Strategic Timed Use of Fenbendazole Deworming Blocks in Stocker Cattle

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Introduction

Weight gains of young grazing beef cattle have been shown to be influenced by clinical or subclinical gastrointestinal parasitism.[1-4] In the northern United States producers have traditionally practiced deworming of stocker cattle as they begin spring grazing. Recent studies of the epidemiology and control of gastrointestinal trichostrongyle populations have elucidated the inadequacy of such a program.[3] Cattle treated at turn-out are almost immediately reinfected from over-wintered larvae present on permanent pastures. Following the infection the parasites mature and eggs are deposited on the pastures. Therefore significant pasture contamination with infective third-stage larvae will develop from mid-summer until fall, provided appropriate weather conditions for larval development, survival and distribution exist.[5,6]

Based on a knowledge of parasite epidemiology, attempts have been made to develop more effective control programs employing the strategic use of anthelmintics early in the grazing season.[5-9] Such programs entail either multiple anthelmintic treatments spaced to coincide with parasite prepatent periods or the continuous administration of anthelmintic over a period of time. A strategic parasite control program is currently advocated in Virginia based on suggestions by Armour,[1] Herd,[3,7,8] and Hansen,[9,10] and involves deworming at turn-out and again three and six weeks later (0,3,6). The initial deworming is aimed at eliminating parasites acquired from winter grazing or from the resumption of development of inhibited parasite larvae. Anthelmintic retreatment at three-week intervals eliminates developing stage of parasites before patency occurs and pastures are recontaminated. By the time the six-week treatment is given most remaining over-wintered larvae will have been ingested and killed by anthelmintic treatment or have died due to rising temperatures and desiccation.

This strategic control program, with its recommended increase in the number of treatments, has only been accepted to a limited degree by producers. This is partly due to the fact that the program requires extra handling of animals at periods of time when other responsibilities on the farm are pressing. Producers have, therefore, sought approaches for administering anthelmintics which require less labor and handling of cattle than traditional administration of anthelmintics. Studies in Louisiana and Alabama have demonstrated the anthelmintic efficacy of a 25 pound Enproal® Safe-Guard™ dewormer block[a] feed blocks containing fenbendadzole (FBZ)[11,12] The development and marketing of these blocks have been met with considerable enthusiasm by beef cattle producers in Virginia.

Ivermectin may also be utilized in the strategic deworming program.[16] This anthelmintic has been documented to have at least a fourteen day residual effect in cattle against *Ostertagia ostertagi* and *Dictyocaulus viviparous* 1[3-15] Consequently, when ivermectin is used in the strategic program the number of treatments can be reduced. Since the two week residual effect may be added to the three week prepatent period, five weeks can elapse between the initial treatment and the follow-up treatment. Because two administrations provide at least ten weeks before eggs are again shed in the feces no additional treatment is required.

The present study was conducted to evaluate the consumption and suitability of FBZ dewormer blocks when utilized in two different strategic deworming programs.

Materials and Methods

Cattle—Sixty-five cross-bred beef steers were purchased during April 1987 from surrounding auction sales and were estimated to range from 9-14 months of age. The previous history of anthelmintic treatment in the cattle was unknown. Cattle ranged in weight from 465 to 735 lbs. with a mean weight of 613.7 lbs at the initiation of trial.

[a] *Hoechst-Roussel Agri-Vet Company, Somerville, NJ.*

On April 29, 1987 cattle were grouped into blocks based on frame size and breed and were then randomly divided into three groups.

Pastures—Three adjacent pastures known to contain parasite larvae were used. The pastures consisted of blue grass, clover and tall fescue forages of equal quality and type and had been grazed in a parasite control study the previous spring and summer.[17] Following the conclusion of that study in the fall, cow/calf pairs were allowed to graze all pasture until approximately 6 weeks before the current trial began.

Cattle groups were divided to provide equal stocking rates of 1.1 acres per steer. This provided for group sizes of 25 (pasture 1), 25 (pasture 2), and 15 (pasture 3) animals and resulted in a stocking rate of 561 pounds of animal per acre.

