Seasonal Control of Gastrointestinal Parasites Among Dairy Heifers Using Two Strategically Timed Treatments of Fenbendazole

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Introduction

Animals grazing on contaminated pastures become infected with nematode internal parasites. These parasites have a direct life cycle — eggs laid by the female adult worm pass in the feces and, under favorable environmental conditions, hatch and go through two molts to an infective or third larval stage (L_3). If L_3 are ingested by grazing cattle, further development to the fourth larval stage (L_4) and adult takes place in the alimentary tract. With *Ostertagia*, this parasitic development occurs in the crypts of the gastric glands and the cycle takes at least 3 weeks. In Vermont, development of this parasite is arrested at the L_4 stage in late fall. When spring arrives, these larvae become egg-laying adults and can again contaminate the pasture. In addition the L_3 larvae overwinter on pasture.

A successful approach to parasite control, as suggested by Armour (1) in Scotland and Herd (2) in Ohio, eliminates these internal adult parasites by anthelmintic treatment 3 weeks after turnout. A second treatment 3-4 weeks later is designed to eliminate those parasites ingested after the initial treatment. It is hoped that the population of L_3 would be minimal after this time and the threat of infection reduced.

In Vermont, because of renewed interest in improving pasture management and productivity, we employed this strategic treatment approach on two grazing schemes: conventional continuous grazing and paddock rotation.

Materials and Methods

In the summer of 1982 sixty Holstein-Friesian heifers, 7-18 months old, in their first grazing season, were selected to study the effect of two strategically timed anthelmintic treatments under continuous or rotational grazing management. We weighed, tagged, and blocked the heifers according to age and weight, and randomly assigned them to one of four groups:

(1) treated, continuous, 16 head;
(2) control, continuous, 16 head;
(3) treated, rotational, 14 head;
(4) control, rotational, 14 head.

This was a blind study, where treated animals received a fenbendazole suspension* 10% w/w (5 mg/kg) orally at 3 and 7 weeks (day 22 and 50) after turnout and controls received placebos. We evaluated the following parameters: animal weight gains, fecal egg counts, herbage larvae and botanical composition of pastures.

We allotted continuously grazed animal to two, 5.5 hectare (ha) permanent pastures that had been previously used for grazing heifers and dry cows. These pastures consisted mainly of white clover, Kentucky bluegrass, and orchardgrass. Each contained two small wooded areas. Effective grazing density was 3.2 animals/ha. Herbage samples for parasitic larval counts were taken from 14 predetermined sites every 2 weeks (3); samples for other forage analyses were taken every 30 days from the same sites. Cage exclosures were used to measure herbage growth (4). Calves were weighed every 4 weeks and a fecal egg count was determined using the Wisconsin sugar floatation method. We clipped the pastures once in July.

Each rotationally grazed group was allotted one of 10, 0.4-ha paddocks having separate access and water. The heifers grazed each paddock for 1-6 days, depending on available forage, according to the Voisin system (5). The cycle was repeated every 20 to 36 days, depending on plant growth and maturity.

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Because of excess forage early in the season, four paddocks in each group were not grazed until after midsummer. Normally, that forage would be removed as hay but, because of owner preference, the material was chopped and blown on to the ground with a flail chopper. Herbage samples were taken from three sites, chosen randomly from 14 possible sites, before each grazing. Paddocks were mowed once in July. Supplemental hay (4 kg/head/day) was provided the last 10 days of the experiment. An analysis of variance was used to measure all parameters statistically.

Results

Weight data are summarized on Table I.

TABLE I: WEIGHT DATA. June 2-October 20, 1982.

