

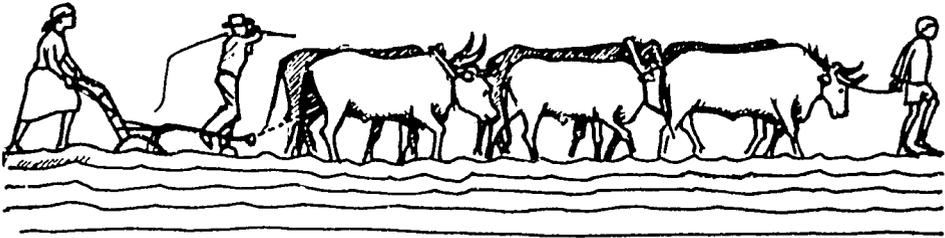
AGRICULTURAL TECHNOLOGY IMPROVEMENT PROJECT (ATIP)

EFFECTS OF IVERMECTIN ON PACKED CELL VOLUME
OF GOATS WHEN USED TO TREAT LICE INFESTATION

BY

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PREFACE

ATIP working papers are prepared and circulated to make ATIP research findings easily available to GOB personnel and researchers interested in Botswana Farming Systems.

This paper presents information on a Researcher Managed, Researcher Implemented (RMRI) trial on the efficiency of the drug Ivermectin (Ivomec¹) in controlling sucking lice (Linognathus africanus) of goats.

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ABSTRACT

Seventy-two goats belonging to four separate farmers in Marapong village of the Tutume Agricultural District were divided into a treatment group consisting of 54 animals and a control group of 18 animals. The treated animals were given a sub-cutaneous injection of 200 micrograms of Ivermectin per kilogram of body weight after a blood sample was drawn. A packed cell volume (PCV) test was run on the blood samples. Additional PCV's were run on days 14, 28, and 56. There was a statistically significant increase in the PCV's of treated animals at day 28 and 56 post injection when compared to treated animals on day 0 and to the controls on day 56. It was concluded that animals treated with Ivermectin to remove live infestation, should be hardier and consequently be more resistant to disease problems and hopefully less prone to illness and death, especially at the end of the dry season when these animals are typically at their lowest physiological ebb, and are subject to many severe stresses.

INTRODUCTION

Between August 1988 and the beginning of this trial (25 October, 1989), infestation of goats by sucking goat lice (*Linognathus africanus*) was commonly observed. All 20 of the herds ATIP worked with in the three villages were infested, and many kids died or were debilitated and weakened by what was perceived as lice induced anaemia. During this period of low rainfall, internal parasite burden appeared to be minimal.² It was felt that if anaemia were in fact being caused by the heavy lice infestation, then controlling this infestation might decrease the anaemia and resultant debilitation and susceptibility to concurrent diseases.

Malnutrition is always a problem at the end of the dry season because goats are grazed communally and all grazing and browse for 2 to 4 km from the village has been utilized. In addition, the kids are usually kraaled at night and kept separate from the does so some milk off-take can occur for human usage. The kids are then allowed to nurse, are re-kraaled, and the does are allowed to wander free to find forage wherever they can. The kids are usually released from the kraal for a few hours in the afternoon but virtually no forage is available to them in the village area. A supplemental feeding programme for kids was tried but was unsuccessful. Farmers were unwilling to plant, harvest, or store forage plants and would not purchase feed.

The Packed Cell Volume (PCV) is a simple laboratory test that indicates the percentage of cells (both white and red) that occur in a given amount of blood. Sucking lice consume these cells, most of which are red cells, thereby causing anaemia or loss of red cells and their oxygen carrying capacity. Therefore the PCV itself can be used as an estimate of the number of red cells present or degree of anaemia that goats are suffering.

OBJECTIVE

The objective of this trial was to test the hypothesis that goats found to be infested with lice and anaemic at the end of the dry season could be treated with a therapeutic dose of Ivermectin (200 mcg per kg of body weight) thus reducing the lice infestation and

². This observation is based on worm burden egg count data published elsewhere (Thedford, Kelemogile, Worman, and Baathodi, 1990).

facilitating recovery from the anaemia. This recovery would be evidenced by an increase in the PCV from day 0.

JUSTIFICATION

Throughout the dry winter period, infestation by Linognathus africanus is seen as a severe complication to survival, especially to young born that year. Anaemia caused by heavy infestation, coupled with malnutrition as a result of depleted grazing and browsing and milk off-take for human use appears to be a major cause of death loss, especially among kids. This study was designed to look at the effect of controlling lice in the complete herd not just on kids, because transmission can occur back to the kids from the affected adults.

DESIGN

Out of the eight cooperating goat herds from the village of Marapong, four were selected to be tested. They were selected because of their location in the village, proximity to other herds, and equality in their grazing and browsing potential. The herd of one farmer, herd number 15, was selected as an untreated control. Herds of two other farmers (herd numbers 13 and 17) were treated herds, with all individuals within those herds given a therapeutic dose (200 mcg/kg of body weight) of Ivermectin. After day 0, blood samples were collected. The herd of a fourth farmer (herd number 16) was also used as a treatment herd but only 10 animals from this herd were injected.