Treatment—All steers in a group were treated similarly. Groups were treated according to the following protocol:

Group 1—Steers were administered FBZ suspensions (Panacur® 5-mg-kg) by oral drench at the beginning of the trial. They were then given access to FBZ medicated blocks (Safeguard Dewormer Block®) for 3 days beginning at 21 days and again at 42 days after grazing began. Blocks were administered at the rate of 1 block for 8000 lbs of cattle weight. At the expected daily rate of consumption (0 .1 pound of block/100 pounds body weight) this would deliver a therapeutic dose of 5 mg/kg of FBZ over 3 days. Prior to medicated block placement cattle were trained to consume blocks by providing similar nonmedicated blocks (En-Pro-Al® Starter blocks) for a period of 10 days. At all other times standard livestock mineral mix was available to cattle but was removed during periods of exposure to medicated and non-medicated blocks.

Group 2—Steers were injected subcutaneously with ivermectin (Ivomec® 200 mcg/kg) at the beginning of the grazing trial. This group was then given access to the FBZ medicated blocks beginning 35 days post trial start, using the same dosage and training periods as described for Group 1.

Group 3—This was a nontreated control group. No anthelmintic treatment was provided for cattle in this group during the course of the trial.

Parasitological parameters and observations

Steers were weighed on a portable scale at the beginning of the trial, and on days 29, 44, 72 and 111 (the end) of the trial. On the same days fecal samples from all steers were collected and parasite egg counts determined by the modified McMaster technique. Serum samples were also collected from all animals on days 1, 29, 72 and 111, and were analyzed for the content of serum pepsinogen using an enzymatic-colorimetric method.[18] Pasture herbage samples were collected two days before the trial began and on days 30, 52, 105 and 22 days after the trial conclusion (day 133). Samples were collected randomly from the pastures and no closer to fecal pats than cattle were grazing. Herbage samples were analyzed for trichostrongyle larvae according to the technique of Jϕrgensen.[19] Larvae counts were expressed as number of larvae per kg of dry herbage.

Monitoring block consumption

Both nonmedicated and medicated blocks were placed in several locations on each pasture in areas where cattle were seen to rest. Each block was weighed every 3 days for determination of consumption rates. Additional starter blocks were added to pastures as needed to maintain their presence throughout the entire 10 day training period. In cases where an individual block did not show signs of being consumed within the first 3 days it was moved to a new location.

Statistical analysis

Analysis of variance was used to analyze selected parameters. Using a significant F test for treatment group, individual controls were used to compare results for each treatment group.

Results

The average weight gain for each of the three groups during the 111 day grazing period is shown in Fig. 1 and Table 1. Average weight gain for groups one, two and control were 203.2, 176.1 and 139.0 pounds per animal respectively. Weight gain was significantly greater for groups 1 and 2 when compared with the nontreated control group ($P<.05$) (Table 1, Figure 1). Significant differences in gain were also evident during the second time period (days 29 to 72). Group 2 gained 22.5 lbs more than controls ($P<.05$) and Group 1 gained 38.8 lbs more than controls ($P<.01$) and 16.4 lbs more than group 2 ($P<.05$).

TABLE 1. Mean weight gains for treatment groups during grazing periods in 1987.

Period	Group 1 Mean (lbs.)	Group 1 S.E.	Group 2 Mean (lbs.)	Group 2 S.E.	Control Mean (lbs.)	Control S.E.
4/29-5/27	78.0	7.11	73.0	4.88	66.0	6.88
5/27-7/9	84.8[a,c]	4.37	68.4[b,c]	5.20	45.9[d]	5.44
7/9-8/17	40.8	4.22	34.7	4.95	27.1	5.44
4/29-8/17	203.2[a]	9.40	176.1[a]	9.25	139.0[b]	13.03

Values within rows with different superscripts[a,b] are different ($P<.05$).
Values within rows with different superscripts[c,d] are different ($P<.01$).

