Tylan, and MGA fed until 35 d before slaughter.

RESULTS AND DISCUSSION

Feedlot Performance

Initial BW did not differ for heifers assigned to the 4 treatment groups (Table 2). Days on feed were 150.2 to 150.8 among the 4 treatment groups. Days on feed did not differ among the 4 treatment groups by experimental design. During the study, similar numbers of heifers died or were removed for each of the 4 treatment groups (2.7 to 3.9%; Table 2). Final BW was greater for heifers from the RTM group compared with heifers from the RT and RTwd groups ($P < 0.01$) and from the RTMwd ($P < 0.05$) group (Table 2). Final BW did not differ ($P > 0.05$) for heifers from the RT and RTwd groups (Table 2). Perrett et al. (2008) observed similar results when using more than 6,000 feedlot heifers in a large pen commercial feedlot trial. Cattle were randomly assigned either to a diet containing MGA, monensin, and tylosin or to a diet containing monensin and tylosin but without MGA (control). Final BW was greater for heifers in the MGA group when compared with control cattle (Perrett et al., 2008).

Dry matter intake was greater for heifers from the RTM and RTMwd groups than for those from the RT and RTwd groups ($P < 0.01$) but did not differ for those from the RTM and RTMwd groups (Table 2). Dry matter intake did not differ ($P > 0.05$) for heifers from the RT and RTwd groups (Table 2). Perrett et al. (2008) also observed greater DMI for cattle fed MGA when compared with cattle in the control group. Average DMI is presented in Figure 1. Inspection of Figure 1 suggests that heifers fed MGA had feed intake greater than heifers not fed MGA, especially after d 60, which would be the days subsequent to implantation with Revalor-200. Additionally, DMI decreased the quickest and greatest for heifers in the group that had MGA withdrawn (Figure 1). This was an expected response because withdrawal of MGA allows heifers to express estrus (Zimbelman et al., 1970). It is of interest that DMI continued to decrease from d 35 until slaughter for heifers from the RTMwd group. Average daily gain was greater for heifers from the RTM group than for those from the RT, RTwd, and RTMwd groups ($P < 0.01$; Table 2). Average daily gain was not significantly different ($P > 0.05$) for heifers from the RT and RTwd groups (Table 2). Because all heifers were fed for 150.2 to 150.8 d, total BW gain followed the same pattern as ADG. The G:F ratio did not differ ($P > 0.05$) for heifers from the 4 experimental groups (Table 2). In the present experiment, when the live performance measurements were carcass adjusted, there were no appreciable changes in the interpretation of the results (Table 2).

Using study designs somewhat similar to the study design used herein, but with approximately 10 to 30% the number of heifers per experimental group, Mader and Lechtenberg (2000; Exp. 3) and Macken et al. (2003) reported that heifers fed MGA had greater ADG and G:F than heifers not fed MGA, consistent with the data reported herein. Kreikemeier and Mader (2004) reported no statistically significant difference between heifers fed MGA and those not fed MGA for ADG, DMI, and G:F. Under the feeding and management conditions of this study, the data showed that heifers fed MGA had greater DMI, greater ADG, and greater total BW gain, which resulted in greater final BW based on both live and carcass-adjusted performance. However, G:F did not differ significantly among the experimental groups. These results are similar to the results obtained by Perrett et al. (2008), except for feed efficiency. Perrett et al. (2008) observed that feed conversion (measured as F:G) was significantly better for cattle fed MGA than for those not fed MGA.

Zimbelman et al. (1970) reported that heifers returned to estrus in approximately 3 to 7 d after removal of MGA from the ration. Although daily estrus activity was not one of the parameters measured in this study, study monitors noted a substantial number of heifers in estrus within 1 to 3 d after MGA removal.

Carcass Measures. Dressing percentage was ($P < 0.01$) greater for heifers from the RTMwd group compared with those from the RTM and RT groups, but not for those from the RTwd group (Table 3), and was ($P < 0.01$) greater for heifers from the RTwd group compared with those from the RT group. Dressing percentage ranged from 64.5 to 64.9% among the 4 groups. Heifers in the RTM group had greater ($P < 0.01$) HCW, marbling score, 12th-rib fat thickness, calculated YG, and percentage QG Prime and Choice but had smaller ($P < 0.01$) color scores, percentage of color scores >6 (fewer dark cutters), percentage of YG 1, 2, or 3, and LM area when compared with heifers from the RT, RTwd, and RTMwd groups (Table 3). Likewise, Perrett et al. (2008) observed greater HCW, YG, and marbling scores for cattle fed MGA compared with control heifers. Dressing percentage, however, did not differ between treatments (Perrett et al., 2008).

