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Production responses following strategic parasite control in a beef cow/calf herd

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Abstract

Strategic parasite control has been reported to improve performance in a beef cow/calf herd that does not demonstrate clinical parasitism. This study was conducted to determine if strategic anthelmintic treatment at turnout and at midsummer would improve growth and reproduction. Two cow/calf groups of similar composition were grazed on separate, but equivalent pastures in the spring, and at midsummer, they were moved to new pastures. The treated group was given fenbendazole at turnout (cows) and at midsummer (cows and calves). The control group was not treated. The study was repeated in the following year. Across both years of the study, parasite egg counts were substantially reduced in both the treated cows ($P < 0.005$) and treated calves ($P < 0.0001$). The calves in the treated group significantly ($P < 0.0001$) outgained the control calves in both years of the study by 19.3 kg and 13.2 kg, respectively. Average daily gain (ADG) after adjusting for birth weight and birth date for treated calves was 0.13 kg greater than for control calves (0.83 vs 0.70) for the 2-year study ($P < 0.0001$) There was also a significant ($P = 0.0357$) increase in the reproductive performance of the cows. The pregnancy rate averaged across years was 94% for the treated cows compared to 82% for the control animals.

Keywords: Beef cattle; Cow/calf; Nematodes; Reproductive performance; Weight gain; Strategic deworming

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Parasite control programs have changed dramatically over the past decade. In the past only animals suffering from clinical parasitism would be treated. Recent studies document that animals infected with subclinical levels of gastrointestinal (G.I.) nematodes benefit from anthelmintic treatment. Bumgarner et al. (1986) found a 22.5 kg weaning weight advantage when parasites were controlled in a cow/calf herd compared to an untreated control group ($P < 0.01$). Similarly, Wohlgemuth et al. (1990) measured a 31 lb (14.1 kg), 205 day adjusted weaning weight advantage. Stuedemann et al. (1989) observed an improvement in pregnancy rate of cows treated with an anthelmintic and a significant increase in the calving rate in addition to a 0.04 kg average daily gain (ADG) advantage for the treated calves ($P < 0.05$).

The knowledge that subclinical or production parasitism adversely affects productivity has resulted in an increased use of anthelmintics by producers. Historically these products have been most commonly administered whenever it was convenient, and not based on the most appropriate time for the effective control of the parasites. Strategic parasite control is the timely use of anthelmintics to remove the parasite population before economic losses occur and before the parasites mature, begin laying eggs and contaminate the animals' environment. The economic benefits of this preventive approach have been recognized (Myers, 1988; Stuedemann et al., 1989). Many producers are adopting strategic parasite control and are shifting the timing of treatment to prevent economic losses.

Studies in Minnesota have shown that the number of worms in cattle decrease significantly over the winter and begin to rise in the spring (Stromberg et al., 1991). Similar observations were reported by Andrews and Hanson (1984) for North Dakota cattle. Parasite burdens and egg production continued to increase over the summer, resulting in significant pasture contamination (Stromberg and Corwin, 1993). Therefore, the infection pressure for the calf born in winter/spring would increase throughout the grazing season. Understanding this epidemiology has led to cows being treated with an anthelmintic before turnout to spring pasture to eliminate or reduce the role of the cow as a source of pasture contamination. Cows and their calves were treated at midsummer to prevent further pasture contamination when the animals were moved to fresh pastures. This strategic treatment program has been shown to provide seasonal control of nematode parasitism in Midwest cow/calf herds (Bumgarner et al., 1986; Stromberg et al., 1991; Stromberg and Corwin, 1993). This study was conducted to determine if a strategic treatment program would improve performance of a cow/calf herd over a period of two grazing seasons. Production parameters evaluated were cow and calf weights, calf ADG, cow condition scores and the pregnancy status of the cows at weaning. Fecal egg counts were also followed over both years of the study.

1. Materials and methods

1.1. Animals

A purebred Shorthorn herd at the West Central Experiment Station in Morris, MN, was used for this study. This herd was established in 1914 and since then new introductions into the herd were breeding stock only. Sixty cows and 12 bred heifers were allocated into two groups (treated and control) by stratified random selection based on age and sire of the dam in early May of the first year. In the second year cattle groups were similar with 61 cows and four bred heifers. The cows and bred heifers were examined for pregnancy each October and only pregnant animals were retained. Replacement bred heifers were allotted in the same manner the second year.

1.2. Experimental procedure

Calving occurred from 8 February through 13 May, and 6 March through 25 May for the 1984 and 1985 study years, respectively. The bulk of the calves were born from mid-March to late-April. Cows and calves were all grouped together after calving until early May on a small calving pasture of approximately 2.0 ha. Calves were tattooed, eartagged and weighed at birth.

