
THE PROCEEDINGS OF THE
NEW ZEALAND SOCIETY
OF
ANIMAL PRODUCTION
VOLUME 62 2002

Effect of topical ivermectin treatments on weight gains in beef weaners

W.B. McPHERSON, J.Y. BOWIE, W.G. RYAN[2], S.J. GROSS[2], M.C. WEBSTER[1]

MSD AGVET, Wiri, Auckland, New Zealand.

ABSTRACT

Four trials were conducted in separate geographic regions in New Zealand, using a total of 483 cattle to compare different treatment regimes with topical ivermectin in weaned beef calves. Trial cattle received topical ivermectin at 500µg/kg liveweight once (control group), four times (4x) or six times (6x) at six-weekly intervals commencing at weaning (March/April) and continuing into early or late summer (November/February). Cattle were weighed at intervals of approximately six weeks, and at each weighing faeces were collected from approximately 50 per cent of the cattle in each study, the same animals being sampled on each occasion. In each study, pooled faecal samples from each treatment group were cultured for identification of parasitic nematode larvae.

Geometric mean faecal egg counts in control groups were generally low throughout the study, reaching a peak mean count of 703 eggs per gram on Day 123. Three control cattle in one study and one in another study were salvage treated with ivermectin to avoid development of overt parasitic gastroenteritis. With the exception of these four cattle, the controls in all studies maintained a healthy appearance, suggestive of a low parasite challenge. Larval differentiation demonstrated that *Cooperia* and *Trichostrongylus* were the predominant parasite species throughout the trial period, regardless of region. In contrast *Ostertagia* was present in each trial but at low prevalence and generally in only the latter period of the trials.

Average daily weight gains in 6x groups ranged from 355 to 655 grams, in the 4x groups from 323 to 636 grams and in control groups (1x) from 211 to 538 grams. In all trials the 4 and 6x treated groups gained significantly more weight than the control animals ($p<0.05$). In all trials the 6x group gained weight at a greater rate than the 4x group. In one study the weight gain benefit of the 6x group was significantly better than that of the 4x group ($p<0.05$) and in the other three studies it was greater, but the difference was not significant.

In each study, the 6x groups had a higher mean valuation than the other groups. Overall, dollar valuations per head ranged lowest to highest from the control to the 6x treated group. The valuations emphasise the significant impact parasitism can have on beef weaners in New Zealand in their first year of life and demonstrate the substantial economic impact of subclinical parasitism.

In these trials, the treatment of beef weaners with ivermectin topical solution at 6-weekly intervals, from weaning through to mid-spring, was beneficial for improving weight gains, animal values and parasite control.

INTRODUCTION

The clinical impact of parasitism on beef cattle production is well known (Brunsdon, 1968, 1969), while the sub-clinical effects appear to be inevitable in all grazing cattle in New Zealand. These effects are likely to be most severe and of longest significance in cattle in their first year of grazing life. Although the impact of parasitism is not confined to young or weanling calves, it is this age group that has little or no acquired resistance and minimal nutritional reserves on which to draw when challenged by parasites. The nutritional demand is therefore met by compromising muscular and skeletal growth. As a result, improved liveweight gains and economic benefits have been shown to result from treatment of beef weaners to control subclinical parasitism (Cairns and Gallagher, 1964; Cooper, 1970; McLeod *et al.,* 1975; McMullan *et al.,* 1981; McPherson *et al.,* 1989).

In New Zealand, *Ostertagia* is regarded as the most economically significant parasite, largely due to sub-clinical effects. It assumes additional importance because its life cycle includes a period of inhibition, commencing in late summer/autumn with development resuming in late winter/spring (Brunsdon, 1972; Brunsdon, 1980).

In general parasite control in beef cattle is heavily dependent on the use of anthelmintics. Calves have been generally drenched at weaning but recommendations and practise for the following months vary from one or two drenches upwards. Some early recommendations for fewer drenches were based on a trial data generated when cattle formed only a small proportion of the stock on most farms. Because of the lower stocking density in these studies, trial cattle were exposed to relatively low levels of infection (Brunsdon *et al.,* 1975). Weaning is now spread over a much longer time period, and may commence as early as February or March, especially in the warmer north and east coast areas, or may be completed in April-May in the cooler regions of the lower North Island and in the South Island.

The development of injectable and, more recently, topical endectocides has had a major impact on the ease of administration of worm control. These formulations provide extended activity of unprecedented parasite control and allow the interval between treatments to be increased (Brunsdon *et al.,* 1989; Hong *et al.,* 1995; McKenna, 1990).

