PEER REVIEWED

Efficacy of Mid-Summer Doramectin Pour-on Application for Parasite Control in Spring Calving Cow-Calf Herds in the Northern Great Plains

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Abstract

One-hundred-twenty cow-calf pairs grazing native pasture in southcentral North Dakota were used in a prospective study to evaluate efficacy of mid-summer topical doramectin application for control of lice compared to non-treated controls. Pairs were allocated to one of two treatment groups and placed on eight separate pastures. On day -40, cows were weighed and body condition score (BCS) evaluated.

On day 0 (day of treatment) pairs allotted to the treatment group were treated topically with 227 mcg/lb of doramectin in mid-July. Cows were examined for lice monthly from day 134 through day 238. Fecal samples collected from cows and calves were examined for parasite eggs, and horn fly counts were taken on selected cows in each replicate. Weights and BCS (cows only) were taken for cows and calves. Steer calves were committed to a finishing program to evaluate effect of doramectin on feedlot performance and carcass characteristics.

Percentage of cows positive for lice in the doramectin-treated group was lower on days 161-162, 184-185, 210-211 and 238-239 than non-treated cows. Doramectin-treated cows and calves had lower fecal egg counts on days 21 and 42 than non-treated controls. Mid-summer application had no effect on cow BCS, cow body weight, calf average daily gain or steer carcass characteristics.

Mid-summer application of doramectin was effective for control of lice through the winter. Internal parasite load in this study may not have been high enough to detect a difference in performance in spring calving cow-calf pairs.

Résumé

Un total de 120 paires vaches-veaux au pâturage dans des pacages indigènes du centre sud du Dakota du Nord ont été utilisées dans une étude prospective pour évaluer l'efficacité de l'application topique mi-estivale de doramectin pour le contrôle des poux par rapport à des paires non-traitées. Les paires ont été allouées à l'un des deux groupes de traitement et placées dans huit pâturages distincts. Au jour 40, les vaches ont été pesées, la condition corporelle a été évaluée et des échantillons fécaux ont été recueillis.

Au jour 0 (jour de traitement), les paires du groupe traité ont reçu une application topique de 227 mcg/lb de doramectin à la mi-juillet. Les vaches étaient examinées chaque mois pour la présence de poux des jours 134 à 238. Les échantillons fécaux recueillis des vaches et des veaux ont été examinés pour détecter la présence d'œufs de parasites. Des décomptes de mouches ont été faits sur certaines vaches en particulier dans chacune des réplications. Le poids et la condition corporelle (pour les vaches seulement) ont été mesurés chez les vaches et les veaux. Les bouvillons ont été soumis à un programme de finition pour évaluer l'effet du doramectin sur la performance en parc d'engraissement.

Le pourcentage de vaches positives pour les poux dans le groupe traité avec le doramectin était moindre que dans le groupe non-traité aux jours 161-162, 184-185, 210-211 et 238-239. Les vaches et les veaux traités avaient des décomptes d'œufs fécaux plus faibles que les animaux non-traités aux jours 21 et 42. L'application mi-estivale n'a pas eu d'effet sur la condition corporelle, le poids des vaches, le gain de poids quotidien des veaux et les caractéristiques de carcasses des bouvillons.

L'application mi-estivale de doramectin était efficace pour le contrôle des poux jusqu'à l'hiver. La charge interne parasitaire dans cette étude n'a peut être pas été suffisante pour détecter une différence dans la performance des veaux des paires vaches-veaux avec mise bas printanière.

Introduction

Doramectin,[a] an avermectin endectocide, is used to control a variety of cattle parasites.[9,11] A strategically timed single-dose regimen of doramectin has proven to be highly effective for control of gastrointestinal nematodosis.[2] Doramectin has shown persistent efficacy against infestations of both nematodes and lice.[2,3] Infection with *Cooperia oncophora* and *Ostertagia ostertagi* were effectively controlled for up to 28 and 35 days, respectively, after topical treatment.[7] Skogerboe *et al*[12] reported that acquisition of *Bovicola bovis* and *Linognathus vituli* infestations was prevented in treated cattle for 77 and 105 days, respectively.

Rooney *et al*[11] found doramectin-treated cattle had greater average daily gain than control cattle in louse and grub studies, but no difference in average daily gain between treated and control cattle was found in studies examining mite control. Doramectin-treated calves gained 25.8 lb (11.7 kg) more than untreated calves in one Mississippi study, and 21.6 lb (9.8 kg) more in an Idaho study when cows and calves were treated two to three months postcalving.[2] Definitive results for the use of doramectin are not found in the literature. This is likely due to the complex combination of variables which can affect performance response to anthelmintic treatment.

