

SMALL STOCK SCIENCE

Q 3011

U.F.H. DEPARTMENT OF ANIMAL SCIENCE

LECTURER : J G RAATS

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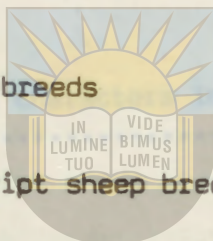
FIRST SEMESTER

5 LECTURES/WEEK

1 PRACTICAL/WEEK

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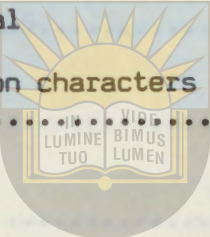
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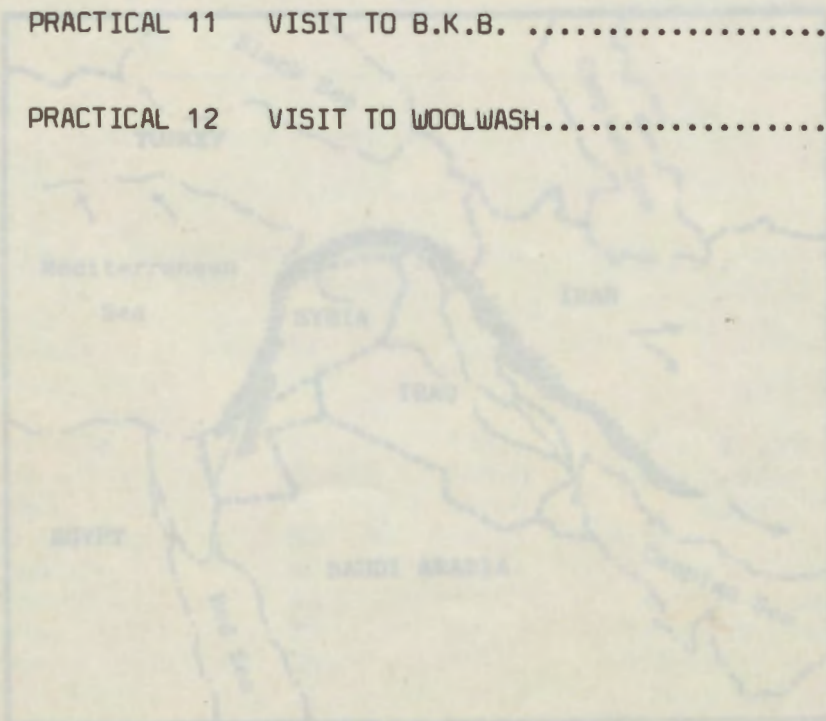


Fig. 14 The Fertile crescent

SMALL STOCK SCIENCE (Q 3011)

CHAPTER 1

THE BIRTH OF THE SMALL STOCK INDUSTRY

Small stock, (sheep and goats) belong to the family Bovidae or hollow horned ruminants. This family includes the subfamily Caprinae from which the genus capra (goats) and ovis (sheep) descended.

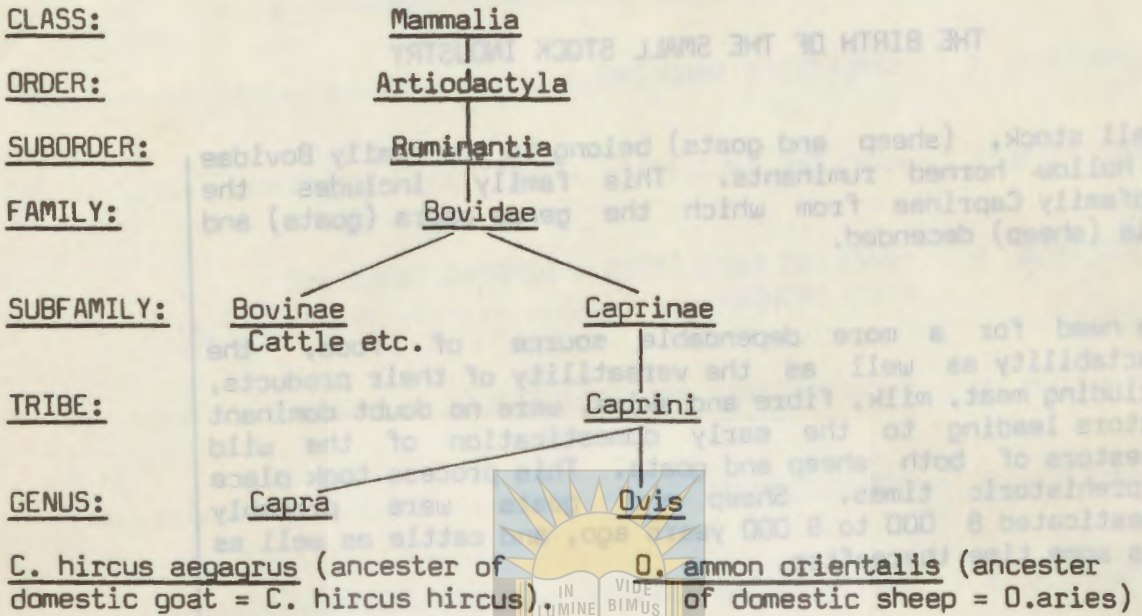
The need for a more dependable source of food, the tractability as well as the versatility of their products, including meat, milk, fibre and skins, were no doubt dominant factors leading to the early domestication of the wild ancestors of both sheep and goats. This process took place in prehistoric times. Sheep and goats were probably domesticated 8 000 to 9 000 years ago, and cattle as well as pigs some time thereafter.