Recommendations for the required number of endectocide treatments and the interval between them vary considerably. (Brunsdon & Adams, 1975; McMullan *et al.,* 1981). McPherson *et al.,* (1989) reported significant eco-

[1] MSD AGVET, Granville, NSW, Australia.

[2] Merck AgVet, Woodbridge, New Jersey, USA.

nomic advantages in trials using six treatments of injectable ivermectin in beef weaners at six weekly intervals, compared to four treatments at six weekly intervals.

This paper reports trials conducted in widely different locations of the North Island and one South Island location, in which beef weaners received topical ivermectin four times or six times, at six-week intervals, commencing at weaning in March or April.

MATERIALS AND METHODS

A total of 483 recently weaned beef calves (heifers in three trials, steers in one) were used in four trials. The weaners were typical beef breeds for New Zealand and at the start of the study, all cattle were approximately 8 months old (Table 1).

At weaning, calves were individually identified and restrictively randomised by ranked live weight into three groups, each of approximately 40 calves. Each group was then randomly allocated to receive one of the treatment regimes.

1. IVOMEC Pour-On for Cattle: Treatment on one occasion only, at weaning (Day 0) (Control or 1x group).
2. IVOMEC Pour-On for Cattle: Treatment four times at intervals of six weeks, starting on Day 0 (4x group).
3. IVOMEC Pour-On for Cattle: Treatment administered six times at intervals of six weeks, starting on Day 0 (6x group).

Treatments were administered according to manufacturer's recommendations, by applying ivermectin along the backline at 1 ml per 10 kg bodyweight (minimum dose of 500 µg/kg).

Trial cattle grazed together throughout the trial. Management of cattle within each trial was identical for each group and was undertaken according to the management routine on each farm.

Pre-treatment faecal samples were obtained from approximately 50 percent of cattle in each group on Day 0, and from the same animals on each day of weighing. Faecal egg counts (eggs per gram of faeces) were determined for individual samples, using a modified McMaster technique. Larval differentiation was conducted on cultures from pooled faecal samples from each treatment group. Any animal that appeared to be developing clinical parasitism was salvage treated with topical ivermectin.

At the end of each trial, independent valuers, blinded to treatment regimes, assessed individual cattle in each group.

Weight gain in each trial from Day 0 to final weighing was compared by analysis of variance for a randomised block design. As all cattle were pastured together in each trial, the experimental unit was the animal. Within each trial, differences between treatments were declared significant when $p<0.05$.

RESULTS

Three cattle from Trial 3 and one from Trial 4 required salvage treatment. Apart from these cases, there were no signs of clinical parasitism in trial cattle, and control cattle appeared healthy throughout the trial periods.

Faecal Egg Counts

Mean faecal egg counts ranged from 19 to 260 eggs per gram (epg) on Day 0. With the exception of Trial 3 (Northland) in which control counts rose to 703 epg on Day 123, faecal egg output remained generally low in all groups throughout the study, particularly for the 6x and 4x treated groups.

Mean faecal egg counts for the control groups (treated once on Day 0) were positive from Day 41 to Day 120 in all but the North Canterbury trial. In this trial the mean egg count was zero on two occasions, Day 43 and Day 252. Except for the North Canterbury trial egg counts in control groups tended to increase until about the mid point of the trial then steadily decline; these counts were always low (<50 epg) in the North Canterbury trial (Figures 1a - 1d).

FIGURE 1A: Faecal egg counts for cattle in Central North Island trial.

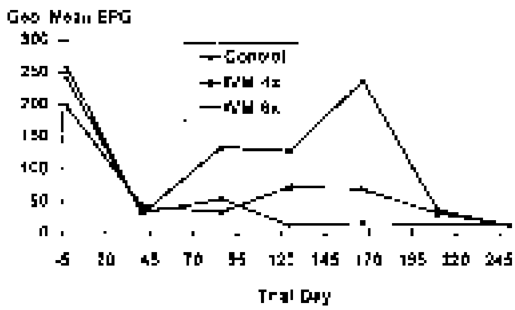


TABLE 1: Summary of information on trials and animals.

