

EFFECTS OF PARASITIC INFESTATION ON THE PRODUCTIVITY OF ALPACAS (*LAMA PACOS*)

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SUMMARY

*A trial was carried out in alpacas (*Lama pacos*) to determine the economic benefit of controlling both external and internal parasites using ivermectin (Ivomec, Merck, Sharpe and Dohme). After four months the treated male alpacas had gained on average 3.1 kg more than the untreated males and their fleece weighed 0.36 kg more. Treated females gained 1.9 kg more than the controls but their fleece weighed 0.03 kg less. This resulted in a net financial benefit to the farmer of US\$3.54 for each male alpaca and US\$1.36 for each female.*

INTRODUCTION

One of the major industries in southern Peru is the export of alpaca wool. The alpaca (*Lama pacos*) is a member of the camelid family and its nearest relative is the llama (*Lama llama*). A few of the farms are owned by the state and others by co-operatives but the majority of alpacas are owned by Andean peasants (campesinos). According to Mauricio de Romana, Vice-president of the International Alpaca Federation (pers. comm.), neither breeding nor productivity have improved since the time of the Incas.

In the Andes there are four members of the camelid family which are considered not to be true ruminants because they have only three stomachs (Escobar, 1982). There has been great confusion concerning the taxonomy of South American camelids and it is thought that they are all of the same species as they are able to interbreed and produce fertile progeny (Leon, 1931, quoted by Escobar, 1982). The vicuña and alpaca are valued for their fibre, the llama is used as a beast of burden and the alpaca, llama and guanaco are killed for meat.

The aims of the trial were to assess the physical effects of internal and external parasites on the production of alpacas and to make an economic assessment of the value of controlling these parasites. The physical effects were measured by weight gain and the weight of fibre (wool) produced at shearing.

MATERIALS AND METHODS

The farm

The trial was based at Sallalli which is approximately 150 km from Arequipa, 4,300 m above sea level and is 1,600 hectares (one third of which is bare sand and rocks) carrying 600 alpacas and llamas.

Animals

The whole of the year's crop was involved in the trial, 51 tuyes (animals born between January and April 1987) were used; 25 in the control group and 26 in the treatment group. On the day the trial commenced each animal was weighed and on the basis of weight and sex, assigned in a random manner to either the control or

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treatment groups. The method used ensured that there were animals of similar weights in each group.

Field examinations

The farm was visited each month from November 1987 until April 1988. At each visit the animals were weighed, faeces samples taken and the animals examined for the presence of lice and mange. Lice were collected for identification and counted from five body sites selected at random, each consisting of all the skin visible at a single spreading of the wool. If there were lesions of mange in the axilla or groin a skin scraping was taken.

In March 1988 the alpacas were sheared for the first time and the wool weighed to the nearest 50 g. About 5 cm of wool is left on each alpaca so that it does not die of exposure after shearing.

After each examination the animals in the treatment group received a subcutaneous injection of ivermectin at the rate of 200 mcg per kg liveweight (0.2 ml per 10 kg) to control internal and external parasites. Animals in the control group seriously affected with mange were treated with ivermectin at the same dose rate.

Laboratory examinations

Lice were identified using a dissecting microscope. Preparations for the identification of mange mites were made by boiling the skin scrapings in a solution of 10% potassium hydroxide.

Nematode eggs were counted by an improved modified McMaster method (Davies, 1984). When the numbers of worm eggs were low a qualitative method was used. This involved analysis of the entire faecal sample by mixing with saturated saline and allowing all eggs to float to the surface. For the examination for eggs of *Fasciola hepatica* the method described by Davies (1984) using three sieves of diminishing apertures was used.

Statistical analysis

The results were analysed using Student's t-test, (Moroney, 1960).

RESULTS

Six alpacas died during the trial, two from the control and four from the treatment group; these were all in the lower third of liveweights in November 1987.

The mean number of lice was calculated for each group (Table I). It can be seen that there was a significant difference between the levels of infestation in the control and treatment groups. Only one louse species was found on the alpacas and this was identified as *Microthoracicus praelongiceps* (Soulsby, 1986).

At the start of the trial seven animals had mange (*Sarcoptes scabiei* var *aucheniae*), four in the control and three in the treated groups. One male control animal was so badly affected that it had to be treated. During the trial a further 11 animals in the control group developed mange (five females and six males). The condition of one was so severe that the animal had to be treated. One male and one female in the treatment group developed mange during the trial.

