Onderstepoort Journal of Veterinary Science and Animal Industry, Volume 3, Number 1, July, 1934.

The Influence of Feed on the Merino Sheep.

By G. S. MARÉ, B.Sc. (Agric.), and V. BOSMAN, M.Sc., Sheep and Wool Research Officers, Grootfontein School of Agriculture, Middelburg, Cape.

1. INTRODUCTION.

Feed plays an important part in wool production. The sheep farmer is aware that during droughts his sheep are lighter in body weight, and produce lighter and finer fleeces. Different research workers have concluded that feed influences the sheep and its fleece.

Probst (1926) found that the variation of wool growth along a staple from one of his stud rams could be explained by the influence of winter feed conditions.

Wilson (1927) in dealing with wool production in California asserts that " sheep which are improperly or poorly fed produce light frowsy fleeces lacking the life which is so essential to good wool."

Duerden and Bosman (1927) found an absence of uniformity of growth along a wool staple and it was presumed to have resulted from feed influences.

Hardy and Tennyson (1930) in describing wool fineness influenced by rate of growth, showed that the period of greater growth was associated with a general thrifty condition of the sheep, also that the weight of wool increased with an increase in length and fibre thickness.

Wilson (1931) found considerable differences in the fleece characteristics when three Romney wethers were fed on maintenance rations and then on sub-maintenance rations.

Weber (1932) found a difference in scoured fleece weights, fibre fineness and length by feeding different quantities of ground corn and alfalfa to sheep.

Snell (1932) found a significant effect on rate of growth, diameter and crimp of wool fibres by changing the planes of nutrition.

An experiment, concluded at the Grootfontein School of Agriculture shows the influence of different planes of nutrition on two groups of Merino hamels in respect of body weights, fleece weights and fibre fineness. The sheep were fed on lucerne hay, mealies, oats and saltbush in varying quantities, these being common feeds used by the South African farmer.

2. PLAN OF THE EXPERIMENT.

A. Sheep and Management.

Twenty-four three-year-old Merino hamels were selected from the Grootfontein flocks that are bred and reared on Karroo veld. The sheep were subjected to a preliminary feeding period of four weeks. They were then divided into two groups of eleven each, two of the hamels being discarded as they reacted unfavourably to the rations.

Selection of the groups was based on body weights and a macroscopic examination of the fleece so that the groups were similar. The lots, recorded as 26 and 27, were then shorn, and shoulder samples of each sheep taken periodically for laboratory analysis. One animal of lot 27 died at the commencement of the experiment and one of lot 26 after nine months.

Each group was subjected to a different plane of feeding, 26 receiving a sub-maintenance ration, and 27 a full ration. Each lot was confined to a small enclosure 28 by 36 feet in which housing was provided with suitable feeding troughs and clean drinking water.

There were two distinct feeding periods. For the first nine months 26 received a sub-maintenance ration and 27 a full ration. For the second nine months half of lot 26 was placed on a full ration, and the remainder treated as before. Half of 27 was retained on a full ration and the remainder on a sub-maintenance ration. In this way for the second feeding period groups 26 and 27 each consisted of five well fed and five underfed sheep and served as a confirmatory test to the first nine months' period. The regrouping of lots 26 and 27 therefore resulted in:

5 sheep well-fed for 18 months;
5 sheep underfed for 18 months;
5 sheep well-fed for 9 months then underfed for 9 months;
5 sheep underfed for 9 months then well fed for 9 months.

Body weights were recorded weekly after the usual starvation period of fifteen hours. Shoulder wool samples were analysed periodically and the weights of fleeces recorded at shearing.

B. Feed.

The feed consisted of lucerne hay, crushed yellow mealies, whole oats and fresh oldman saltbush. To this ration was added a mixture of salt and bonemeal made in the proportion of 1:2. All feed was weighed before each feeding, which took place twice a day. The animals consumed all of their daily ration, an analysis of which is given in Table 1. The rations are given as averages for the periods mentioned and slight variations are not recorded.

TABLE 1.—AVERAGE DAILY RATION PER SHEEP.

