



Flock of Menz sheep
as used in the trials.

IMAGE: PITTARDS

Improvement of sheepskin quality after treatment against cockle with diazinon

K.Bayou, Veterinary Consultant, Ethiopia

B.Alemu, Y.Chanyalew, S.Gizaw — Debre Birhan Agriculture Research Centre

D. Birhan and D.Tumsa — Pittards-Ethiopia Tannery Share Company, Ethiopia

Infestations of lice and keds are the cause of cockle defect and the reason for considerable loss in the value of sheepskins in Ethiopia. Spray treatment using diazinon is known to be effective at controlling these infestations, but the quality of skins from sheep that have been parasite free from birth has never been evaluated.

The findings from extensive trials on two breeds of sheep shows that the cockle defect can be eradicated, coupled with a significant improvement of both skin grades and value.

The relationship between lice, keds and cockle defect

Cockle is an allergic reaction of sheepskins caused by the faeces and saliva of lice and keds. It is manifested as small nodules of 0.5 to 1mm in diameter, or as greyish or brownish discoloration on the dermis of the skin. This is apparent only when the skin is flayed and processed in the tannery, where the defect causes rejection or downgrading in more than 50% of processed skins^[Legend 1]. An example of the defect is shown in *Panel 2*.

This skin disease was first identified and associated with the sheep louse *Bovicola ovis* by Heath *et al* in 1995 in New Zealand sheep, and Pfeffer had discovered an association between sheep keds and cockle in 1969. The presence of the disease was confirmed in Ethiopia in an FAO project in 1996-98

(TCP/ETH/4558&6712), which also identified diazinon as a cost effective product that eliminated lice and keds and controlled cockle^[Legend 2]. A number of trials that demonstrated the effect of diazinon on these ectoparasites and cockle itself were performed in Ethiopia and other countries.

However, there is scepticism about the effect of diazinon in controlling these diseases. This was due to the inconsistency of treatments given so far which did not cause a change in the problem, but received much publicity.

Area/location for the study

The sheep flocks studied in these investigations were maintained at Debre Birhan Agricultural Research Centre. This is a mixed farming area known for sheep production, and is



Panel 2: Example of cockle defect on crust sheepskins



located at an altitude of 2850m above sea level in central Ethiopia some 120 km north-east of Addis Ababa. This location experiences a bimodal rainfall pattern consisting of a long rainy season extending from June to September, and a short rainy season from March to May^[Legend 3].

Animals used in the study

Menz and Horro breed sheep were used for the study, which extended from October 2009 to January 2011:

MEMZ SHEEP

Of this flock of 599 sheep, 413 were rams and 186 ewes. These originated from Debre Birhan, Sela Dingay and Tarma Ber, all within the North Shoa Zone of the Amhara Region in the central highlands (altitude between 2,500 and 3,000 m above sea level).

This breed was selected because of the poor skin quality associated with skins from the Amhara Region due to cockle skin defects. It is also a fat-tailed breed of relatively small size (mature ewes range from 25 to 35 kg), indigenous to the study area, and one of the few African wool-bearing sheep.

HORRO SHEEP

Of this flock of 265 sheep, 86 were rams, and 178 ewes. These originated from their traditional habitat in western Ethiopia in Ambo area (altitude of 1,400–2,000 metres above sea level with a dependable annual rainfall averaging 1,000–1,400 mm.) and quarantined for two weeks before joining the trials. This is a also fat-tailed hair breed, but larger than the Menz breed, mature ewes ranging from 35 to 45 kg (*Galal, 1983*).

Coat colours are mostly uniformly brown or light brown (83%). A few of the sheep are white with brown (10%), plain white (3%), plain black (2%) (*Tibbo et al., 2004b*).

Management of the flocks

FLOCK HUSBANDRY AND BREEDING

For the duration of the study, the animals were grouped according to breed, and each breed was grouped by sex. Each animal was identified with an ear tag number, and each group housed in separate pens with concrete floors.

Apart from grazing separately in natural pasture during day time, these sheep were provided with

hay. In addition, their food was supplemented with concentrates at 300g/day, and watered twice a day. The only exception to this segregation was when selected rams joined the ewes for breeding purposes.

These flocks were also vaccinated against sheep pox, PPR, pasteurellosis, and treated against nematodes and trematodes in June, September and January. Routine health monitoring was undertaken every morning and any animals that had problems were treated with antibiotic and/or antihelmentics as deemed necessary. Both flocks had clinical records concerning their health and mortality, and they had body weight measurement every month.