Domestication was centered in the village-farming communities of the Near Eastern Mountain ranges, also known as the fertile crescent (see Fig.1.1). From this primary center, the village-farming way of life diffused in all directions. Breeds of sheep and goats have been developed in relatively isolated geographic areas where adaptation to peculiar environmental factors has been dominant. This is evident from the large numbers of specialized breeds that exist over the world today, e.g. wool production (Merino), meat production (British mutton breeds), milk production (East Friesian) and pelt production (Karakul). Similar differences exist between Angora-, Boer-, and milk goats.



Fig. 1.1 The fertile crescent

The following simplified classification of mammals gives a general picture of the history of sheep and goats.



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ECONOMIC IMPORTANCE OF SMALLSTOCK2.1 Economic importance of small stock in the world2.1.1 Sheep

Hundreds of breeds of sheep exist over the world today and include a wide variety of sizes, shapes, types and colours. Wool-type breeds have become most important in the southern hemisphere, particularly in Australia, New Zealand, South Africa, and Argentina and Uruguay in South America. Fat-tailed and fat-rumped sheep are common in the desert and semi desert areas of the Near East, Asia, and Africa. These sheep are valued for many purposes, e.g. carpet wool, milk and meat which are the most important. Dairy breeds of sheep are more common in Central and Southern Europe. Northern short-tailed varieties, noted for their prolificness, are found in the Scandinavian countries. Mutton breeds originating from Britain, which are common there as well as in the U.S.A., Canada and New Zealand are widely distributed throughout the world.



Fig. 2.1 Global distribution of sheep.

Table 2.1. Approximate sheep numbers in world (million)

Country	1972	1984
Australia	163	138,6
USSR	139	145,0
China	71	107,0
New Zealand	60	70,3
Argentina	42	28,4
India	43	
Turkey	37	
Iran	36	
South Africa	31	27,5
Great Britain	27	23,2
USA	19	11,4
World total	822	

Table 2.2. Approximate world production from sheep

	Tons (million)	% of world
Mutton & lamb	5,9	8,0*
Wool: grease	2,8	
clean	1,5	5,0**
Milk	6,8	1,0
* world prod. of beef & veal, mutton & lamb, pork & poultry		
** world prod. of cotton, synthetic, cellulose, wool, mohair and silk.		

2.1.2 Goats

Goats, as well as sheep, produce a wide variety of products, of which milk, mohair, and meat are most important. An estimated 270 varieties of goats exist over the world today of which the vast majority would be classed as multipurpose breeds. The majority of milk goats are found in Europe, mainly in countries along the Mediterranean Sea (France, Greece, Spain, Germany, Italy and also in Switzerland and Norway). Other countries with high milk production from goats include Northern Africa (Morocco, Sudan, Algeria and Nigeria), Mexico and parts of Asia (Turkey, Iran, China, Pakistan, India, Bangladesh and Yemen). Presently, there are few breeds identified as specialized meat producers. Goat breeds kept principally for meat production are found in South Africa and West Africa. Dual-purpose breeds (meat and milk) are mainly found in developing countries of Africa and Asia. Hair producing goats are Angoras found in South Africa, Turkey, Texas, Argentina, Lesotho also in Australia and New Zealand and Cashmere in Kashmir, Tibet, China and Iran.

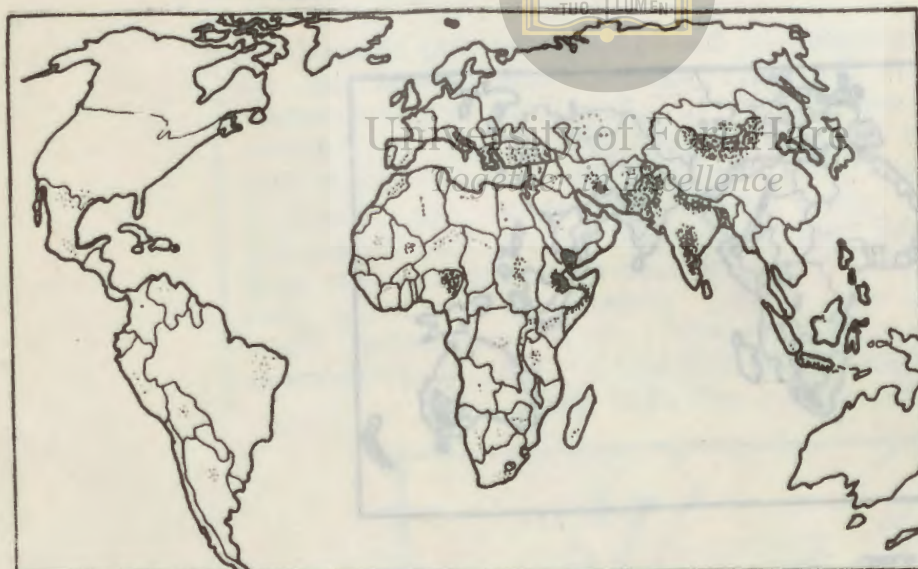


Fig. 2.2 Global distribution of goats

Table 2.3. Approximate goat numbers in world (million)