Period.	Lot.	Treatment.	Ration in Ounces.					Nutrients in Pounds.			
			Lucerne.	Mealies.	Oats.	Saltbush.	Bonemeal and Salt.	Total Dry Matter.	Dig. Crude Protein.	Total Digestible.	Nutritive Ration.
Preliminary.....	26 and 27	Well-fed	8	10	4	0	1	1·23	·13	·96	6·65
First 9 months.....	26	Underfed	5	5	3	6	1	·82	·09	·59	5·87
	27	Well-fed	8	10	4	8	1	1·35	·14	1·01	6·21
Second 9 months....	26C	Underfed	4	4	3	6	1	·71	·07	·51	5·78
	26D	Well-fed	8	10	4	8	1	1·35	·14	1·01	6·21
	27C	Underfed	4	4	3	6	1	·71	·07	·51	5·78
	27D	Well-fed	8	10	4	8	1	1·35	·14	1·01	6·21

3. EXPERIMENTAL RECORDS AND RESULTS.

A. Sheep Weights.

The live weights are summarized in Tables 2 and 3.

TABLE 2.

Average Live Weights (in lb.) for the First Nine Months.

Lot.	Treatment.	Initial.	Shorn.	1st 3 Months.	2nd 3 Months.	3rd 3 Months.	Per cent. Increase over 9 Months.
26	Underfed	90·7	83·0±2·21	82·2	79·5	75·5±2·00	− 9·4
27	Well-fed	92·1	85·1±2·51	89·2	95·0	101·9±2·65	+ 19·7

TABLE 3.

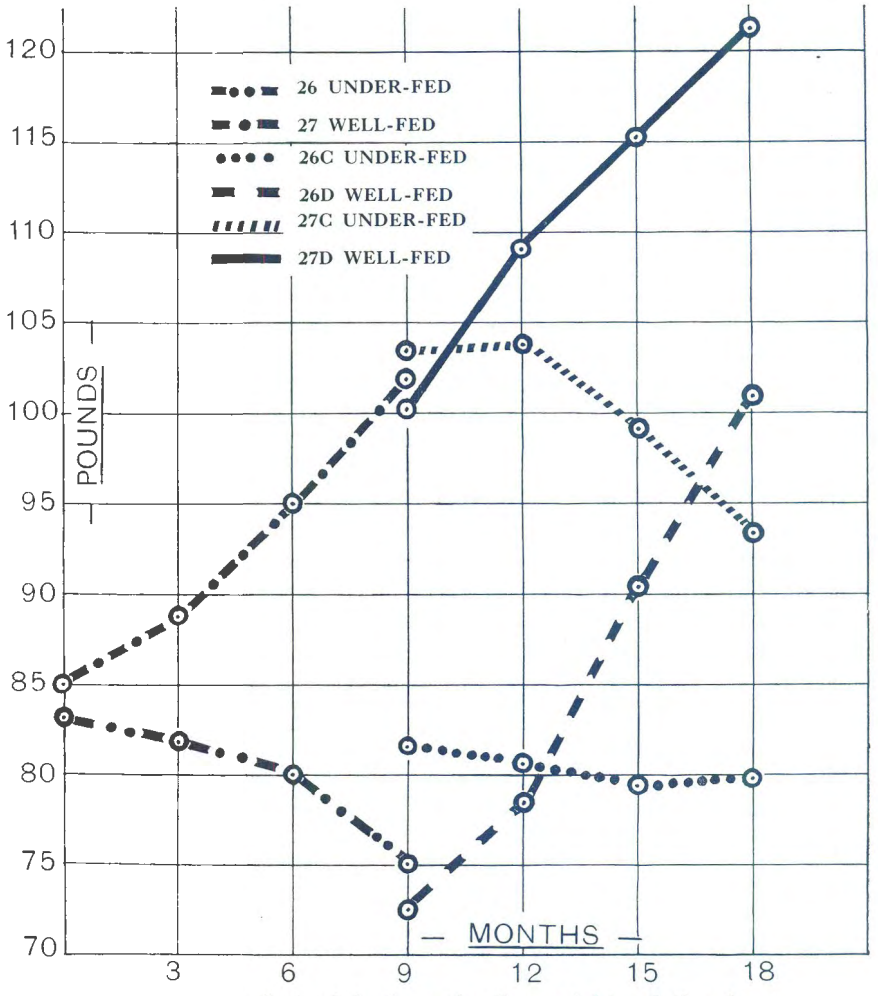
Average Live Weights (in lb.) for the Second Nine Months.