	Mean Initial wt	Mean Final wt	Total gain	Average daily gain
	— — — — — — — kg — — — — — — —			(kg/day)
Continuous grazing:				
Treated:	224	331	107	.76
Control:	232	349	118	.84
Rotational grazing:				
Treated:	242	325	83	.59
Control:	261	344	83	.59

Statistical analysis revealed no significant differences between treated and control heifers in daily gains on either continuous or rotational pastures during 140 days after treatment, *(Figure 1 & 2)*. Adjustments for initial age and weight did not change this conclusion. Heifers on continuous grazed pasture gained more than on rotational pasture ($p < .001$).

Fecal egg counts *(Figure 3)* from rotationally grazed groups showed significant differences between treated and control groups at days 78 and 106. There were no significant differences in egg counts between treated and control groups in the continuously grazed groups, *(Figure 4)*.

There were significant differences in numbers of infective larvae recovered after day 100 (mid-August) between rotational and continuously grazed pastures, *(Figures 5 & 6)*. Because of variability in larval numbers, control rotational paddocks did not differ significantly from treated, although six control samples had larval counts exceeding 3,000 and a peak of 11,300 larvae/kg of dried forage. Samples obtained for botanical composition from continuous pastures contained over 50% white clover whereas those from rotational paddocks never had more than 15% clover. Meteorological data is shown in *Figure 7 & 8*.

Discussion

The results from anthelmintic treatment in this experiment can be interpreted from the following propositions:

The level of parasitism was too low to affect weight, fecal egg count or herbage larvae.

This appeared to be particularly true of the animals on the continuous grazing system. These pastures were of better quality than we anticipated and grazing density was not adequate to reduce the amount of available forage to a level that would have forced the heifers to eat near fecal pads, where concentrations of larvae numbers are greatest (6). We designed the overall experiment to have animals gain 0.5 kg/day, but since the animals on the continuous pastures gained 0.8 kg/day it was not possible to make a direct comparison with the rotationally grazed groups.

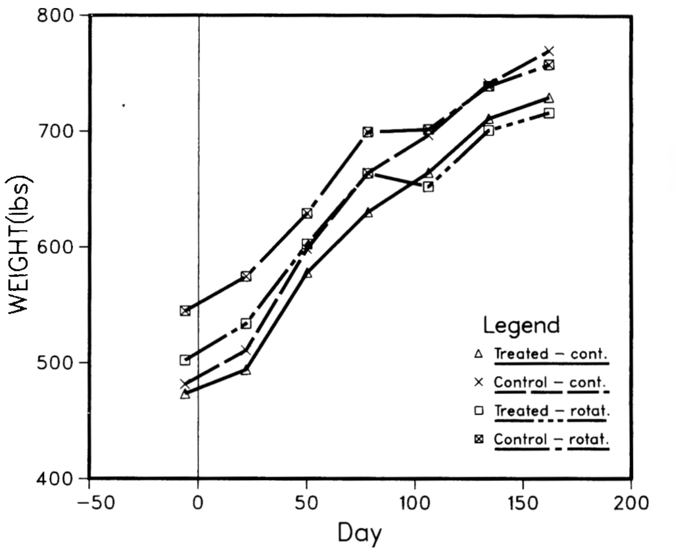
The quality and quantity of forage on rotational paddocks contained less than 5% clover and the heifers were forced to eat close to fecal pads. After mid-August (day 106), forage intake was minimal and some heifers lost weight and under such conditions one would anticipate higher levels of parasitism (7). However, the fecal egg counts remained low and levels on rotational paddocks were no higher than on the continuous pasture. On the other hand, Michel (8) showed that fecal egg count was poorly correlated to actual worm burden and that the numbers of eggs shed by the female worms may be highly variable. Other have shown that the levels of infective larvae correlate much better with weight gains of individuals (9, 10). In this study there were significantly more infective larvae recovered on the rotational paddocks than on the continuously grazed pastures. Armour (11) reported that levels of infective L_3's over 1,000/kg of forage were associated with clinical disease, and levels of 200-300/kg caused weight loss (8, 10). Nevertheless, we did not see differences in weight gain as reported in other studies using strategic anthelmintic treatments (1, 2, 10, 12).