Except for dressing percentage, withdrawal of RT (RTwd group) had no effect on differences in any of the carcass measurements (Table 3). Heifers in the RTMwd group had significantly ($P < 0.05$) decreased carcass measures compared with those in the RTM group (HCW, marbling score, rib fat, calculated YG, percentage QG Prime and Choice, and percentage YG 1, 2, or 3) but had increased ($P <$ 0.01) color scores, percentage of color

Table 3. Effects of different combinations of melengestrol acetate (MGA), Rumensin, and Tylan on carcass traits of feedlot heifers

	Treatment[1]				
Item	RT	RTM	RTwd	RTMwd	SE
Dressing %	64.5[a]	64.6[ab]	64.8[bc]	64.9[c]	0.18
HCW, kg	337[a]	346[c]	339[ab]	341[b]	1.6
Marbling score	495[a]	509[b]	492[a]	499[a]	7.90
Color score	5.07[b]	4.98[a]	5.10[b]	5.07[b]	0.02
Rib fat, cm	1.38[a]	1.60[c]	1.35[a]	1.47[b]	0.02
KPH fat, %	1.8	1.8	1.8	1.7	0.04
LM area, cm^2	91.8[bc]	87.1[a]	92.2[c]	90.1[b]	0.86
Calculated YG	2.5[a]	3.0[c]	2.4[a]	2.7[b]	0.05
Proportional carcass measures					
Percentage color score >6[2]	3.1[b]	0.7[a]	4.6[bc]	5.0[c]	
	(0.6)	(0.3)	(0.8)	(0.8)	
USDA Prime and Choice,[3] %	35.1[a]	46.8[c]	32.7[a]	40.4[b]	
	(2.7)	(2.9)	(2.6)	(2.8)	
YG 1, 2, or 3,[4] %	95.2[c]	88.2[a]	96.3[c]	92.7[b]	
	(1.1)	(2.1)	(0.9)	(1.4)	
Abscessed livers, %	8.9[a]	8.8[a]	9.8[a]	11.5[a]	
	(1.0)	(1.0)	(1.1)	(1.2)	

[a–c]Numbers within a row without the same superscript differed at $P < 0.05$.

[1]RT = Rumensin (Elanco Animal Health, Greenfield, IN) and Tylan (Elanco Animal Health) fed continuously; RTM = Rumensin, Tylan, and MGA (Pfizer Animal Health, New York, NY) fed continuously; RTwd = Rumensin and Tylan fed until 35 d before slaughter; RTMwd = Rumensin, Tylan, and MGA fed until 35 d before slaughter.

[2]Percentage color score >6 identifies dark-cutting carcasses.

[3]Least squares means and contrasts for proportional carcass measures were calculated from a generalized linear mixed model analysis. Estimates of SE for each treatment are listed in parentheses.

[4]USDA grades were assigned by USDA graders as reported by the packing plant, and distributions represent the percentage of carcasses assigned a given grade.

scores >6 (more dark cutters), and LM area (Table 3).

In their third experiment, Mader and Lechtenberg (2000) reported heifers fed MGA showed little difference in carcass characteristics compared with those not fed MGA, with the exception of a smaller LM area, and higher YG. Kreikemeier and Mader (2004) noted greater marbling scores for MGA-fed heifers compared with non-MGA-fed heifers, with no differences in other carcass measures. Heifers fed MGA in the study by Macken et al. (2003) had significantly improved marbling scores and percentage of cattle grading Choice and Prime compared with heifers not fed MGA. The results of this study suggest that MGA does have a large impact on carcass measures, and results contradict most of the carcass results presented by Mader and Lechtenberg (2000) and Kreikemeier and Mader (2004). However, it is important to interpret carcass results based on a common end point. Perry and Fox (1997) demonstrated the impact that different end points (constant age, YG, or BW) have on carcass measures. The results in Tables 2 and 3 are from cattle slaughtered at a constant days on feed and are therefore heifers on MGA that gained at a faster rate and likely reached their optimal slaughter point sooner than those not fed MGA. Contradictory results in carcass evaluations are not unexpected when end points are not consistent among the studies. Comparing the results of this study, in which HCW were approximately 340 kg, with those reported by Mader and Lechtenberg (2000), in which the average HCW was 290 kg, is likely to generate contrasting results in characteristics that are greatly influenced by slaughter end point, such as HCW, carcass fat, and yield.