	1977	19
Africa	131	
N. America	10	
S. America	21	
Asia	231	
Europe	11	
USSR	5	
World	410	
Developing	386	
Developed	24	

Table 2.4. Approximate world production from goats

	Tons (million)	% of world
Meat	2,6	4,0*
Mohair	0,027	0,1**
Milk	8,2	2

* See Table 2.2

** See Table 2.2

2.2 History and importance of small stock in South Africa

The first sheep recorded in South Africa (15th century) were a fat-tailed breed. These sheep had their origin in Southern and Central Asia from where they migrated to Egypt and North Africa and then moved southwards across East Africa.

The first recorded importation of sheep to the Cape occurred in 1657 when some sheep were brought from Holland, followed by a small shipment of coarse-woolled sheep from India. These animals were crossed with the hairy indigenous breed, obtained from the Hottentots. During these early days the need for fresh meat and vegetables to supply passing ships placed the emphasis on meat production rather than wool production.

In 1789 more than a century later, the first Merino's (two rams and four ewes from the Escorial flock of Spain) arrived at the Cape. South Africa was the first country in the world outside Europe to obtain the Escorial Merino. However, in 1798, the nucleus of this flock were sent to Australia where it laid the foundation for the most important sheep and wool industry in the world. Fortunately, some of the progeny had been sold to sheep farmers in the Cape prior to 1797. These Merinos, together with importations during the period 1803 to 1820 of Escorial- and Negretti Merinos from Spain, Saxony Merinos from Germany and Rambouillets from France could be regarded as the progenitors of the present-day Merino in South Africa.

With the arrival of the British Settlers (1820) and later during the Great Trek (1834), the woolled sheep industry became established in the Eastern Cape, Orange Free State and in parts of Transvaal and Natal. During the second half of the 19th century, Merinos were also imported from France (Rambouillet), Australia (Wanganellas), America (Vermonts), and Tasmania (Tasmanian Merino). Today, the Merino and Merino type form the largest part (76% = 61% Merino & 15% other wool) of the sheep population, in this country, which produces some of the best quality fine wools and is the fourth largest wool producer in the Western World.

Except for the Merino, other sheep breeds were also imported to South Africa of which the Blackhead Persian, Karakul and German Merino contributed significantly towards the development of the sheep industry.

The Blackhead Persian (indigenous to Northern Africa and the Near East) reached the country in 1870 when a disabled ship touched at Port Beaufort on the West coast. Three ewes and a ram on board, which were kept for slaughter purposes, aroused the attention of farmers who acquired the sheep in exchange for local sheep. This non-woolled fat-tailed sheep is particularly well adapted to the dry western parts of Southern Africa. For several years the Blackhead Persian was considered the most important of the non-woolled breeds in South Africa, but lost it's popularity as a mutton breed due

79,4% or 29,2 mil are
woolled sheep.
Karoo Agric. Vol 3 No 7 1996

to its poor mutton conformation and localisation of fat. Today, there are an estimated 100 000 Blackhead Persians left in the Republic. A mile-stone in the history of the Blackhead Persian was the development of the Dorper from a cross between the Blackhead Persian and the Dorset Horn (British Mutton breed).

The Karakul industry of Southern Africa was established with the importation of the first Karakul sheep into Namibia during 1907. This breed adapted well to conditions in the Southern semi-arid regions of Namibia and the dry North-Western Cape and Namaqualand, having originated in the desert areas of Central Asia (Bokhara). The annual production of Karakul pelts (SWAKARA) in Namibia and the R.S.A. is about five million pelts, which is produced from 3,0 and 1,9 million sheep respectively. Namibia is the largest Karakul pelt producer in the world and together with the R.S.A. produce almost 50% of the world karakul pelts. The remainder is produced mainly in Russia, Afghanistan and Argentina.



The German Mutton Merino was first introduced into South Africa in 1932. The need for a mutton type sheep for fat lamb production in the intensive farming areas of the Western Cape as well as in the high rainfall grasslands, resulted in wide distribution of this breed. The embargo placed on the export of German Mutton Merinos from Germany to South Africa resulted in the selection of a German Merino type which is more adapted to local conditions, and officially called the South African Mutton Merino. This breed lends itself particularly well to cross breeding as well as mothering stock for fat lambs. Two dual-purpose breeds (Dohne Merino, and Dormer) were developed from S.A. Mutton Merino crosses. Presently, the S.A. Mutton Merino is one of the three most important sheep breeds in South Africa.