The accumulation of high levels of pasture larvae in the Voisin system of rotational grazing occurred too late in the grazing system to affect weight gains.

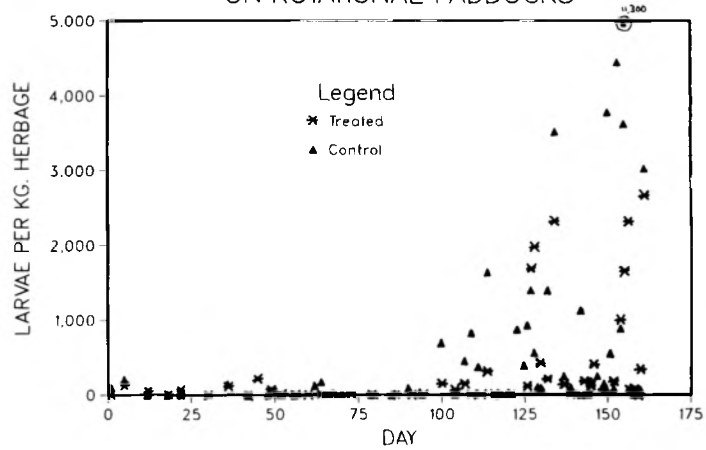
This grazing system used clean paddocks in midsummer and thus exposure by the heifers to infective larvae was delayed. Michel and others (9, 4), have shown that movement of calves in midsummer on to clean pasture was as effective as anthelmintic treatment in preventing the effects of parasitic disease as shown by impaired weight gains. Therefore, although a significant rise in pasture larvae did occur as has been reported in other rotational schemes of grazing (7), the heifers were not continually exposed to these high levels until after September when marginal pastures were supplemented.

High pasture larval levels can be a source of infection during subsequent grazing seasons both in the form of arrested L_4's in overwintering animals and, more seriously, as overwintered L_3 on pasture (13). Anthelmintic treatment early in the pasturing season however, appeared to reduce these larval peeks.

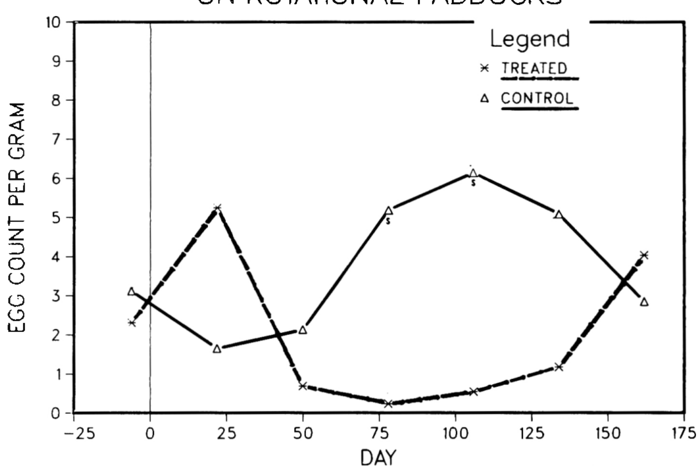
MEAN WEIGHT OF ANIMALS
for Continuous and Rotational Paddocks



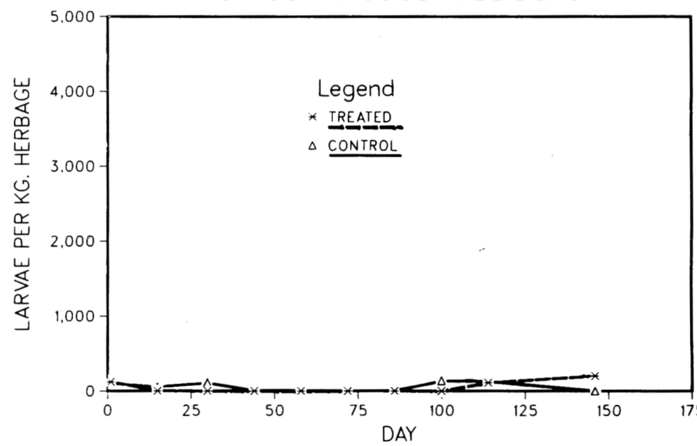
INFECTIVE HERBAGE LARVAE
ON ROTATIONAL PADDOCKS