The purpose of this study was to determine the efficacy of topical application of doramectin in mid-summer for control of lice, and to determine the effect on weight change, body condition score (BCS), fecal egg counts and subsequent carcass characteristics of calves. No reports on the efficacy of mid-summer doramectin application for fall and winter lice control in spring calving cows were found. In addition, studies have not been conducted to determine whether application of doramectin at this time of the year will effectively control parasites in cattle grazing native pastures on the northern Great Plains.

Materials and Methods

One-hundred-twenty mixed breed beef cows (average weight 1153 lb [524 kg] on day -40) ranging from two to five years of age and their calves were used in the study. Eight separate pastures were used to create four replicates per treatment. Each pasture consisted of approximately 80 acres of mixed native grasses and held 15 cow-calf pairs and one bull. All eight pastures were contiguous. Calves were born in the spring of 2000 on the ranch in southcentral North Dakota. Bulls were placed with the cows on day –40 and removed on day 42 of the study. Cattle placed in each pasture were stratified by age of dam, weight of dam, date of birth and sex of calf, and assigned randomly to one of two treatment groups with four replicated pastures for each treatment group. Treatments included either a control (no doramectin) or topical treatment with doramectin at labeled dose (227 mcg/lb); each calf received treatment identical to its dam. Bulls in the treatment group received doramectin pour-on on day 0 of the study. Cows and calves grazed native pasture throughout the grazing season and received no additional supplemental feed.

Day 0 was the day of treatment. Fecal samples from cows were taken on days 0, 21, 42 and 84; fecal samples from calves were collected on days 0, 21, 42, 84 and 197. Fecal egg counts were performed using the Wisconsin centrifugation-flotation procedure with saturated sucrose as the flotation medium.[3] Cow BCS and weights were recorded on day –40, 0, 21, 42, 84, 210 and 238. Cow weights on day –40 were used to stratify cow-calf pairs to treatment, but neither cow weight or BCS at day –40 were included in the final statistical analysis. Calf weights were taken on days 0, 21, 42, 84, 197 and 261.

Calves were weaned on day 84 of the study. Steer calves were placed in a growing program until study day 197, when they were shipped to a feedlot for finishing. Body weights were taken in the feedlot on day 261 when steers were reimplanted. At harvest, carcass data were collected, however, final feeding performance data were not available as steers from the two treatment groups were commingled in the same pen at the feedlot.

Horn flies were counted on a subset of cattle in each pasture (six head per pasture) on days -3, 4, 11, 18, 25 and 32 of the study. Cows to be used for horn fly (*Haematobia irritans*) counts were randomly selected on day –40, and the same cows were counted on each of the days noted above. The same technician counted horn flies on each data collection day. A separate technician recorded data while the counter identified selected cows and counted the flies. High powered binoculars were used to count flies on one side of the cow. When horn fly counts exceeded 100, a system of estimating fly density and fly coverage was used to count flies, and counts were rounded to the nearest five flies. All horn fly counts were conducted approximately two to three hours after sunrise. Horn fly counts were not conducted during rainfall events; if raining, the technician waited until the rain stopped before conducting counts.

Lice infestation was determined on each cow on days 134, 161, 184, 210 and 238. This phase of the study was conducted while the cows were managed in drylot for winter feeding. Cows had access to open-front sheds and were fed a grass hay and corn silage-based diet appropriate for their weight and stage of gestation. Cattle were fed in concrete feed bunks.

During lice examination, each cow was restrained in a commercial squeeze chute, haltered and examined for the presence of lice, including *Haematopinus eurysternus, Haematopinus quadripertusus, Solenopotes capillatus and Linognathus vituli*. *Solenopotes capillatus* was the primary species found on the cattle in the study, however, no effort was made to delinate lice infestations by particular species. The muzzle, cheeks, withers and back were examined for lice on each cow during each examination. Data for lice counts was recorded as either positive or negative for the presence of lice. A single scientist, trained by Larry Smith, DVM, Lodi, WI, did each examination.