2.3 The need and development of new sheep breeds in South Africa

For the production of good quality fine wool, a relatively high level of nutrition is necessary, and this should as far as possible remain constant throughout the year. Such conditions are encountered in the relatively dry central parts of South Africa. The greatest concentration of Merino sheep is therefore found in these areas.

2.3.1 High rainfall sour veld areas

In the high rainfall, sour veld areas of South Africa which are characterized by large fluctuations in the nutritional status of the veld as well as the massive build up of parasites during the Summer months, Merino farming was not very successful prior to 1940. Inadequate parasite control, (mainly in lambs: highly sensitive to parasites), during summer compelled the farmers to adopt an Autumn lambing season. The low nutritional level of the natural winter carrying forced the farmers to provide cultivated pastures to

ewes and lambs during this period. However, the low fertility and slow growth rate of the Merino, which was the only fine wool breed available at that time, did not justify the use of expensive cultivated pastures. Furthermore, skin folds, particularly in the danger zone of the crutch, are detrimental under high rainfall conditions inducing fleece rot and Blowfly strike. As a result, most farmers in these areas obtained large numbers of Merino wethers, mainly from the Karroo, which they kept for one or more seasons in the production of wool and mutton.

These conditions led to the development of the Dohne- and Grassveld Merino during the 1940's. The Dohne Merino, which is a plain-bodied mutton-woolled breed, was developed in the sour-grass areas of the Eastern Cape from a cross between the German Mutton Merino and the Merion. The purpose of this cross was to combine the mutton properties, adaptability, and fertility of the German Mutton Merino with the wool properties of the Merino in one breed. Wool production was more profitable than mutton production (see Fig.2.4) during the development stages of this breed, which made a dual purpose breed much more suitable than a pure mutton breed. Breeders of the Grassveld Merino in the grass-veld areas of the Eastern Transvaal (Ermelo) have set themselves the same objectives, namely a large-framed, smooth-bodied fertile sheep, specially suited for the production of both fine wool and mutton. The only difference in the development of those two breeds, being that the Grassveld Merino has been selected from pure Merinos, adapted to the grass-veld areas of the Eastern Transvaal. For the same reasons, individual breeders in the Eastern Cape and Orange Free State developed the Letelle, Walrich and Kaffrarian Polled Merino. These breeds can be regarded as large bodied, plain type sheep, producing both medium-fine wool and mutton. Thus, in certain respects the production trend of all these breeds is similar to that of the European mutton breeds, namely, more mutton, more lambs and quicker growth, but with medium to fine wool. In recent years, the Walrich, Kaffrarian' polled Merino and Dohne Merion became one breed society, all under the same name, Dohne Merino.

2.3.2 Winter rainfall areas of the Western Cape Province

Merino farming is not a viable proposition in the intensive farming areas of the Winter rainfall region of the Western Cape. Relatively small farms, limited flock sizes and surplus food during Winter (veld and cultivated pastures) make this area more suitable for intensive fat-lamb production. For the production of fat lambs in the Western Cape, it is essential that lambs are born in Autumn or early Winter when there is a surplus of food and less parasites. A fast maturing mutton breed which could lamb in Autumn was therefore required. Of the fat-lamb breeds available only the Dorset Horn lambed in the Autumn, but since this breed is markedly subject to lung disorders (Muellerius), it was not suitable as a pure breed. In 1940 it was decided to cross the Dorset Horn with the German Mutton Merino. The purpose of this cross was to combine the mutton properties of the Dorset Horn and the resistance of the German Merino to lung worm in one breed, to which the name Dormer was given.

2.3.3 The arid North-Western Cape Province

In the predominantly arid north-western regions of South Africa, woolled sheep cannot always be farmed with success owing to the low and uncertain rainfall. In these areas the sheep farmer must consequently farm with a hardier non-woolled breed. The sheep population of these areas originally consisted of indigenous fat-tailed breeds (Ronderib and Namaqua Afrikaner) and later on, the Blackhead Persian. These fat-tailed breeds, however, possess undesirable conformational features, which prevent them from producing a slaughter lamb of high quality. These breeds also have a low milk production, with the result that the growth of lambs is slow.

In 1936 some British mutton breeds were crossed with local Blackhead Persian and Ronderib Afrikaner sheep. From the results obtained it was clear that the mutton characteristics of the fat-tailed breeds could be considerably improved by crossing them with the imported pure-bred mutton breeds. The Dorset Horn x Blackhead Persian cross with its long breeding season, proved to be the most suitable for the South African conditions.

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The Dorper breed can be farmed in all regions suited to wool production. It is also well adapted to the thickly bushed regions of this country as well as the regions where grass seed is a problem. It can be dipped easier than woolled sheep and has therefore an advantage in heavily tick infested areas.

