Chapter 7

Haemonchus spp. in sheep farmed under resource-poor conditions in South Africa - effect on haematocrit, eye colour and body condition

A.F. Vatta[a,b], R.C. Krecek[b], M.J. van der Linde[c], P.W. Motswatswe[d] and J.W. Hansen[e]

[a]*Onderstepoort Veterinary Institute, Private Bag X05, Onderstepoort, 0110 South Africa*

[b]*Department of Veterinary Tropical Diseases, Faculty of Veterinary Science, University of Pretoria, Private Bag X04, Onderstepoort, 0110 South Africa*

[c]*Department of Statistics, Faculty of Natural and Agricultural Sciences, University of Pretoria, Pretoria, 0002 South Africa*

[d]*Department of Agriculture, Conservation and Environment, North-West Province, Private Bag X2039, Mmabatho, 2735 South Africa*

[e]*Animal Production and Health Division, Food and Agriculture Organization of the United Nations, Viale delle Terme di Caracalla, Rome, 00100 Italy*

Abstract

A longitudinal study was conducted of the differential faecal egg counts, haematocrits and body condition scores (BCS) of sheep of resource-poor farmers at Rust de Winter, Gauteng Province, and Kraaipan, North-West Province. The animals were scored for level of anaemia using the FAMACHA[©] method, an assay for the clinical evaluation of anaemia caused by *Haemonchus* spp. Animals considered to be in danger of dying from anaemia caused by haemonchosis were selectively treated with an anthelmintic.

Lower haematocrit values were registered during periods of heavier *Haemonchus* infection, which periods occurred from October to March for the sheep at Rust de Winter and from September/October to February or April for the sheep at Kraaipan.

Seasonal variations in body condition were clearly evident in the sheep at Kraaipan but not at Rust de Winter. The animals at Kraaipan showed lower BCS from July to December. The BCS for Rust de Winter where the animals were grazed on a private farm were generally higher than those of Kraaipan, where communal grazing is practised.

Although there was agreement between the higher *Haemonchus* egg counts, lower haematocrits and increased incidence of anaemic eye colour scores, very few animals were treated.

7.1. Introduction

Although worms have been studied in sheep raised under commercial farming conditions (Horak, 1978; Horak and Louw, 1977) and some work has been done in indigenous goats (Boomker et al., 1994), little is known of the effects of worms on production in sheep raised by resource-poor farmers. The objectives of the current study were the same as those described for the goats in Chapters 3-6. In brief, the aim was to evaluate the effect of *Haemonchus* infection on haematocrit, ocular mucous membrane (eye) colour and body condition score in sheep farmed under resource-poor conditions.

7.2. Materials and methods

7.2.1. Study sites, animals and sampling

Two study sites situated within the summer rainfall area of South Africa were selected: one near Rust de Winter, Gauteng Province, and one in Kraaipan, North-West Province. The sites correspond to those sites selected for the goats in Chapters 3 to 6. At Rust de Winter, all the weaner and adult sheep were sampled/scored at the visits. At Kraaipan, a representative sample of the sheep flock was selected based on the first animals brought into the crush at the first visit, and when available the same goats were sampled/scored throughout the trial period. Unfortunately, the initial sample set started to dwindle in number and for this reason every 10th sheep brought into the crush in May 1999 was added to the sample group. This resulted in four sheep being added to the representative sample groups. A summary of the trial periods and frequencies of visits; breeds of animals; sample sizes; anthelmintics used; grazing practices; vegetation types; winter supplementation; and rainfall is given in Tables 2.1.1 and 2.1.2.

During the day, the sheep at Rust de Winter grazed on the natural vegetation, but from May 1999, they were grazing separately in an enclosed paddock of fallow land. At Kraaipan, the sheep were grazed on communal pasture tended by a shepherd. The animals at both sites were penned in kraals at night.