Statistical analysis—A repeated measures mixed linear model with fixed effects of treatment, time period and treatment by time period interaction was used to analyze cow pasture-phase weight, cow post-pasture-phase weight, cow pasture-phase BCS, cow post-pasture-phase BCS, cow pasture-phase nematode egg count, pasture-phase fly count, calf post-pasture-phase weight, and calf post-pasture-phase nematode egg count. The model was augmented with fixed effects for sex of calf, sex of calf by treatment interaction and sex of calf by treatment by time period interaction to analyze calf pasture-phase weight and calf pasture-phase nematode egg count. Weight gain was calculated as the difference between appropriate least-squares means. Sex of calf estimates were combined if sex by treatment and sex by treatment by time period interactions were not significant ($P > 0.05$). Treatment contrasts were made at each time period following a significant treatment or treatment by time period interaction ($P \le 0.05$). Nematode egg counts (eggs per gram of feces, EPG) and fly counts were transformed to natural log (count + 1) for purposes of analyses and were back-transformed for reporting purposes.

A mixed linear model with fixed effect of treatment was used to analyze hot carcass weight, rib eye area, percent KPH fat, fat thickness and marbling score. The Cochran-Mantel-Haenszel (CMH) statistic was used to test for associations between treatment and liver score, presence of lice, USDA quality grade and USDA yield grade.

Results

The percentage of animals positive for lice was lower ($P \le 0.03$) in animals treated with doramectin than non-treated control animals (Table 1) on days 161, 184, 210 and 238. Lice counts on day 134 were similar ($P = 0.62$) between treatment groups.

Treatment with doramectin did not affect cow body weight ($P \ge 0.13$; Table 2) or BCS ($P \ge 0.07$; Table 3) compared to controls. Calf weight through day 261 and average daily gain through day 84 were unaffected by treatment ($P \ge 0.19$; Table 4).

Table 1. Effect of topical treatment of cow-calf pairs with doramectin on percentage of animals positive for lice infestation.

	Treatment		
Day of study	Non-treated	Doramectin[a]	*P*-value
134	4.3	2.2	0.62
161	41.3	0	< 0.001
184	43.5	4.3	< 0.001
210	31.1	4.3	< 0.001
238	19.6	4.3	0.03

[a] Dose 227 mcg/lb of body weight

Table 2. Effect of topical treatment of cow-calf pairs with doramectin on cow body weight (lb) with advancing day on pasture and post-pasture.

	Treatment		
Day of study	Non-treated	Doramectin[a]	*P*-value
0	1344 ± 26.6	1322 ± 26.4	0.41
21	1357 ± 26.6	1333 ± 26.4	0.37
42	1397 ± 26.6	1353 ± 12.0	0.13
84	1362 ± 26.6	1335 ± 12.0	0.39
210	1507 ± 27.5	1476 ± 12.3	0.31
238	1547 ± 27.5	1522 ± 12.3	0.45

[a] Dose 227 mcg/lb of body weight

Table 3. Effect of topical treatment of cow-calf pairs with doramectin on cow body condition score[a] with advancing day on pasture and post-pasture.

	Treatment		
Day of study	Non-treated	Doramectin[b]	*P*-value
0	5.9 ± 0.11	5.9 ± 0.11	0.66
21	5.8 ± 0.11	5.8 ± 0.11	0.92
42	6.3 ± 0.11	6.2 ± 0.11	0.66
84	5.7 ± 0.12	5.4 ± 0.12	0.07
210	5.7 ± 0.07	5.8 ± 0.06	0.30
238	5.5 ± 0.07	5.4 ± 0.07	0.56

[a] Body condition score; 1 emaciated, very thin, 9 obese
[b] Dose 227 mcg/lb of body weight

Total fecal egg counts (all genera) for cows were similar ($P = 0.80$) in each treatment group on day 0 (Table 5). Nematode eggs per gram (EPG) of feces (total and trichostrongylid-type) for cows treated with doramectin pour-on were lower on days 21 ($P < 0.001$) and 42 ($P = 0.01$) compared to control cows. Calves treated with doramectin had lower trichostrongylid-type and total EPG of feces on days 21 and 42 ($P \leq 0.03$) compared to the control calves (Table 6). Treatment of cows and calves with doramectin pour-on in our study did not significantly reduce the nematode EPG of feces for total eggs at day 84 in cows ($P = 0.35$) or calves ($P = 0.71$; Tables 5 and 6).

Fly counts were lower on day 4 on treated animals compared to non-treated controls (9.8 vs 38.7; $P = 0.02$; Table 7), but no differences were measured later in the study.