2.3.4 Mutton breeds for crossbreeding in the arid, wool producing areas

The pollution of wool by kemp fibres as a result of crossbreeding Merino ewes with non-woolled mutton breeds for the production of slaughter lambs in the extensive wool producing areas of South Africa, caused great concern in the wool industry. The crossbreeding of Merino sheep usually takes place after a major rise in mutton prices or when old ewes are kept for slaughter-lamb production off the veld. A need thus arose for an adapted (hardy) mutton type of sheep with no kemp which could be used for crossbreeding with Merinos for the production of slaughter lambs in the extensive (drier) wool producing areas of South Africa.

The Vandoor was developed from a cross between the Van Rooy which is an indigenous, non-woolled fat-tailed breed and the Dorset Horn. Problems with fat distribution, kemp and heavy horns forced the breeders to use the S.A. Mutton Merino as a third cross. At a later stage, another white-woolled mutton breed, namely the Afrino was developed from a cross between the Ronderib Afrikaner (an indigenous fat-tailed breed with a mixed hair and wool coat), Merino and the S.A. Mutton Merino.

2.2.2 The significance of the sheep industry

South Africa is the world's fifth biggest wool producer. It processes more than half of the clip locally before 90% of its total wool production is exported. Fig. 2.3. graphically represents the sheep numbers in S.A. since the first official census in 1911.

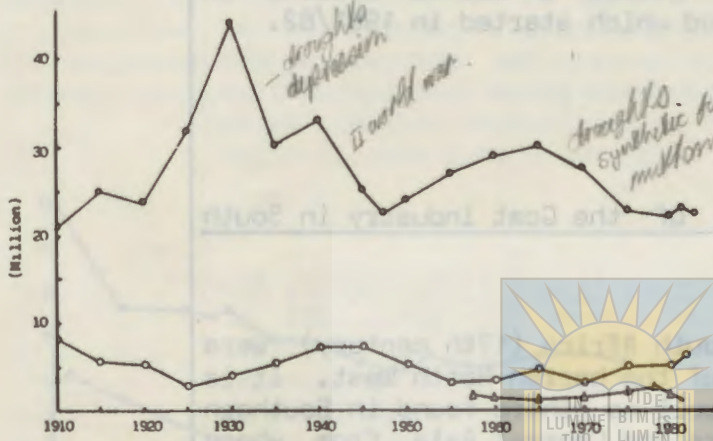


Fig. 2.3 Sheep numbers in South Africa (●—●) woolled (▲—▲) non-woolled (▲—▲) Karakul.

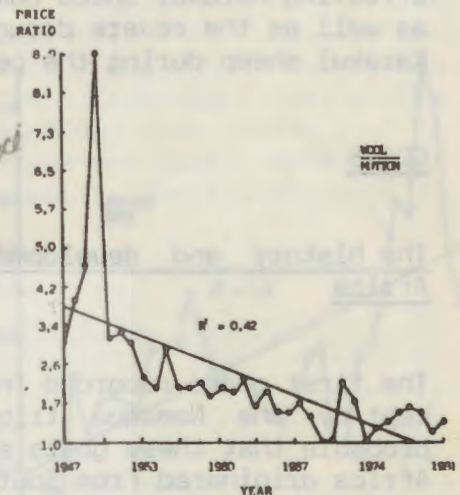


Fig.2.4 Relationship between price of wool and mutton.

The number of woolled sheep increased in course of time, until by about 1930 there were approximately 50 million sheep in the country of which 43 million were woolled sheep. After 1930 a notable decline occurred in the woolled sheep population, attributable to protracted droughts and unfavourable economic conditions (1933). The decline in numbers continued until 1947 when it reached the low point of less than 25 million. A gradual increase followed until 31 million woolled sheep was reached in 1966. During the period 1965 to 1972 droughts as well as the sharp increase in the production of synthetic fibre, with the resulted low wool prices caused a decrease in sheep numbers. Although there was an increase in the wool price during the energy crisis of 1973, woolled sheep numbers continued to decline. (See Fig. 2.2). This trend was probably due to the rise in mutton prices during the same period. The reduction in the woolled sheep numbers during 1983/84 season is a result of drought. Non-woolled sheep numbers are mainly affected by mutton price and climatic conditions. The sheep numbers in the National States of Southern Africa are presented in Table 2.5.

Table 2.5: Numbers (x 1000) of sheep in the National States (1974/75).

Transkei	2 473,6
Bophuthatswana	225,0
Ciskei	193,5
Gazankulu	4,0
Kwazulu	283,1
Lebowa	120,2
Qwa Qwa	5,7
Venda	4,4
Total	3309,5

wool price
droughts.

From the above it seems that wool price is not as high as it was in 1947. That the price of wool and mutton is not as high as it was in 1947. Droughts are the primary factor affecting wool sheep numbers. (1983/84) of the wool is exported to which is a reason that any factor affecting the economic conditions in these countries will affect the wool price.

for research, by issuing publications, and by collaborating with manufacturers and retailers in promotional projects. The funds required for its activities are contributed by farmers who pay a levy on all wool sold.

