UNIVERSITI PUTRA MALAYSIA

AN EVALUATION OF VARIOUS ANTHELMINTICS ON SHEEP

AZIZAH BINTI DARUS

AN EVALUATION OF VARIOUS ANTHELMINTICS ON SHEEP

BY

AZIZAH BINTI DARUS

AN ANIMAL INDUSTRY PROJECT PAPER SUBMITTED AS PARTIAL FULFILMENT FOR THE DEGREE OF DOCTOR OF VETERINARY MEDICINE OFFERED BY THE FACULTY OF VETERINARY MEDICINE AND ANIMAL SCIENCE, UNIVERSITY PERTANIAN MALAYSIA, SERDANG, SELANGOR.

JANUARY 1989

UNIVERSITI PERTANIAN MALAYSIA

TABLE OF CONTENTS

LIST OF TABLES

* Trade name

** Commersial-Merino-Border-Lester-Cross

LIST OF FIGURES

ABSTRAK

Abstrak daripada kertas projek yang dikemukakan kepada Fakulti Kedoktoran Veterinar dan Sains Peternakan untuk memenuhi sebahagian daripada keperluan kursus VPD 401 Projek Perindustrian Ternakan.

AN EVALUATION OF VARIOUS ANTHELMINTICS ON SHEEP

by

Azizah binti Darus

1989

Penyelia Dr. Hew Peng Yew.

Penilaian telah dilakukan terhadap keberkesanan berbagai-bagai anthelmintik dari segi pengurangan keluaran telor nematod yang di gunakan dalam biri-biri dipelihara secara semi-intensif. Anthelmintik yang digunakan ialah Valbazen* (albendazol), Levacide* (levamisol), Ivomec* (ivermectin) dan Systamex* (oxfendazol). Lima belas ekor* Poll Dorset, 15 Suffolk, 19 Tibet, 19 Local, 16 biri-biri dari kumpulan Suffolk/ CMBLX**/Wiltshire dan 16 dari kumpulan Poll Dorset/CMBLX telah dipilih secara rawak untuk pengiraan telor cacing pada hari rawatan, seminggu dan dua minggu selepas rawatan, menggunakan teknik Modified McMaster.

Dari laporan makmal, spesis helmin yang terdapat di ladang ini ialah Haemonchus contortus, Strongyloides

---

* Jenama
* Commersial-Merino-Border-Lester-Cross

papillosus, Monieza expansa, .Eurytrema spp., Dictyocaulus spp., Trichostrongylus spp. dan Oesophagostomum spp.. Selain dari helmin, sampel tinja daripada kumpulan Poll Dorset dan CMBLX menunjukkan kehadiran koksidia di ladang ini. Bagaimanapun, tiada tanda-tanda klinikal diperhatikan.

Kajian juga menunjukkan rintangan nematod terhadap Valbazen dan Levacide. Systamex dan Ivomec didapati masih berkesan iaitu 86.9% dan 100% masing-masing.

ABSTRACT

An abstract of the project paper presented to the Faculty of Veterinary Medicine and Animal Science in partial requirement for the course VPD 401 - Animal Industry Project.

AN EVALUATION OF VARIOUS ANTHELMINTICS ON SHEEP

by

Azizah binti Darus

1989

Supervisor : Dr. Hew Peng Yew

The efficacy of various anthelmintics in reducing nematodes egg output was evaluated in sheep reared under semi-intensive system. Anthelmintics used were Valbazen* (albendazole), Levacide* (levamisole), Ivomec* (ivermectin) and Systamex* (oxfendazole). Fifteen Poll Dorset, 15 Suffolk, 19 Tibet, 19 Local, 16 sheep from the group Suffolk/CMBLX**/Wiltshire and 16 from the group Poll Dorset/CMBLX were selected at random for faecal egg count on day of treatment, 1st. and 2nd. week after treatment. Data were obtained from previous records and also from faecal examinations by the Modified McMaster technique.

From laboratory reports, the species of helminths present in this farm are Haemonchus contortus. Strongyloides papillosus, Monieza expansa, Eurytrema spp.,

---

* Trade name
** Commersial-Merino-Border-Lester-Cross

Dictyocaulus spp., Trichostrongylus spp. and Oesophagostomum spp. Beside helminths, faecal determination from group Poll Dorset and CMBLX revealed coccidia oocysts However, no clinical sign were observed.

This study revealed nematode resistance against Valbazen and Levacide. Systamex and Ivomec were still effective with 86.9% and 100% efficacy, respectively.

INTRODUCTION

Parasitic infestation present a very serious problem in the wet tropics, such as Malaysia which favour the survival of the free-living stages. Gastrointestinal parasitism is an important infestation (Devendra, 1983) affecting ruminant productivity. Ruminants harbour a wide variety of internal parasites such as helminths and protozoa. In sheep, the common parasites found in the gastrointestinal tract include Haemonchus contortus (90%), Trichostrongylus colubriformis (59%), Oesophagostomum columbianum (25%) and Monieza expansa (22%)(Rehana et.al, 1986). Gordon (1950) has reported that Haemonchus contortus is an important pathogenic parasite in sheep and goats and in Indonesia it is believed to be the most important nematode of these species (Anon,1973). In cattle, nematodes such as Haemonchus spp. Trichostrongylus spp., Cooperia spp., Bunostomum spp., Toxocara vitulorum and Strongyloides papillosus had been reported by Dahlan (1983) and are considered common gastrointestinal parasites in the wet tropics (Copeman et. al. 1977). These parasites cause considerable damage to the gastrintestinal tract and Dahlan (1983) reported that in calves, they had an adverse effect on average daily weight gains. Adverse effects of lungworm and liverfluke has also been reported in ruminant. Beside helminths, another internal parasite which also cause socio-economic losses in the livestock industry is coccidia. Coccidiosis has been reported as a primary

protozoal disease in livestock that can cause low weight gains (Dahlan, 1983) especially in young animals.

