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Effect of different ivermectin treatments on weight gains in beef weaners

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ABSTRACT

Three trials involving a total of 345 animals have been conducted in widely separated geographical regions in New Zealand, using a similar trial design to compare different treatment regimes for ivermectin in beef weaners.

Commencing at weaning and continuing into late winter/spring, trial animals received ivermectin subcutaneously at 200 μg/kg live weight either once (control group), or four (4x) or six times (6x) at 6-week intervals. The mean faecal egg counts in control groups varied considerably from Day 0 to trial end ranging from 183 to 271 epg on day 0, 166 to 715 epg on day 84,and 8 to 69 epg at trial end. Larval differentiation demonstrated that *Ostertagia* , *Trichostrongylus* and *Cooperia* predominated, regardless of the region. Salvage treatment of varying numbers of control animals was necessary in each trial, and deaths associated with parasitism also occurred in control group animals. These confirm that beef weaners in these regions are likely to be exposed to substantial parasite challenge in their first year of life.

Average daily weight gains ranged from 0.41 to 0.50 kg for groups treated with ivermectin six times, from 0.35 to 0.38 kg for groups treated four times, and from 0.23 to 0.28 kg for control treated ones. In each trial, the 6x group gained significantly ($P < 0.01$) more weight than the 4x group which in turn gained significantly ($P < 0.01$) more than the control group. Similarly, dollar valuations per head ranged highest to lowest from the 6x, to the control group.

In these trials treating beef weaners with ivermectin at 6-week intervals from weaning through to mid-spring was beneficial for improving weight gains, animal values and parasite control.

Keywords Ivermectin; beef weaners; parasite control; weight gains; animal values.

INTRODUCTION

Anthelmintic treatment of beef weaners at weaning and then through their first winter is widely advocated in New Zealand. Various studies have indicated the sub-clinical nature of parasitism in extensively reared beef weaners. Improved liveweight gains and economic benefits have been shown to result from treatment of beef weaners to control this parasitism (Cairns and Gallagher, 1964; Cooper, 1970; McLeod *et al.*, 1975; McMullan *et al.*, 1981).

Recommendations for the number of anthelmintic treatments required and the interval between them vary considerably. Some suggest two treatments; one in April-May and other in July-August (Brunsdon *et al.*, 1975). Others suggest three treatments at 6-week intervals commencing at weaning (Anon, 1968). Still other advisors require an additional treatment in the spring, to take into account findings in epidemiological studies of *Ostertagia osteragi*. In New Zealand, inhibition of *Ostertagia ostertagi* commences in late summer/autumn and development resumes in late winter/spring (Brunsdon, 1972; Brunsdon, 1980). Many farmers treat only at weaning and in early winter, and see no reason to give additional treatments; although anecdotal field comments from farmers who treat young beef animals in the spring, suggest a positive weight gain response to this treatment.

Weaning practices have altered since earlier advice on parasite control recommended giving an initial anthelmintic treatment at weaning in

April-May. 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.

More efficacious products have become available in recent times. In particular, the advent of ivermectin has introduced a specific parenteral "endectocide" for cattle, which is unique in its chemistry and mode of action and capable of controlling both internal and external parasites with a high level of efficacy (Egerton *et al.*, 1978; Campbell *et al.*, 1983; Leaning, 1983). The commercially available injectable formulation of ivermectin demonstrates persistent or sustained activity in cattle which effectively controls infections of specific endoparasites for up to 7 or 14 days after administration (Bremner *et al.*, 1983; Barth, 1983; Swan and Harvey, 1983; Armour *et al.*, 1985).

This paper reports trials conducted in widely differing locations of the North Island, in which beef weaners received ivermectin by subcutaneous injection according to the manufacturer's recommended dose rate of 200 μg/kg live weight either once (control group), four times (4x), or six times (6x), commencing at weaning in mid-March or late April and continuing at a 6-week interval.

MATERIALS AND METHODS

A total of 345 beef weaners (heifers in two trials, steers in one) were used in three trials conducted between 1982 and 1987. Specific information for each trial is shown in Table 1.

