Impact of doramectin treatment at the time of feedlot entry on the productivity of yearling steers with natural nematode infections

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Objective—To measure the reduction in fecal nematode egg counts and productivity impact of treatment of yearling steers with doramectin at entry into the feedlot, compared with control steers treated only with fenthion.

Animals—6,096 crossbred yearling steers with a mean (± SD) body weight of 377.0 (± 37) kg.

Procedure—Steers were implanted with zeranol and alternately separated to fill each of 24 pens. Groups of steers within 12 matched pairs of pens were randomly allocated to treatment with doramectin or no treatment with doramectin for internal nematodes. Fecal samples were collected from approximately every twentieth steer from each pen at day 0 and at reimplant (approx day 60). Each steer was weighed on day 0 and at reimplant and then mean body weights of steers per pen were determined at 120 to140 days after trial initiation.

Results—Treatment steers had a significantly lower fecal egg count at reimplant than control steers. Treatment steers had a significantly greater mean daily gain during the study, significantly greater feed consumption, significantly lower feed-to-gain ratio, and significantly better quality carcass grades at slaughter.

Conclusions and Clinical Relevance—Under the conditions of our trial, there was a significant fecal egg count reduction response to doramectin treatment, which resulted in significantly improved productivity. Results of economic analysis of return on investment indicated that even with low egg counts in heavy body weight cattle, nematode egg count reduction with doramectin significantly improved returns. (*Am J Vet Res* 2001;62:622–624)

Doramectin[a] is an avermectin endectocide with the chemical structure of 25-cyclohexyl avermectin B1. The commercial injectable product is dissolved in an oil-based formulation and became available for use in the United States in 1996. In cattle, this product is effective against a wide variety of parasitic internal nematodes[1] and external arthropods.[2] The efficacy of doramectin and its effect on productivity have been evaluated in a series of trials in grazing stockers[3] and in feedlot cattle.[4]

Johnson et al[4] indicate that the use of injectable doramectin substantially reduces fecal egg counts and improves productivity when used in small pen feedlot trials with weaned calves or light-body-weight yearling steers, compared with untreated control steers. In that study, mean fecal egg counts before treatment were 30 to 35 and 75 to 90 **eggs/gram (EPG)** of feces, respectively, and mean body weights at the time of entry into the feedlot were 220 and 259.1 kg, respectively. It is not known whether the findings of Johnson et al are applicable to the use of doramectin in heavy body weight yearling steers in commercial feedlots. The purpose of the study reported here was to evaluate the efficacy and resultant productivity responses to doramectin treatment of heavy-body-weight yearling steers at the time of feedlot entry.

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Materials and Methods

Animals—Six thousand ninety-six crossbred steers were purchased from California pastures in May 1998 and shipped to a 50,000-steer capacity commercial feedlot south of Burley, Idaho. Steers were processed at arrival as follows: each was given an ear tag, vaccinated,[b] and provided an zeranol implant.[c] Steers were fed a standard feedlot ration. Approximately 60 days after trial initiation, all steers were reimplanted with trenbolone acetate and estradiol.[d] Twenty-four steers died during the trial, all unrelated to treatment; therefore, 6,072 steers were weighed on the final day. Thirty-eight steers lost ear tags in the packing plant, and 11 carcasses were condemned at slaughter. Therefore, the final carcass analysis was conducted on 6,023 steers.

Experimental design—Following initial processing of the steers, they were each weighed and alternatively assigned to 1 of 12 equivalent pairs of pens (24 pens total) that were next to each other. When pens were filled, groups of steers within each pair of pens were randomly assigned to receive treatment with doramectin (treatment steers) for internal nematodes or no treatment (control steers). The number of steers in each pen ranged from 150 to 300. At the time of weighing, a fecal sample was collected from approximately 1 of every 20 steers for a fecal egg examination (472 steers). Samples were sent to Colorado State University Diagnostic Laboratories where the samples were analyzed, using the modified Stoll method.[5] Control steers not treated for internal nematodes received fenthion[e] topically at approximately 1 ml/50 kg of body weight on day 0, whereas treatment steers received doramectin SC at a dosage of 200 µg/kg in the neck. Steers were monitored daily by feedlot staff and weekly by the primary author. Each steer was reweighed at reimplant, and fecal samples were collected from the same steers that had been tested on day 0. Steers within each pair of pens were weighed and sent to Miller Packing (Hyrum, Utah) on the same date. The trial was terminated 120 to 140 days after initiation.

