Effect of Deworming Heifers on Gain and Reproduction

S.L. Boyles
Formerly Livestock Specialist
NDSU Extension Service

L.J. Johnson
Livestock Specialist
NDSU Extension Service

W.D. Slanger
Professor
Animal and Range Sciences

B.J. Kreft
Research Specialist
Central Grasslands Research Center

J.D. Kirsch
Chemist
Animal and Range Sciences

Oxfendazole (Syntex, West Des Moines, IA) is a benzimidazole anthelmintic with proven efficacy against a spectrum of gastrointestinal parasites of cattle.

Yazwinski et al. (1986) suggested the efficacy of oxfendazole could be further improved by injection into the rumen rather than oral administration. Closure of the oesophageal groove after oral administration may reduce efficacy by allowing direct passage to the abomasum and reducing retention time in the gastrointestinal tract (Prichard and Hennessy, 1981). However, Bairden et al. (1983) observed no difference between oral and intraruminal administration. Intraruminal injection offers the opportunity for a rapid and easy way to administer oxfendazole therapy (Owen et al., 1989). Producers need not catch every animal in a head restraint, but rather simply confine the herd within a narrow alley.

Previous research has dealt with fecal egg counts and, in some cases, average body weight gain. The objective of this trial was to evaluate the effect of intraruminally injected oxfendazole on fecal egg counts, average body weight gain, variability of gain and reproductive performance of developing heifers.

Materials and Methods

Fifty-two Angus- and Gelbvieh-cross heifers weighing about 700 pounds were used in the trial. The average age of the heifers at the start of the trial was 303 days. Heifers were individually identified by clearly marked eartags. All animals appeared healthy and did not exhibit signs of parasitism (anemia, anorexia, diarrhea, dermatitis, and submandibular edema). The heifers had not received an anthelmintic prior to the trial.

The heifers were randomly allotted by age to one treatment group (n = 26) and one control group (n = 26). All starting weights were determined by averaging two weighings, 24 hours apart. Cattle were weighed on approximately 28 day intervals.

The treatment heifers received oxfendazole intraruminally at a rate of 4.5 mg/kg of live body weight (Couvillion et al., 1989); 1 ml of 22.5% formulation/50 kg live body weight. The suspension was injected into the rumen through the body wall of the left paralumbar fossa using a Synanthic Tru-Fire Rumen Injector® (Syntex, West Des Moines, IA). The injector was pushed until the shroud was depressed, automatically inserting the needle, followed by delivery of the oxfendazole. Pressure was maintained against the animal for approximately one second to ensure anthelmintic delivery.

The initial day of treatment was January 31, 1991. The heifers were maintained in adjacent feedlot pens and remained there until pasture turnout (June 14, 1991). Subsequent deworming treatments occurred 17 and 30 days after pasture turnout. Injection sites were palpated 28 days after each injection.

The treatment groups were allotted to separate feedlot pens during the initial part of the trial (January 31, 1991 to June 14, 1991). They were maintained

Table 1. Composition of feedlot diets for growing heifers

Ingredient	Dry matter	As-fed
Alfalfa hay, %	40.94	21.65
Barley, %	25.75	13.93
Corn silage, %	19.08	37.37
Clover silage, %	14.23	27.06
Nutrient		
Metabolizable energy, Mcal/kg	2.29	
Net energy maintenance, Mcal/kg	1.41	
Net energy gain, Mcal/kg	.84	
Crude protein, %	12.92	
Calcium, %	.78	
Phosphorus, %	.26	
Potassium, %	.69	

on the same growing diet (Table 1). All heifers had free choice access to a vitamin fortified salt-trace mineral supplement.

The heifers were turned out on adjacent smooth bromegrass *(Bromus inermis)* pastures June 14, 1991. The pastures were similar in topography and acreage. Each pasture had a separate water trough but similar water source. The heifers remained on these same pastures until palpation for pregnancy in the fall.

