
VOLUME 62 2002

Effect of control of internal parasitism on productivity of Merino breeding ewes

R.M.W. SUMNER, T.G. WATSON[1,2] AND B.C. HOSKING[1]

AgResearch, Whatawhata Research Centre, Private Bag 3089, Hamilton, New Zealand.

ABSTRACT

Thirty eight adult Merino breeding ewes were drenched with Ivomec and given a controlled release anthelmintic (benzimidazole) capsule in August 1992 and a repeat treatment when their faecal egg count (FEC) began to rise above 50epg in May 1993. The Treated ewes were grazed with an undrenched control group (n=114) between August 1992 and December 1993.

Mean FEC in the Untreated group peaked over lambing at 600epg in 1992 and 800epg in 1993. Mean FEC in the Treated group remained below 50epg during the active period of the capsule. The Treated ewes had a higher survival rate, were heavier, grew more wool from late July 1993 and weaned more and heavier lambs in 1993 than the Untreated ewes.

At a mean Merino wool price of 500c/kg greasy, returns from the increased wool production more than equates with the anthelmintic treatment cost. Increased returns would be gained from improved ewe survival and increased lamb production.

Keywords: Merino; ewes; anthelmintic; wool production; lamb production.

INTRODUCTION

Effective control and management of gastro-intestinal parasites can have a major impact on profitability of farming Merinos under Australian conditions (Barton and McCausland, 1987) but this has not been quantified under New Zealand conditions. Potential gains to wool production of Romney sheep through the control of nematode parasites have been estimated to be up to 45% in young sheep and 10% in adult sheep (Brunsdon, 1988). Depressing effects of gastro-intestinal parasitism on wool growth appear to be greater in lambing than in non-pregnant ewes (Donald, 1979) while the ingestion of large numbers of parasitic larvae can also depress wool growth (Barger and Southcott, 1975).

Although there is little substantive work, sheep breeds potentially differ in resistance to parasitism (Watson *et al.*, 1992). Results of a survey of a sample of North Island farmers running Merino sheep suggested the control of gastro-intestinal parasitism over lambing to be the most serious problem affecting overall productivity of Merino relative to Romney sheep on their farms (R.M.W. Sumner, unpublished). While aspects of the epidemiology of intestinal parasitism in Merino sheep have been studied extensively in Australia, there are no comparative data for Romney and Merino sheep in the same environment.

The trial reported here was established in 1992 to monitor the magnitude of the potential gains in productivity for adult Merino breeding ewes on North Island hill country associated with preventing the establishment of a gastro-intestinal parasite infection.

MATERIALS AND METHODS

A flock of 152 Merino breeding ewes born in 1987 and 1988 and grazed at Whatawhata Research Centre since 1989 were used. The flock was part of another trial where five shearing treatment groups were shorn once-yearly at approximately 10 week intervals (R.M.W. Sumner, unpublished). Prior to lambing in August 1992 the flock was randomised on live weight and allocated to four anthelmintic treatment groups (n = 38) balanced for age and shearing treatment. In early August one group was drenched with ivermectin (Ivomec®; 0.2mg/kg Merck, Sharp and Dohme (NZ) Ltd.) and given a controlled release anthelmintic (albendazole) capsule (Extender 100™; NuFarm Ltd.). The application of another anthelmintic treatment was planned for when the faecal egg count (FEC) began to rise above the basal level. Two groups were scheduled to receive a therapeutic dose of either a benzimidazole or an ivermectin anthelmintic if their mean FEC exceeded 500 eggs per gram faeces (epg) for two samplings. The remaining control group was scheduled to remain undrenched with anthelmintic unless their mean FEC exceeded 1500epg when all ewes in the group would receive a salvage drench of ivermectin anthelmintic. As the FEC of the two intermediate groups and the control group did not reach a level of 500epg for more than one sampling these three groups remained undrenched and their data combined as one group. The two groups are subsequently referred to as Treated and Untreated. All ewes were grazed together throughout with 34 Treated and 86 Untreated ewes surviving to December 1993 when the trial concluded.