The continued prevalence of gastrointestinal parasites is due to many factors which include a high fecundity of these parasites together with the continued use of pasture in extensive grazing systems and high stocking rates (Soetedjo et.al. 1980).

To overcome and control gastrointestinal parasitism, anthelmintic medication has become one of the remedies available (M.M.Ikeme, 1971). Periodic medication of animals will not only help in the prevention of outbreaks of helminthiasis but also in preventing contamination of pastures by reducing faecal egg output, thus interrupting the life cycle of the parasites (Roy & Sukhla, 1971). A number of broad-spectrum anthelmintics, which are relatively non-toxic chemical compounds are currently in use against gastrointestinal nematodes of ruminant in Malaysia. Amongst these are levamisole, dl-tetramisole thiabendazole, oxfendazole, fenbendazole and the latest compound ivermectin.

The objectives of this paper are :- to evaluate the efficacy of various anthelmintics on nematodes of sheep in this farm; to assess the the efficacy of several anthelmintics on different breeds; and to study the efficiency of the deworming programme in this farm.

In this project paper, investigation was only done on gastrointestinal nematodes.

LITERATURE REVIEW

ANTHELMINTICS EFFECTIVENESS.

Under intensive systems, successful control of ovine helminthiasis depends on the efficacy of different anthelmintics (Cawthorne & Cheong, 1984). A survey done by Gettinby et.al., (1987) showed that the most commonly used anthelmintics in both cattle and sheep were from the benzimidazole group, followed by levamisole and finally the recently introduced ivermectin.

Benzimidazole (Oxfendazole & Albendazole).

The benzimidazole group which includes albendazole and oxfendazole are broad spectrum anthelmintics (Soetedjo et.al. 1980).

Oxfendazole has been reported by Michael et.al., (1979) in their studies in Egypt, to be highly effective against gastrointestinal and respiratory tract nematodes and cestodes of sheep. Bairden and Armour (1983) showed that oxfendazole given orally or intraruminally was extremely effective against Ostertagia ostertagi and Cooperia oncophora, including arrested larvae in cattle. Taylor et.al., (1985) reported that the efficacy of oxfendazole against lungworm (Dictyocaulus viviparus) in

calves was an 84.8% reduction in faecal egg output; in sheep its efficacy against nematodes was less (69% - 74%) at a dose rate of 4.5 mg/kg.(Dash, 1985); Cawthorne and Whitehead (1983) reported the efficacy against Ostertagia circumcinta in sheep to be about 79.6% compared to albendazole of only 52.7%.

Albendazole effectiveness has been reported in cattle by William et.al., (1977). It is recommended for use against adult flukes (Boray et.al. 1983). Other benzimidazole compounds such as fenbendazole, mebendazole, thiabendazole and oxfendazole, which are used for nematode control, only have marginal efficacy against adult flukes and that also at an increased dose rate (Duwel et.al. 1975). Recently, a new compound of benzimidazole, triclabendazole, has been reported by Boray et.al., (1983) to be highly effective against mature and immature flukes of sheep and cattle with a maximum tolerated dose of 200 mg/kg.

The safety of oxfendazole has been reported in all species of domesticated animals by Morgan (1982). There is also a report by Jara et.al., (1984) that oxfendazole and albendazole were both safe for use in sheep without any effect on the digestibility of cellulose substrate.

Levamisole.

Levamisole which have been used against nematodes has been reported to have an efficacy of 56 - 70% by Dash (1985) at a dose rate of 7.0 mg/kg., while Cawthorne and Whitehead (1983) reported a 99.9% efficacy against Ostertagia circumcinta in sheep.A recent report by McKellar et.al., (1987) showed that levamisole gave a poor response in terms of excretion of nematode eggs in ewes compared to either ivermectin or oxfendazole.

Levamisole, the next most frequently used drug in ruminants after the benzimidazole group, could be use safely in sheep (Gettinby et.al., 1987). Jacob (1977) reported that levamisole had no side-effects on pigs.

Ivermectin

Ivermectin is reported to be effective against various parasites, such as nematodes in domesticated animals (Campbell, 1985) , lungworms in cattle (Armour et al., 1983) , sucking louse Solenopotes capillatus (Barth & Preston, 1983), Parafilaria bovicola in cattle (Swan et. al., 1983). More recently , it has been reported to be effective against chorioptic and sarcoptic mange in cattle (Barth & Preston, 1988).

Effectiveness of ivermectin given orally is reported

to be similar to oxfendazole (McKellar et.al., 1988) in suppressing nematode eggs. A study by Cawthorne and Whitehead (1983) showed that its efficacy against Ostertagia circumta in sheep was 100% compared to oxfendazole (79.6%) In calves effected by lungworms (Dictyocaulus viviparus), the response to ivermectin was 97.4% , higher than oxfendazole (84.4%).

Persistence of ivermectin after parental administration against gastrointestinal nematodes in cattle was at least 14 days (Barth & Preston, 1983). In sheep, it was reported that ivermectin given subcutaneously persisted longer (about 28 days), which was one week longer than ivermectin given orally in supressing egg output (McKellar, 1987). In goats, Swan and gross (1985) reported no adverse reaction to ivermectin.

Oxyclozanide.

Oxyclozanide, one of the active ingredients in Nilzan*, has been used as an anthelmintic in ruminants. It has been reported to be effective against Fasciola hepatica in sheep (Walley, 1966) and Fasciola gigantica in ruminant (Roy & Sukhla, 1971). It is also effective against both mature and immature flukes at a dose rate of 15 mg/kg and 60 mg/kg respectively. However, Edward (1972) has reported that it is not very effective against immature flukes in

---

* trade name

sheep, even at a high dose rate of 60 mg/kg. Another experiment by Khadim et. al., (1972) in sheep naturally infected with Fasciola gigantica, showed that oxyclozanide is 85 - 95 % effective in reducing egg output 2 - 6 weeks after treatment.