At weaning, calves were individually identified and restrictively randomised on the basis of ranked live weight into three groups of 36 to 40 calves each. Treatments (Control, 4x or 6x) were randomly allocated to the three groups thus formed. Initial treatments were given to calves of all groups, including controls, close to weaning (Day 0); subsequent treatments were given to calves in the 4x and 6x groups at 6-week intervals, thereafter. In the event of any animal becoming sufficiently parasitised, provision was made for salvage treatment with ivermectin.

Experimental animals grazed together for the duration of the trial, according to management practices of each individual farmer co-operator. Thus, management practices differed to some extent for each property. Generally, rotational grazing management, typical of beef-farming properties using ryegrass-clover pastures (with some native grasses) supplemented during winter with hay, green feed, or liquid molasses, was followed.

Animals were weighed at the start of the trial, at 6-week intervals until all groups had received all assigned treatments, and then at 4- to 7-week intervals until the conclusion of the trial.

Pre-treatment faecal samples were obtained from approximately 50 per cent of the animals in each group on Day 0 and from the same animals on each occasion the animals were weighed. 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.

At the completion of the trial, independent cattle buyers valued the individual animals in each group, without knowledge of treatment regimens

TABLE 1 Summary of information on trials and animals

Trial Identity	Location	Start date	Finish date	Duration (days)	Breeds	n	Sex	Age (months)
ASR 9180	Kaikohe, Northland	17 Mar 1982	7 Dec 1982	265	Simmental	120	Heifer	6-7
TS-NZ-001	Gisborne, East Coast	14 Mar 1985	4 Dec 1985	265	Angus, Angus x	108	Steer	7-8
TS-NZ-002	Kimbolton, Manawatu	30 Apr 1986	4 Jan 1987	259	Angus, Angus x	117	Heifer	7

used in the trial.

Weight gain from Day 0 to the final weighing day (259, 265, or 266) was compared by analysis of variance for a randomised block design. Because all animals were pastured together in each trial, the experimental unit was the animal. Significant differences between treatments within each trial were declared when $P < 0.01$.

RESULTS

Equal numbers of animals were present in the respective groups at the start of each trial; however data from a number of animals were removed from each trial because of death, absence from final weighing (presumed escaped), or incomplete castration. Parasitism was determined to have contributed to the death of one control animal in trial 9180 (Northland) and 11 control animals in trial TS-NZ-001 (East Coast); the death of one control animal in TS-NS-002 (Manawatu) was unexplained.

In each trial, salvage treatment was required for one or more control animals, some of which required more than one treatment. Fourteen control animals were salvage treated in the Northland trial, 25 in the East Coast trial, and one in the Manawatu trial. One 4x animal in the Northland trial required salvage treatment in November, 16 weeks after its last scheduled treatment.

Table 2 summarises faecal egg counts for each trial, by treatment group and by trial day. Mean counts shown include results from animals that were salvage treated.

The mean egg count for each group in each trial was generally low to moderate on Day 0. Egg counts were decreased by Day 42 (April 24 - June 11) and remained at low levels thereafter for the 6x groups. The mean egg count of control groups (treated once on Day 0) in the Northland and East Coast trials increased from Day 42 to Day 84 (June). In the Northland trial, egg counts in controls increased toward June levels again during October/November (a rise mirrored by the 4x group) but in general, the trend in the trials was a slow decline from June to November. In the Manawatu trial mean egg counts in all groups decreased by Day 42 and remained low throughout the trial.

In each trial, larval cultures and differentiation demonstrated the presence of the three genera of importance in New Zealand (*Ostertagia, Trichostrongylus* and *Cooperia*). *Haemonchus* was present between April and October in the Northland and East Coast trials, but only during

TABLE 2 Mean faecal egg counts (eggs/ g faeces) from animals in 3 trials.

Treatment	Day of trial 0	42	84	126	168	210	238	Final[1]
Trial 9180, Northland								
Control	183[2]	69	319	384	81	314	201	69
Ivermectin x 4	185[2]	72[2]	25[2]	50[2]	66	308	318	208
Ivermectin x 6	172[2]	6[2]	8[2]	88[2]	81[2]	90[2]	6	11
Trial TS-NZ-001, East Coast								
Control	97[2]	29	715	295	105	50	53	15
Ivermectin x 4	75[2]	29[2]	153[2]	22[2]	23	11	27	12
Ivermectin x 6	60[2]	26[2]	100[2]	46[2]	17[2]	0[2]	9	8
Trial TS-NZ-002, Manawatu								
Control	307[2]	28	31	7	6	0	ND	5
Ivermectin x 4	305[2]	16[2]	21[2]	4[2]	13	13	ND	6
Ivermectin x 6	307[2]	28[2]	31[2]	7[2]	6[2]	0[2]	ND	5

[1] Final trial day; Trial 9180, 265; Trial TS-NZ-001, 266; Trial TS-NZ-002, 259.
[2] Ivermectin treatment
ND Not determined

April in the Manawatu study.