FEC were monitored at 3 week intervals between 14 August 1992 and 13 December 1993, except over lambing. Faecal larval cultures were prepared at strategic times throughout the trial period and composition of egg output recorded. Ewes were weighed at approximately 10 week intervals prior to each of the shearing treatment groups being shorn. Individual fleece weights were recorded at shearing and a midside fleece sample taken for measurement of washing yield. Between 23 June 1993 and 13 December 1993 an area (approximately 10cm x 10cm) on the midside of each ewe was clipped at approximately 6 week intervals. The patch sample was

[1]AgResearch, Ruakura Agricultural Research Centre, Private Bag 3123, Hamilton, New Zealand.
[2]Present address: Pfizer Laboratories Ltd., Animal Health Group, CPO Box 3998, Auckland, New Zealand.

washed, the total weight of clean wool grown on the clipped patch calculated and mean fibre diameter measured (Lynch and Michie, 1976). Clean wool growth rate during each period was estimated by proportioning clean fleece weight according to the relative weight of clean wool clipped from the midside patch during that period.

Lambs were individually identified and weighed at birth and weaning.

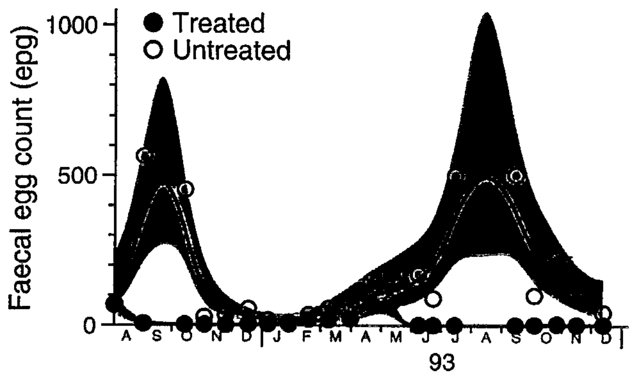
Data from the 120 ewes which survived for the duration of the trial were analysed for effect of ewe age by t-test. Variables repeatedly measured through time were analysed for effect of drenching treatment by Bayesian smoothing (Upsdell, 1994) and other variables analysed for effect of drenching treatment by t-test. FEC data were transformed for analysis using loge(FEC + 1) and results back-transformed for presentation.

RESULTS AND DISCUSSION

Age of ewe effects were not significant for all measured characteristics and will not be further discussed.

A curve was fitted to the loge(FEC + 1) transformed data for the Treated and Untreated groups at each sampling. The back-transformed curve and data are plotted in Fig. 1. Anthelmintic treatment suppressed FEC to below a mean of 50epg for 5 months following administration. The Untreated group showed a marked seasonal peak in FEC during late pregnancy and early lactation, as reported by O'Sullivan and Donald (1970), with FEC of the Untreated ewes being significantly higher than the Treated ewes from August to October 1992 and from June to November 1993.

FIGURE 1: Back-transformed mean values for faecal egg count of ewes treated and untreated with anthelmintic. Lines are significantly different at 5% level where shaded areas do not overlap.

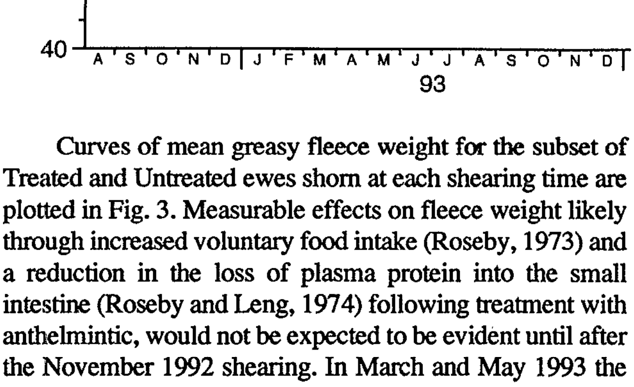


Faecal larval cultures from the Untreated group during the peri-parturient and autumn periods demonstrated a high proportion of *Ostertagia* spp., *Trichostrongylus* spp. and the large-intestinal complex of *Chabertia* spp. and *Oesophagostomum* spp. Previous studies at the trial site have demonstrated the presence of benzimidazole resistant strains of the first two genera (M.D. Bown and B.C. Hosking, personal communication). It is therefore plausible that while the controlled release device may have restricted the establishment of benzimidazole susceptible parasites and a large proportion of the benzimidazole resistant ones, the establishing population would have been benzimidazole resistant. Should this be the case continued use of the capsules will increase and prolong selection pressure as the only eggs being deposited on the pasture during the life of the capsule would be benzimidazole resistant. Despite albendazole having ovicidal properties (Barger, 1993) the viability of some eggs from the Treated group was confirmed by larval culture. An accurate assessment of the degree of development of eggs from the Treated group was not however possible.