The only side effect in sheep treated with oxyclozanide was the softening of the faeces with an increased frequency of defaecation which lasted shortly after dosing (Khadim et al., 1972). This confirmed the findings by Roy and Sukhla (1971) who also found that animals on a high nitrogenous diet were not affected and this drug was well tolerated even by pregnant ewes.

ANTHELMINTICS RESISTANCE.

There have been many reports of the occurence of anthelmintic resistance by gastrointestinal nematodes in sheep. Anthelmintic resistance against nematodes could pose problems to sheep enterprises (Cawthorne & Cheong, 1984). Resistance to one anthelmintic is usually accompanied by a cross resistance to other anthelmintics in the same group (Hall et al., 1978) This is quite true in the case of benzimidszole compounds where thiabendazole, a compound of benzimidazole, was found to be resistant against Haemonchus contortus in sheep (Cawthorne & Cheong, 1984). Resistance to other benzimidazole compounds, such as

---

* trade name

fenbendazole, were also reported.

Levamisole resistance has also been reported by Hall et. al. (1981) against a strain of Trichostrongylus colubriformis.

Parasitic resistance to ivermectin has also been reported.

MATERIALS AND METHODS.

FARM UNDER STUDY.

The project was carried out in Pusat Pembiakan Lembu Baka at Ijok, Batang Berjuntai, Selangor. The sheep farm was started on October 1987. Before that the area was used for cattle breeding. There is also a deer farm at this centre. The area of the centre is approximately 200 hectres of which 160 hectres were for pasture and fodder production, 3 hectres for sheep houses, with the rest for the deer farm.

The objectives of this farm are:-

a. to achieve a population of 5000 sheep;

b. to produce cross breds with Suffolk as the base breeder or breeding pure Suffolks;

c. to study the ideal breed that can adapt to the local environment;

d. to supply good breeder sheep to farmers and estates under the `PAWAH' system or subsidy.

The breeds in this farm are Malin (Kelantan), Tibet (Thailand), Poll Dorset (Aust. & N.Z.), Suffolk (Aust, & N.Z.), CMBLX**(Aust. & N.Z.) and Wiltshire (Aust. & N.Z.). All sheep brought in were between 1 - 2 1/2 years old and it was expected that all females were

** Commercial-Merino-Border-Lester-Cross

four months pregnant. The present population of sheep in this centre is about 1260.

ANIMAL MANAGEMENT.

The farm is run under a semi-intensive system with sheep being allowed to graze from 8:30 am. till 2:30 pm. and then kept in the sheds with raised and slatted flooring at night or during rainy weather. Rotational grazing was practised with 20 animals per hectre. However, sometimes overstocking occurred. The grass was mostly Setaria kazungula, with some Panicum maximum and Bracharia decumbens. Legumes were Stylosanthus guyanensis and Leucaena leucocephala. Goat pellets which contained low copper levels were given as a supplement once daily. Both male and female sheep were fed with about 200 - 300 g. per day. No such supplement was given to lambs. Lambs were kept in the sheds with their dams till they were 2 - 3 months of age (stall feeding), before being allowed out to graze. Pregnant and lactating ewes were fed extra concentrates of about 600 g. each daily.

Lambs are kept together in the same shed until they are weaned at 3 months of age, after which the males and females are separated. All the sheep were allowed to graze in flocks which comprised of:- Suffolk and Poll Dorset, Tibet, Local, Suffolk/CMBLX/Wiltshire and Poll Dorset/CMBLX. Pasture management for each group are as

follows :-

Suffolk and Poll Dorset.

Both breeds grazed together on a combined pasture of Setaria kazungula and Stylosanthus guyanensis. Rotational grazing was on two areas, side by side, measuring about 2 hectres. The pastures were on a smooth slope with jungle and swamp bordering the slope. Before 1987, these areas were used only for hay production. The grasses were mostly dry with a few fresh patches.

On arrival at Ijok, these sheep were dewormed with Nilzan*, followed by Valbazen*, Ivomec* and finally Systamex*. Deworming was done every two weeks.

Fifteen sheep were selected at random from Suffolk and 15 sheep from Poll Dorset. The total number of each breed was 60.

Only data on Valbazen and Ivomec were available from previous records.

---

* Trade name

Tibet.

The animals were grazed on a combined pasture of Setaria kazungula and Stylosanthus guyanensis, located on a smooth slope with a small swamp at the foot of the slope bordering the area. Green grass was short while taller grass (< 1 foot) were dry with only few green areas. Pastures were in clusters with clay in-between. This pasture had been used previously for hay production only.

Deworming was done every three weeks using Nilzan*, followed by Valbazen*, Levacide*, Ivomec* and finally Systamex*.

Nineteen sheep were selected from a total of 350 sheep. Only data on Valbazen and Levacide were available from the records.

Local.

The sheep were grazed on a hilly, dry area. Grases were mostly dry and very short (overgrazing). The pastures were of Setaria kazungula with Stylosanthus guyanensis Cattle has grazed on this pasture previously.

Deworming programme was every 3 weeks with Nilzan*.

* Trade name

followed by Valbazen*, Ivomec* and finally Systamex*.

Nineteen animals were selected from about 600 sheep. Only data on Valbazen was available.

Suffolk, Commercial-Merino-border-Lester-Cross (CMBLX) and Wiltshire.

Pasture was mainly Setaria kazungula with some Bracharia decumbens and Stylo. guyanensis. The grass was green and tall (up to 2 feet). The ground are moist and undulating with jungle at one border and a small stream running beside the other border. The pasture had been used as grazing area for cattle previously. Most of the area obtained indirect sunlight during the day.