Carcass data were collected at the time of harvest from steer calves enrolled in the study (Table 8). No significant differences were found between treatment groups for liver abscess rate (P=0.29), hot carcass weight (p=0.53), KPH fat (p=0.73), fat thickness (p=0.50), rib eye area (p=0.63), or marbling score (p=0.55). Frequency of USDA carcass quality grades and yield grades for control and treated animals are shown in Table 9. No significant ($P \geq 0.29$) differences were found between

Table 4. Effect of topical treatment of cow-calf pairs with doramectin on calf weight and average daily gain (lb) with advancing day on pasture and post-pasture.

	Treatment			
Day of study	Non-treated	Doramectin[a]	SE	*P*-value
0	290.0	286.4	14.5	0.81
21	344.1	369.8	14.5	0.76
42	409.0	399.3	14.5	0.49
84	511.5	541.2	14.5	0.33
197	806.3	776.8	39.2	0.48
261[b]	1098.7	1056.0	39.2	0.37
ADG d 0-84	2.64	3.04		0.19

[a] Dose 227 mcg/lb of body weight
[b] Interim weight of steers in the feedlot: 24 non-treated calves and 21 doramectin-treated calves.

Table 5. Effect of topical treatment of cow-calf pairs with doramectin on nematode eggs per gram of feces[a] from cows.

	Treatment		
Day of study	Non-treated	Doramectin[b]	*P*-value
Trichostrongylid-type eggs			
0	8.2	9.0	0.79
21	3.4	0.5	< 0.001
42	1.7	0.5	0.01
84	2.0	1.5	0.39
All genera eggs			
0	8.3	9.0	0.80
21	3.7	0.7	< 0.001
42	1.7	0.5	0.01
84	2.0	1.5	0.35

[a] Retransformation of geometric means of actual count
[b] Dose 227 mcg/lb of body weight

Table 6. Effect of topical treatment of cow-calf pairs with doramectin on nematode eggs per gram of feces[a] from calves.

	Treatment		
Day of study	Non-treated	Doramectin[b]	*P*-value
Trichostrongylid-type eggs			
0	2.9	4.0	0.42
21	5.9	1.2	0.001
42	6.0	2.1	0.01
84	13.9	13.8	0.98
197	1.1	1.0	—
All genera eggs			
0	3.4	5.3	0.22
21	9.8	1.9	< 0.001
42	7.6	3.3	0.03
84	17.3	15.4	0.71
197	1.4	1.0	—

[a] Retransformation of geometric means of actual count
[b] Dose 227 mcg/lb of body weight

Table 7. Effect of topical treatment of cow-calf pairs with doramectin on fly count[a] found per side of cow.

	Treatment		
Day of study	Non-treated	Doramectin[b]	*P*-value
-3	107.4	60.1	0.29
4	38.7	9.8	0.02
11	17.0	6.8	0.10
18	39.8	64.1	0.34
25	51.7	60.8	0.73
32	21.2	41.4	0.20

[a] Retransformation of geometric means of actual count
[b] Dose 227 mcg/lb of body weight

Table 8. Effect of topical treatment of cow-calf pairs with doramectin on subsequent carcass characteristics of steer calves.[a]

Carcass characteristic	Treatment		
	Non-treated	Doramectin[b]	*P*-value
Liver abscess, %	0	4.8	0.29
Hot carcass wt, lb	772.0	754.2	0.53
KPH fat, %	2.0	1.9	0.73
Fat thickness, in	0.40	0.40	0.50
Rib eye area, sq. in	13.2	12.8	0.63
Marbling score[c]	418.0	343.0	0.55

[a] 24 steer calves in the non-treated group and 21 in the doramectin-treated group
[b] Dose 227 mcg/lb of body weight
[c] 400=small 0

Table 9. Effect of topical treatment of cow-calf pairs with doramectin on subsequent frequency of USDA carcass quality grade and yield grade in steer calves.[a]

Quality grade, %	Treatment	
	Non-treated	Doramectin[b]
High Choice	4.5	0.0
Choice	4.5	4.8
Low Choice	45.5	47.6
High Select	13.6	19.0
Low Select	22.7	28.6
Standard	9.1	0.0
Yield grade, %		
YG 1	22.73	9.52
YG 2	45.45	47.62
YG 3	31.82	38.10
YG 4	0.00	4.76

[a] 24 steer calves in the non-treated group and 21 in the doramectin-treated group
[b] Dose 227 mcg/lb of body weight

treatment groups for any of the carcass characteristics examined.