A faecal egg count reduction (FECR) test was carried out in the sheep at Kraaipan towards the end of the trial. Except for one sheep, the animals utilised for this purpose had not been included in the sampling group mentioned above. Four of the sheep included in the test had two to six permanent incisors while the rest had deciduous incisors only. None of the animals had been treated with an anthelmintic effective against nematodes within 12 weeks of the start of the FECR test.

7.2.2. *Diagnostic techniques*

Faecal samples were collected at each visit from the sheep at Rust de Winter and the representative sample set at Kraaipan (the "trial" animals). Additional samples were collected from April 1999 onwards at Kraaipan to ensure that there would be sufficient faeces for a good yield of third-stage nematode larvae (L_3) when cultures were made (see below). The faecal samples were processed for nematode faecal egg count (FEC), following the method of Van Schalkwyk et al. (1995) and at a sensitivity of 100 eggs per gram of faeces (epg). *Strongyloides*, *Nematodirus* and *Trichuris* eggs were counted separately from the other nematode eggs, which are herein referred to as "strongyle" eggs (Order Strongylida — Molin, 1861).

Samples were screened for trematode eggs using the following method. Half a gram of faeces (1g for the sheep at Rust de Winter) was weighed off from each of 10 faecal samples (five faecal samples for the sheep at Rust de Winter) randomly selected from those collected at each visit to a site. The faeces were pooled and the sedimentation method as described by Van Wyk et al. (1987) was modified for pooled samples as described in Chapter 6. Ten-percent aliquots were examined for trematode eggs.

Faeces remaining after the FECs had been completed were cultured for third-stage nematode larvae (L_3) at a temperature of approximately 25°C until November 1999 when a new room was used and the temperature then adopted was approximately 26°C. Where possible, at least 50 L_3 were identified per culture, using the keys of Van Wyk et al. (1997a) and Dunn (1978). No attempt was made to differentiate *Teladorsagia* larvae from those of *Trichostrongylus* spp. The proportional FECs of the various strongyle worm genera were calculated using the proportions of the strongyle L_3.

The animals were bled and their haematocrits were determined using the microhaematocrit method. The strongyle FECs and haematocrits of the sheep (this chapter) and goats (Chapter 4) at Kraaipan were compared statistically. The details of this analysis are, however, recorded in Appendix 5.

The efficacies of the anthelmintics used in the sheep at Kraaipan were assessed by means of the FECR test using the method of the World Association for the Advancement of Veterinary Parasitology (WAAVP) (Coles et al., 1992), which uses the reduction in FECs following anthelmintic treatment as an indication of anthelmintic efficacy. The arithmetic mean of the treatment and control groups at 10 to 14 days after treatment are utilised to calculate the percentage reduction of FECs and the upper and lower 95% confidence intervals. If the percentage reduction is less than 95% and the lower confidence interval is less than 90% resistance is determined to be present. Resistance is only suspected if only one of the conditions is met. The faeces remaining after the FECs had been done were pooled separately per group and cultured for L_3 recovery (post-treatment cultures). The proportions of L_3 were applied to the strongyle FECs to estimate the relative contribution of each genus (Coles et al., 1992; Presidente, 1985). However, since *Haemonchus* was the predominant strongyle genus in the post-treatment culture for the control animals (82%, $n = 79$), the calculations were performed only for the *Haemonchus* egg counts.

Table 7.1 gives the mean FECs of the animals at the visit dates immediately prior to the dates on which the anthelmintic treatments for the FECR tests were carried out. The animals were ranked according to these FECs from lowest to highest. The animals were then divided into groups of three. Each individual within each group was then randomly assigned to a treatment or control group (Table 7.1), with the help of a table of random numbers. The treatment and post-treatment dates of the FECR tests and the sizes of the groups included in the tests are also recorded in Table 7.1.

The sheep were body condition scored on a scale of one (emaciated) to five (obese) and half scores were assigned where appropriate (Fig. 2.1).