Liver Abscesses. Unexpectedly, no significant ($P > 0.05$) treatment effects were detected for percentage of heifers with liver abscesses (Table 3). Liver abscess severity scores were also not different among the 4 groups and ranged between 32 and 43% for A−, between 25 and 32% for A, and between 29 and 37% for A+. It is of interest that there were no increases in liver abscess in heifers with Tylan removed from the diet during the last 35 d on feed (RTwd and RTMwd groups).

IMPLICATIONS

Under the conditions of this study, including MGA in a feedlot heifer feeding program that includes Rumensin and Tylan results in increases in both carcass weight and carcass quality traits of economic importance. Withdrawal of Rumensin and Tylan 35 d preslaughter does not appear to affect carcass weight and carcass quality traits of economic importance adversely. However, withdrawal of MGA, Rumensin, and Tylan 35 d preslaughter does adversely affect carcass weight and carcass quality traits of economic importance when compared with a feeding program including MGA, Rumensin, and Tylan.

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LITERATURE CITED

Bloss, R. E., J. I. Northam, L. W. Smith, and R. G. Zimbelman. 1966. Effects of oral melengestrol acetate on the performance of feedlot cattle. J. Anim. Sci. 25:1048.

Kreikemeier, W. M., and T. L. Mader. 2004. Effects of growth-promoting agents and season on yearling feedlot heifer performance. J. Anim. Sci. 82:2481.

Lauderdale, J. W. 1983. Use of MGA (melengestrol acetate) in animal production. p. 193 in Anabolics in Animal Production: Public Health Aspects, Analytical Methods and Regulation. Office International des Epizooties, Paris, France.

Macken, C. N., C. T. Milton, T. J. Klopfenstein, B. D. Dicke, and D. E. McClellan. 2003. Effects of final implant type and supplementation of melengestrol acetate on finishing feedlot heifer performance, carcass characteristics and feed economics. Prof. Anim. Sci. 19:159.

Mader, T. L., and K. F. Lechtenberg. 2000. Growth-promoting systems for heifer calves and yearlings finished in the feedlot. J. Anim. Sci. 78:2485.

Nagaraja, T. G., and M. M. Chengappa. 1998. Liver abscesses in feedlot cattle: A review. J. Anim. Sci. 76:287.

NRC. 1996. Nutrient Requirements of Beef Cattle. 7th ed. Natl. Acad. Press, Washington, DC.

O'Brien, C. A., R. E. Bloss, and E. F. Nicks. 1968. Effect of melengestrol acetate on the growth and reproductive physiology of fattening heifers. J. Anim. Sci. 27:664.

Perrett, T., B. K. Wildman, G. K. Jim, A. R. Vogstad, R. K. Fenton, S. J. Hannon, O. C. Schunicht, S. M. Abutarbush, and C. W. Booker. 2008. Evaluation of the efficacy and cost-effectiveness of melengestrol acetate in feedlot heifer calves in western Canada. Vet. Ther. 9:223.

Perry, T. C., and D. G. Fox. 1997. Predicting carcass composition and individual feed requirement in live cattle widely varying in body size. J. Anim. Sci. 75:300.

Raun, A. P., C. O. Cooley, E. L. Potter, R. P. Rathmacher, and L. F. Richardson. 1976. Effect of monensin on feed efficiency of feedlot cattle. J. Anim. Sci. 43:670.

Zimbelman, R. G., J. W. Lauderdale, J. H. Sokolowski, and T. G. Schalk. 1970. Safety and pharmacologic evaluations of melengestrol acetate in cattle and other animals. A review. J. Am. Vet. Med. Assoc. 157:1528.