PRE-MATING TREATMENT OF BREEDING EWES WITH THIABENDAZOLE

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SUMMARY

Details are presented of field trials, comparing the lambing performance of breeding ewes treated with thiabendazole within the three weeks before the commencement of mating, with that of untreated control ewes. In 16 trials involving 16 350 commercial breeding ewes, treated ewes gave a very highly significant mean response, weighted according to the variance of each flock, of 6.55% additional lambs born. Diagnostic techniques that may be of use in predicting responses are examined, and it is proposed that the proportion of the flock shedding nematode eggs at the time of treatment may have a positive correlation with the response. The known pharmacological properties of thiabendazole are discussed relative to the responses in this series of trials.

The pre-mating anthelmintic treatment of breeding ewes with thiabendazole was first reported by Murray *et al.* (1971). In a series of controlled trials, they demonstrated that the practice resulted in improved lambing performance from treated stud Romney ewes, the response being attributable to an increase in multiple births. A review of available data, including his own studies on the subject, was presented by Lewis (1972) at the Invermay Farmers' Conference. Despite an earlier "feeling of improbability about the whole matter" he has continued studies on the subject. It is known that other workers have studied the phenomenon but unfortunately their work is as yet unpublished.

This paper presents in detail the results obtained in a series of sixteen trials conducted on commercial flocks. It also includes detailed information presented in summary form by Murray *et al.* (1971), and discusses other pertinent data obtained during the conduct of the trials.

MATERIALS AND METHODS

For the ten stud ewe trials, nine of which were reported by Murray *et al.* (1971) the method of recording was fully set

out in their paper, and involved identification and records from individual ewes. In the sixteen commercial trials, various techniques have been used to obtain data, involving either individual or group identification.

In five trials, randomization within recognized age groups (*i.e.*, 2-tooth, 4-tooth, etc.) was carried out. In four trials, the 2-tooth ewes, and the mixed-age ewes were handled as separate groups for randomization, while in the remaining seven trials mixed-age ewes as a bulk class were randomized without reference to age of the individual. In some trials faecal egg counts (eggs per gram of faeces, e.p.g.) were made from samples taken at time of treatment; in some, "indicator" ewes were slaughtered for total nematode parasite data. Wool production parameters were measured in four trials.

All treated ewes received thiabendazole* as a 13.3% preformed suspension according to mean body weight of the group, and where selenium was indicated it was administered to both "treated" and "control" ewes. Flocks were selected for trial work on the basis of the willingness of the farmers concerned to co-operate and not because of any suggestion of nematode parasitism limiting ewe fertility.

RESULTS

The lambing performance of ewes in both stud and commercial trials is reported as total lambs born against ewes mated. Hence this does not reflect docking percentages, where environmental factors and perinatal mortalities are accounted for.

Details of the ten stud trials are presented in Table 1. These trials were all conducted in 1969 and a reasonable geographic spread was achieved in this series. In summary these trials (including the negative response in which a clerical error was suspected) showed that 4440 ewes treated with thiabendazole three weeks before mating commenced produced 139.3% lambs compared with 135.5% lambs from 4558 untreated control ewes.

In the past six years, sixteen similar trials in commercial breeding ewes have been undertaken, and the results of these are shown in detail in Table 2. Again reasonable geographic spread was achieved and seasonal differences were encountered. In this series 8550 treated ewes produced 114.9% lambs compared with 108.5% lambs from 7800 control ewes. The mean response, weighted according to the variance of each

*"Thibenzole" Merck Sharp & Dohme (N.Z.) Ltd.

TABLE 1: TEN PRE-TUPPING TRIALS WITH STUD EWES*

Location	*No. Ewes*	*No. Lambs*	*Lambing %*	*Advantage*	*Mean e.p.g. (range)*	*No. Samples (% positive)*	*Response as % of Control %*
Kaeo							
Treated	201	245	121.9	5.9			5.08
Control	206	239	116.0				
Wellsford							
Treated	365	497	136.2	4.7			3.57
Control	359	472	131.5				
Argyll							
Treated	921	1287	139.7	5.6	70	90	4.17
Control	1023	1372	134.1		(0-600)	(23%)	
Takapau							
Treated	501	734	146.5	2.8	93	45	1.95
Control	499	717	143.7		(0-1200)	(24%)	
Rangitikei							
Treated	296	409	138.2	2.1	167	36	1.54
Control	305	415	136.1		(0-1950)	(42%)	
Manawatu							
Treated	333	453	136.0	0.2	85	44	0.15
Control	327	444	135.8		(0-1000)	(36%)	
Mt. Hutt							
Treated	422	621	147.2	5.4			3.81
Control	419	594	141.8				
Ashburton							
Treated	228	286	125.4	—10.9			—7.99
Control	237	323	136.3				
Kelso							
Treated	643	943	146.7	4.9			3.45
Control	643	912	141.8				
Waikoikoi							
Treated	530	708	133.6	5.8			4.54
Control	540	690	127.8				

*Summarized by Murray *et al.*, 1971.