Deworming was every 2 weeks with Nilzan*, followed by Valbazen*, Ivomec* and finally Systamex*. Sixteen sheep were selected out of about 100 animals for faecal egg counts two weeks after dewormed with Ivomec.

Poll Dorset and CMBLX.

The land had been used as a grazing area for cattle previously. The pasture was situated on low-lying land which was always wet, with a small stream almost at the end

---

* Trade name

of it. The type of pasture was Setaria kazungula with Stylosanthus guyanensis which was young, tall and green.

Deworming was done every 2 weeks with Nilzan*, followed by Valbazen*, Ivomec* and finally Systamex*. Sixteen sheep were selected from this group. Only data on Systamex was available from records.

ANTHELMINTICS

Anthelmintics used in this farm were :-

a. Nilzan* which contain oxyclozanide and levamisole hidrocloride administered at a dose rate of 15 mg/kg and 7.5 mg/kg. orally.

b. Valbendazole* which contain albendazole, administered at a dose rate of 5 mg/kg. orally or 15 ml/animal.

c. Levacide* with levamisole as the active ingredient, administered at a dose rate of 7.5 mg/kg or 5 ml/animal subcutaneously.

d. Ivomec* with ivermectin as the active ingredient given, at a dose rate of 200 ug/kg. or 2 ml/animal subcutaneously.

e. Systamex* which contain oxfendazole was used at a dose rate of 4.5 mg/kg. or 2.5 ml/animal, orally.

---

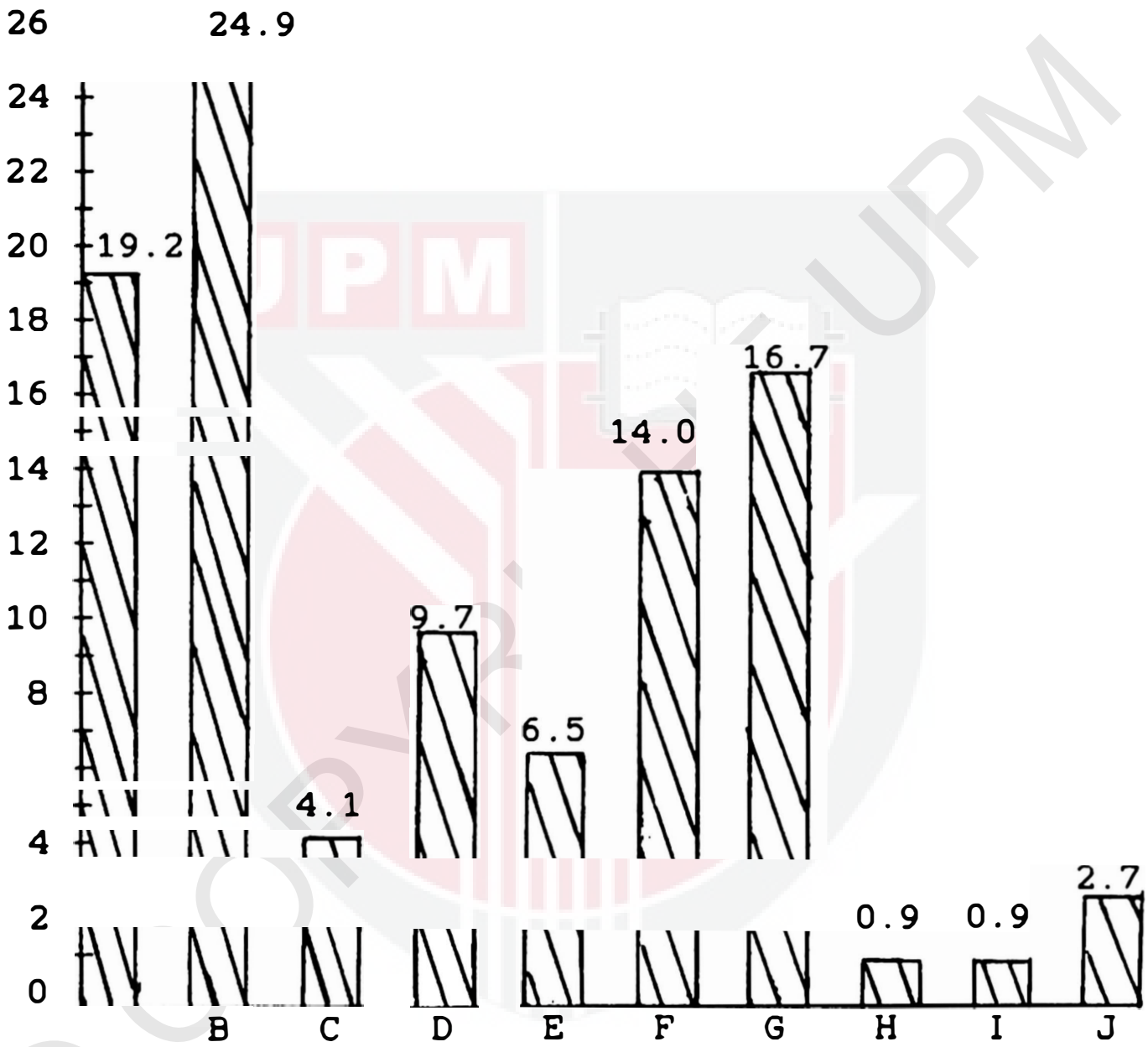
* Trade name

DATA COLLECTION.

Data was collected from the records of each flock. The animals were selected at random from each group for parasitic egg count which was then recorded. Faecal samples were collected on the day of treatment with án anthelmintic, at first and finally, second week after treatment. Faecal examination was also done during my stay there on flock Suffolk/CMBLX/Wiltshire and group Poll Dorset/CMBLX. All samples taken were recorded and were taken from adult males and females between 1 - 2 years of age.