Use of the priming drench, in this case ivermectin, at the time of insertion of the capsules was effective in inducing an immediate reduction in parasite burden relative to a slow rundown effect reported when capsules are used by themselves (Barger, 1993).

Curves of mean live weight for each drench treatment group of ewes are plotted against time in Fig. 2. Allowance has been made in the data to compensate for fleece weight associated with the different shearing treatments. The increasing difference in live weight between the Treated and Untreated groups is supportive of trends reported by Venning (1991) where capsule treated ewes were up to 5kg heavier at weaning than untreated ewes. It is of note that the liveweight effect in the present trial appears to be cumulative with a greater effect in the second year than in the first year. As the sheep were grazed as a single flock, and therefore exposed to the same larval challenge, it is suggested that the increased divergence in live weight was due to the control of ingested parasite larvae by the anthelmintic released from the capsule.

FIGURE 2: Mean values for live weight of ewes treated and untreated with anthelmintic. Lines are significantly different at 5% level where shaded areas do not overlap.



Curves of mean greasy fleece weight for the subset of Treated and Untreated ewes shorn at each shearing time are plotted in Fig. 3. Measurable effects on fleece weight likely through increased voluntary food intake (Roseby, 1973) and a reduction in the loss of plasma protein into the small intestine (Roseby and Leng, 1974) following treatment with anthelmintic, would not be expected to be evident until after the November 1992 shearing. In March and May 1993 the effect approached significance and was significantly different in August, October and December 1993. The mean difference in fleece weight between the Treated and Untreated groups in August, October and December 1993, when the complete fleece was grown following administration of the anthelmintic treatment, was 0.7±0.2kg. This is equivalent

FIGURE 3: Mean values for greasy fleece weight of ewes treated and untreated with anthelmintic. Lines are significantly different at 5% level where shaded areas do not overlap.

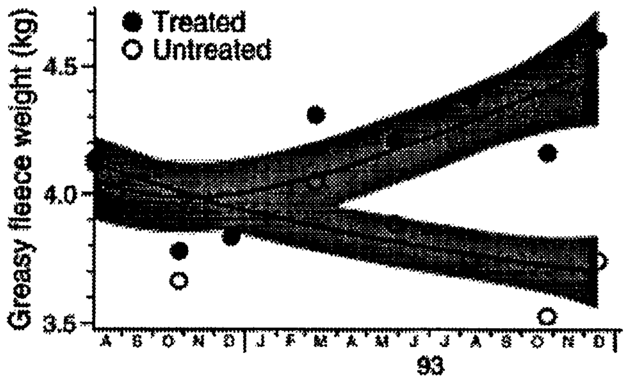
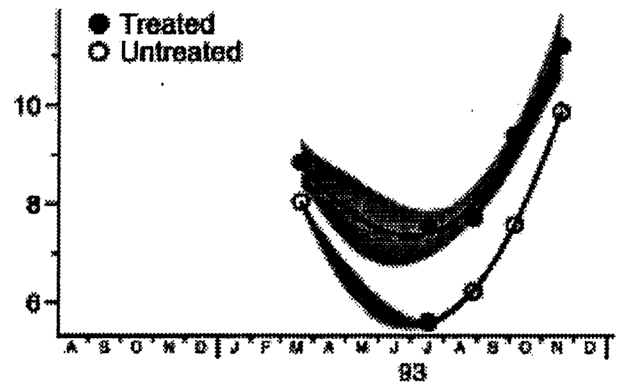


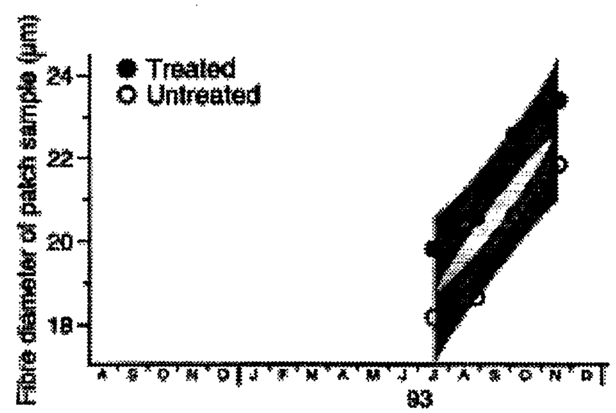
FIGURE 4: Mean values for clean wool growth rate of ewes treated and untreated with anthelmintic plotted at the mid-point of each clipping period. Lines are significantly different at 5% level where shaded areas do not overlap.



to an increase of 19% above the Untreated group, or twice that reported for adult Romney sheep by Brunsdon (1988) following the use of oral anthelmintics.