TREATMENT WITH DIAZINON AND PARASITE COUNT

Lice and ked counts were taken on the neck, shoulder, back, belly, flank, and rump, before any treatment, and two weeks after treatment with diazinon to confirm the efficacy of the treatment.

Treatment with diazinon (0.06%) - using a knapsack sprayer to spray the solution across the whole body of each sheep - had taken place one month after the introduction of the Horro breed. The treatment was repeated: twice at two week intervals when the animals were handled individually, then every three months thereafter.

SKIN QUALITY ASSESSMENT

The sheep were slaughtered in three rounds. In each round the skins were salted, then processed to the pickled stage for grading, with the results from the first round (untreated with diazinon) used as a benchmark for skin grading. The first round of slaughter took place at Ethiopia Tannery premises, the remaining slaughter at the Luna Abattoir. All of the carcass weights and dressing percentages were recorded:

First round: 10 sheep from the Menz flock, and 10 sheep from the Horro flock were taken at random and slaughtered May 2, 2010. This was to determine the skin grade of the sheep before treatment started and served as the benchmark. At this stage there were no lambs of suitable size available for slaughter.

Second round: 400 sheep were slaughtered on October 4, 2010. Among them were 13 Menz and 13 Horro sheep selected

Panel 3: Ectoparasite infestation of sheep slaughtered

1st round: (Benchmark) Without treatment with diazinon (Slaughter May 2, 2010)								
	Menz adult sheep (10 total)		Horro adult sheep (10 total)		Menz lambs (0 total)		Horro lambs (0 total)	
	Lice	Keds	Lice	Keds	Lice	Keds	Lice	Keds
Total	910	12	954	0	na	na	na	na
Average	91	1.2	95.4	0	na	na	na	na
2nd round: Treatment with diazinon (Slaughter October 4, 2010)								
	Menz adult sheep (12 total)		Horro adult sheep (12 total)		Menz lambs (1 total)		Horro lambs (12 total)	
	Lice	Keds	Lice	Keds	Lice	Keds	Lice	Keds
Total	204	24	1254	0	108	0	0	0
Average	17	2	104.5	0	108	0	0	0
3rd round: Treatment with diazinon (Slaughter 19 January, 2011)								
	Menz adult sheep (20 total)		Horro adult sheep (20 total)		Menz lambs (19 total)			
	Lice	Keds	Lice	Keds	Lice	Keds	Lice	Keds
Total	922	34	1004	2	0	0	0	0
Average	46.1	1.7	50.2	0.5	0	0	0	0



Panel 4: Skin grades from the three rounds of slaughter

1st round: (Benchmark)			
Grade	Menz Adult	Horro Adult	Menz and Horro lambs
1st grade	-	-	-
2nd grade	-	-	-
3rd grade	-	20%	-
4th grade	-	20%	-
5th grade	50%	60%	-
Reject RA	10%	-	-
Reject RB	40%	-	-
Reject RC	-	-	-

(No lambs were available for slaughter in 1st Round)

2nd round:			
Grade	Menz Adult	Horro Adult	Menz and Horro lambs
1st grade	-	-	33.33%
2nd grade	-	-	41.67%
3rd grade	8.33%	-	16.67%
4th grade	-	33.33%	8.33%
5th grade	25%	58.33%	-
Reject RA	66.67%	8.33%	-
Reject RB	-	-	-
Reject RC	-	-	-

3rd round:			
Grade	Menz Adult	Horro Adult	Menz and Horro lambs
1st grade	-	-	38.46%
2nd grade	-	-	41.67%
3rd grade	8.33%	-	16.67%
4th grade	-	33.33%	8.33%
5th grade	25%	58.33%	-
Reject RA	66.67%	8.33%	-
Reject RB	-	-	-
Reject RC	-	-	-

(Two skins were missing following tannery processing from 3rd round)

randomly, and 12 lambs of Menz breed and 1 lamb of Horro breed, being the only lambs available for slaughter.

Third round: 79 sheep were slaughtered January 19, 2011. Among them were 20 Menz and 20 Horro adult sheep selected randomly, and 20 Menz lambs and 19 Horro lambs.

The adult sheep and lambs selected at random were studied for infestation with lice and keds, and these findings are presented as *Panel 3*.

GRADINGS OF THE SKINS FROM THE THREE ROUNDS OF SLAUGHTER

All of the skins from the sheep and lambs taken at random and presented in *Panel 3* were processed to the pickled and crust stages. Only pickled skins were graded as some of the defects were masked by the dye used in the dyeing process. This grading was based on the cockle defects only, without considering defects such as flay cuts, sheep pox or putrefaction [Legend 4].