Statistical analysis—Data were analyzed with a mixed procedure or frequency procedure, using a software program.[f] Repeated measures mixed general linear model, which included block and treatment, was used to analyze mean

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daily gains, feed consumption, feed-to-gain ratio, quantitative carcass measurements, and cost/return variables. All variables, which were expressed as mean values per pen, were weighted by the initial number of steers in the pen. Nematode egg counts were analyzed with a repeated measures model that included block, treatment, block by treatment, animal within block by treatment, day of study, and treatment by day of study. Comparisons between treatment pairs were made for each data collection time (day of study). All nematode egg counts were transformed to the natural log (EPG + 1) before analysis and after analysis were back-transformed to geometric means for presentation. Differences were considered significant at $P < 0.05$.

Results

Body weights of 6,096 steers were recorded on initiation of the study (day 0), and all steers were implanted with zeranol. The 3,047 treatment steers had a mean (± SD) body weight of 377.1 (± 37) kg, and the 3,049 control steers had a mean body weight of 376.4 (± 37) kg. On day 0, the geometric mean fecal egg count for 237 treatment steers (9.8 EPG; 95% **confidence limit [CL]**, 6.4 to 12.7 EPG) was not significantly ($P = 0.747$) different from the geometric mean fecal count for 235 control steers (9.1 EPG; 95% CL, 6.9 to 13.7 EPG). All of the nematode eggs were of the trichostrongylid type.

Steers were reimplanted with trenbolone acetate and estradiol on approximately day 60, at which time they were each weighed, and the same 428 (24 samples were unusable) steers as on day 0 were tested for fecal egg counts. At that time, the geometric mean fecal egg count in treatment steers (0.2 EPG; 95% CL, 0.0 to 0.5 EPG) was significantly ($P = 0.011$) less than in control steers (0.7 EPG; 95% CL, 0.4 to 1.1 EPG). Mean steer body weight at reimplant was 496.4 kg for control steers and 501.8 kg for treatment steers (body weight was not analyzed).

Mean daily gain (kg of body weight/d) was significantly ($P = 0.002$) greater for treatment steers from trial initiation on day 0 to reimplant on approximately day 60 (2.01 kg/d), compared with control steers (1.90 kg/d; difference between group means = 0.11 kg/d). From the time of reimplant to the end of the study at day 120 to 140, mean daily gain was not significantly ($P = 0.355$) different between control steers and treatment steers (1.25 vs 1.29 kg/d, respectively; difference between group means = 0.04 kg/d). Mean body weights, as determined by mean values per pen, at the end of the study were 606.8 kg for control steers and 617.3 kg for the treatment steers. Mean daily gain for the entire study was significantly ($P < 0.001$) greater for treatment steers (1.65 kg/d), compared with control steers (1.57 kg/d; difference between group means = 0.08 kg/d).

In treatment steers, an improvement in mean daily gain appeared to come as a result of an increase in consumption and efficiency of use. Mean daily feed consumption on an as-fed basis was significantly ($P < 0.001$) improved in treatment steers (13.17 kg of intake/steer/d), compared with control steers (12.95 kg/steer/d; difference between group means = 0.22 kg/steer/day). This additional 0.22 kg of intake/steer/d was accompanied by a significant ($P = 0.001$) improvement in feed-to-gain ratio of treatment steers (7.99), compared with control steers (8.27; difference between group means = –0.28).