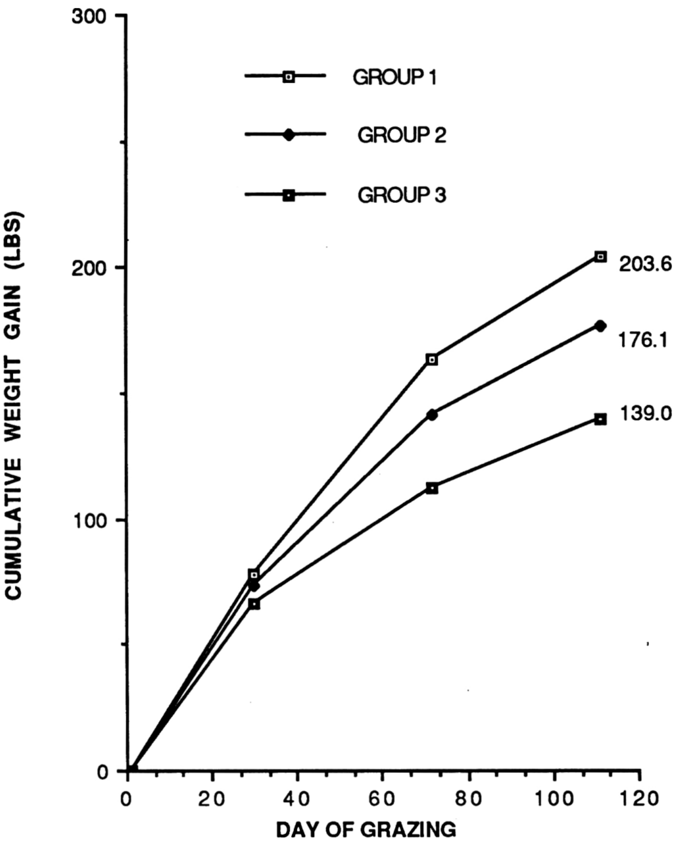

FIGURE 1. CUMULATIVE WEIGHT GAIN IN POUNDS FOR GRAZING SEASON 1987.

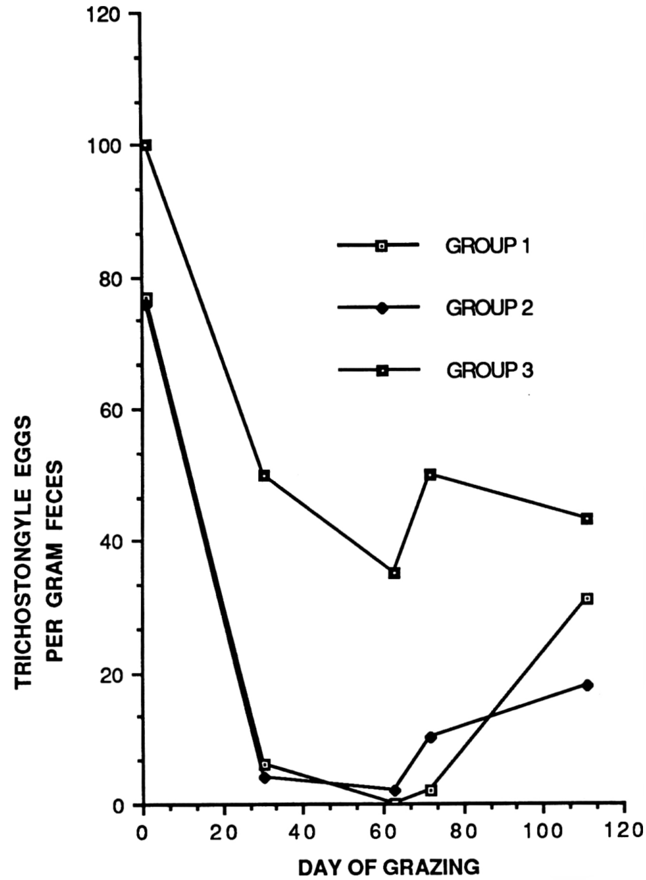

FIGURE 2. TRICHOSTRONGYLE EGGS PER GRAM OF FECES DURING 1987.