FECAL EGG COUNT PER GRAM
ON ROTATIONAL PADDOCKS



INFECTIVE HERBAGE LARVAE
ON CONTINUOUS PADDOCKS



FECAL EGG COUNT PER GRAM
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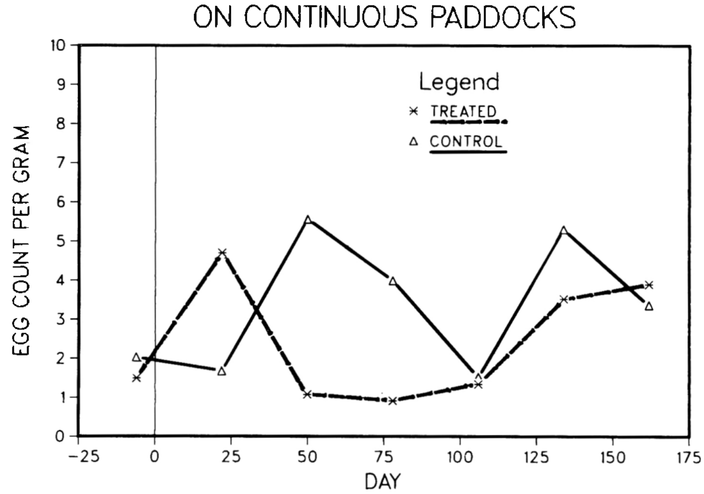
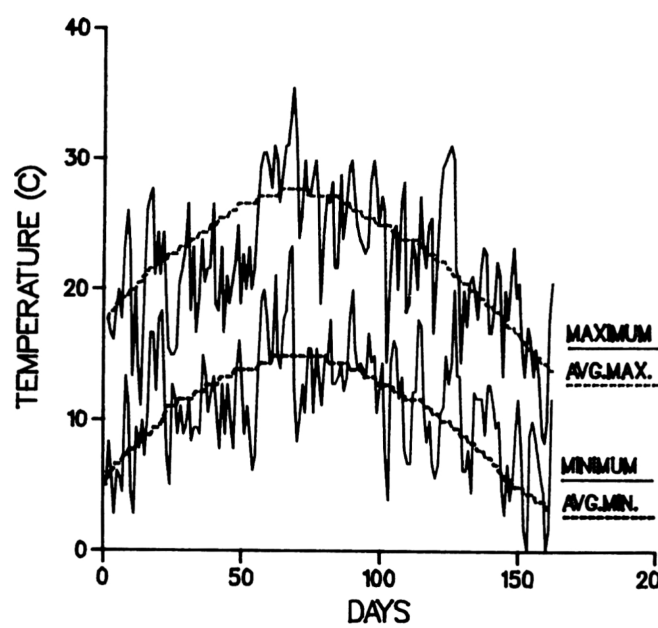
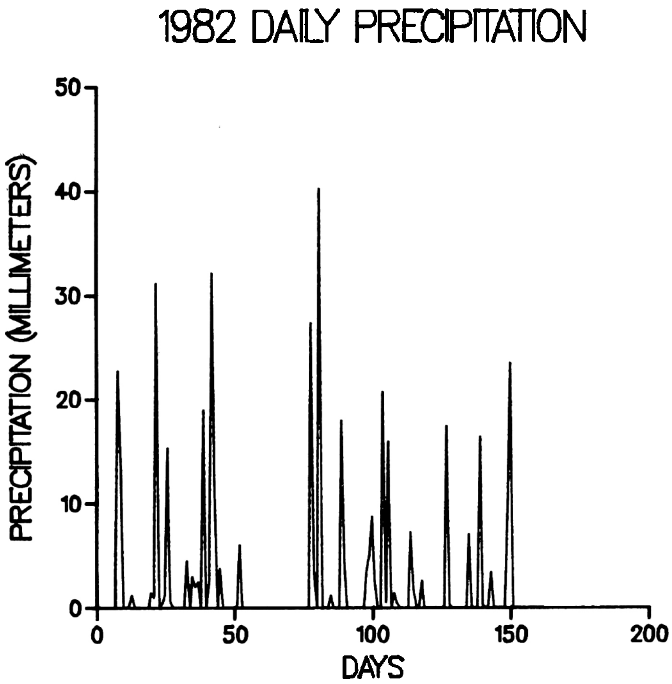