During the course of the study, deaths and treatments for respiratory tract distress were recorded. The following 24 steers died from signs unrelated to treatment with doramectin or fenthion: 16 (0.52%) control steers and 8 (0.26%) treatment steers. Data for these steers were included in the analyses for as long as they remained in our study. A single treatment for respiratory tract distress was conducted in 8% of the treatment steers and 7.5% of the control steers. Multiple treatments were required for 1.0% of the treatment steers and 1.1% of the control steers.

At slaughter, dressing percent (ie, carcass weight/live weight × 100; carcass weight is live weight minus head, hide, feet, and entrails) and quality grades were recorded on 6,023 carcasses. The USDA inspectors at the Miller Packing Plant in Hyrum, Utah performed carcass condemnations and grading. Dressing percent was 62.1% in treatment steers and 62.0% in control steers. Overall analysis of Mean Quality Grade Percentages revealed a significant difference between treatment steers and control steers (**Table 1**). There was a significant improvement in quality grades in the treatment steers such that there were approximately 5% more choice grades and 5% fewer select grades than in the control steers.

An economic analysis of observed improvement in carcass quality in treatment steers, compared with control steers, was done on the basis of payment from the packinghouse to the feedlot management. Also, cost analysis of improvement in feed-to-gain ratio in treatment steers was done on the basis of feed costs plus interest on feed costs in our trial. These variables were calculated for significant differences in productivity responses between treatment steers and control steers,

Table 1—Comparison of mean quality grade percentage of meat* at slaughter between steers that received treatment with doramectin (treatment steers) for internal nematodes or no treatment (control steers)

Treatment	Prime	Top choice	Choice	Select	No. roll	Control vs treatment steers
Control steers (%)	0.10	3.92	41.3	52.3	2.4	—
Treatment steers (%)	0.36	4.31	46.4	46.9	2.1	—
Difference (%)	0.26	0.39	5.1	−5.4	−0.3	$P = 0.001$

*A total of 6,023 carcasses were evaluated.
No. roll = USDA grade rated below "select". Animals receive no stamp based on lack of marbling or high age.

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and each was significantly different from the other except for the initial price of the steers.

Mean cost to initially purchase the 6,096 steers in our study was $635.81 for control steers and $634.57 for treatment steers ($P = 0.496$; difference between group means = –$1.24). When the 6,023 carcasses were sold, the heavier carcasses of the treatment steers, with improved carcass quality, returned $774.06, and the carcasses of the control steers returned $760.42. On a return per steer sold basis, the significant ($P = 0.001$) difference in revenue was $13.64/steer. On a revenue (return minus purchase cost) per steer started basis, the difference increased to $17.06/steer.

The improvement in mean daily gain for treatment steers was 0.08 kg/d, and the increased feed consumption by the treatment steers was 0.22 kg/steer/d. On the basis of the feed costs per day in our study, the mean cost per kilogram of gain for the treatment steers was $0.22 and for the control steers was $0.23 ($P = 0.003$; difference between group means = $0.01/kg).

Discussion

Results of a previous small pen feedlot trial with 180 (3 treatment groups of 60 each) steers weighing 259.1 kg at the time of feedlot entry had similar results to our study.[4] In that study, doramectin treatment significantly reduced fecal egg counts and feed-to-gain ratio and significantly increased feed consumption and mean daily gain, compared with untreated control steers.

In our study, doramectin treatment of more than 3,000 steers weighing a mean of 377.3 kg at entry into a commercial feedlot setting again significantly reduced fecal egg counts and feed-to-gain ratio and significantly increased feed consumption and mean daily gain, compared with untreated control steers. In evaluating economic return, doramectin treatment returned $13.64 more per steer sold than untreated control steers. In evaluating economic revenue/steer started, that additional revenue was $17.06/steer.

[a]Dectomax, Pfizer Animal Health, Exton, Pa.
[b]Bovishield 4, Pfizer Animal Health, Exton, Pa.
[c]Ralgro Implants, Schering Plough, Union, NJ.
[d]Revalor-S, Hoescht Roussel Vet, Warren, NJ.
[e]Spotton, Bayer Corporation, Shawnee Mission, Kan.
[f]SAS/STAT Software: changes and enhancements through release 6.12, Cary, NC.

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