7.2.3. Scoring for level of anaemia

At the scheduled visits, the author or one of the assistants on the project scored each animal

Table 7.1

Faecal egg count reduction test in sheep : details of groups and results

Location	Mean FEC (interval)[a]	Treatment date of FECR test (interval)[b]	Anthelmintic (oral dosage)	Control group		Treatment group		FEC reduction	95% Confidence Interval
				Mean Post-treatment FEC[c]	n	Mean Post-treatment FEC[c]	n		
Kraaipan	8230 (28)	29 Feb 2000 (10)	Levamisole (7.5 mg kg^{-1})	7844	6	0	8	100	Undefined
			Rafoxanide (7.5 mg kg^{-1})	7844	6	0	7	100	Undefined

[a]Mean faecal strongyle egg counts in eggs per gram of faeces at last visit before treatment date of FECR test (interval in days between last visit and FECR test).
[b]Treatment date of faecal egg count reduction test (interval in days between treatment date and date of post-treatment collection of faecal samples).
[c]Mean faecal *Haemonchus* egg counts in eggs per gram of faeces.

for level of anaemia using the FAMACHA$^{©}$ card (Van Wyk et al., 1997b). The author ensured that each assistant for whom scores were recorded had been adequately trained in the method. Excepting for the few visits that the author could not undertake, the scoring was always performed under his direct supervision. Occasionally, monitoring was done in-between scheduled visits by the animal health technicians (AHTs) assisting with the project at Kraaipan. However, these scores were not included in any of the analyses discussed in this paper. Only the animals that were considered to be pale, i.e. categories four and five, were treated with an anthelmintic. At times, animals scored as category three were erroneously treated by the AHTs at Kraaipan.

To promote farmer co-operation, animals that showed signs indicative of *Oestrus ovis* infection (profuse mucous nasal discharge and difficulty in breathing through the nose) were at times also treated with rafoxanide [Nasalcur™, Hoechst Roussel Vet (now Intervet), 7.5 mg kg^{-1}]. With respect to the trial animals, one to two sheep were treated on four occasions at Rust de Winter, and one to eight were treated on 12 occasions at Kraaipan.

7.3. Results

Figs. 7.1 and 7.2 depict the FECs, mean haematocrits and mean BCS for the two study sites. Third-stage larvae of *Haemonchus* spp., *Teladorsagia*/*Trichostrongylus* spp., *Oesophagostomum* spp. and *Strongyloides* spp. were identified in the faecal cultures from both trial sites (Appendix 3). However, since *Haemonchus* predominated in many of the cultures, the graphs of the FECs were drawn to reflect the mean *Haemonchus* FECs and the mean total FECs for the other strongyle genera. Maximum individual *Strongyloides* FECs never exceeded 200 epg and *Nematodirus* and *Trichuris* eggs were not found. Complete results for the L$_3$ cultures were not obtained on numerous occasions for the sheep at Rust de Winter mainly because of difficulties in obtaining sufficient faeces from the animals for FEC and culture. L$_3$ culture results were incomplete for the sheep at