1982 DAILY TEMPERATURES





Summary

Two strategically timed treatments with fenbendozole (5 mg/kg) significantly reduced fecal egg counts, 28 and 56 days after treatment, in rotationally grazed, replacement heifers and appeared to reduce infective larval levels on pasture. Similar treatments to continuously grazed heifers also caused depression of fecal egg counts but these were not significantly different from those of controls. As a result of anthelmintic treatment no differences were noted in average daily gain in either continuously grazed or rotationally grazed heifers. However, a significant difference in weight gains in favor of the continuously grazed groups was noted. It appeared that animals with more forage of better quality gained more weight and had lower exposure to infective larvae even though they did not show any differences in fecal egg counts from animals on poorer forage with lower weight gains.

References

1. Armour, J. 1975. Parasitic gastroênteritis in cattle. Vet. Res. 95:391-395. - 2. Herd, R. P. and L. E. Heider. 1980. Control of internal parasites in dairy replacement heifers by two treatments in the spring. J. Am. Vet. Med. Assoc. 177:51-54. - 3. Taylor, E. L. 1939. Technique for estimation of pasture infestation by strongyloid larvae. Parasit. 31:473-478. - 4. 't Monnetje, L. 1978. Measuring quantity of grassland vegetation. p 63-95. *In* L. 't Monnetje (ed) Measurement of grassland vegetation and animal production. Commonwealth Agricultural, Bureaux, Hurley, Berkshire, England. Bull. 52. - 5. Voisin, A. 1959. Grass productivity. Philosophical Library, N.Y. p. 353. - 6. Goldberg, A. 1970. Development, migration and survival on pasture of gastrointestinal nematodes of cattle: Summer contamination. Proc. of Helm. Soc. of Wash. Vol. 37:166-169. - 7. Ciordia, H. et al. 1964. Effects of rotational grazing systems on gastrointestinal nematodes in beef yearlings. Am. J. Vet. Res. 25:1473-1478. - 8. Michel, J. F. and M. B. Lancaster. 1970. Experiments on control of parasitic gastroenteritis in valves. J. Helminth 44:107-140. - 9. Michel, J. F. 1974. Arrested development of nematodes and some related phenomenons. Advanc. Parasit. 12:279-366. - 10. Henriksen, A. A. 1976. Ostertagiasis in Calves. 1. The effect of control measures on infection levels and body weight gains during the grazing season in Denmark. Vet. Parosit. 2:259-272. - 11. Armour, J. 1979. Preventive medicine for cattle: A report on a symposium held by the British Cattle Veterinary Assoc. Bov. Pract. 14:150. - 12. Myers, G. H. and A. C. Todd. 1980. Increased weight gains of Wisconsin dairy heifers following systematic deworming with fenbendazole. Am. J. of Vet. Res. 41:1886-1889. - 13. Gibbs, H. C. 1980. Persistence on pasture of infective larvae of nematodes parasitizing Maine dairy cattle. Am. J. Vet. Res. 41:1694-1695.