Lot.	Treatment.	Initial.	1st 3 Months.	2nd 3 Months.	3rd 3 Months.	Per cent. Increase over 2nd 9 Months.
26C	Underfed	81·7±2·64	80·4	79·1	79·4±3·50	− 2·8
26D	Well-fed	72·6±1·70	78·5	90·4	101·0±3·90	+ 39·1
27C	Underfed	103·4±4·82	103·7	98·3	92·7±3·14	− 10·4
27D	Well-fed	100·4±2·11	109·1	115·4	121·2±4·70	+ 20·7

The initial shorn weights for the two groups after the pre-experimental period were 83·0±2·21 and 85·1±2·51 pounds respectively, which show no significant difference between lots 26 and 27 at the commencement of the experiment. The response of live weights to the different planes of feeding is illustrated graphically in Chart I. Photographs of the sheep are shown in Figures 1-4.

At the end of nine months, lot 26, the underfed group, gave an average of 75·5±2·00 pounds which shows a decrease of 9·4 per cent. on the initial weight. Lot 27, the well-fed animals, weighed 101·9 pounds or an increase of 19·7 per cent. The sheep were not shorn at the end of nine months, hence the weights include fleeces. In Table 2A are given the figures which take into account body weights only. The estimated body weight at the end of nine months was obtained by deducting half the grease weight of the fleece at the close of eighteen months from the live weight.

CHART I.



Showing the effect of feed on the live weights of the sheep.

TABLE 2A.

Average Body Weights for the First Nine Months.

Lot No.	Initial.	Estimated at End of 9 Months.	Percentage Increase.
26.....	83·0 ± 2·21	69·9 ± 1·89	— 15·8
27.....	85·1 ± 2·51	94·3 ± 2·52	+ 10·8

Fig. 1.—Showing the influence of feed on live sheep. Lot 26C. Underfed for 18 months. Av. body weight 68.9 pounds.

Fig. 2.—Showing the influence of feed on live sheep. Lot 26D. Underfed for 9 months. Well-fed for 9 months. Av. body weight 88.6 pounds.

The results differ slightly from those in Table 2 in that lot 26 now shows a bigger decrease, viz. 15·8 per cent. instead of 9·4 per cent. Lot 27 shows a smaller increase, viz. 10·8 per cent. instead of 19·7 per cent.

During the second nine months lot 26C was further reduced in weight to 79·4 pounds, a decrease of 2·8 per cent. Lot 26D gradually gained to 101·0 pounds or 29·1 per cent. when changed from the reduced ration to the full ration.

Lot 27C, that was formerly well-fed, decreased in weight to 92·7 pounds or by 10·4 per cent. when it was underfed. Lot 27D gained 20·7 per cent. when kept on the sam eration as for the first nine months.

The final live weights in Table 3 include fleece weights, while in Table 3A only body weights are taken into account.

TABLE 3A.

Average Body Weights for the Second Nine Months.

Lot.	Treatment.	Initial.	Final.	Percentage Increase.
26C.....	Underfed	76·5 ± 2·36	68·9 ± 3·10	— 9·9
26D.....	Well-fed	66·4 ± 1·70	88·6 ± 3·53	+ 32·0
27C.....	Underfed	96·5 ± 4·65	78·8 ± 2·97	— 18·4
27D.....	Well-fed	92·0 ± 1·69	104·3 ± 3·22	+ 13·2

In Table 3A group 26C shows a decrease of 9·9 per cent. Group 26D which was changed to a full ration, showed an increase of 32 per cent.

Lot 27C was placed on a lower plane of feeding and decreased by 18·4 per cent. Lot 27D was kept on a full ration and increased by 13·2 per cent.

The percentage increase as reflected in Tables 3 and 3A differ slightly, but both serve to indicate the marked effect of feed on body weight.

B. FLEECE WEIGHTS.

The sheep were shorn at the end of eighteen months and the wool produced compared on a scoured basis in Table 4.

TABLE 4.

Wool Production in Pounds.