Fig. 7.1 : Strongyle faecal egg counts, haematocrits and body condition scores from sheep at Rust de Winter
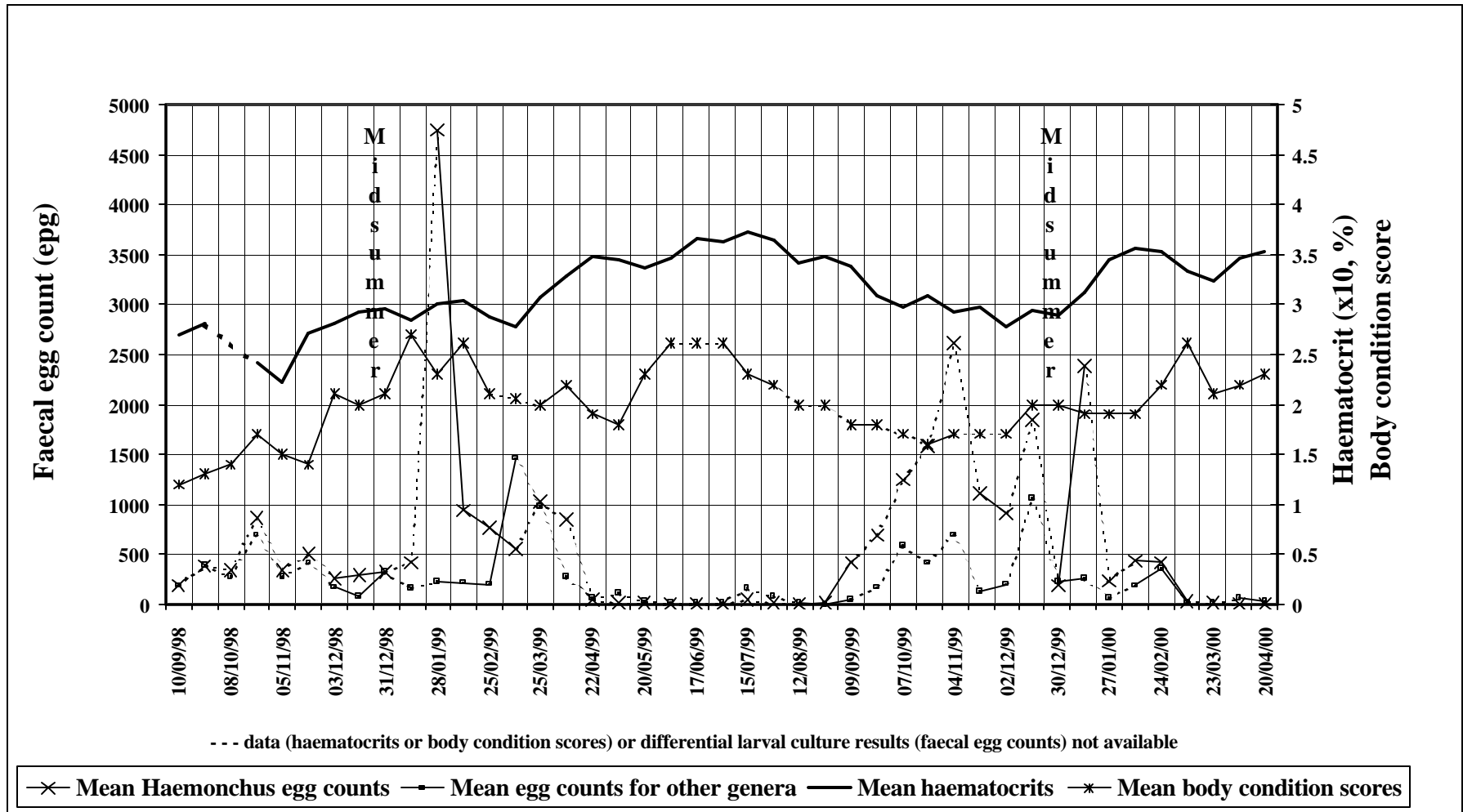