Fecal samples were collected manually from the rectum of all heifers beginning on day 0 of the trial and at the end of each weigh period. Samples were kept cool but not frozen. The cooled fecal samples were delivered in styrofoam containers to a commercial lab within 24 days for analysis. The Wisconsin Sugar Centrifugal Method (Bliss, 1989) was used to determine fecal worm eggs per gram (EPG). Samples were analyzed for *Haemonchus placei* (barber-pole worm)/ *Trichostrongylus axei* (small stomach worm), *Ostertagia ostertagi* (small brown stomach worm), *Cooperia spp.* (small intestinal worm), *Nematodirus helvetianus* (thread-necked worm), *Bunostomum phlebotomum* (hookworm), *Strongyloides papillosus* (intestinal threadworm), *Oesophagostomium radiatum* (nodular worm), *Trichuris spp.* (whipworm), *Moniezia spp.* (tapeworm) and *Eimeria spp.* (coccidia). EPG was determined for each parasite egg type and received a score of 0, 1, 2 or 3 (0 = 0, 1 = 1-10; 2 = 11-50; 3 = 50+ EPG). Total fecal eggs counts were also recorded.

Blood samples were taken via the jugular vein on a weekly basis when the oldest heifer reached 12 months of age (March 12, 1991). Blood samples were centrifuged at the corral. The serum was collected and immediately placed in a cooler with ice for transport to the laboratory and the samples were stored for later progesterone analysis. Heifers were determined to have reached puberty if progesterone levels reached 1 ng/ml (Rutter and Randel, 1986). Individual heifers were not bled after reaching this progesterone threshold level.

All heifers were vaccinated on May 1, 1991. The treatment consisted of a standardized combination of lyophilized, attenuated strains of bovine rinotracheitis virus diarrhea, parainfluenza-3 virus propagated in a stable cell line; accompanied by liquid, inactivated, standardized *Campylobacter fetus, Leptospira canicola, L. grippotyphosa, L. harjo, L. icterohaemorrhagiae* and *L. pomona* bactrin diluent (Beecham Laboratories, Bristol, TN).

Estrus synchronization and artificial insemination techniques were used, followed by clean-up bulls. A two-injection procedure with a prostaglandin analogue (Syntex, West Des Moines, IA) was used. The first injection of prostaglandin analogue was on May 31, 1991. Eleven days after the first injection, a second injection of prostaglandin analogue was administered. Heifers were observed for heat after each injection and bred. Five days after the second prostaglandin injection, clean up bulls were turned in. The bulls were fertility checked and treated with oxfendazole 14 days prior to introduction. There was one bull per group and the duration of natural service was 45 days. There was no rotation of bulls between the groups. Bulls were observed to assure ability to breed. All heifers were palpated for pregnancy at the conclusion of the trial (October 2, 1991) which was 66 days after removing the bulls.

Results and Discussion

No adverse local or systemic reactions were observed in this trial. The injection site area was wiped with a cloth, if deemed necessary, to remove dirt or mud. Rudimentary sanitation practices should reduce the potental for abcesses.

Total fecal worm egg counts before treatment were similar (P=.64) for treatment (2.19 EPG) and control (1.87 EPG) heifers (Table 2.). Number of worm eggs per gram of feces appeared to be higher for heifers in January (2.03 EPG) than for heifers in September (.19 EPG), which is in agreement with data reported by Ward et al. (1979, 1991). Deworming decreased or eliminated total fecal worm EPG throughout the trial. There appeared to be some reduction in efficacy during March (P = .09), August (P = .09) and September (P = .18), but treated heifers still had lower total fecal egg counts.

Table 2. Total fecal worm eggs per gram of sample

Month	Control		Dewormed		Probability Level
	Avg.	SD[b]	Avg.	SD[b]	
January	1.87	1.973	2.19	2.832	.6409
February	2.36	2.221	.11	.309	.0001
March	.85	2.440	.00	.000	.0956
April	7.63	7.192	1.21	1.951	.0001
May	4.52	5.018	.00	.000	.0001
June	4.52	4.056	.60	1.691	.0001
July	2.48	3.578	.00	.000	.0025
August	.30	.897	.00	.000	.0949
September	.38	.143	.00	.000	.1848

[ab] n = 26

Based on total egg counts, neither group of heifers initially appeared to be severely infected. Wohlgemuth et al. (1991) observed similar total egg counts for treated (4.8 EPG) and control (12.1 EPG) cows in another North Dakota study in which adjusted weaning weights were 33 pounds heavier due to anthelmintic treatment. Ward et al. (1991) stated that cattle carrying clinical infection levels (200 to 300 EPG) or higher would likely have improved pregancy rates or heavier body weights due to deworming. Response at lower infection levels is dependent on worm species present, age of animal, level of nutrition and general health of the animal (Ward et al., 1991).