TABLE 2: SIXTEEN PRE-TUPPING TRIALS WITH COMMERCIAL EWES

Location	*No. Ewes*	*No. Lambs*	*Lambing %*	*Advantage*	*Mean e.p.g. (range)*	*No. Samples (% positive)*	*Response as % of Control %*
Waimea Plain 1967							
Treated	200	265	132.5	7.6	N.D.	N.D.	6.08
Control	200	249	124.9				
Waimate 1968							
Treated	173	210	121.4	14.4	440	10	13.46
Control	172	184	107.0		(0-3000)	(70%)	
Puketitiri 1968							
Treated	200	253	126.5	4.5	N.D.	N.D.	3.69
Control	200	244	122.0				
Gladstone 1968							
Treated	175	140	80.0	2.9	340	40	3.76
Control	175	135	77.1		(0-2850)	(65%)	
Otama 1969							
Treated	201	316	157.2	9.7	N.D.	N.D.	6.58
Control	202	298	147.5				
Gladstone 1969							
Treated	200	195	97.5	—3.5	64	45	—3.46
Control	199	201	101.0		(0-750)	(31%)	
Pirinoa 1969							
Treated	1122	1486	132.4	12.4	N.D.	N.D.	10.33
Control	382	458	120.0				
Lincoln 1970							
Treated	397	613	154.4	6.9	17	6	4.68
Control	377	556	147.5		(0-100)	(17%)	

Hororata 1970										
Treated	....	....	....	....	152	199	130.9	0.7	0	24	0.54
Control	....	....	....	....	159	207	130.2				
Te Anau 1970										
Treated	....	....	....	....	795	884	111.2	—0.4	33	9	—0.36
Control	....	....	....	....	837	934	111.6		(0-200)	(22%)	
Lincoln 1971										
Treated	....	....	....	....	597	563	94.3	3.1	214	45	3.40
Control	....	....	....	....	558	509	91.2		(0-2100)	(64%)	
Outram 1971										
Treated	....	....	....	....	419	573	136.8	10.2	113	45	8.06
Control	....	....	....	....	428	542	126.6		(0-2300)	(47%)	
Taieri 1971										
Treated	....	....	....	....	355	531	149.6	—1.0	45	45	—0.66
Control	....	....	....	....	354	533	150.6		(0-300)	(31%)	
Taupo 1971										
Treated	....	....	....	....	1320	1373	104.4	6.8	170	90	6.97
Control	....	....	....	....	1315	1289	97.6		(0-1350)	(65%)	
Taumarunui 1972										
Treated	....	....	....	....	994	1011	101.7	2.7	274	102	2.73
Control	....	....	....	....	992	982	99.0		(0-2550)	(66%)	
Taupo 1972										
Treated	....	....	....	....	1250	1212	96.9	5.5	336	231	6.02
Control	....	....	....	....	1250	1143	91.4		(0-7650)	(53%)	
Totals										
Treated	....	....	....	....	8550	9824	114.9	6.4			5.88
Control	....	....	....	....	7800	8464	108.5				

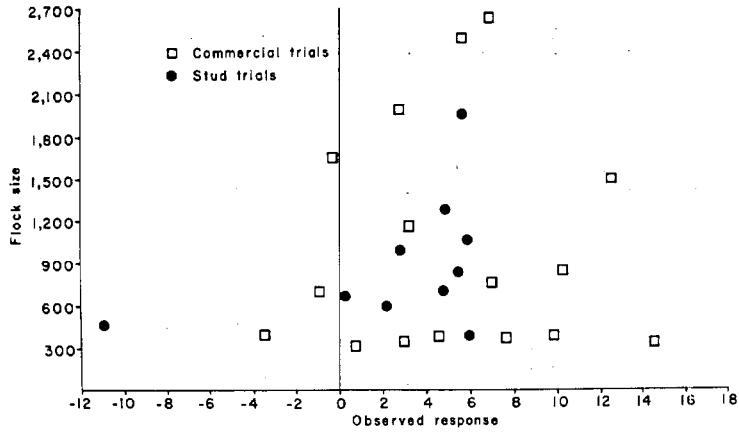

FIG. 1: *Distribution of observed responses according to flock size.*

flock was 6.55% ($P < 0.001$). The Romney was the predominant breed in this series though other breeds were used in one or two trials.