For the determination of nematode eggs and coccidia oocyst counts per gram of faeces (epg.), the Modified McMaster Technique was used. Faecal samples were collected directly from the rectum of each animal at mid-morning, on the day of treatment,first and second week after treatment.

FIGURE 1 MORTALITY RATES WITH PREDISPOSING CAUSES IN SHEEP FROM OCTOBER 1987 TO OCTOBER 1988



CAUSES OF DEATH

A - HELMINTHIASIS
B - PNEUMONIA
C - MELIOIDOSIS
D - BLUE TONGUE
E - SEPTICAEMIA
F - PASTEURELLOSIS
G - UNDIAGNOSED
H - RUMEN IMPACTION
I - KIDNEY PROBLEM
F - MISCELLANEOUS

RESULTS AND DISCUSSION

Helminthiasis (19.2%), after pneumonia (24.9%) was the major cause of mortality in sheep at Ijok from October 1987 till October 1988 (FIG. 1). Most of the sheep that died due to helminthiasis were adults between 1 1/2 to 2 years because all the sheep that were brought here were only rams and ewes. Until now, only few lambs have been born and for most of those that died no autopsies were performed due to autolysis.

From laboratory reports, the most common helminths were Haemonchus contortus which concurred with finding by Rehana et al. (1986), followed by Strongyloides papillosus. Other parasites were Monieza expansa, Eurytrema spp., lungworms, Trichostrongylus and Oesophagostomum spp. Coccidia was also found in a few cases but since 1987, only one mortality due to coccidiosis was reported. Faecal examination for occyst count was done on group Poll Dorset and CMBLX which had been treated with Systamex. The result was shown in Table 1.

Some of the fatal helminthiasis cases had faecal egg counts of between 100 to 242,000 epg (Appendix 2). It may be hard to believe of sheep mortality with only 100 epg., but most of these sheep had been dewormed recently(2 - 3 days) so which was why there was low faecal egg count.

However, those are also cases of numerous or few Haemonchus contortus in the abomasum. Some of the sheep had a very heavy worm egg count (>200,000), but they still survived, possibly due to immunity and good nutrition. Before sheep were brought to this farm, some areas were used for cattle

Table 1: Coccidia oocyst count from group Poll Dorset/CMBLX treated with Systamex.

	Faecal oocyst count		
	Pre-treatment	Post-treatment	
Animal	Day 0	1st week	2nd week
1	1,500	1,400	600
2	3,500	1,500	400
3	3,700	1,000	1,400
4	100	300	0
5	1,500	400	300
6	1,200	400	300
7	1,800	1,600	1,200
8	3,500	2,100	2,900
9	1,400	800	1,100
10	1,800	700	700
11	400	100	800
12	500	900	300
13	200	600	400
14	1,800	1,500	2,000
15	1,200	5,800	1,200
16	1,000	1,600	100
TOTAL	25,100	20,700	13,700
MEAN	1,569	1,293	856
SD	+1,135	+1,331	767

SD - standard deviation

grazing. However, a few local goats and sheep were kept previously on a small area for research purposes. Occurence of helminthiasis in this farm were observed since the first month that sheep was brought in. All sheep imported to this farm were supposed to be free from clinical helminthiasis. Thus, heavy parasitism occurred mainly after reaching the

farm. It is possible that the newly imported sheep ingested pasture contaminated with large number of nematodes larvae from previous cattle, local goats and sheep. Stress during transportation , a change of environment and malnutrition may have exacerbated the situation. The high fecundity of helminths together with continued use of pastures in a semi-intensive grazing system with high stocking rates (> 20 animal/hectre) will ensure the continued presence of helminths such as Haemonchus contortus (Soetedjo et al., 1980).

To overcome the helminthiasis problem, this farm have used many anthelmintics. The first anthelmintic used was Nilzan which contains oxyclozanide that affects flukes, and levamisole hydrochloride that affects nematodes. Nilzan had been administered biweekly. According to the manager, treatment with Nilzan was effective, but there was no record on the farm to support his statement. However, this may be true as there was a report that oxyclozanide was highly effective against flukes in ruminants (Roy and Sukhla, 1971) and levamisole was reported to have an efficacy against nematodes of between 56 - 70 % (Dash, 1985). After using Nilzan for 2 3 months, it was substituted with Valbazen (albendazole), administered also at 2 weeks intervals and also for 2 months. The anthelmintic was later substituted by Ivomec (ivermectin) administered every 2 weeks but for a month, followed by

Systamex (oxfendazole) on the same dosing interval and similar period as the above. Ivomec was then used again. At present, the strategy of the deworming programme was to use Ivomec and Systamex alternately.

Analysis of the drugs used in this farm are only on its effectiveness against nematodes. The evaluation were made by comparing the efficacy of drugs used in the same breed and also by comparing the efficacy of a drug in other breeds.

The effect of Valbazen and Ivomec in reducing nematode eggs output in Poll Dorset were 81% and 100% respectively (Table 2) . In Poll Dorset we can see that

Table 2: Comparative anthelmintic efficacy of Valbazen and Ivomec against nematodes in Poll Dorset.

Anthel.	Mean faecal egg count after treatment ± SD			
	Day 0	Day 7	Day 14	Mean weekly Reduc.(%)
Valbazen	1080±1897	100±125	313±606	207±443 81
Ivomec	313±606	0 ± 0	0 ± 0	0 ± 0 100

Ivomec was highly effective compared to Valbazen . However, Valbazen efficacy in this farm on Poll Dorset can be considered to be higher than oxfendazole/Systamex (also a benzimidazole drug) which has been reported by Dash (1985) to have efficacy of 69 - 74 % against nematodes. So Valbazen could still be used as the anthelmintic of choice

instead of Ivomec. Furthermore, Ivomec ($1.80c /animal). is more expensive than Valbazen ($1.05c /animal).