The South African Wool Commission: This body is completely divorced from the Wool Board. It began operations in 1960 following the passing of the Wool Commission and Wool Amendment Act. The Commission seek to stabilize the wool market in the Republic and, to achieve its object may, amongst other things, prepare a table of minimum prices for all types of wool produced in the country assess reserve prices for individual lots of wool, buy any wool at the minimum price, and supplement the sale price to bring wool to its minimum price. By means of levies imposed on wool sales it finances its activities and builds up a wool stabilization fund.

The International Wool Secretariat (I.W.S.): Australia, New Zealand and South Africa together account for about 80% of raw wool exports of the free world and there can be little doubt that should these three countries compete amongst themselves revenue amounting to vast sums would be jeopardized. Consequently the I.W.S. was formed which today represents some 200,000 woolgrower's.

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The head office of the I.W.S. is in London and has sub offices in 19 other countries. The Board of the I.W.S. consists of 13 members of which Australia has 7, New Zealand 3 and South Africa 3. Each of these countries supply funds on a prorata basis for the functioning of this organisation. The function of the I.W.S. is to promote and serve the wool industry at an international level. The International woolmark is an example of the I.W.S. consumer protection project. This woolmark project is considered responsible for the greatly improved wool demand in Europe.

Mohair: The Mohair industry is also served by two bodies which operate in much the same way as outlined above. These bodies are known as the Mohair Board and the South African Mohair Grower's Association. Levies collected on the sale of mohair by the Mohair Board are used to finance the activities of the S.A. Mohair Grower's Association.

The National Mutton Sheep Performance and Progeny Testing Scheme was introduced in 1964 to provide (a) objective measurements for selection and (b) the necessary data for calculating phenotypic and genetic parameters for the more important mutton breeds. The scheme operates as an on-the-farm recording scheme and corrected weight gain up to weaning and ewe production records are the main selection criteria.

The South African Fleece Testing Centre was founded in 1965 to provide central fleece measurement facilities to woolled sheep breeders. The National Performance Testing Scheme for Woolled Sheep was launched in 1973 to provide a more

intensive follow-up to participating breeders. Traits recorded are fleece weight (greasy and clean), clean yield percentage, fibre diameter, crimps for 25 mm, staple length, body weight and birth status. Sheep are ranked for clean fleece weight and body weight. All fleece measurements are done free of charge.

Through both schemes the Department also provides a specialist extension service to the sheep industry. Short courses in the principles of selection are conducted regularly and the attendance at such a course is a prerequisite for participation in the woolled sheep scheme. The educational and advisory service offered through the schemes is perhaps their most important function.



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CHAPTER 3

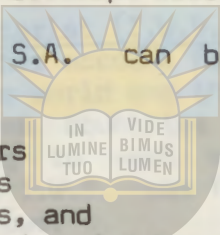
BREED DESCRIPTION OF THE MOST IMPORTANT SMALL STOCK

BREEDS IN SOUTH AFRICA

Small stock breeds are classified by origin and use and, particularly, according to fineness and length of fibre. Sheep breeds in S.A. are classified into the following major categories:

- Fine wool breeds
- Mutton-wool breeds
- Non-woolled mutton breeds
- Fat-tailed breeds
- Karakul sheep, and
- Indigenous nondescript breeds

The majority of goats in S.A. can be classed into the following main classes:



- Fibre producers
- Meat producers
- Milk producers, and
- Indigenous nondescript breeds

Generally, all small stock breeds must comply with their specific breed standards, prescribed by the different breed societies. However, these standards are more or less the same within certain types of animals, e.g. fibre producers, mutton/meat producers and milk producers. The following is an attempt to rationalize breed standards and cull faults for the major classes of small stock.

1. TYPE

Wool sheep (not Angoras) are grouped into different types according to the presence or absence of skin folds on the neck (frontal folds), as well as to the number and size of such folds. A positive correlation exist between frontal development and development on other parts of the body, in that more and larger folds generally occur on the remainder of the body as the frontal folds increase in number and size, and vice versa. The classification of wool sheep into different types, is in part, an attempt to provide a better description of the animal and to estimate its production potential. Fold development has an effect on the amount of wool produced (skin area available) and reproduction - see Chapter (9.2.6).

The different "types" are the following:

(a) Plain: in full fleece, shows no visible transverse frontal folds.

(b) Light and medium front: (i) light: one or two small transverse frontal folds. Small body wrinkles not visible in full fleece.

(ii) Medium: two or three medium sized transverse frontal folds. small body wrinkles not visible in full fleece.

(c) Full front: Three medium-heavy (large) transverse frontal folds. Frontal folds which in full fleece visibly extend over the neck are permissible, provided they are not excessively large. Indications of body folds may be visible in full fleece. Animals with excessive development on the body should not, however, be included in this type.

(d) Over-developed type: animals of this type are not suitable for sheep-farming purposes - disqualified (culled).

2. WOOL/MOHAIR PROPERTIES.

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The following selected fleece characteristics should be considered in evaluating the animal.