Factors affecting larvae survival include temperature, moisture, type of soil, forage plants and pasture management (Williams and Bilkovich, 1973). Normal pasture dates for spring turn-out in North Dakota are approximately May 15. Turning the heifers out on a later date (June 14) may provide some measure of parasite control (Armour, 1980). Feeding stored forage could reduce risk of early-season pasture infections (Nansen et al., 1987). The rationale for this approach is that substantial numbers of infective larvae may overwinter on pasture. These larvae die off as increasing temperatures stimulate activity and deplete parasite energy reserves. A change in diet can also increase nematode fecal egg counts (Armour, 1980). The relatively late pasture turnout date did not elemintate the need for anthelmintic treatment to reduce EPG during June and July (P = .0001). However, the later turn-out date allowed easier access to heifers for the artificial insemination program.

Fecal worm egg count scores were similar for all worm species measured prior to anthelmintic treatment (Table 3). *Haemonchus placei/ Trichostrongylus axei* fecal worm egg count score was reduced by treatment with oxfendazole during the feedlot and pasture phase of the trial, which is in agreement with other research. *Ostertagia ostertagi* and *Cooperia spp.* egg populations were

Table 3. Fecal worm egg count score[1].

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Haem/Tric									
Control	.23	.50[a]	.08	.96[a]	.77[a]	.75[a]	.75[a]	.08	.19
Deworm	.50	.00[b]	.00	.42[b]	.00[b]	.12[b]	.00[b]	.00	.00
Ostertagia									
Control	.42	.27[a]	.08	.46[a]	.46[a]	.67[a]	.04	.08	.15
Deworm	.31	.00[b]	.00	12[b]	.00[b]	24[b]	.00	.00	.00
Cooperia									
Control	.58	.58[a]	.00	.50[a]	.08	.21	.00	.00	.00
Deworm	.65	.00[b]	.00	.04[b]	.00	.00	.00	.00	.00
Nematodirus									
Control	.77	.62[a]	.00	.19	.04	.04	.00	.00	.00
Deworm	.62	.15[b]	.00	.08	.00	.00	.00	.00	.00
Bunostomum									
Control	.00	.00	.00	.00	.00	.00	.00	.00	.00
Deworm	.00	.00	.00	.00	.00	.00	.00	.00	.00
Trichuris									
Control	.04	.00	.00	.00	.00	.00	.00	.00	.00
Deworm	.08	.00	.00	.00	.00	.00	.00	.00	.00
Oesophagostomium									
Control	.00	.00	.00	.34[a]	.08	.08	.00	.00	.00
Deworm	.08	.00	.00	.00[b]	.00	.00	.00	.00	.00
Strongyloides									
Control	.00	.00	.00	.00	.00	.04	.00	.00	.00
Deworm	.00	.00	.00	.00	.00	.00	.00	.00	.00
Moniezia									
Control	.38	.35	.04	.00	.00	.04	.04	.15	.12
Deworm	.42	.08	.15	.04	.00	.04	.00	.00	.46
Eimeria									
Control	.27	.35	.48	.27	.69	.71	.21	.04	.00
Deworm	.19	.58	.46	.46	.58	.72	.12	.08	.12

[1] Each heifer's fecal count was scored 0 for 0 eggs per gram, 1 for 1-10 EPG, 2 for 11-50 EPG and 3 for 50+ EPG. The numbers are the averages of these scores.
[ab]Means for type within time are different (P < .05).

reduced in treated heifers until July. *Ostertagia ostertagi* egg counts were similar for treatment and controls during the pasture phase. A 30-45 day interval between deworming treatments may be required to break the cycle for egg-laying adult worms (Meyers, 1988). *Cooperia spp.* egg counts for both control and dewormed heifers were effectively nil during the pasture phase of the experiment. *Nematodirus helvetianus* egg populations were lower (P < .05) 28 days after the initial anthelmintic treatment, but similar during the rest of the trial. *Nematodirus helvetianus* did not appear to be a problem for either group during the pasture phase. Fecal egg populations for *Bunostomum phlebotomum, Strongyloides papillosus, Oesophagostomum radiatum, Trichuris spp.* were low or did not appear to be prevalent in either experimental group. *Moniezia bendeni* and *Eimeria spp.* egg counts were not affected by treatment. Ward et al. (1991) observed that level of infection in cows for *Moniezia bendeni* and *Eimeria spp.* were consistently low throughout a three-year trial.