Valbazen, as shown in Table 3, has no effect against nematodes, while Ivomec was 100 % effective. In Suffolk, it was clear that the nematodes had developed resistance against Valbazen. Ivomec has been used after the failure of Valbazen but it is wise to use other anthelmintics before

TABLE 3: Comparative anthelmintic efficacy of Valbazen and Ivomec in Suffolk.

	Mean faecal egg count after treatment ± SD			
Anthel.	Day 0	Day 7	Day 14	Mean weekly Reduc.(%)
Val.	1087±987	1787±1630	2913±3174	2350±2545 no effect
Ivomec	2913±3174	0 ± 0	0 ± 0	0 ± 0 100

using Ivomec for fear of the development of parasitic resistance against Ivomec in future. The use of Systamex (oxfendazole) and other benzimidazole drugs is not advisable since resistance to Valbazen (albendazole) could cause cross resistance to other benzimidazole drug (Hall et al., 1978). It could also be expected that albendazole would be ineffective when used in Poll Dorset since both Suffolk and Poll Dorset grazed together in the same pastures, where there would be a possiblity for the pasture to be contaminated with albendazole-resistance larvae.

The breed Tibet also showed Valbazen resistance,

while Levacide (levamisole) was only of 10.7 % effective (Table 4) which was much lower than the efficacy of 56 - 70 % as reported by Dash (1985). It therefore seems that both Valbazen and Levacide were ineffective against nematodes in Tibet sheep. At present the farm is using Ivomec in Tibet but data on this is not available, yet.

Table 4: Comparative anthelmintic efficacy of Valbazen and Levacide against nematodes in breed Tibet.

	Mean faecal egg count after treatment ± SD			
Anthel.	Day 0	Day 7	Day 14	Mean weekly Reduc.(%)
Valbazen	0 ± 0	5 ± 23	21±53	13 ± 41 no effect
Levacide	121±276	211±296	5 ±23	107±232 10.7

For local sheep (Table 5), Valbazen at first showed effectiveness of 78 % which was slightly higher than reported by Dash (1985), but then after several weeks, albendazole was completely ineffective against nematodes.

Table 5: Efficacy of Valbazen against nematodes in local sheep

	Mean faecal egg count after treatment ± SD				
Anthel.	Day 0	Day 7	Day 14	Mean weekly	Reduc.(%)
Valb. 1	74±205	0 ± 0	42±107	21±76	78
Valb. 2	158±241	42±84	326±1005	184±737	no effect

For group Poll Dorset and CMBLX, only data on Systamex (oxfendazole) was available for analysis (Table 6) It was found that the efficacy of Systamex against

nematodes was 86.9% which is higher than reported by Dash (1985) and also more effective than Valbazen treatment in group Poll Dorset.

Table 6: Efficacy of Systamex against nematodes in Poll Dorset and CMBLX.

	Mean faecal count after treatment ± SD				
Anthel.	Day 0	Day 7	Day 14	Mean weekly	Reduc.(%)
Systamex	694±1839	56±103	125±201	91±161	86.9

The efficacy of Valbazen (Table 7) and Ivomec (Table 8) against nematodes was compared in a few breeds of sheep. Valbazen was shown to be still effective when used in the breed Poll Dorset, but ineffective when used in Suffolk, Tibet and Local sheep, whereas Ivomec was 100% effective in both Poll Dorset and Suffolk.

TABLE 7: Efficacy of Valbazen against nematodes in Poll Dorset, Suffolk, Tibet and Local.

Group	Reduction (%) in 2 weeks
Poll Dorset	81 %
Suffolk	Resistant
Tibet	Resistant
Local	Resistant

TABLE 8: Efficacy of Ivomec against nematodes in Poll Dorset and Suffolk.

Group	Reduction (%) in 2 weeks
Poll Dorset	100 %
Suffolk	100 %

Deworming at this farm were done every 2 - 3 weeks. This is not ideal, since a frequent suppressive programme with broad spectrum anthelmintics is likely to result in the persistance of anthelmintic resistant strains (Kelly & Hall, 1979 a,b). The rate at which a frequency of individuals within a population carrying resistant genes can increase depends on the amount of genetic variation within the population and the intensity of selection pressure applied, viz. dose rate and frequency of treatment (Kelly & Hall, 1979 a; Georghion & Taylor, 1977). A similar dose rate administered to sheep without taking into account the size of the animals will cause nematodes in smaller and larger sheep to develop resistance due to higher or lower doses, respectively.

Resistance occurs principally where an anthelmintic is applied at a dose rate sufficient to kill most or all the susceptible worms, but very few of the resistant ones (this is called the discriminating dose). In this situation the resistant parasiteswill multiply thus increasing the resistant worms in the following generation (Soetedjo et al., 1980). The high frequency of treatment in this farm have resulted in reducing the number of susceptible worms at each treatment which finally will eliminate the susceptible thus leaving the increasing resistance parasites in the farm. Frequent deworming also will increase the cost of production.

For an effective endoparasitic control, the deworming programme recommended by Tajuddin and Chong (1988) was at monthly or bi-monthly interval, drenchings for 4 weeks to 6 months old lambs and bi-monthly in adults. However , during the wet seasons, monthly deworming is required even for adults. This programme also had been used in calves (Rajamanickam, 1971).