Lot.	Treatment.	Grease Weight.	Scoured Weight.
26C.....	Underfed for 18 months	10·46	4·21
26D.....	Underfed for 9 months Well-fed for 9 months	12·36	4·65
27C.....	Well-fed for 9 months Underfed for 9 months	13·86	4·76
27D.....	Well-fed for 18 months	16·82	5·55

Fig. 3.—Showing the influence of feed on live sheep. Lot 27D. Well-fed for 18 months. Av. body weight 104.3 pounds.

Fig. 4.—Showing the influence of feed on live sheep. Lot 27C. Well-fed for 9 months. Underfed for 9 months. Av. body weight 78.8 pounds.

Lot 26C which was underfed for 18 months produced 4·21 pounds of scoured wool. Lot 27D was well-fed for 18 months and clipped 5·55 pounds which shows a difference of 1·34 pounds or 31·8 per cent.

Lots 26D and 26C, both starved for half the experimental period and well-fed for the other half produced 4·65 and 4·76 pounds respectively. These values do not differ significantly and are both an advance on lot 26C.

C. Fibre Fineness.

Wool sampling was confined to a closely clipped and marked shoulder area three inches in diameter. A staple for fibre thickness measurements was shorn every three months from each sheep so as to represent the growth for the three-monthly period. It was clipped in such a way that part of the place of sampling was common for consecutive shearings. Each three-monthly sample was cut into fragments, thoroughly mixed in ether and 250 fibres measured as a random selection on a Zeiss-Hegener Micro Camera.

TABLE 5.

Fibre Thickness in μ.

Groups.

Period.	26. Underfed, 11 Sheep.	26C. Underfed, 5 Sheep.	26D. Well-fed, 5 Sheep.	27. Well-fed, 10 Sheep.	27D. Well-fed, 5 Sheep.	27C. Underfed, 5 Sheep.
Initial.....	17·9 (80's)	—	—	17·7 (80's)	—	—
1st 3 months...	16·6 (90's)	—	—	17·2 (80's)	—	—
2nd 3 months..	14·9 (120's)	—	—	17·6 (80's)	—	—
3rd 3 months...	14·3 (150's)	—	—	16·9 (90's)	—	—
Initial.....	—	15·0 (120's)	13·6 (150's)	—	16·2 (90's)	17·7 (80's)
4th 3 months...	—	14·9 (120's)	16·4 (90's)	—	16·6 (90's)	15·9 (100's)
5th 3 months...	—	14·9 (120's)	17·5 (80's)	—	16·9 (90's)	13·7 (150's)
6th 3 months...	—	14·5 (150's)	17·8 (80's)	—	16·9 (90's)	13·4 (150's)

Note.—The equivalent spinning counts are given in brackets as determined by Duerden (1929).

The mean fibre thickness for the groups are compared in Table 5, and graphically in Chart II. The wool of group 26, the underfed sheep, became finer, ranging from 17·9μ, an 80's quality, to 14·3μ, a 150's quality. For the second nine months period group 26C, a sub-division of 26, remained fairly constant in fibre thickness when it received a ration similar to that of the first nine months. Lot 26D, the remainder of 26, were well-fed and recovered in fibre thickness to the initial quality number at the commencement of the experiment, namely an 80's.

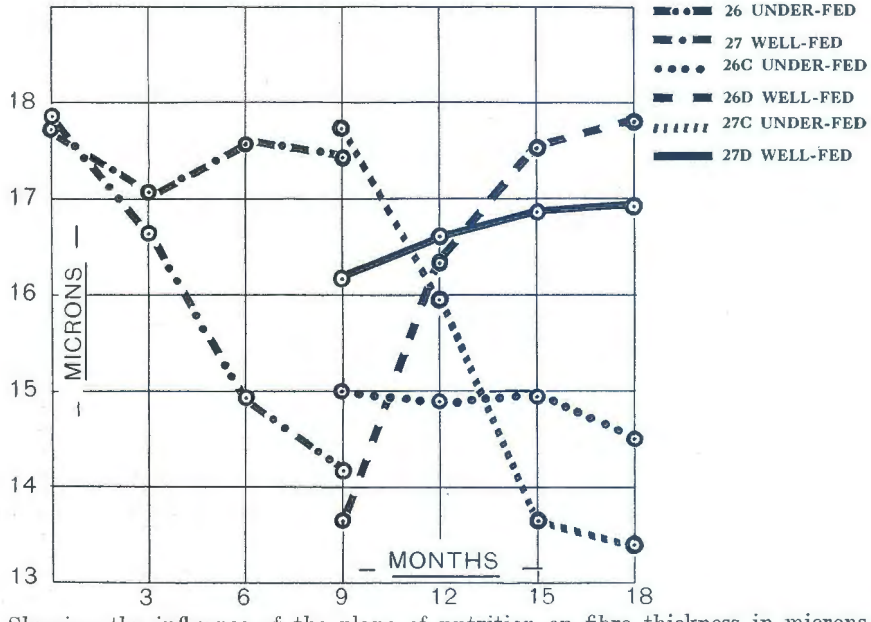
Lot 27, the well-fed animals, remained fairly constant for the first nine months, and so did its sub-division, lot 27D. Group 27C, the remainder of group 27, were underfed and the wool was refined to 13·4μ, a 150's quality. It is therefore shown that a wool can be changed from an 80's quality to a 150's quality by reduced feeding. The reverse, namely from a 150's to an 80's quality can be effected by changing the ration to a sufficient one.