Length

Fineness

Uniformity of length and fineness

Quality

Freedom from kemp

a) Length should be judged in relation to the animal's age, size and condition and reproductive history (rearing of lamb/kid, etc.). Wool length could be judged according to the following general classification:

12 months wool growth:	70 mm to 90+ mm
10 months wool growth:	50 mm to 80 mm
8 months wool growth:	35 mm to 70 mm
6 months wool growth:	20 mm to 50 mm

A good length for mohair is equivalent to at least 25 mm (1 inch) growth per month.

b) Fineness which refers to fibre thickness should be judged in relation to the animal's age and level of nutrition. Generally, the finer the fibre, the higher the unit value. Fibre thickness of wool is determined in practice according to the size of the crimp. The smaller the crimp the finer the wool and vice versa. In mohair, fineness is judged according to the staple size and handle.

TABLE 3.1 NwGA Fineness Classes

Description	NwGA Symbol	Spinning count (Minimum)	Micron thickness (Maximum)
Superfine	FF	70 +	Less than 19
Fine	F	70	19
Medium	M	64 - 70	19 - 21
Strong	S	60 - 64	21 - 23
Overstrong	SS	58 - 60	23 - 25

d) Quality This property in wool, which is basically associated with uniformity of fibre thickness, is judged by taking into account the definition of crimp (well defined even crimp), the handle of the wool and the presence or absence of deviating (noticeably coarse or hairy) fibres. A lack of definition or harsh handle of the wool indicates excessive variation in fibre diameter.

In mohair, style (refers to twist) and character (refers to crimp or waves), plus handle and yolk, colour and lustre which together form almost the whole concept of quality. The ideal mohair has a good lustre and soft handle with enough yolk to nourish the fleece. Any coloured fibres in the fleece of the angora are a disqualification. Dull white fleeces are undesirable and a harsh handle should be avoided.

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e) Freedom of kemp Both wool and mohair should be free of kemp, which is a straight (+ 10 mm long), coarse, brittle and non-elastic fibre with an off-white colour.

4. CONFORMATION

The following body characteristics and cull faults should be considered in evaluating the animal (subjectively).

Size
Head
Forequarters and neck
Back and barrel
Hindquarters
Legs

a) Size is determined mainly by length, width and depth of the back and barrel and is important with regard to both meat and fibre production, fertility, and adaptation. Size should be judged in relation to age, level of nutrition, litter size and breed.

b) Head The head should be strong with well developed jaw. Horns, if permissible, should be strong.

Faults: small defective jaw (under - or overshot) and inverted eyelids.

c) Forequarters and neck Shoulders should be firm and well attached. Withers should be broad and level with the back. The neck should be in proportion to the rest of the body and well set. The chest should be deep and broad.

Faults: loose shoulders, high sharp withers, u-neck, devil's grip and narrow chest.

d) Back and barrel The back should be long, broad and straight. The ribs should be well-sprung and the barrel showing good depth throughout.

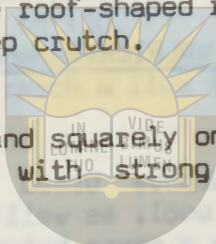
Faults: hollow back, too short back, lankiness and slab-sidedness.

e) Hindquarters should be broad with an open crutch.

Faults: goose rump, excessive roof-shaped rump, narrow hips and pin bones, too deep crutch.

f) Legs The animal should stand squarely on all four legs. The legs should be straight with strong joints and in proportion to the body.

Faults: knock-knees, cow hocks, sickle hocks, hocks too straight, weak pastern joints (fetlock), widely split hooves.



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SHEEP

A. FINE WOOL BREEDS

1. MERINO

The merino is a white wool sheep which produces a large amount of high quality fine wool, as well as a reasonable carcass. In full fleece, the Merino appears rather massive, with wool extending down the front legs to the knees and down the hind legs to below the hock and the belly is also fully covered with wool. Plain bodied to over developed types are found in the S.A. Merino. The ram has well developed horns which appear heavy and turn backwards away from the head while the ewe is either hornless or have small light horns.

- * The average mature weight of rams and ewes are 85 and 50 kg respectively.
- * Mature rams and ewes produce 10 and 6 kg wool per annum.
- * Wool varies from superfine to overstrong
- * Average lambing percentage is 80
- * It has an intermediate breeding season.

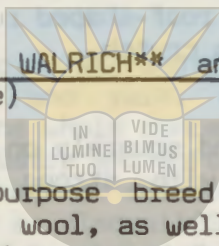
Uses of the Merino

It is farmed mainly for the production of fine wool of high quality. Although it is kept mainly for wool production, the

Merino makes the largest contribution (large numbers) of all small stock breeds towards the production of mutton in South Africa mainly in the form of mature wethers and culled ewes. The Merino is farmed mainly under extensive conditions throughout most parts of South Africa (except in hot humid and savanna areas). Merino wethers play an important role in utilizing "remote" areas on farms in which the close supervision necessary for ewes with lambs is not possible, the grazing is inadequate for ewes with lambs or vermin is difficult to control.