Analysis of variance indicated significant differences in fecal egg counts between treated (Groups 1 and 2) and control (Group 3) animals on days 29 and 72 of the trial (Table 2, Figure 2). An apparently higher fecal egg count at the beginning of the trial in the control group was not found to be statistically significant. By the end of the trial small numbers (18.4-31.3 eggs per gram average) of trichostrongyle eggs were present in the feces of animals in both treatment groups.

Table 3 and Figure 3 summarize the serum pepsinogen values for the groups. All groups showed increasing values throughout the grazing season. Group 1 had a lower average serum pepsinogen level at the end of the trial than Group 2 ($P<.01$). Serum pepsinogen values for Group 2 and the control group roughly paralleled each other throughout the course of the study while values for Group 1 tended to remain lower.

TABLE 2. Mean fecal trichostrongyle eggs per gram of feces.

Date	Group 1 Mean (epg)	Group 1 S.E.	Group 2 Mean (epg)	Group 2 S.E.	Control Mean (epg)	Control S.E.
April 29	77.3	26.3	76.1	17.5	100	26.9
May 28	6.3[b]	3.4	4.2[b]	2.9	50[a]	32.7
July 9	2.2[b]	2.2	10.4[b]	4.2	50[a]	19.6
August 17	31.3	12.3	18.4	9.5	43.3	18.2

Values within rows with different superscripts[a,b] are different ($P<.05$).

TABLE 3. Mean serum pepsinogen values (IU/ml) for groups.

Date	Group 1 Mean (IU/ml)	Group 1 S.E.	Group 2 Mean (IU/ml)	Group 2 S.E.	Control Mean (IU/ml)	Control S.E.
April 29	.71	.07	.87	.11	.71	.09
May 28	.72	.09	.96	.09	.95	.19
July 9	.87	.08	1.13	.11	1.19	.14
August 17	.96[a]	.10	1.42[b]	.13	1.26	.20

Values within rows with different superscripts[a,b] are different ($P<.01$).

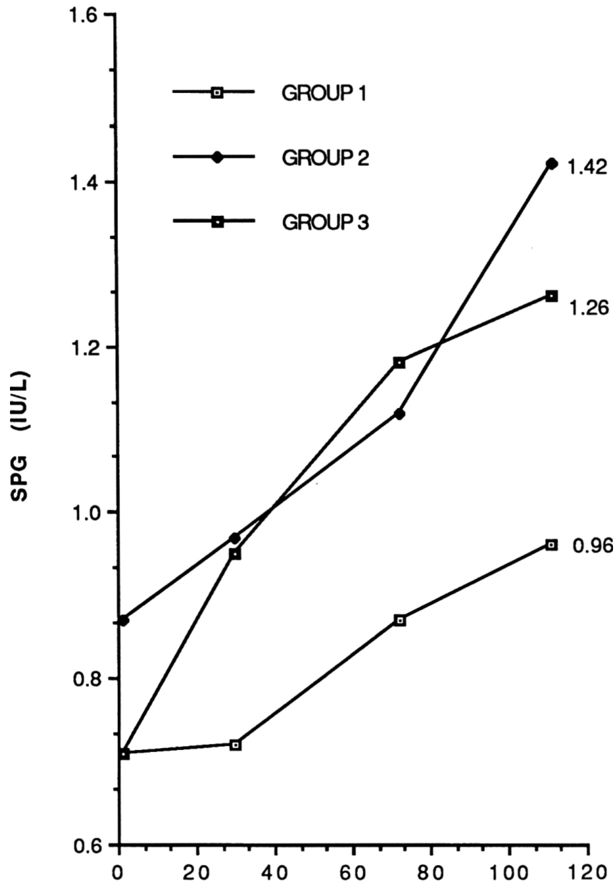

FIGURE 3. SERUM PEPSINOGEN LEVELS (IU/L) FOR GROUPS DURING 1987.