Farmers continued their usual management strategies. This consisted of night kraaling and grazing adult goats on communal lands during the day. The kids were allowed to nurse at night but were kraaled during the day to protect them from predators. No does in these herds were being milked at this time. All goats had previously been tattooed and ear tagged for identification.

The animals designated as treated animals were bled on days 0, 14, 28 and 56. All of them were given Ivermectin after bleeding on day 0. All control animals were bled on day 0 and 56. Blood was collected via needle and syringe and micro-capillary tubes were filled from these. The micro-capillary tubes were centrifuged at 1800 RPM for 7 minutes and PCV was read by the same person, each test day, using a Hawksley micro-hematocrit reader. The use of the PCV provides an accurate estimate of the relative number of RBC's present in the blood sample, and an estimate as to the existence of anaemia or recovery of the condition through regeneration of RBC's. This regeneration is not immediately evident but should start by day 28 post-treatment, and progress through day 56.

Each goat was examined each test day for the presence of lice. They were each evaluated by the same person and assigned a grade "1" through "5", "1" being very few to no lice, "2" very few lice, "3" moderate number of lice, "4" being a severe infection, and "5" indicating a very severe infection with emaciation and pale mucous membranes.

RESULTS

From all herds there were 59 animals who received treatment. This represented 75.6 percent of the total of 78 animals involved throughout the programme. Nineteen served as controls (24.4 percent). The number of animals on each test day is not consistent due to missing animals (strays, one death and one eaten). All goats were evaluated (Table 1) for lice infestation each time their blood was sampled and assigned a grade from "1" to "5". Only

two kids were graded "5", one of these was a kid from the herd that was partially treated, was born late in the season, and was sampled only on day 56 as a control. The other was from the control herd and graded as "4" at the start of the trial and a grade "5" at the end of the trial 56 days later. In all herds, numerous kids were born during the test period. All were graded "1" in the treated group while two of the control group showed infestation. Not all kids were sampled or examined in the control group. All kids born to the treatment group were examined and graded, but not sampled. This grade assessment was very subjective and probably does not relate closely to the PCV readings.

TABLE 1: GRADE OF LICE INFESTATION

GRADE	DAY 0		DAY 14 TREATED	DAY 28 TREATED	DAY 56	
	TREATED	CONTROL			TREATED	CONTROL
1	44	3	57	57	54	16
2	7	0	0	0	0	0
3	5	3	0	0	0	1
4	3	4	0	0	0	0
5	0	0	0	0	0	2 ^b
TOTAL GOATS	59	10	57	57	54	19
	69				73	

a. Includes both treated and controls
 b. Includes kids born since start of trial.

The decrease in obvious infestation (subjective evaluation) could be attributed to the warming of the weather and subsequent decrease in lice activity. Grade of infestation did not correlate with PCV. The only valuable observation was that there was no visible presence of lice on the treated goats, while 3 of 19 controls were infested and 2 of these were very severe with obvious anaemia.

The results of the micro-hematocrit testing (PCV) procedure indicated that there was a statistically significant increase in PCV in all treated animals on day 28 and day 56 when compared to their day 0 readings (Table 2). There were also significant increases in PCV on day 28 and 56 when compared to day 14 (Table 3). However, there was an actual decrease in PCV from day 0 to day 14 (Table 2) which could be explained by a delay in body response to self-repair, i.e., replacement of red cells. It is not uncommon to see this delay. In addition, the testing occurred at the end of the dry season when forage was virtually absent.

TABLE 2 EFFECT OF IVERMECTIN ON PCV OF GOATS AT DAY 0, DAY 28, AND DAY 56

	DAY 0	DAY 14	DAY 28	DAY 56
NUMBER	69	55	56 **	54 **
MEAN PCV	27.12	26.51	28.84	28.59
S.D.	3.33	3.01	2.59	2.49

** Are significantly different from the control (day 0) at the 0.01 level.

TABLE 3 EFFECT OF IVERMECTIN ON PCV OF GOATS COMPARING DAY 28 AND 56 TO DAY 14 LEVELS

	DAY 14	DAY 28	DAY 56
NUMBER	55	56 **	54 **
MEAN PCV	26.51	28.84	28.59
S.D.	3.01	2.59	2.49

** Are significantly different from day 14 values at the 0.01 level

The PCV's of the treated goats were compared at day 14 and 28 to the 18 controls on day 56 (Table 4). There was no significant difference in values between treated goats on day 14 and untreated goats on day 56. There was, however, a highly significant difference between those levels seen in the treated goats on day 28 when they were compared to day 56 controls.