Ivomec, which has a higher efficacy should be used carefully by this farm because the higher the efficiency of an anthelmintic, the greater is its potential for selection of resistant strains especially if it is used at the discriminating dose (this is usually in excess of the normal recommended dose) as reported by Soetedjo et. al. (1980). Thus treatment with Ivomec must not be too frequent and the dosage not lower or higher than the recommended dose. Furthermore, the anthelmintics used should be changed after three cycles of usage (Tajuddin & Chong, 1988) to avoid the development of resistance. At present time, this farm changes anthelmintics after each treatment at 2 - 3 weeks interval.

The effectiveness of an anthelmintic used not only depend on the frequency and dosage with which it is used, but also in relation to the grazing management and animal husbandry practises in the farm; in particular on the importance of the dosed animal as a source of pasture

contamination. In this farm, the sheep were allowed to graze on the same area for too long (about 1 1/2 months) or sometime the rotation of pastures was too short (less than a week) due to overstocking. This will expose the animal to highly contaminated pasture with infective larvae. Furthermore, the lambs (2 -3 months) which were highly susceptible to infestation were allowed to grazed together with adult sheep on the pasture. The satisfactory approach to the control of endoparasites is to prevent the exposure of susceptible animals to excessively infested grazing (Soetedjo et al., 1980).

Under field conditions, the selection pressure (dose or frequency) imposed on a worm population is much dependant on the effectiveness with which the anthelmintics are used to limit or control pasture contamination with worm eggs. The effectiveness of an anthelmintic does not only depend simply on the frequency, but more important is the way in which the anthelmintic is used, i.e, the age of the animal that is treated, its relative importance at the time of treatment, wether or not treatment is accompanied by a move to clean or safe pasture and the efficacy of the anthelmintic at the dose rate employed (Cawthorne & Whitehead, 1983).

CONCLUSION

In this study , it is found that the efficacy of Ivomec and Systamex against nematode were 100% and 86.9% respectively, which was more effective compared to Valbazen and Levacide.

Overall, Valbazen was ineffective in most breeds except in Poll Dorset while Levacide has some effect. Therefore this farm could only use Ivomec and Systamex alternately for deworming.

SUGGESTION

Suggestions to improve the efficiency of "DEWORMING PROGRAMME" are:-

a. Prevent the exposure of susceptible animals to infested pasture by letting the lambs to graze separately from adults on pasture with low contamination.

b. Reduce stocking rate to prevent infestation by large numbers of larvae.

c. Anthelmintic treatment should be done at a monthly or bi-monthly intervals and anthelmintics to be changed after 2 - 3 treatments. At present anthelmintic treatment should be used regularly (once a month) for lambs below one year old and

older animals at larger intervals. A rational program for worm control should be worked out based on the epidemiology of the parasitic problem and host/parasite relationship.

REFERENCES

1. Anon (1973). Report on animal diseases in Indonesia. Directorate of Animal Health, Ministry of Agriculture, Jakarta.

2. Bairden, K., Armour, J. and Reid, J.F.S. (1983). Comparison of oral and intraruminal administration of oxfendazole against Ostertagia ostertagi and Cooperia oncophora. Vet. Rec., 113: 448-449.

3. Barth, D. and Preston, J.M. (1985). Efficacy of ivermectin against sucking louse Solenopotes capillatus. Vet.Rec., 116: 267.

4. Barth, D. and Preston, J.M. (1988). Efficacy of topically administered ivermectin against chorioptic and sarcoptic mange of cattle. Vet.Rec.,123: 101-104.

5. Boray, J.C., Crowfoot, P.D., Strong, M.B., Allison, J.R., Schellenbaum, M., Von Orelli, M. and Sarasin, G. (1983). Treatment of immature and mature Fasciola hepatica infections in sheep with triclabendazole. Vet. Rec., 113: 315-317.

6. Campbell, W.C. (1985). Ivermectin An update. Parasit. Today. Vol. 1: 10-16.

7. Cawthorne, R.J. and Cheong, F.H. (1984). Prevalence of anthelmintic resistant nematodes in sheep in south-east England. Vet. Rec., 114: 562-564.

8. Cawthorne, R.J. and Whitehead, J.D. (1983). Isolation of benzimidazole resistant strains of Ostertagia circumcinta from British sheep. Vet. Rec., 112: 274-277.

9. Copeman, D.B., Brotowidjoyo, M.D. and Fabiyi, J.P. (1977). Control of Bovine Helminths in wet Tropics. First Joint Prod. Conf. Australian Ass. of Cattle Veterinarions and the Ass. of Veterinary Surgeons, Malaysia, Kuala Lumpur 16th - 20th May, 1977.

10. Dahlan, I. (1983). The effect of gastrointestinal parasite infestation on the performance of young Brahman X Kedah-Kelantan cattle. Mardi Res. Bull., 11,3: 351-359.

11. Dash, K.M. (1985).. Differential efficacy of levamisole and oxfendazole against resistant male and female Trichostrongylus colubriformis. Vet. Rec.,117: 50-53.

12. Devendra, C. (1983). Goats: Husbandary and potential in Malaysia. Bulletin 158, Ministry of Agriculture, Malaysia.

13. Duwel, D., Kirsch, R. and Reisenleiter, R. (1975). Vet. Rec., 97:371.

14. Edwards, C.M. (1972). Treatment experimentally-produced acute fascioliasis in sheep. Vet. Rec., 90: 523-526.

15. Gettinby G. , Armour , J., Bairden, K. and Plenderleith, R. W. J. (1987) . A survey by questionnaire of parasitic worm control in cattle and sheep at the Glasgow University Lanark practice. Vet. Rec., 121: 487-490.

16. Gordon, H.McL. (1950): Australian Vet. J., 26: 14-28.

17. Hall, C.A., Ritghie, P.A., Mc Donell (1981). Investigation for anthelmintic resistance in gastrointestinal nematodes from goats. Res. in Vet. Sci. 31: 116-119.