The distribution of responses in all 26 trials, according to flock size (Fig. 1) shows that, of the twenty-six trials, twenty-two have shown positive responses.

Meaningful egg count data were obtained from ewes in 14 of the 17 sampled flocks. The remaining three flocks returned 10 or fewer samples. While the number of samples taken varied widely, mean egg counts at the time of pre-mating anthelmintic treatment ranged from zero in a trial where the observed response was +0.7%, through 45 e.p.g. where the observed response was −0.4%, to 340 e.p.g. (response +2.9%) and 336 e.p.g. (response +5.5%).

To minimize the variation of lambing percentages in individual trials, the observed response was calculated as a percentage of the lambing performance of the controls (*i.e.*, control lambing has been made 100%); when this correction was applied to the data there was a trend suggesting a relationship between increasing responses and mean e.p.g.

However, there was a closer and significant ($P < 0.10$) relationship between increasing response to treatment and the proportion of faecal samples showing any nematode eggs.

Forty ewes slaughtered over three tupping periods in the Wairarapa had total nematode counts ranging from 0 to approximately 4000 with a mean burden of under 1000 worms.

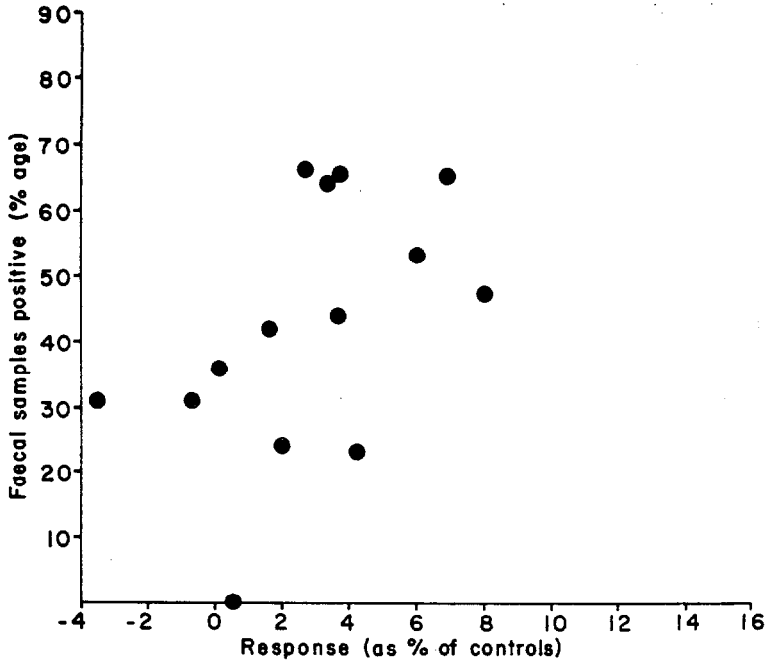

FIG. 2: *Corrected lambing responses relative to percentage of faecal samples containing nematode eggs.*

The genera represented were predominantly *Ostertagia, Trichostrongylus* and *Cooperia.*

Limited observations based on four of these trials suggested that productive responses occurred in terms of increased greasy wool weight and reduction of break. The frequency of occurrence of these responses and indeed their magnitude, could not be predicted on the basis of data presently available.

Body weight data of ewes participating in the trials were obtained in only six of the twenty-six trials; in most of these weighing was confined to a sample of ewes only. There are, therefore, insufficient data to attempt to relate response to body weight, but records show no body weight increase over the perimating period in response to treatment, in any trial where the necessary measurements have been taken.

DISCUSSION

It is apparent from the control lambing figures reported in these trials that the commercial flocks represent a reasonable

cross-section of New Zealand sheep, with a spread around mean figures that would correct (*i.e.*, allowing for lamb deaths) to something approaching the New Zealand national average.