Detailed measurement of wool growth rate and mean fibre diameter was undertaken during the second year to more closely indicate the timing of the increase in wool growth rate apparent in fleece weight measurements. Mean wool growth rate of the Treated group was greater than the mean of the Untreated group between July and December 1993 (Fig. 4) with the effect appearing to be greater at the time of highest FEC when the gastro-intestinal parasite infection would have

FIGURE 5: Mean values for fibre diameter of the clipped midside wool patch of ewes treated and untreated with anthelmintic plotted at the mid-point of each clipping period. Lines are significantly different at 5% level where shaded areas do not overlap.



been at its peak. Mean fibre diameter of the clipped midside patch (Fig. 5) followed a similar trend to that of wool growth rate with mean fibre diameter increasing in relation to increased wool growth rate associated with the spring flush of feed. Mean fibre diameter of the Treated group was also coarser than the Untreated group. A similar treatment effect on fibre diameter, due principally to increased feed intake, was reported by Brunsdon (1964).

Means for ewe survival and lambing performance are given in Table 1. A total of 4 Treated and 27 Untreated ewes died during the 18 month trial with an effective death rate of the Untreated ewes being approximately twice that of the Treated ewes in both years. It was not possible to record the causes of death. Differences in the proportion of dry ewes, ewes lambing multiples and lamb birth weight in 1992 were independent of the anthelmintic treatment as the first treatment was given immediately prior to lambing. There was no effect of drenching treatment on the proportion of dry ewes in 1993.

The proportion of dry ewes was higher than that reported by Sumner and Scott (1990) for Romney, Coopworth and Perendale sheep on the same property reflecting both the lower inherent fertility of Merino sheep in the Waikato (Dobbie *et al.*, 1985) and possible experimental constraints associated with synchronised single-sire mating. Lamb survival for both groups in 1992 and for the Treated group in 1993 is comparable to that reported for crossbred wool breeds

TABLE 1: Within year means for lambing performance of ewes treated and untreated with anthelmintic.

	Treatment	Ewe survival (%)	Dry ewes (%)	Ewes lambing multiples (%)	Lamb birth weight (kg)	Lamb survival (%)	LW[1]/EPM (%)	Lamb weaning weight (kg)	WLW[2]/EWL (kg)
1992	Treated	95	38	14	4.0	79	56	18.8	21.0
	Untreated	89	34	16	3.9	77	59	18.6	19.4
	SED	5	10	7	0.2	9	12	0.9	-
1993	Treated	94	32	17	4.3	81	65	21.7	23.0
	Untreated	85	29	3	3.7	73	53	17.1	18.1
	SED	5	10	6	0.2	9	11	1.0	-

[1] Lambs weaned/ewes present at mating.
[2] Weight lamb weaned/ewes weaning lambs.

at Whatawhata Research Centre with Merino lambs tending to be lighter at birth and weaning than crossbred wool type lambs (Sumner and Scott, 1990).

Within breed reproductive performance and ewe live weight are closely interrelated (Coop, 1962). Lambs born to the heavier Treated ewes in 1993 were heavier at birth and weaning than lambs born to the lighter Untreated ewes. When combined with a tendency for the Treated ewes to give birth to more multiples with a better survival than Untreated ewes this resulted in the Treated ewes weaning more lambs and a greater total weight of lamb than Untreated ewes.

If a single capsule were to be administered annually to control intestinal parasites rather than multiple "back to back" use as in this trial, the optimal time to insert the capsule into Merino ewes would be 2 to 4 weeks pre-lambing. The device would then be able to prevent contamination of the pasture with eggs of benzimidazole susceptible and some benzimidazole resistant strains for up to 120 days (Venning, 1991). While our results indicated that use of capsules can increase productivity in Merino breeding ewes the magnitude of this increase will be dependent on the level of over-wintered pasture infestation which may vary from year to year. Any productivity gains also need to be balanced against the increased likelihood of developing anthelmintic resistance.