18. Ikeme, M.M. (1971). The anthelmintic efficiency of 'Nilverm' against the adult and immature stages of the gastrointestinal parasites of Nigerian Fulani Zebu cattle. Trop. Anim. Hlth. Prod., 3: 107-114.

19. Jacobs, D.E., Lean, I.J. and Oakley, G.A. (1977). Levamisole: Efficacy against Trichuris suis. Vet. Rec., 100: 49.

20. Jara, W., Sumano, H. and Ocampo, L. (1984). Effects of three benzimidazole anthelmintics on the ruminal fermentation ability of sheep. Vet.Rec., 115:565-566.

21. Kadhim, J.K., Jabbir, M.H. and Ayoub, A.T. (1972). Treatment of Fasciola gigantica in sheep. Trop. Anim. Prod., 5: 22-26.

22. Kelly, J. D. and Hall, C. A. (1979 a). Advances in pharmacology and chemotherapy, Vet. Rec., 16:89-128.

23. Kelly, J.D. and Hall, C.A. (1979 b). New South Wales Veterinary Proceedings, 15: 19-31.

24. McKellar, Q.A. and Marriner, S.E. (1987). Comparison of the anthelmintic efficacy of oxfendazole or ivermectin administered orally and ivermectin administered subcutaneously to sheep during the periparturient period. Vet. Rec., 114: 383-385.

25. Michael, S.A., El Refail, A.H., Mansour, W.H., Selim, M.K. and Higgins, A.J.(1979). Efficacy of oxfendazole against natural infestations of nematodes and cestodes in sheep in Egypt. Vet.Rec., 104: 338-340.

26. Morgan, D.W.T. (1982). Toxicity study of oxfendazole in pregnant sows. Vet. Rec., 111: 161-163.

27. Rajamanickam, C. (1972). Parasitic problems associated with dairy cattle in Malaysia. Veterinary Division, Ministry Of Agriculture and Fisheries, Malaysia. (Mimeograph)

28. Rehana, A.S., Awang, I.P.R. and Sheikh-Omar, A.R. (1985). Incidence and factors affecting endoparasitism in goats in Serdang, West Malaysia. Kajian Vet., 17(2): 127-131.

29. Roy, R.M. and Sukhla, S.S. (1971). Oxyclozanide - activity against Fasciola gigantica in naturally infected buffalo, cattle, sheep and goats. Trop.Anim. Health Prod. 3: 26-31.

30. Soetedjo, R., Berjajaya, D., Henderson, A.W.K. and Kelly, J.D. (1980). Use of disophenol for the control of Haemonchus contortus in sheep in West Java, Indonesia. Trop. Anim. Hlth. Prod., 12: 198-202.

31. Swan, G.E., Soll, M.D., Carmichael, I.H. and Schroder, I. (1983). Efficacy of ivermectin against Parafilaria bovicola. Vet. Rec., 113: 260.

32. Swan, G.E. and Gross, S.J. (1985). Efficacy of ivermectin against induced gastrointestinal nematode infections in goats. Vet. Rec., 117: 147-149.

33. Tajuddin, I. and Chong, D.T. (1988). Rubber Research Institute Of Malaysia Research On Sheep Integration Under Rubber. Simp. On Sheep Production In Malaysia., 73-82.

34. Taylor, S.M., Mallon, T.R. and Kenny, J. (1985). Comparison of early season suppressive anthelmintic prophylactic methods for parasitic gastroenteritis and bronchitis in calves. Vet. Rec., 117: 521-524.

35. Walley, J.K. (1966). Oxyclozanide in the treatment of the liver fluke Fasciola hepatica in sheep and cattle. Vet. Rec., 78: 267-275.

36. Williams, J.C., Knox, J.W., Sheehan, D.S. and Fuselier, R.H. (1977). Vet. Rec., 101: 484.

APPENDIX 1

ANTHELMINTICS COST.

1. **NILZAN**

   Price — $33.00 per litre

   Dosage — 20 ml per sheep

   Cost per sheep = $0.66

2. **VALBAZEN**

   Price : $70.00 per litre

   Dosage — 15 ml per sheep

   Cost per sheep = $1.05

3. **LEVACIDE**

   Price : $30.00 per litre

   Dosage . 5 ml per sheep

   Cost per sheep = $0.15

4. **SYSTAMEX**

   Price : $120.00 for 4 litre

   Dosage : 2.5 ml per sheep

   Cost per sheep = $0.75

5. **IVOMEC**

   Price : $180.00 per 200 ml

   Dosage : 2 ml per sheep

   Cost per sheep = $1.80

Note: All prices were from the manager of the farm.

APPENDIX 2

FAECAL EGG COUNT FROM FATAL HELMINTHIASIS CASES.

Id. no.	egg/gram
0285	4090
0213	57,000
158	100,000
1523	66,000
0202	5,700
181	6,000
S 163	12,500
152	19,000
21207	11,500
0264	88,000
S 17	28,800
0301	30,000
0356	5,500
21199	200
16254	9,900
16253	2,400
374	21,000
101	4,400
100	4,400
348	11,100
49	400
4703	64,600
6904	800
16899	300
4727	3,300
1761	25,400
16831	100
16818	200
16827	1,300
1168 B	9,200
3887	5,900
1144	5,400
1788	3,800
043	13,700
113	114,800
1708 B	26,900
1181	24,600
1905	> 10,000
1157	4,400
7451	1,600
7357	10,100
0907	8,400
K/0318	31,500
133	81,000
0077	64,700
86/851	5,700
No tag	242,000
8865	19,000
9131	6,600

Continued ....

Id. no.	egg/gram
9194	1,400
1913	100
21255	37,900
16901	1,400
21282	1,100
3594	100
16218	200
16820	12,300
0296	88,000
BT 110	1,700
54	400
46519	1,500
7725	5,900
7975	23,600
5445	8,700

Note: All data from farm records.