At the start of the trial all groups showed a similar level of helminth infection (Table II). In December there was a marked difference between the control and treatment groups in the numbers of infected animals. However, by February the number of infected control animals had fallen to that of the treatment group. No attempt was made to identify the nematode eggs by cultural methods but some eggs, e.g. *Lamanema chavezii* and *Nematodirus* spp., were easily identified by their shape and

TABLE I
The mean number of lice present on the alpacas

Month	Mean number of lice present on alpacas			
	Control females 13	Control males 12	Treated females 13	Treated males 13
Nov. 87		Only qualitative assessments made		
Dec. 87	9.23	16.67	4.62	2.69
Jan. 88	2.92	8.25	0.19	1.15
Feb. 88	8.55	8.25	1.00	1.33
Mar. 88	4.45	4.00	2.90	0.84
Total	25.15	37.17	8.71	6.01

The differences between the treated and controls were significant: Females—at the 5% level ($t = 2.51$); Males—at the 0.1% level ($t = 5.37$).

size. The majority of eggs seen were not identifiable and were recorded as strongyle eggs.

At no time during the trial were eggs of *Fasciola hepatica* seen in the faeces samples. An examination of likely habitats failed to reveal the presence of the intermediate host *Lymnaea truncatula*.

These results show that ivermectin is effective in controlling both external and internal parasites of South American camelids. There was a highly significant difference in weight gain between the male treatment and control groups (Table III). The treated females gained on average 1.9 kg more than the controls but this was not statistically significant. The wool weights were calculated as an average for each group (Table IV). The differences were not significant.

Alpaca wool was valued at US\$2.90/kg to the campesino, and alpaca carcasses between US\$0.70 and US\$1.50/kg. To simplify calculations a figure of US\$1.00/kg is used (this includes meat, bones and offal). Animals are sold on a liveweight basis. The retail price in Arequipa of ivermectin was US\$48 for a bottle of 200 ml. In the short period of the trial the treated females increased in value over the controls by US\$1.36 each: thus the 10 treated females increased in value to the campesino by US\$13.60. (Table V). The 10 treated males increased their mean value by US\$3.54 each compared with the untreated controls and so their total extra value to the campesino was US\$35.40.

TABLE II
The number of alpacas with helminth eggs in their faeces

Month	Number of alpacas with eggs present in faeces			
	Control females	Control males	Treated females	Treated males
Nov. 87	12/13	12/13	13/13	13/13
Dec. 87	10/13	11/13	3/13	3/13
Jan. 88	7/11	5/12	1/13	4/13
Feb. 88	1/11	1/11	2/13	1/13
Mar. 88	4/11	7/11	1/13	0/10

TABLE III

The mean weight gain of weaned alpacas between November 1987 and March 1988 and the gain expressed as a percentage of the original body weight

	Control females	Control males	Treated females	Treated males
Mean initial weight in kg.	21.3	22.3	21.1	20.9
Mean weight gain in kg.	6.2	5.7	8.1	8.8
Mean % weight gain	25.5	24.5	38.3	40.8

The difference between the treated and controls was significant: Males—at the 0.1% level ($t = 4.77$); Both—at the 1% level ($t = 3.57$) but females not significant ($t = 2.00$).

DISCUSSION

Since all factors other than ivermectin treatment were the same for the treated and control groups, it can be concluded that any variation in the performance of the two groups can be attributed to the presence or absence of parasites. There was a significant difference between the average weight gains of the two groups which can therefore be attributed to parasitic infestation.

Unfortunately the causes of the deaths of the six alpacas were not ascertained because they were not presented for post-mortem examination but it is unlikely that parasites were the cause of death since more alpacas died in the treatment than in the control group. Those which died all had comparatively low liveweights in October. As there was a severe drought at Sallalli it is possible that they died of malnutrition.

From the differences in parasite levels between the treatment and control groups it can be concluded that ivermectin had a major effect on *M. praelongiceps*, *S. scabei* and all the nematodes. This is in agreement with the findings of Guerrero *et al.* (1986) who considered that this drug represents a major advance in the treatment of parasitic infestations in alpacas. It could be concluded that lice were the major cause of weight loss and loss of wool production. This is at variance with the opinion of Guerrero and Alva (1986b) who considered that lice are only of "nuisance value".