Ostertagia/Trichostrongylus, Haemonchus, Cooperia, Oesohagostomum, Monezia and *Eimeria.* were the predominant parasites most often detected in the present study. Wohlgemuth et al. (1991) had similar results in another North Dakota study. However, Wohlgemuth et al. (1991) did not evaluate *Monezia spp.* and *Eimmeria spp.* Osteragiasis, a parasitic gastritis caused by the nematode *Ostertagia ostertagi,* is the most important

gastrointestinal helminth infection of cattle in temperate climates (Meyers and Taylor, 1989). Studies on the epidemiology of parasitic gastroenteritis mainly caused by *Ostertagia ostertagi* have led to recommendations for prevention of the disease (Block et al., 1985). The annual costs of gastrointestinal nematodiasis in the United States has been estimated to be in excess of $250 million (Gibbs and Herd, 1986).

Group weights were equal (P = .98) at the start of the trial (Table 4). Other than in September when the control average was 3.3 pounds higher, the treatment average weight was higher than that of the control during both feedlot and pasture phases. The difference was only statistically significant (P = .10) in May. Effect of breeding activity may have affected the gains from May to June. Average body weight remained the same from September to October for the control group and actually decreased for the treatment group.

Differences between groups with regard to average daily gain (ADG) are presented in Table 5. Through May, the treated heifers grew faster (P = .005) and with less variability (P = .12). From July to September, the controls grew faster but with more variability (P = .09). Overall ADGs were similar in amount (P = .19) and variability (P = .71). The increase in ADG for treated heifers was only .06 pound per day. Deworming improved gains in the feedlot and also reduced variation in gain during both feeding phases. The within-group correlations between feedlot and pasture average daily gain were zero. An explanation for the lack of difference in rates of gain is that the controls were not able to express their growth potential under the nutritional and parasitic environments of the feedlot, but were able to compensate once they had access to all the grass they wanted to eat. This hypothesized dif-ference in nutritional environment could also explain the zero correlation within the treated group. The pasture gain for controls was almost twice that in the feedlot; dewormed heifers gained 1.5 times faster upon reaching the pasture.

Table 4. Effect of deworming on body weight (kg).

Date	Control		Deworm		Probability level
	Avg.	SD[a]	Avg.	SD[b]	
January	317.9	21.00	317.8	24.57	.98
February	328.9	23.62	331.4	24.46	.71
March	350.2	25.56	356.5	25.04	.37
April	360.9	25.53	364.8	27.60	.60
May	370.5	22.43	382.2	27.09	.10
June	384.3	23.90	386.7	27.69	.74
July	387.1	24.91	394.9	27.96	.29
August	429.8	26.98	429.4	29.72	.34
September	438.6	30.22	443.3	29.89	.58
October	438.9 +	30.35	437.4 +	31.87	.86

[ab]n=26

Table 5. Average daily gain by regression (kg).

Situation	Control		Deworm		Probability Mean	Probability Variance
	Avg.	SD[a]	Avg.	SD[b]		
ADG Feedlot	.457	.1155	.540	.083	.0047	.1148
ADG Pasture	.876	.1718	.822	.1210	.1979	.0859
Total ADG	.559	.0717	.587	.0774	.1893	.7059

[ab]n=26

Table 6. The effect of deworming on reproductive performance.

Item	Control		Deworm		Probability Level
	Avg.	SD[a]	Avg.	SD[b]	
Birth date	April 4	11.5	April 4	10.7	.88
Puberty, days	349.5	15.6	348.6	13.2	.83
Pregnancy/Open	4 of 26		1 of 25		.18

[ab]n=26

The average birth date for both groups was April 4, 1990. Onset of puberty was similar across both groups (P=.83). Block et al. (1985) observed that deworming resulted in 44 fewer days to first breeding in dairy heifers. The controls had an average age of 349.5 days at puberty and the dewormed heifers were 348.6 days of age.

There were four open heifers in the control group and two in the dewormed group (Table 6). However, one of the open treated heifers had a poorly developed reproductive tract and was deleted from the reproduction analysis. Analysis was based on four open heifers in the control group and one open heifer in the treated group (P = .18). Three of the five open heifers were sired by the same breed. There was no difference between breed of sires of heifers. Virtually the same percentage of heifers (65 percent) conceived via artificial insemination in the two groups.

Implications

Deworming by intraruminal injection of oxfendazole reduced numbers of several species of internal parasites. No abscess developed at the injection sites. Dewormed heifers gained faster in the feedlot and with less variability of gain. This reduction in gain variability was also evident during the pasture phase; however final body weights were not different between groups. Intraruminal injection of oxfendazole was an effective and easy way to administer the anthelmintic.

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