CONCLUSIONS

The potential productivity gains achievable through control of intestinal parasitism in Merino breeding ewes were significant in economic terms. At a mean Merino wool price over the last three seasons of 500 c/kg greasy, the monetary gain from the increased wool production achieved through control of intestinal parasitism in Merino breeding ewes more than equates with the current costs of a controlled release anthelmintic capsule and dose of ivermectin. Providing the anthelmintic treatment is given at the start of lambing increased returns are achievable through an improved ewe survival and an increased weaning weight of more lambs per ewe mated compared with ewes not suitably treated with anthelmintic.

ACKNOWLEDGEMENTS

To A. Bishop, R.M.A Goodwin, R.G. Iti, B.I. Loveridge, A.W. Richards and P.M. Speedy for management of the sheep and technical assistance with faecal and wool sampling, and wool measurement, D.J. Brears, C.S. Cooke and P.F. McKee for faecal egg counting and M.P. Upsdell for biometrical analyses of the data.

This research was carried out with the financial support of the Foundation for Research, Science and Technology. The slow release anthelmintic capsules were provided by NuFarm Ltd. and SmithKline Beecham Ltd.

REFERENCES

Barger, I. A. 1993. Anthelmintic resistance and controlled release capsules. *Proceedings 23rd Sheep and Beef Cattle Seminar,* Publication No. 150, Veterinary Continuing Education, Massey University, Palmerston North. pp. 129-136.

Barger, I. A., Southcott, W. H. 1975. Trichostrongylosis and wool growth. 3. The wool growth response of resistant grazing sheep to larval challenge. *Australian Journal of Experimental Agriculture and Animal Husbandry* **15:** 167-172.

Barton, N. J., McCausland, I. P. 1987. Production and economic returns from Merino weaner sheep subjected to four frequencies of anthelmintic administration in East Gippsland, Victoria. *Australian Journal of Experimental Agriculture* **27:** 759-764.

Brunsdon, R. V. 1964. The effect of infestation by nematodes of the family Trichostrongylidae and the tapeworm Moniezia expansa upon the liveweight gain and wool production of young sheep. *New Zealand Veterinary Journal* **12:** 129-134.

Brunsdon, R. V. 1988. The economic impact of nematode infection in sheep: Implications for future research and control. *In* The Economic Importance of Parasites of Livestock in New Zealand. Editor A. C. G. Heath. Miscellaneous Publication No 1. New Zealand Society for Parasitology. pp. 4-16.

Coop, I. E. 1962. Live weight - productivity relationships in sheep. I. Live weight and reproduction. *New Zealand Journal of Agricultural Research* **5:** 249-264.

Dobbie, J. L., Hickey, S. M., Smart, S. H. 1985. Farming for fine wools. *Proceedings of the Ruakura Farmers' Conference* **37:** 16-20.

Donald, A. D. 1979. Effects of parasites and disease on wool growth. *In* Physiological Limitations to Wool Growth. Editors J. L. Black and P. J. Reis. University of New England Publishing Unit. pp. 99-114.

Lynch, L. J., Michie, N. A. 1976. An instrument for the rapid automatic measurement of fiber fineness distribution. Textile Research Journal 46: 653-660.

O'Sullivan, B. M., Donald A. D. 1970. A field study of nematode parasite populations in the lactating ewe. Parasitology 61: 301-315.

Roseby, F. B. 1973. Effects of Trichostrongylus colubriformis on the nutrition and metabolism of sheep. I. Feed intake, digestion and utilization. *Australian Journal of Agricultural Research* **24:** 947-954.

Roseby, F. B., Leng, R. A. 1974. Effects of Trichostrongylus colubriformis on the nutrition and metabolism of sheep. II. Metabolism of urea. *Australian Journal of Agricultural Research* **25:** 363-367.

Sumner, R. M. W., Scott, M. L. 1990. Effect of shearing once-yearly in January, once-yearly in July or twice-yearly in January and July on ewe performance. *Proceedings of the New Zealand Society of Animal Production* **50:** 329-334.

Upsdell, M P. 1994. Bayesian smoothers as an extension of nonlinear regression. *The New Zealand Statistician* **29**(2): In press.

Venning, M. S. 1991. Controlled release anthelmintic capsules. *Proceedings 21st Sheep and Beef Cattle Seminar,* Publication No. 134, Veterinary Continuing Education, Massey University, Palmerston North. pp. 61-63.

Watson, T. G., Hosking, B. C., Hurford, A. P. 1992. Breed variations in expression of nematode faecal egg count. *Proceedings of the New Zealand Society of Animal Production* **52:** 69-71.