The herd was separated into the two groups in early May. Cows and calves were individually weighed and cow body condition scores were assigned (Evans, 1978). Cows in the treated group were given fenbendazole suspension, orally, at 5 $mg\,kg^{-1}$ body weight (Panacur®/Safe-Guard®, Hoechst–Roussel Agri-Vet Co., Somerville, NJ). The two groups were grazed separately on two similar, 8.1 ha native grass pastures. In mid-July all the cows and calves were weighed and moved to a second set of equivalent native grass pastures, each of about 6.1 ha. These pastures had not been grazed since the previous October in both years of the study. At this time, cows and calves in the treated group received fenbendazole suspension orally at 5 $mg\,kg^{-1}$ body weight.

In early October both groups were removed from pasture and the animals were weighed individually, cow body condition scores assessed, pregnancy status of cows determined by rectal palpation and calves were weaned. The weights in May and October were both recorded after water had been withheld for the previous 16 h (shrunk weight). The bull calves were not castrated until after weaning. All cows were maintained as a single group throughout the winter in a large lot and fed large round bales of corn stalks, grass hay and alfalfa hay. Replacement heifers were maintained as a separate group and fed alfalfa hay and corn silage.

Trace mineral salt, limestone and water were available free choice throughout the trial. Insecticide ear tags were used on all cows throughout the fly season in both years of the study. Pastures, when limited by inadequate growth, were supplemented with grass hay (ad libitum) in large round bales. Treated and control groups were supplemented equivalently, as needed in June and again in August and September in both years of the study. In the spring cows were observed for estrus for 5 days, and bred (by artificial insemination) 12 h after observed standing estrus starting 1 June. Cows not showing estrus after 5 days were synchronized with a prostaglandin product (Lutylase, Upjohn, Kalamazoo, MI). These cows were bred approximately 76 h later by artificial insemination. Bulls were introduced on 12 June for 52 days and then removed to insure insemination of all cows.

Rectal fecal specimens were collected from individual animals when the animals were weighed in May, July and October. The number of nematode eggs per gram of feces (EPG) was determined by use of the Wisconsin double centrifugal flotation technique (Cox and Todd, 1962). Fecal samples were not collected from the very young calves at turnout in the spring.

Cow weights, body condition scores and egg counts (transformed using the natural logarithm), and calf egg counts (transformed using the square root) were statistically analyzed using a repeated measures analysis of variance with a randomized complete block treatment design; year was the block (Winer, 1971). Calf body weights were analyzed using a repeated measures analysis of covariance with randomized complete block treatment design. The covariates were birth weight and birth date of the calf and the block was the year. Calf ADG were analyzed using an analysis of covariance with a randomized complete block treatment design. The covariates and block were the same as for the calf body weights. Pregnancy rates were analyzed using a GSK (Grizzle–Starmer–Koch) model with year included as a block (Freeman, 1987). All statistical analyses were done using the GLM (General Linear Models) or CATMOD (Categorical Models) procedures of Statistical Analysis Systems Institute Inc. (1991) on a PC computer. A P-value of 0.05 or less was considered significant.

2. Results

Comparison of the variances over the 2 years of the study allowed the two successive years to be included in the same statistical analysis. The control cows gained an average of 18.3 kg ($P = 0.0010$) more than the treated cows over the 2-year period (Table 1). Both groups had similar condition scores when turned out onto pasture. While there was a loss of body condition for both the treated cows and the control cows, the treated

Table 1
Cow weight gains, body condition scores at turn out and at weaning and the pregnancy status for treatment and control groups

	Treated	Control
Cow weight gain (kg)		
Year 1	3.9 (5.6)	29.7 (5.1)
Year 2	14.9 (5.8)	25.3 (4.9)
Average	9.3 (3.8)	27.6 (3.9) *
Turnout body condition		
Year 1	4.9 (0.181)	4.6 (0.124)
Year 2	4.5 (0.236)	4.6 (0.230)
Average	4.7 (0.139)	4.6 (0.141)
Weaning body condition		
Year 1	4.5 (0.171)	4.8 (0.192)
Year 2	3.2 (0.173)	3.8 (0.231)
Average	3.9 (0.134)	4.3 (0.136) **
Pregnant (%)		
Year 1	97.1 (2.8)	85.3 (6.1)
Year 2	91.2 (4.9)	78.8 (7.1)
Average	94.2 (2.8)	82.1 (4.7) ***

* $P = 0.001$; ** $P = 0.0218$; *** $P = 0.0357$. Numbers in parentheses are standard errors of the mean.

Table 2
Mean weight gain, weaning weight and average daily gain for treated and control calves

	Treated	Control
Weight gain (kg)		
Year 1	124.9 (3.3)	102.1 (3.5)
Year 2	113.8 (3.1)	99.0 (3.5)
Average	119.2 (2.3)	100.6 (2.5) *
Weaning weight		
Year 1	184.4 (4.0)	162.8 (4.2)
Year 2	177.5 (3.7)	161.8 (4.2)
Average	180.8 (2.7)	162.3 (3.0) *
Average daily gain		
Year 1	0.89 (0.132)	0.75 (0.145)
Year 2	0.77 (0.132)	0.66 (0.118)
Average	0.83 (0.023)	0.70 (0.040) *

* $P = 0.0001$. Numbers in parentheses are standard errors of the means.

cows' condition scores were significantly ($P = 0.0218$) lower at weaning (Table 1). There was a significant ($P = 0.0357$) advantage in reproductive performance (fewer open cows) in the treated group over the 2 years of the study. The advantages were 11.8% and 12.4% for each of the 2 years, respectively. One cow was removed for a malignant growth on the eye and her calf was left in the study in the first year.