Murray *et al.* (1971) showed that the response observed in stud ewe trials was attributable to an increase in the number of ewes bearing multiple foetuses to term. Collection of data from the majority of the commercial trials was not specifically designed to record this information, although, where individual ewe data were available, this observation was confirmed.

From a preliminary study of ovulation rates in 2-tooth ewes following pre-mating treatment with thiabendazole in 1972, T. D Quinlivan (pers. comm.) reported that ovulation rate appeared to increase more rapidly with increasing body weight in treated ewes compared with untreated ewes. The data are presented graphically in Fig. 3. This, for the first time, indicates that the mechanism by which the response in lambing performance is mediated is by raising the ovulation rate, rather than influencing some other point in the reproductive cycle. It also suggests that there is, for 2-tooth ewes, a minimum weight, below which treatment given may not produce improvements in lambing performance.

Faecal nematode egg counts and total nematode counts from these trials were generally low, and indicate only that there is a wide range in the nematode burdens, and faecal egg

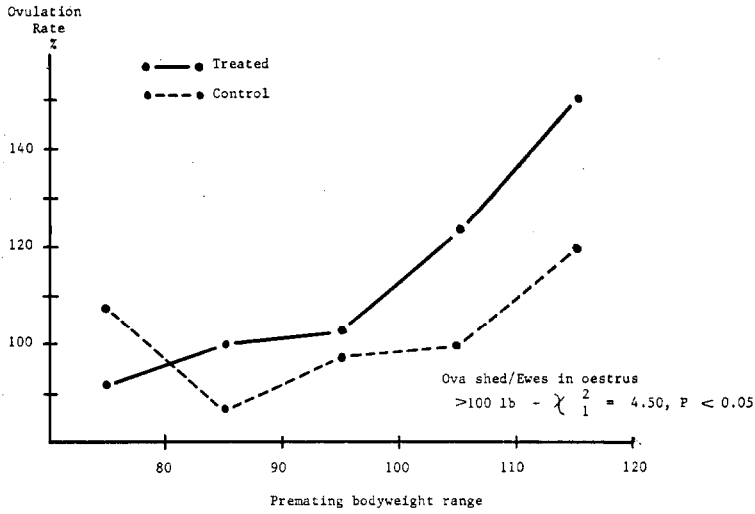

FIG. 3: *Relationship between pre-mating body weight and ovulation rate.*

counts of adult ewes. This could be reasonably expected when account is taken of the variations likely in the immune response to nematode infection in adult animals. One thing is clear, however, namely, that in almost any population of adult breeding ewes, a proportion of the flock are carrying a worm burden (even a modest one), and this burden is shedding nematode eggs at a season of the year when the ewe is under little "stress", although larval populations of nematodes on pasture could be high at this time.

The question then arises — is the observed effect in the reported trials attributable to the removal of the parasites from that portion of the ewe population carrying a significant worm burden? If it is so, there is certainly no body weight response in favour of the treated ewes of sufficient magnitude to account for the observed response. The effects of very small parasite burdens in adult sheep on their "thrift" is largely unknown, although digestibility studies in cattle (Heinemann, 1968) suggest that modest worm burdens interfere with digestibility of feeds, and Andrews *et al.* (1971) have shown in young sheep that both macro- and micro-element absorption or retention may be impaired by infection with gastro-intestinal nematodes.

It is well known that nematode parasite burdens in sheep can depress appetite, although whether this is due to frank pathology in the digestive tract, toxins excreted by the worms, disturbance of mineral metabolism, or some other physiological disturbance is as yet unexplained. In this area the possibility of interactions between the various factors involved in the animal's internal environment cannot be excluded.

Consideration must also be given to the wide range of known pharmacological activities of thiabendazole. In addition to its anthelmintic action, which is well documented, the compound is now well-recognized as an antimycotic of some importance (Robinson *et al.*, 1964; Sinclair and Howes, 1968). Other lesser-known properties of the compound have been described by Campbell (1971); these are an analgesic action similar to aspirin, and antipyretic and non-steroid anti-inflammatory activity. It must be stressed that the studies which demonstrated these characteristics were conducted on monogastrics, and the possible influence of any of these pharmacological actions on the reproductive cycle of the sheep can only be a matter of speculation.

It is apparent that there are many questions yet to be answered before a full explanation of the lambing responses shown in these trials can be given. It is hoped that further work will explore this phenomenon and attempt to elucidate further its apparently complex nature.

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