TABLE 4: EFFECT OF IVERMECTIN ON PCV OF GOATS AT DAY 14 AND DAY 28 WHEN COMPARED TO PCV AT DAY 56

	DAY 14	DAY 28	DAY 56
NUMBER	55	56	18
MEAN PCV	26.51	28.84**	26.72
S.D.	3.01	2.59	4.85

** Is significantly different from day 56 controls (n: 18) at the 0.01 level.

To double check comparisons, all animals that had paired blood samples were compared (Table 5). It was found that the 54 treated pairs, using the paired t-test, had increased PCV's between day 0 and 56. This was statistically significant at the 0.01 level. The eight control goats showed no significant change in PCV between day 0 and day 56.

TABLE 5: COMPARISON OF ALL ANIMALS THAT HAD PAIRED SAMPLES ON DAY 0 AND DAY 56

	DAY 0		DAY 56		NUMBER OF PAIRS
	MEAN PCV	S.D.	MEAN PCV	S.D.	
TREATMENT	27.19	3.53	28.59**	2.49	54
CONTROL	26.63	2.92	25.38	3.70	8

** Within a row, indicates a significant increase in PCV from day 0 at the 0.01 level.

The mean PCV's of goats belonging to each farmer were compared to see if there were a detectable difference between farms. Farmer with herd number 13 had goats which were significantly higher in PCV than all the others when compared on day 0¹. The comparisons between goats from herd number 13 and goats in herd number 16 and 17 were significant at the 0.01 confidence level, while the comparison with those from herd number 15 was significant at the 0.05 level. It was found that farmer with herd number 13 had been using a solution of tick dip (1 TSP Gamma-Tox mixed into about 1/2 l. water) and had been applying it to ears, feet and tail of the goats on about a weekly basis. She also had rubbed used motor oil to these same areas four months earlier.

When the PCV's of the goats of the individual farmers was compared on day 56 the following was found (Table 6). There were significant differences in the PCV's between goats from herd number 17 and the control (those in herd number 15) at the 0.01 level, and between goats from herd number 13 and the control (herd number 15) at the 0.05 levels. The difference in PCV (1.25 percent) between the goats in herd number 16 and the control (herd number 15) was not significant. The farmer with herd number 16 was the farmer whose complete herd was not treated, with only 10 of approximately 30 animals being treated. This could indicate cross infection from kraal mates.

¹ Farmer with herd number 13 -- PCV = 29.18, Farmer with herd number 16 -- PCV = 26.00, Farmer with herd number 17 -- PCV = 25.96, and Farmer with herd number 15 (control) -- PCV = 26.90.

TABLE 6: MEAN PCV OF GOATS BY FARMERS ON DAY 56

FARMER	HERD NO.13	HERD NO.16	HERD NO.17	HERD NO.15 (CONTROL)
NUMBER	21	9	36	12
MEAN PCV	28.33	27.33	29.03	26.08
S.D.	2.70	3.64	2.97	4.14

* A significant difference from the control at the 0.05 level

** A significant different at the 0.01 level

CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations drawn from this trial are:

1. Ivermectin when given to goats infested with lice (even though 75 percent of the animals were grade "1" (few to none)), caused a significant increase in the PCV after day 14 post-treatment. Ivermectin is an excellent external parasiticide as well as an anthelmintic.
2. Animals treated with Ivermectin should be hardier and consequently be more resistant to disease problems and hopefully less prone to illness and death, especially at the end of the dry season when these animals are typically at their lowest physiological ebb and are subject to many severe stresses.
3. Twice yearly treatment with 200 mcg/kg of Ivermectin sub-cutaneously would be the best recommendation. The first of these should be late in the wet season or early in the cool, dry season -- May or June -- and the second late in the cool, dry season -- October or November. The first suggested time period would reduce lice infestation while the population was at its lowest; prior to the period of increased activity and reproduction. This timed treatment would also reduce the number of gastro-intestinal nematodes, both adult and inhibited larvae, at the end of their most active reproductive period. Consequently, the potential threat from nematodes through the dry season would be reduced, and the possible loss due to lice would be decreased. The second suggested treatment period would accomplish the same result by reducing the carryover potential for lice and greatly reducing the reproduction potential of gastro-intestinal nematodes as they start into their most damaging phase -- the wet season.
4. At current Livestock Advisory Centre prices, the cost for treatment per adult goat is about 0.70t per head. The cost is reduced in smaller goats as the dose is correspondingly reduced. When the effect of this drug against internal as well as external parasites is considered, the cost effectiveness become obvious. To obtain this effect, however, strategic timing of treatment is necessary. Total economy of use of this product is very difficult to evaluate due to the debilitation of animals and poor gain, rather than outright death loss. Also cost of other products, with use potential, cost of construction and maintenance of spray races and dips would have to be evaluated. When comparing the effect of this product with single use products such as the benzimidazoles, and the frequency of use, ivermectin will have some edge if used strategically.

REFERENCES

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