Table 3
Mean eggs per gram of feces for treated and control cows and calves

	May	July	October
Cows			
Year 1			
Treated	31.6 (10.1)	7.7 (2.9)	2.1 (0.6)
Control	74.3 (42.7)	121.8 (59.2)	17.6 (7.4)
Year 2			
Treated	5.6 (1.2)	1.2 (0.3)	3.7 (0.7)
Control	21.6 (3.8)	15.5 (7.0)	8.4 (2.6)
Average			
Treated	19.1 (5.5)	4.6 (1.5)	2.9 (0.50
Control	48.4 (25.6)	71.6 (34.8) *	12.8 (3.8) **
Calves			
Year 1			
Treated	NR [a]	59.3 (8.4)	7.3 (0.9)
Control	NR	45.6 (9.2)	345.9 (42.6)
Year 2			
Treated	INR	22.3 (4.7)	108.3 (10.1)
Control	NR	33.0 (6.6)	442.4 (46.4)
Average			
Treated	NR	41.4 (5.2)	61.7 (8.8)
Control	NR	40.6 (5.8)	389.7 (32.4) *

* $P < 0.0001$; ** $P = 0.0083$. [a] NR, data not reported. Numbers in parentheses are standard errors of the means

The calf weight gains, weaning weights and average daily gains are presented in Table 2. There was an 18.6 kg advantage in weight gain at weaning ($P = 0.0001$) for the treated group and they were weaned 18.5 kg heavier at weaning than the controls ($P = 0.0001$). There was an 0.13 kg ADG advantage for treated calves over the 2-year study. Two calves died of pneumonia shortly after birth and one calf was stepped on by the dam at birth in the first year. In the second year one calf died at birth and one set of twins died of pneumonia in early August.

Egg counts were generally higher for the control cows, compared with cows in the treated group, and were significantly higher at the July ($P < 0.0001$) and October ($P = 0.0083$) collections (Table 3). Treated calves also had significantly lower fecal egg counts ($P < 0.0001$) at weaning in October compared to untreated controls.

3. Discussion

This study demonstrated the benefits of the strategic administration of an anthelmintic in a cow/calf herd in the North Central USA. The calves in the treated group significantly outgained the control calves with an average advantage of 18.6 kg over 2 years and also had lower fecal egg counts (Tables 2 and 3). Similar findings have been reported in Georgia by Ciordia et al. (1982, 1984, 1987a,b) for five different treatment programs, with weight gain advantages ranging from 2.6 kg to 15.9 kg for the five groups compared to untreated controls. Bumgarner et al. (1986) found a mean weight gain advantage of 18.7 kg for calves in treated herds. The weight gain/weaning weight advantage realized when nematode parasites are controlled throughout the grazing season provided a major economic advantage for the producer. Such cattle productivity advantages may have been due to decreased pasture contamination (Stromberg et al., 1991), improved cow and calf appetite (Fox, 1993) and/or increased milk production by the dam. There was a substantial ($P < 0.05$) increase in milk production in beef cows following anthelmintic treatment (Stromberg and Corwin, 1993). Treated cows produced an average of 3.49 kg milk per suckling vs 2.76 kg per suckling for the untreated cows using the weigh–suckle–weigh method.

It was found in the current study that the treated cows gained less weight than the untreated cows (Table 1). Similar observations have been made in other studies (Ciordia et al., 1982, 1984, 1987a,b; Bumgarner et al., 1986). Myers, 1988 suggested that lactation and/or pregnancy may confound cow weight gain so that cow weight gain may not be meaningful as a parameter of production. Similarly, the variation observed in body condition scores might also be explained in this manner. The treated cows also shed fewer helminth eggs, thus not adding as much pasture contamination as those in the untreated control group.

This study also found a significant increase in the reproductive performance of strategically treated cows. An overall average of 94.2% of the treated cows were pregnant compared to 82.1% in the control group over the 2 years (Table 1). A substantial increase in pregnancy rates (98% vs 75%) has also been documented by Stuedemann et al. (1989) in mature beef cows on a 65-day breeding program as well as a similar increase in calving rate. Similar advantages were observed by Holste et al.

(1986) and Pate and Richey (1988) in beef cattle. It is thought that parasites may indirectly affect pregnancy, perhaps by their influence on appetite and forage utilization. Wiltbank et al. (1962, 1964) observed that low energy intake had a negative effect on reproductive performance. The strategic administration of an anthelmintic may improve weaning weights in calves and reproductive performance in cows in a pastured cow/calf herd.

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