Nematode infections were always very low, the maximum egg count being 1,100 strongyle eggs per gram. The highest levels of parasitism were very low when judged by the criteria of Soulsby (1986). In other research stations in Peru counts of several thousand eggs per gram have been regularly recorded in alpacas (Guerrero and Alva, 1986b), but they also consider that the faecal egg count bears no relationship to the

TABLE IV

The mean weight of wool produced per group of alpacas related to body weight

Wool weight	s.d.	Body weight	Wool weight	s.d.	Body weight
1.05 kg	Female control 0.14	28.3 kg	1.42 kg	Male control 0.54	27.9 kg
1.02 kg	Female treated 0.19	29.5 kg	1.78 kg	Male treated 0.28	31.0 kg

The differences were not statistically significant.

TABLE V
The economic benefits of controlling parasites in alpacas

	Increase in body weight kg (\$ value in brackets)	Weight of wool kg (\$ value in brackets)	Gain in value of animal (\$)	Cost of treatment (\$)	Net gain in value (\$)
Treated females Mean of 12	8.1(8.1)	1.02(2.96)	11.06	0.46	10.60
Control females Mean of 11	6.2(6.2)	1.05(3.04)	9.04	–	9.04
Difference	1.9(1.9)	–0.03(–0.08)	1.81		1.36
Treated males Mean of 10	8.8(8.8)	1.78(5.16)	13.96	0.60	13.36
Control males Mean of 12	5.7(5.7)	1.42(4.12)	9.82	–	9.82
Difference	3.1(3.1)	0.36(0.96)	4.14		3.54

NB: a) Price of alpaca carcase = \$1.0 per kg; b) Price of alpaca wool = \$2.9 per kg; c) Price of ivermectin = \$0.24 per ml.

damage caused by the helminths: the presence of a single egg means that the animal is losing productivity. Animals living at 4,000 m on the dry western side of the Andes are often under considerable nutritional stress. This was seen during this trial when the rains failed. It is also probable that the drought affected the level of helminth infection, as the number of infested animals in November was high but dropped in the control animals between January and February 1988. The failure of the rains probably reduced the pasture contamination.

Guerrero and Alva (1986a) consider that mange is one of the principal causes of financial loss to the campesino. However, their work was carried out in Puno on the wet eastern side of the Andes. In this study two alpacas in the control group were so severely affected, that for humane reasons, they had to be treated. Nine other control animals showed signs of the disease but recovered spontaneously. It is possible that the failure of the rains and the consequent dryness prevented the development of a more severe disease (Soulsby, 1986).

There is a considerable gain to the campesino if he treats his animals (Table V). In this trial for an outlay of US\$10.60 there was an increase in value of the animals of US\$59.60. A campesino should obtain similar gains. The annual per capita income in the sierra is about US\$250 and so with 20 treated animals this will be increased by US\$49 or almost 25 per cent. Guerrero and Alva (1986a) showed comparable financial gains with their animals which were only treated twice a year, before and after the rains. Thus the recommendation to the Peruvian campesino must be "Control the parasites and increase your income". This work has shown that parasitism can be a cause of economic loss in alpacas and that a larger investigation is warranted.

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EFFETS D'UNE INFESTATION PARASITAIRE SUR LA PRODUCTIVITE DE L'ALPACA
(*LAMA PACOS*)

Résumé—Un essai a été mené sur des alpacas (*Lama pacos*) pour déterminer le bénéfice économique réalisé par la lutte contre les parasites internes et externes à l'aide de l'ivomec (Ivermectine, Merck, Sharpe & Dohme). Après 4 mois de traitement, le gain de poids pour les mâles a été d'environ 3,1 kg et de 0,36 kg pour leur toison par rapport aux non traités. Les femelles avaient gagné 1,9 kg en poids vif mais leur toison avait perdu 0,03 kg toujours par rapport aux non traités. Cette thérapeutique procure un bénéfice financier net pour le fermier de 3,54 \$US par mâle et de 1,36 \$US par femelle.

EFFECTOS DE INFESTACION PARASITARIA EN LA PRODUCTIVIDAD DE ALPACAS
(*LAMA PACOS*)

Resumen—Se llevó a cabo una investigación en alpacas para determinar el beneficio económico del control de parásitos internos y externos, mediante el uso de "Ivomec" (Ivermectin, Merck, Sharpe & Dohme). Después de 4 meses las alpacas machos tratadas habían ganado un promedio de 3.1 kg. más que aquellas que no fueron tratadas y su vellón pesó 0.36 kg más. Las alpacas hembras tratadas ganaron 1.9 kg más que los controles, pero su vellón pesó 0.03 kg menos. Este tratamiento dio una ganancia neta al ganadero de US\$3.54 por cada alpaca macho y \$1.36 por cada alpaca hembra.