Trial ID	Location	Start date	Finish date	Days	Breeds	n	Sex	Age (mo)
Trial 1	Central North Island	18-Apr-89	29-Dec-89	251	Angus/Angus x	120	Steer	8
Trial 2	East Coast	13-Mar-89	21-Nov-89	252	Angus	137	Heifers	8
Trial 3	Northland	22-Mar-89	5-Dec-89	257	MG/ MG x Sim/ MG x Sth Devon	118	Heifers	7-8
Trial 4	North Canterbury	19-Apr-90	7-Feb-91	294	Angus	108	Heifers	7-8

MG = Murray Grey; Sim = Simmental

FIGURE 1B: Faecal egg counts for cattle in East Coast trial.

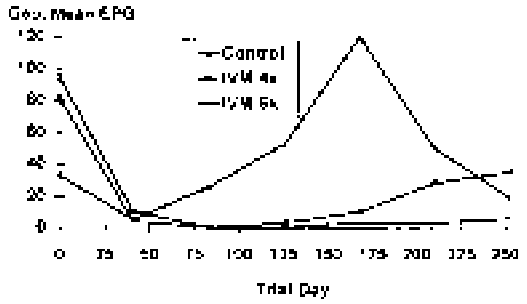


FIGURE 1C: Faecal egg counts for cattle in Northland trial.

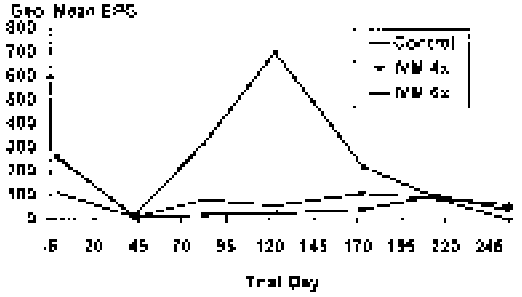


FIGURE 1D: Faecal egg counts for cattle in North Canterbury trial.

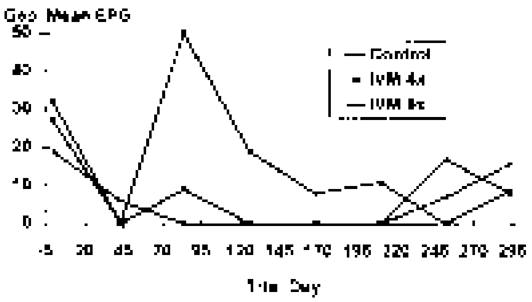
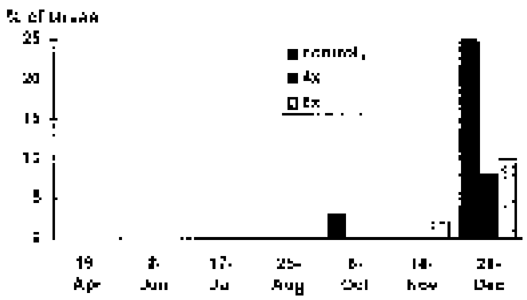


FIGURE 2A: Percentage of *Ostertagia* spp in faecal larval culture in Central North Island trial.



Larval Differentiation

In each trial, larval cultures and differentiation demonstrated the presence of the three genera of importance in New Zealand (*Ostertagia, Trichostrongylus* and *Cooperia*). *Cooperia* was the most common parasite identified in all groups throughout the trial. Generally *Ostertagia* were present in these trials, but only in the latter stages of each trial (Figures 2a - 2d).

FIGURE 2B: Percentage of *Ostertagia* spp in faecal larval culture in East Coast trial.

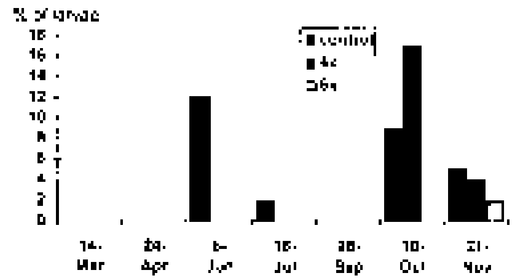


FIGURE 2C: Percentage of *Ostertagia* spp in faecal larval culture in Northland trial.

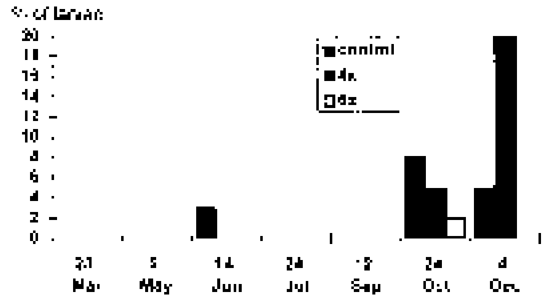
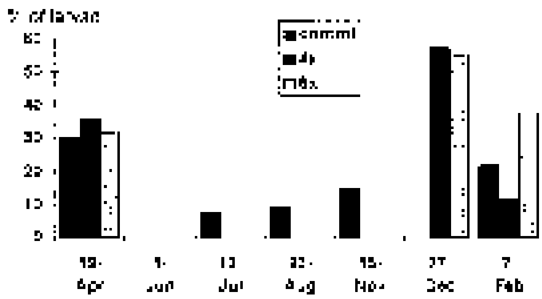


FIGURE 2D: Percentage of *Ostertagia* spp in faecal larval culture in North Canterbury trial.