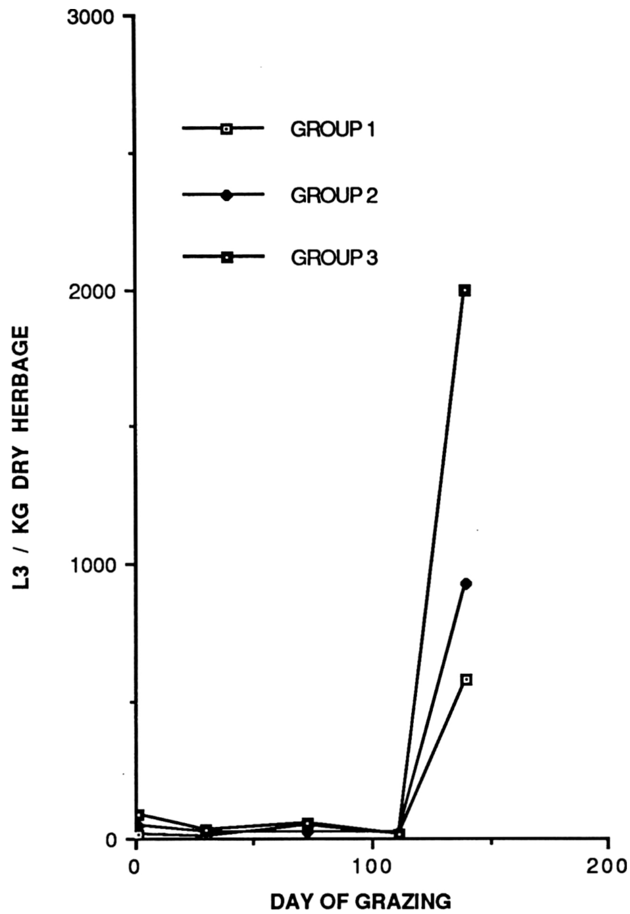

Figure 4. THIRD STAGE LARVAE FROM GRASS ANALYSIS IN 1987.

Table 4 and Figure 4 summarize the pasture larvae levels. Herbage larval counts remained relatively low until late in the season. This late season increase in larval counts followed a period of rainy weather. Larvae numbers were highest in the control group, intermediate in Group 2 and of lower magnitude in Group 1.

TABLE 4. Third stage trichostrongyle larvae counts for each of three pastures during grazing season of 1987.

Date	Group 1 (L_3/Kg dry herbage)	Group 2 (L_3/Kg dry herbage)	Group 3 (L_3/Kg dry herbage)
April 27	15.0	51.0	91.0
May 29	9.0	28.0	30.0
July 17	46.3	25.6	60.2
August 11	17.8	27.0	20.2
September 9	582.0	932.0	2000.0

Weight gains for the various breed group were summarized (Table 5). Gain differences were not found to be significant between breeds (P<.05). A trend toward greater weight gains for exotic versus English type breeds is seen, however.

The target block consumption rate was an average of 0.6 lb/head/day. Consumption of trainer blocks, although considered adequate, did not reach this level throughout the entire 10 day training period. Target consumption of medicated blocks occurred during the first 3 day treatment period in Group 1. However, during the second treatment and the treament of Group 2 animals, consumption rates averaged 0.4 lb/bd/day and the blocks were allowed to

TABLE 5. Weight gain by breed for Aprol 29 to August 17, 1987.

Breed Type	Gain	S.E.
Angus	172	8.4
English Cross	189	13.2
Hereford	195	12.2
Exotic Cross	202	16.7
Exotic	234	19.3

remain on the pastures until target consumption was reached (8 days in both cases). In general, blocks appeared to be highly palatable and were readily eaten by the cattle.

Discussion

A significant beneficial effect of treatment in Group 1 (Panacur at week 0; blocks at 3 and 6 weeks) is indicated by the improved weight gain of 64.2 lbs over non-treated controls. Efficacy of the program is further suggested by the lower serum pepsinogen levels at the conclusion of the trial, a trend of lower fecal eggs counts and lower pasture larvae counts late in the grazing season. These data document that the 0, 3 and 6 treatment program was effective in not only removing initial worms burdens but in preventing recontamination of pastures and hence lowering gastrointestinal trichostrongyle infection throughout the grazing season.