The influence of feed on single wool fibres is demonstrated in photo micrographs in Figure 5. Fibre A, whe nit was well fed for the first nine months, showed a thickness of 35μ. During the second nine months, when it was underfed, the fibre thickness was reduced to 25μ, showing a thinning of 49 per cent.

Fibre B was underfed for the first nine months and then well-fed and showed an increase in thickness from 22·5μ to 27·5μ which is equivalent to 49 per cent.

Fibre C was well-fed for 18 months and remained constant in fibre thickness.

CHART II.



Showing the influence of the plane of nutrition on fibre thickness in microns.

DISCUSSION.

It is shown that quantity and quality in a Merino fleece largely depend on the nutrition of the animal. Underfeeding produces a smaller fleece although a finer fibred one. Good feeding produces a larger fleece but a coarser one. The market value of fine wool is higher than that of coarse wool. During droughts the sheep farmer will therefore expect a higher price per pound of wool but with a diminution of the quantity produced per sheep.

The marked influence of feed on the fleece is of importance where the hereditary characteristics of the Merino are studied. A control of the rations of the animals is necessary to place comparisons of the fleece attributes on a reliable basis when these are studied from one generation to the other.

The effect of the plane of nutrition on the Merino is of great significance to the Merino stud breeder. The characteristics of stud sheep can be changed to a marked degree by changing the feed, and this has often been the cause of disappointment to breeders when well-fed animals bought at high prices have been placed on the veld with less available food.