Weight Gains

Average daily weight gains were 355 to 655 grams for the 6x groups, 323 to 636 grams for the 4x groups, and 211 to 538 grams for the control (1x) groups (Table 2). Significant weight gain advantages ($p<0.05$ or $p<0.01$) over control animals were demonstrated by the 6x and 4x groups in all four trials. Weight gain was always greatest in the 6x treated group, and in one trial (East Coast) was significantly greater than that of the 4x treated group ($p<0.05$).

Valuation

In each trial, the mean dollar valuation per head was highest in the 6x group and lowest for the controls (Table 3). The net advantage (after deduction of treatment cost) obtained for giving four or six treatments with ivermectin, as compared to giving only one treatment at weaning, ranged from $21.37 to $35.78 (NZ$) per head for four treatments and from $42.74 to $87.33 per head for six treatments.

TABLE 2: Mean starting and final live weights (kg) and average daily gain (ADG).

		Mean Body Weight Start	Final	ADG (grams/day)
Central North Island *	255 days			
Control		192[a]	329[a]	538[a]
IVM x 4		192[a]	354[b]	636[b]
IVM x 6		192[a]	359[b]	655[b]
East Coast	252 days			
Control		175[a]	233[a]	227[a]
IVM x 4		177[a]	258[b]	323[b]
IVM x 6		178[a]	267[b]	355[c]
Northland	257 days			
Control		162[a]	217[a]	211[a]
IVM x 4		163[a]	257[b]	364[b]
IVM x 6		162[a]	263[b]	392[b]
North Canterbury	294 days			
Control		167[a]	318[a]	514[a]
IVM x 4		167[a]	335[b]	571[b]
IVM x 6		167[a]	339[b]	583[b]

[a,b,c] within any weighing date, data with different superscripts are significantly different ($p<0.05$ [$p<0.01$ for North Canterbury trial]).

* Start date for this trial was Day -4, not Day 0 and weights were measured over 255 days.

TABLE 3: Comparison of animal valuations, treatment costs and net advantage.

	Mean value $	Treatment cost $	Net $ Advantage (vs Control)
Central North Island			
Control	500	2.98	
IVM x 4	540	11.90	31.07
IVM x 6	560	20.23	42.74
East Coast			
Control	390	2.68	
IVM x 4	420	11.31	21.37
IVM x 6	450	17.85	44.83
Northland			
Control	310	2.38	
IVM x 4	355	11.60	35.78
IVM x 6	412.50	17.55	87.33
North Canterbury			
Control	400	2.88	
IVM x 4	440	12.48	30.40
IVM x 6	480	20.80	62.08

Cost of product was calculated from prevailing retail price at the start of the trial.

DISCUSSION

In these trials salvage treatment was required for only four control cattle. Taken with the generally low faecal egg output, this indicates that there was a relatively low parasite challenge in all four areas. Ivermectin is a parasiticide without significant metabolic or antifungal activity (Burg & Stapley, 1989), the weight gain findings therefore demonstrate the potential impact of subclinical parasitism in beef weaners.

Larval differentiation indicated an increase in the proportion of *Ostertagia* spp. on pasture in the spring, although the absolute number of these larvae appeared to remain low. This contrasts with the general assumption that *Ostertagia* is prevalent throughout the year.

Exposure to low levels of trichostrongylid larvae has been shown to cause weight loss in two-year-old steers (Vlassoff *et al*, 1987). Prevention of larval establishment in the animal, through the use of topical ivermectin can reduce animal exposure to trichostrongylid larvae and thus can avert the consequential weight loss.

In each trial, significant weight gain benefits over controls were demonstrated by the 6x and 4x treatment groups. Weight gain was always greatest in the 6x treated group. In one trial this gain was significantly greater than in the corresponding 4x treated group. These benefits were obtained despite the low level of parasitism present, as assessed by faecal egg counts. This was true even in the North Canterbury trial, where nematode faecal egg counts did not rise above 50 epg at any stage.