TABLE 3 Mean live weight (kg) and rate of gain (kg/d) in each of 3 trials

Trial	Treatment	Mean weight Start	Mean weight Final	Rate of gain
ASR 9180	Control	175.7	236.8	0.23[a]
	Ivm x 4	176.0	277.3	0.38[b]
	Ivm x 6	176.1	309.7	0.50[c]
TS-NZ-001	Control	177.1	248.8	0.25[a]
	Ivm x 4	176.4	269.7	0.35[b]
	Ivm x 6	177.5	297.1	0.44[c]
TS-NZ-002	Control	176.7	251.4	0.28[a]
	Ivm x 4	176.4	269.6	0.36[b]
	Ivm x 6	176.3	283.1	0.41[c]

Within each trial, mean daily gains with different superscripts differ ($P<0.01$).

TABLE 4 Comparison of animal valuations, treatment costs and net advantage (mean value of treated animals less treatment cost for treated animals) - (mean value of control animals less treatment cost for control animals) of ivermectin treatment regimens (NZ$).

Trial	Treatment group	Mean value	Treatment cost[1]	Net advantage
ASR 9180	Control	140	1.60	-
	Ivm x 4	170	7.68	23.92
	Ivm x 6	230	12.48	79.12
TS-NZ-001	Control	400	1.84	-
	Ivm x 4	420	7.82	14.02
	Ivm x 6	445	12.88	33.96
TS-NZ-002	Control	190	1.93	-
	Ivm x 4	220	9.11	22.82
	Ivm x 6	235	14.49	32.44

[1] Cost of product, calculated from retail price prevailing at the commencement of the trial; does not include labour or other charges.

Body weight data for each group in each trial are summarised in Table 3. Average daily weight gains ranged from 0.41kg to 0.50kg for the 6x groups, 0.35 to 0.38kg for the 4x groups, and 0.23 to 0.28 kg for control groups in the three trials.

In each trial, the group given six ivermectin treatments gained significantly ($P<0.01$) more weight than the group given four treatments, which in turn gained significantly ($P<0.01$) more than the group treated only at weaning.

Average dollar valuation for each treatment group in each trial, product costs, and net treatment benefit are shown in Table 4. In each trial, the mean dollar valuation per head was highest in the 6x group and lowest for controls. The net advantage obtained for giving four or six treatments with ivermectin, as compared to giving only one treatment at weaning, ranged from $14.02 to $23.92 (NZ$) per head for four treatments and from $32.44 to $79.12 per head for six treatments.

DISCUSSION

Objective measurements of the level of parasitism present in a given group of cattle is often difficult. In these trials salvage treatment was required for many control animals and deaths associated with parasitism also occurred. These findings indicate that beef weaners in these regions are likely to be exposed to substantial parasite challenge in their first year of life.

Exposure to low levels of trichostrongylid larvae has recently been shown to cause weight loss in 2-year old steers (Vlassoff *et al.*, 1987). Effective prevention of larval establishment in the animal, through the persistent activity of ivermectin injection can reduce animal exposure to trichostrongylid larvae, which could potentially avert this consequential weight loss.

In this series of trials, greatest weight gain advantages were demonstrated by the 6x group in the trials where parasite challenge appeared to be greatest, according to faecal egg counts for control animals (Northland and East Coast). On the other hand, in the Manawatu trial, where egg counts were generally at very low levels, significant weight gain benefits were also achieved by giving additional ivermectin treatments.

In each trial increasing the number of ivermectin treatments returned economic benefits through significantly ($P<0.01$) greater weight gains and enhanced valuations by independent cattle buyers. These benefits far exceed the cost of additional treatments.

In conclusion, treating beef weaners in these regions with ivermectin injection at 6-week intervals from weaning through mid or late Spring was beneficial by improving weight gain, animal values, and parasite control.

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