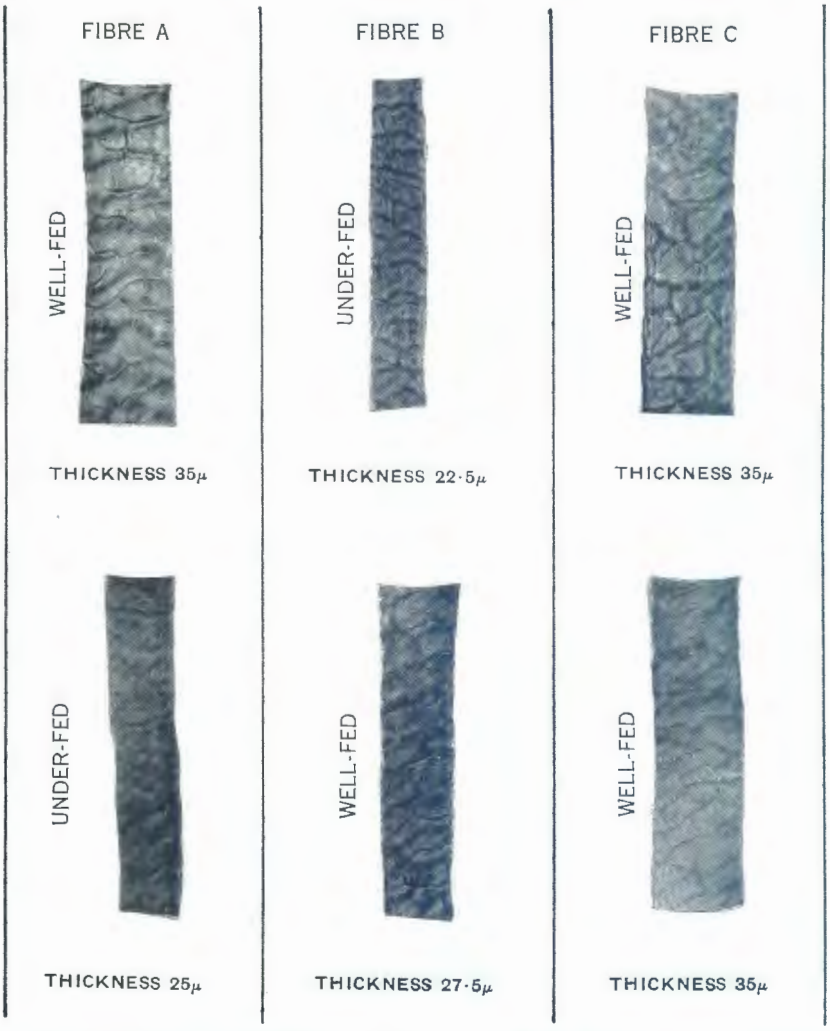


Fig. 5.—Photo micrographs of three wool fibres showing the influence of feed on each of the fibres.

In a study of Merino Stud Ram Wool (Bosman and Maré, 1933), the authors defined wool density as being dependent on the number of fibres per unit area as well as fibre thickness. Feed influences fibre thickness and therefore wool density. If it can be assumed that the number of follicles growing per unit area is not influenced by feed, then the diminution of wool density due to underfeeding is in proportion to the reduction in fibre thickness.

SUMMARY AND CONCLUSIONS.

The influence of feed on two groups of Merino hamels which were given different quantities of lucerne, mealies, oats, and saltbush was studied.

The body weights of the sheep were reduced by 15·8 per cent. when the feed was reduced. The sheep that were kept on a full ration gained 10·8 per cent. on their initial weights.

When the sheep were kept on a reduced ration for nine months and then placed on a full ration, their weights gained by 39·1 per cent.

Underfeeding reduced the scoured fleece weights by 31·8 per cent.

As regards fibre thickness the underfed group produced a considerably finer wool. The initial fibre fineness of 17·9μ was reduced to 14·3μ, a reduction of 36 per cent. in cross sectional area. The latter fibre thickness was restored to the initial stage by good feeding.

An 80's quality wool was reduced to a 150's by starvation and the latter restored to the original quality number by good feeding.

REFERENCES.

BOSMAN, V., AND MARÉ, G. S. (1933). Merino Stud Ram Wool. *The Farmer's Weekly*, 12th April, Bloemfontein.

DUERDEN, J. E., AND BOSMAN, V. (1927). Absence of Uniformity in Growth of the Merino Fleece. *Journ. Text. Inst.*, Vol. 18.

DUERDEN, J. E. (1929). Standards of Thickness and Crimps in Merino Grease Wools. *Journ. Text. Instit.*, Vol. 20.

DUERDEN, J. E., AND BOSMAN, V. (1929). The Standardisation of Wool. *Reprint No.* 30, *Farming in S. Africa*, April.

HARDY, J. I., AND TENNYSON, J. B. (1930). Wool Fineness as Influenced by Rate of Growth. *Journ. Agr. Research (U.S.)*, Vol. 40, No. 5, 457-467.

HENRY, W. A., AND MORRISON, F. P. (1923). Feeds and Feeding. 18th Edition.

PROBST, E. (1926). Die Feinheitsbestimmung Des Wollhaares. *Ztschr. Tierzuchtung u Zuchtungsbiol*, Vol. 6, p. 405.

SNELL, M. G. (1931). Shedding of Wool by Louisana Sheep. *Proc. Amer. Soc., Animal Production.*

WEBER, A. D. (1931). The Effect of the Plane of Nutrition on Wool Growth. *Proc. Amer. Soc., Animal Production*, Kansas State Coll.

WILSON, J. F. (1927). Wool Production in California. *California Agr. Extension Serv. Circular* 12, April.

WILSON, J. F. (1931). The Influence of the Plane of Nutrition Upon Various Factors Related to Wool Production. *The Nat. Woolgrower*, Vol 21, Dec. Univ. of California.