In these studies, cattle in 4x and 6x treatment groups shared pasture with once-treated controls. The relatively high faecal egg output of the controls would have resulted in a higher pasture challenge to the other groups than would have otherwise occurred. It is therefore likely that the results recorded here underestimate the actual value of both of these treatment regimes (i.e., 4x and 6x).

In each trial increasing the number of ivermectin treatments returned economic benefits through significantly greater weight gains and enhanced valuations by independent cattle buyers. These benefits substantially exceeded the cost of treatments (the cost of labour was excluded from these calculations). These findings are consistent with a previous report (McPherson *et al*, 1989) in which weanling beef cattle were treated four or six times with ivermectin injection.

These studies demonstrate that a prophylactic approach to the control of subclinical parasitism in beef weaners, using topical ivermectin at 6-week intervals for 4 or 6 treatments from autumn to the spring is cost effective. The benefits of these prophylactic regimes were seen in improved weight gain, greater animal valuations and in reduced faecal egg counts, allowing reductions in pasture contamination.

REFERENCES

Brunsdon R.V. 1968. Trichostrongyle worm infection in cattle-effect of a field outbreak on production, with a review of the disease syndromes, problems of diagnosis and treatment. *New Zealand Veterinary Journal* **16:**176-187.

Brunsdon R.V. 1969. Trichostrongyle worm infection in cattle: Ostertagiasis and concurrent infections in dairy calves: seasonal patterns of occurrence, pathology and diagnosis. *New Zealand Veterinary Journal* **17:**161-172.

Brunsdon R.V. 1972. Inhibition of *Ostertagia* spp. and *Cooperia* spp. in naturally acquired infections in calves. *New Zealand Veterinary Journal* **20:**183-189.

Brunsdon R.V.; Charleston W.A.G.; Cumberland G.L.B.; Vlassoff A.; Whitten L.K. 1975. Control. *In* Internal Parasites and Animal Production. Eds. R.V. Brunsdon; J.L.Adam. *New Zealand Society of Animal Production Occasional Publication* **No. 4.**

Brunsdon R.V. 1980. Bovine Ostertagiosis in New Zealand. *In Ostertagia* Symposium " 80". Proceedings of the Meeting. Roseworthy Agricultural College, South Australia. 22 May pp.79-100.

Brunsdon R.V.; Vlassoff A.; West C.J.; 1989. Utilisation of persistent anthelmintic activity of ivermectin in a preventative drenching programme for dairy calves. *New Zealand Veterinary Journal* **37:**15-17.

Burg R.W.; Stapley, E.O. 1989. *In* Ivermectin and Abamectin, Ed., W.C.Campbell. Springer-Verlag New York Inc.

Cairns G.C.; Gallagher R.M. 1964. The effect of drenching with Thibendazole and morantel on weight gains in cattle. *New Zealand Veterinary Journal* **12:**26-28.

Cooper K.J.P.1970. Effect of treating beef weaners with tetramisole and methymidine on New Zealand hill country. *New Zealand Veterinary Journal* **18:**57.

Hong C.; Harris T.J.; Grimshaw W.T.R.; Newcomb K.M. 1995. Persistent activity of ivermectin topical and moxidectin injection against *Ostertagia ostertagi* and *Dictyocaulus viviparus* in calves. *Veterinary Record* **137:** 640-647.

McKenna P.B. 1990. Persistent anthelmintic activity of topically administered ivermectin in cattle. *New Zealand Veterinary Journal* **37:** 146-147.

McLeod C.C.; Scharwz G.; Wolff J.E. 1975. Effect of anthelmintic and selenium drenching on liveweight gain in young beef cattle. *New Zealand Journal of Experimental Agriculture* **3:** 213-217.

McMullan M.J.; Leaning W.H.D.; Holmden J.; Cairns G.C. 1981. The effects of anthelmintic treatments on the growth rate of beef calves following weaning. *New Zealand Journal of Experimental Agriculture* **2:** 129-134.

McPherson W.B.; Cairns C.G.; Leaning W.H.D.; Newcomb K.M. 1989. Effect of different ivermectin treatments on weight gains in beef weaners. *Proceedings of the New Zealand Society of Animal Production* **49:** 307-311.

Vlassoff A.; Brunsdon R.V.; Marshall E.D. 1987. The effects of natural Trichostrongylid larval challenge on 2-year-old Friesian steers. *New Zealand Journal of Experimental Agriculture* **5:** 429-433.