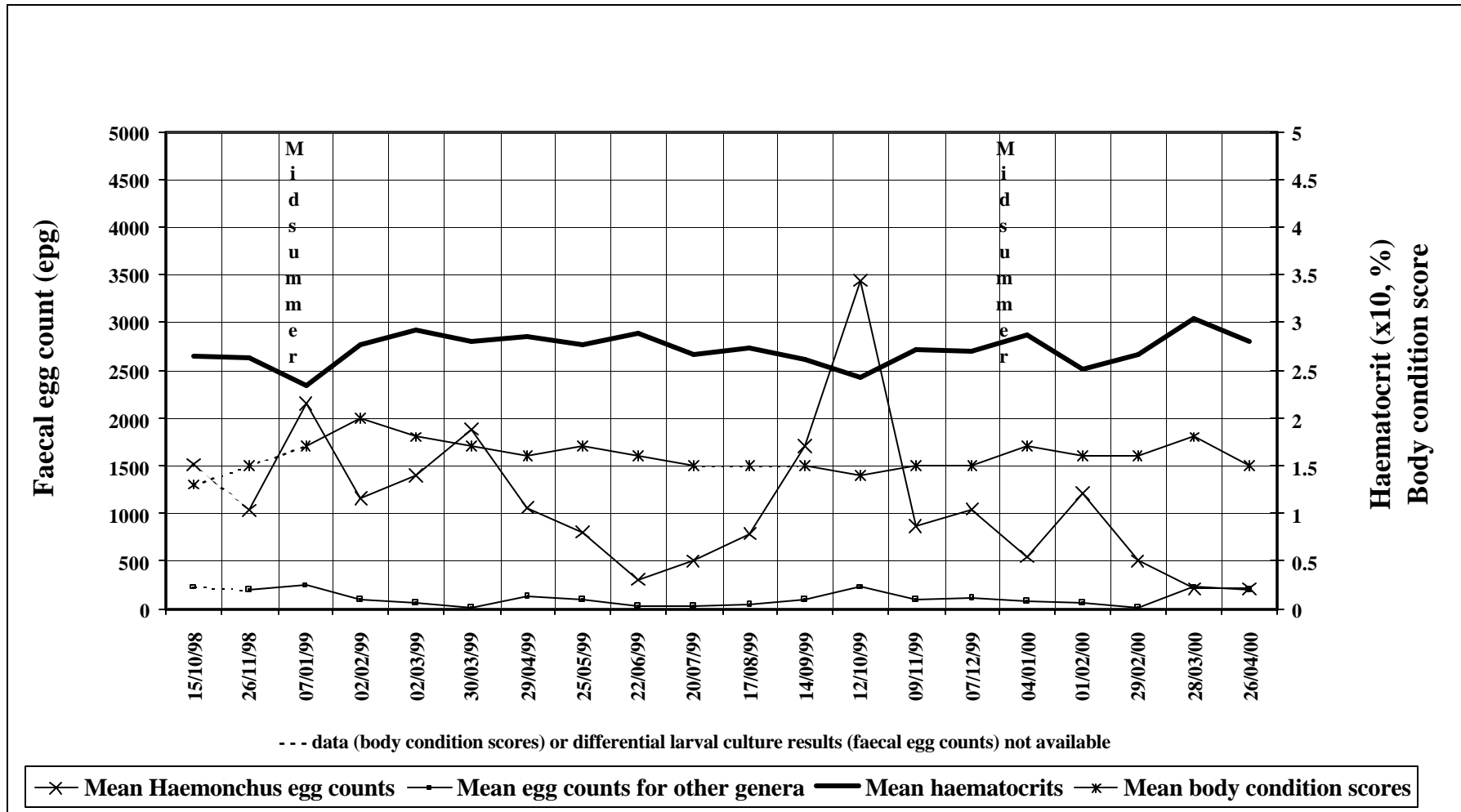
Fig. 7.2 : Strongyle faecal egg counts, haematocrits and body condition scores from sheep at Kraaipan