The findings from the three rounds of trials in terms of commercial gradings are presented in *Panel 4*.

COMPARISONS BETWEEN THE ROUNDS

With reference to *Panel 4*, the second round of slaughter shows considerable improvement when compared to the first round (benchmark) skins where the sheep were without treatment with diazinon.

- Among the Menz sheepskins, the improved gradings can be compared to the benchmark skins which had 40% of

the skins in lower grade RB. We may not see any improvement in the Horro sheepskin quality grossly.

- The major improvement in skin quality is clear when the lambskins were compared to the adult skins. Out of the 13 lambskins processed, 91.67% were in the best skin grades (ie. 1st, 2nd and 3rd Grades), and only 8.33% were graded as 4th grade, with no grade below this rating. The reason for this 4th grade score was due to one of the lambs born early in the trial before any ectoparasite treatment was started and was exposed to lice infestation from the dam.
- None of the other lambs became infested with either of the ectoparasites because the dams delivered their lambs after they were treated with diazinon. Because of its high residual effect, the lambs were also indirectly treated by contact while suckling their dams.

With reference to *Panel 4*, the third round shows some further improvements in skin quality when compared to the second round of slaughter:

- Among the Menz sheep there were no 1st and 2nd grade skins, but only 30% were rejects as compared with the benchmark skins where 50% were classified as rejects.
- Among the adult Horro sheep, there were 5% and 10% 2nd and 3rd grades respectively during the third round slaughter as compared to the second round slaughter.

Out of the 20 lambskins in each of the lamb groups (*second round and third round only*), 90% had the best grades - Grades 1, 2 and 3 - with no 5th grade or rejects. This can be compared with the benchmark skins of the Menz skins with 50% 5th grade and 50% rejects, and the Horro skins with 60% 5th grade.

This improvement of the skin quality of the sheep in both the second and third rounds was because the treatment prevented the lice and keds that caused cockle defect. An improvement of at least one grade in the adult sheepskins and two to five grades in the lambskins was gained in the second round and third round.

An overview of the findings

MENZ SHEEP AND LAMBS:

- There is no significant difference between the skin grades of the adult sheep in the first round (benchmark) and the second round.
- There is a significant difference between the skin grades of the adult sheep the first round (benchmark) and the third round (95% confidence level).
- There is a very significant difference between the skin grades of adult sheep in the first round (benchmark) and those of the lambs in the third round.

HORRO SHEEP AND LAMBS

- There is no significant difference between the skin grades of the adult sheep in the first round (benchmark), and the second and third rounds.
- There is a significant difference between the skin grades in adult sheep in the first round (benchmark) and those of the lambs in the third round.

**Panel 5: Skin grades of Menz and Horro lambs**

3rd round:		
Grade	Menz lambs	Horro lambs
1st grade	42.11%	35%
2nd grade	26.32%	40%
3rd grade	21.05%	15%
4th grade	10.52%	10%
5th grade	0	0
Reject RA	0	0
Reject RB	0	0
Reject RC	0	0
Total skins	19	20

MENZ AND HORRO SHEEP

- There are differences between skin grades in the first, second, and third rounds. This is because the hair size of the Horro sheep was short and did not readily harbour ked infestation as occurred with the Menz sheep.

Comparisons between Menz and Horro lambs

In addition to these findings, the gradings for both Menz and Horro lambs from the third round slaughter are given as *Panel 5*.

Issues stemming from the investigation

The following issues are raised from this study:

- Cockle is a disease that can be controlled once the causative infestations are identified and avoided. The scars left due to the allergic reaction take some time to heal, depending on the damage caused to the skin and the species of the parasite causing the defect.
- The skin of sheep infested with lice alone heal from the scar faster than the skin infested with keds. This is because sheep lice only feed on the secretion and debris of the sheepskin.
- In contrast, keds have a mouth part that pierces and

damages the skin of the host and suck blood. Accordingly, sheep infested with lice do not have such severe skin lesions and scars as sheep infested with keds.