Discussion

Lice infestations typically increase during winter months. There were significant differences between treatments in lice counts conducted in December, January, February and March (days 161, 184, 210 and 238, respectively), but not during the initial November (day 134) count. Phillips *et al*[9] reported a reduction in lice infestation in doramectin-treated cattle throughout their 28-day trial. Skogerboe *et al*[12] suggested that the persistency of topical doramectin against *B. bovis* was 77 days, while Lloyd *et al*[6] reported that the persistent period against *S. capillatus* was 35 days, and greater than 63 days against *B. bovis*. Our study appears to be the first that evaluated lice control during the winter months in a spring-calving beef herd treated with topical doramectin in mid-summer that has yielded positive results.

Treatment with doramectin did not affect cow body weight, nor was a difference noted in BCS between treatment groups. A review of literature[10] indicates that the effect of treatment on cow body weight should be considered equivocal. Cow body weight is influenced by multiple variables, therefore live body weight must be interpreted cautiously. Calf weight and average daily gain were unaffected by treatment. This is in agreement with a report by Ballweber *et al*[2] where average daily gain of calves was not affected by treatment in an Idaho study. The available literature tends to assume that increased milk production by the treated dam is partially responsible when added weight gain is seen in calves, although milk production has not been evaluated. Wohlgemuth *et al*[14] reported higher weaning weights for calves nursing treated (ivermectin) cows compared to calves nursing untreated control cows in North Dakota. We did not observe differences in calf weight gain due to doramectin treatment.

Fecal egg counts in both cows and calves were similar (Tables 5 and 6) between treatment groups on day 0. An immediate decline in EPG of feces after treatment indicates that doramectin was effective for reducing nematode eggs shed initially. Significant differences were found between treatments in trichostrongylid-type egg counts and in all-genera nematode egg counts in both cows and calves on days 21 and 42; fecal egg counts were similar by day 84. This suggests reinfection with internal parasites.

In contrast, calf fecal egg counts were reduced through day 84 in a Mississippi trial, and through day 113 in an Idaho study.[2] Cattle parasite load is influenced by pasture contamination with parasite larvae, fecal egg shedding of cattle grazing the pasture, and climatic conditions favorable for development or persistence of larvae in the environment.[10] In 2000, the year of our study, temperature averaged 41°F (5°C) and total rainfall was 13.1 inches (32.3 cm).[8]

Number of flies present on treated animals was lower than non-treated control animals on day 4, but no differences were measured later in the study. Treated cattle had direct fence-line contact with control cattle in our study, therefore, a reservoir of flies was always nearby. This may have contributed to the rather quick re-population of flies on treated cattle. In contrast to our study, Andress *et al*[1] found fewer flies per side on doramectin-treated cows compared to control cows for four to nine weeks after treatment. However, a minimum of 0.75 miles separated treated and control animals rather than having fence-line contact, as in our study.

No differences were found between groups for any of the carcass characteristics examined in this study. A study by Guichon *et al*[5] investigated carcass characteristics when ivermectin was topically applied on calves upon arrival at the feedlot. Percentage of USDA Choice carcasses was higher for calves in the ivermectin group compared to control calves; however, percentage of carcasses classified as Yield Grade 1 and the dressing percentage were higher for the control group than for the ivermectin group. Our inability to find differences in carcass characteristics may be due to several factors. Calves may have been reinfected with internal parasites by day 84 while on pasture. In addition, management and genetic influences on carcass traits may have been greater than the effect of doramectin treatment on carcass parameters. However, randomization of cattle to treatment groups should have minimized these differences. The relatively small number of steer calves in each treatment group (low statistical power) could have also contributed to our lack of ability to detect differences in carcass characteristics.

This study suggests mid-summer doramectin application was quite effective for fall and winter lice control. However, treatment of cow-calf pairs grazing native pastures in southcentral North Dakota with doramectin pour-on in mid-summer did not result in significant differences in weight gain, BCS, or long-term fly control in the cows, nor was there a weaning weight advantage for calves treated mid-summer with doramectin. Internal parasite load may have been low, and treated cows and calves may have been reinfected with nematodes later in the grazing season. However, there is not good correlation between fecal egg counts and total worm counts,[4,13] therefore we cannot speculate on the internal parasite load in either of the treatment groups.

Conclusions

Mid-summer topical doramectin application can be successfully used to control lice during the fall and winter in beef cow herds in the Northern Great Plains. Under the conditions of our study, no other long-term benefits from treatment with topical doramectin were observed.

Footnote

[a] Dectomax, Pfizer Inc, Exton, PA

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