Kraaipan during October 1998 owing to problems in the laboratory. In these cases, the averages of the proportions for *Haemonchus* spp. and for the other nematode genera for the visit dates immediately prior to and following the dates of missing data were used to estimate the proportional FECs. These results are indicated by dotted lines in Figs 7.1 and 7.2.

A period of higher *Haemonchus* egg counts occurred from October to March at Rust de Winter (Fig. 7.1) and from September/October to February or April at Kraaipan (Fig. 7.2). The mean haematocrits were lower during the periods of heavier worm infection at Rust de Winter and during January and October 1999 and February 2000 at Kraaipan.

The pooled trematode FECs followed a seasonal pattern of amphistome infection in the sheep at Rust de Winter and Kraaipan, with an increase in the counts during the summer months of December/January to March/April. FECs were low, however, with a maximum count of 40 epg recorded in February 1999 at Rust de Winter and 54 epg at Kraaipan. A count of 30 epg was recorded during October 1999 at Kraaipan. All sheep samples examined were negative for *Fasciola* eggs.

Calavas et al. (1998) indicate that body condition scoring performed by different operators on the same animals at the same time is poorly comparable between persons. Thus only those scores recorded by the first author are depicted in Figs. 7.1 and 7.2. The BCS at Rust de Winter ranged between 1.2 and 2.7, but from the beginning of December 1998 onwards, the scores did not fall below 1.6. Although no clear seasonal pattern is evident in the BCS of the sheep at Rust de Winter (Fig. 7.1), the BCS were lower during August 1999 to mid-February 2000. The BCS at Kraaipan were higher during the summer months but lower during July to December 1999 (Fig. 7.2). Overall the BCS at Kraaipan remained poor, however, with scores ranging from 1.3 to 2.0.

Very few sheep were treated at Rust de Winter and Kraaipan during the trial (Table 7.2). Theoretically, considering FAMACHA[©] category three as anaemic in addition to categories four and five did not increase the total scores for anaemic sheep by a substantial degree. Although more animals were scored in FAMACHA[©] categories four and five (and three, four and five) during

10

Table 7.2

Percentage of sheep treated from October to March (*Haemonchus* season) and April to September

Location	Total examined	F[©] 4 and 5 treated[a]	F[©] 3, 4 and 5[b]
Rust de Winter			
Oct 98 - Mar 99	74	6,8%	21,6%
Oct 99 - Mar 00	65	1,5%	20,0%
Apr - Sep 99	65	0	7,7%
Kraaipan			
Oct 98 - Mar 99	130	0,8%	9,2%
Oct 99 - Mar 00	86	1,2%	17,4%
Apr - Sep 99	110	0	5,5%

[a]FAMACHA[©] values 4 and 5 treated.
[b]FAMACHA[©] values 3, 4 and 5 treated (theoretical).

October to March than during April to September, on most occasions the sheep were scored as non-anaemic, i.e. in categories one and two.

Resistance was not detected in the sheep at Kraaipan by the FECR test (Table 7.1).

7.4. Discussion

The high *Haemonchus* FECs during the summers account for the drops in haematocrit seen during these months. Trematodes do not appear to be important parasites in the sheep studied, although confinement of the sheep at Rust de Winter to the enclosed paddock of fallow land from May 1999 onwards would have limited exposure of the sheep to trematode infection.

The sheep at Rust de Winter had been bought not long before the start of the trial, and the poorer condition scores at the beginning of the trial probably reflect a poorer nutritional status at purchase, which improved when the animals started to graze. Rainfall measured at Rust de Winter was below average for June to November 1999 (South African Weather Bureau) and the condition of the grass in the fallow camp where the sheep were confined deteriorated markedly in the winter period as did the

communal grazing at Kraaipan. The sheep were not fed sufficient additional feed to maintain their body condition. At least two of the ewes at Rust de Winter lambed in the spring/summer of 1999/2000 while at the visit to Kraaipan in September 1999 it was observed that many of the ewes had lambed recently. Late pregnancy/parturition/lactation would have placed additional strain on body fat reserves. Higher egg counts were recorded in the Rust de Winter and Kraaipan sheep during October 1999 to January 2000, and in October 1999, respectively. Lack of sufficient grazing, the stresses of the periparturient period and the worms responsible for the higher egg counts probably all contributed to the lower BCS seen during August to mid-February and July to December at Rust de Winter and Kraaipan, respectively.

There is agreement between the higher *Haemonchus* egg counts, lower haematocrits and increased incidence of anaemic eye colour scores. Consequently, the application of the FAMACHA[©] system is suitable for the two study sites. Under supervision of adequately trained personnel, the FAMACHA[©] system has been shown to be an appropriate method of worm control in sheep within the context of an integrated worm control approach on commercial farms (Anonymous, 2000). Nevertheless, the numbers of sheep used in the current study were small and wider application of the FAMACHA[©] system under resource-poor conditions in sheep should be further investigated.