- Horro sheep (bred in the mid and lowland regions of the country), have shorter hair and are mostly infested by lice. Menz sheep have longer and rougher hair, and this is preferred by keds. For this reason the skin grades of the Horro adult sheep studies in these investigations were better than the skin grades of the Menz adult sheep.
- The number of lice and keds counted can sometimes be deceptive. This is because the parasites might die or fall from the sheep after the sheep develop an allergic reaction. It is reported that as small number as 10 lice or keds could cause allergic reaction that resulted in cockle formation on the dermis (*Heath et al*).
- The treatment with diazinon was recommended every three months to avoid the risk of re-infestation and development of cockle scars. Diazinon has a long residual effect since it stays in the skin and causes mortality of infestants for long period of time. Not only does the insecticide treat sheep that are sprayed, it also treats sheep that have not been treated but come in close contact with the treated sheep.
- This occurred with the lambs that were suckling dams treated with diazinon in the trial, hence were free of ectoparasites from birth. Nevertheless, they were treated after two months of age to avoid any infestation, were free of cockle scars, and thus provided better skin quality than their dams.
- Menz sheep skins were downgraded more than anticipated in this investigation. This is because as pox scars healed and became smaller in size they looked like scars caused by lice and keds, and caused difficulties at skin selection.

Summary of the investigation

Cockle is a very significant skin defect caused by lice and keds, and it is known that treating sheep with diazinon will lead to an improvement in skin quality.



Flock of Horro sheep as used in the trials



As a result of sustained flock management on a significant scale, treatment against these infestations using diazinon coupled with good animal husbandry and veterinary services showed that, given time for healing of damage resulting from these infestations, the skin quality of adult sheep improved by one grade.

By avoiding exposure to these infestations from birth, there was a dramatic improvement in the skin quality of lambs. When compared to the skin quality gradings provided by adult sheep that were assessed at the pickle stage, the quality of lamb skins improved was determined as 89% to 90%.

The investigation demonstrates that parasite free sheep from birth will show no cockle defect when compared to sheep that carried the parasites before treatment. ☺

Legend:

- [1] Tannery owners in Ethiopia state that three decades ago over 70% of the production could be considered "best" quality, but today, due to the cockle problem this value has dwindled to 15%. The best skins could be sold as grade 1-3 at USD 80 -100/dozen if cockle was absent. Today the value is less than USD 15/dozen when graded due to this defect. Skins of grade 4 cost USD 64/dozen and skins of grade 5 cost USD 25 /dozen (Kassa, 2009).
- [2] Other insecticides such as amitraz, deltamethrine and coumaphos were also available in Ethiopia, but were more expensive than diazinon.
- [3] The mean annual rainfall for the period 1979-1989 was 960 mm, mean temperature (ranging from an average minimum of 6.3°C to an average maximum of 19°C) and mean relative humidity 60%.
- [4] STATA was used for analysis of variance (ANOVA) and SPSS version

were used to detect significant differences between and within subject effects and to correlate associated factors to the breeds and ages involved in the study.

Acknowledgment:

The consortium: USAID-ATEP, Pittards, and DBARC for sponsoring the trial.

EVA for helping in analyzing the data on the skin grades.

NAHDIC for the diagnosis of diseases and provision of equipment.

R. Hankey and J.Moriarty (Pittards Ethiopia Tannery Share Company) and The Chief of Party of ATEP Mr. T.H. Carr and the Deputy Chief of Party Mr T.Kebede for support throughout the project.

Staff of ATEP, Ethiopia Tannery, and DBARC for their full support during the trials.

References:

- I. B. Leach and K.Bayou (1998): Control of sheep and goat skin diseases for improved quality of hides and skins. Proceedings of an In-service training exercise on hides and skins improvement, Food and Agriculture Organization of the United Nations, March 1998.
- K. Bayou (2009): Cockle is a controllable skin defect. Ethiopian Leather Journal. Vol. 1, No. 3, PP 36-38.
- Heath, A.C.G., Coles, D.J.W., Bishop, D.M., Pfeffer, A., Cooper, S.M., Risdon, P. (1995): Preliminary investigations in to the aetiology and treatment of cockle, a sheep pelt defect. Veterinary Parasitology 56 (1995) 239-254.
- Everett, A.L., Roberts, I.H., Willard, H. J., Apodaca, S.A., Bitcover, E.H., Naghschi, J., (1969): The cause of cockle, a seasonal sheepskin defect, identified by infesting a test flock with ked (*Melophagus ovinus*). J. Am. Leath. Chem. Assoc. 64.460-476.

STYLES MAY HAVE
CHANGED...
THE DEMANDS
FOR STYLE HAVEN'T

www.quakercolor.com



adding colour and finishes to the
automotive world for over six decades



QUAKER COLOR
A Step Ahead...

a division of McAdoo & Allen, with roots in
the leather industry for over a century