Data from treatment Group 2 present a less easily interpreted scenario. The average weight gain of 37.1 pounds more than non-treated controls suggests a benefit to this program. Parasitological data raise some questions about its efficacy, however. The initial ivermectin treatment was effective in dramatically reducing egg shedding as indicated by lower fecal egg counts than those of controls on days 44 and 72 of the trial. However, serum pepsinogen values tended to remain higher throughout the grazing period and were not significantly different from non-treated controls at the end of the trial. Pasture infective larvae levels were also higher at the end of the season for Group 2 than for Group 1.

Consumption of medicated blocks was apparently sufficient to provide adequate anthelmintic doses to the majority of cattle to whom they were offered. This is true, even with the fact that consumption of the calculated anthelmintic dose took a longer period of time than the projected 72 hours. Consumption times were especially prolonged at treatments later in the grazing season. This is presumably due to decreases in forage moisture resulting in less salt diuresis and hence a lower salt intake. Similar high levels of efficacy have been reported whether the fenbendazole dewormer block was consumed in 3 days or up to 10 days.[12] Prolonged administration is a recognized feature of modern benzimidazole anthelmintics. This allows products like FBZ to fit into flexible anthelmintic administration programs.[17]

An economic analysis of both strategic treatment programs is provided in Table 6. All groups were individually handled once. Management of the dewormer block requires a minimum amount of labor to place and monitor the blocks. Labor for treatment with FBZ or ivermectin at the initiation at the program is assumed to be equal at $2.00 per animal. Labor for placement and monitoring of blocks is assumed to be less at $1.00 per animal for each treatment. The 0-5 program (Group 2) provided a cost-benefit ratio of 1:3.6. The 0-3-6 program (Group 1) provided a favorable return of $5 for each $1 invested in the anthelmintic treatment program.

TABLE 6. Economic analysis of two strategic deworming programs for Virginia stocker cattle.

Program	Additional Gain	Additional Profit @ $.80	Additional Cost	Cost:Benefit Ratio
Panacur at turnout plus 2 block treatments (0-3-6)	64	51.20	10.30	5.0
Ivomec at turnout plus 1 block treatment (0-5)	37	$29.60	8.20	3.6
Controls (no program)	0	0	0	

Panacur® Suspension @ $1.25/600 lbs.
En-Pro-Al®/Safe-Guard® Block ® $25
En-Pro-Al® Starter Block ® $6
Ivomec ® $2.70/600 lbls.

The results of this trial further demonstrate the value of strategic, early-season, anthelmintic treatments to young grazing cattle. Three dosings timed at intervals three weeks after the beginning of grazing appeared to protect the cattle against internal parasitism for the balance of the grazing season. This trial was terminated earlier than is typical for yearling beef-cattle grazing systems in Virginia. Termination of the trial was made necessary by the lack of grass due to very dry mid-summer conditions.

Examination of the mean fecal egg counts (Table and Figure 2) suggest that much of the benefit from these control programs is related to the delay in egg output at a critical time of the year. Egg output from the control group was high throughout the entire grazing season. Eggs shed onto pastures early in the grazing season in the control group resulted in increased pasture contamination which could be seen as increased third stage larvae on the pasture herbage, especially late in the season.

Yearly grazing cattle in the United States are frequently dewormed on a schedule based on convenience. Cattle are treated when they are being handled for other reasons such as dehorning and castrating, vaccinating, implanting and ear-tagging. These procedures are usually done in the spring as cattle are prepared for summer grazing. The discovery that additional dewormings after cattle had begun to graze would greatly enhance control of internal parasites and provide significant additional weight gain has made a dilemma for many producers. The attractiveness of the additional gains must be weighed against the extra time, labor and inconvenience of administering additional dewormings. Routes of administration which decrease the amount of labor needed to administer anthelmintics after cattle have been placed on summer grazing pastures have been actively investigated. Rumeno-reticular sustained-release devices, topical applications, and administration of anthelmintics through feed or mineral supplement are either commercially available or under investigation. In order to be effective these alternative methods for deworming must be safe, economical and successful in delivering an appropriate dose of anthelmintic to nearly all cattle in a group. The present study found the FBZ dewormer block to meet these criteria.

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