The availability, adaptability and excellent wool production makes the Merino a popular mother breed for crossbred lambs. In the past, it has been used in the development of the Dohne Merino, Kaffrarian Polled Merino, and Walrich. If old and culled Merino ewes are crossed with a mutton type ram, good slaughter lambs be produced from the veld, yielding a carcass of 15 kg at five to six months of age (30 - 35 kg live mass).

2. DOHNE MERINO including WALRICH** and KAFFRARIAN POLLED MERINO** (** - See next page)



The Dohne Merino is a dual-purpose breed which produces a high yield of medium-fine wool, as well as a good carcass. It has been developed through a cross between Merino ewes and German Mutton Merino (today S.A. Mutton Merino) rams. The Dohne Merino is a hornless, plain bodied sheep, though small body pleats and a light frontal fold are permissible. In general, the Dohne Merino is broader than the Merino and has better mutton conformation. The wool covering is the same as for the Merino.

- * The average mature live mass of rams and ewes are 100 kg and 70 kg respectively.
- * Mature rams and ewes average 11 kg and 4,5 kg wool respectively per annum.
- * Wool varies from fine to strong.
- * Average lambing percentage is 100 - 150.
- * It has an intermediate to long breeding season.
- * Lambs grow fast and under favourable conditions could reach a live mass of 35 kg within four months. The average live mass under veld conditions would be 40 kg at six months.

Uses of the Dohne Merino

The Dohne Merino is kept for both fine wool and mutton production and is found mainly in the high rainfall sour veld areas of South Africa. It's unlimited sexual season makes Autumn and Spring lambing possible and is therefore suitable for fat lamb production under intensive feeding conditions. The Dohne Merino can be used with success in crossbreeding with both mutton breeds and Merino. For example, a cross between a Dohne Merino ram and Merino ewes produce offspring that produce 2% less wool compared to the Merino, but gain 20% on mutton characteristics.

** The Walrich was developed from a cross between Merino Ewes and Precoce Merino rams (fine wool Merino with good Mutton characteristics from France). The Kaffrarian polled Merino was selected from sheep with 25% Walrich, 25% Polled Merino and 50% Merino blood.

3. LETELLE

The Letelle is a large bodied, plain type sheep which produce a good quality fine wool. It has been selected from the Merino with emphasis on mutton production together with a reasonable amount of fine wool.

- * The average mature live mass of rams and ewes are 110 kg and 75 kg respectively.
- * Mature ewes produce an average 4,1 kg wool per annum.
- * Wool varies from superfine to strong, although sheep with wool stronger than medium is not excepted.
- * Average lambing percentage 100 to 130.
- * It has an intermediate breeding season.
- * Lambs grow fast, and could reach a live mass of 40 kg at five months.



Uses of the Letelle

As a dual-purpose breed, it is kept for the production of both fine wool and mutton, the latter in the form of lambs, wethers and culled ewes. Due to the high quality wool produced, wethers can be used for wool production and then sold at the age of 4 years as mutton. Wethers of this age can yield a 36 kg carcass.

B. MUTTON-WOOL BREEDS

1. S.A. MUTTON MERINO

The S.A. Mutton Merino was developed from the German Mutton Merino** through selection under local conditions. The S.A. Mutton Merino is a large bodied (high on the leg) dual-purpose sheep which produces a reasonable amount of coarse wool.

- * The average mature weight of rams and ewes are 110 kg and 90 kg respectively.
- * Average lambing percentage is 150 and higher.
- * Under favourable feeding conditions, average daily gain (ADG) of lambs can be as high as 400 g. Under veld conditions, lambs may reach 34 kg at three months of age. Lambs are usually marketed at five months of age at which stage super grade lambs are produced.
- * Mature rams and ewes produce an average 5,5 kg and 3,2 kg of wool.
- * Wool varies from strong to overstrong, however this wool appears to be medium to fine wool if judged by the size of crimps.
- * It breeds throughout the year.

Uses of the S.A. Mutton Merino

This dual-purpose breed is kept for mutton production mainly with wool as a secondary product. The S.A. Mutton Merino lends itself particularly well to crossing with other breeds. For this reason it has been used as one of the parent breeds in the development of the Dohne Merino and Dormer, and today it is still widely used in crosses with Merino ewes for the production of mother stock in fat-lamb production. The S.A. Mutton Merino is one of the three most important sheep breeds in South Africa, in terms of stud animals. It is well adapted to both Summer and Winter rainfall areas.

- ** The German Mutton Merino was developed in Germany from a cross between the Merino Precoce from France and the Mele sheep which were further selected for dual production of mutton and wool.



2. DORMER

The Dormer is a plain bodied, polled sheep, possessing well-developed mutton properties and produces a coarse white wool. It was developed from a cross between the Dorset Horn (from U.K.) and the German Mutton Merino (S.A. Mutton Merino).

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- * The average mature body mass of rams and ewes are 100 kg and 77 kg respectively.
- * Average lambing percentage may be as high as 150.
- * Lambs grow fast and may reach a live mass of 33 kg at three to four months of age. Lamb carcasses have an excellent fat distribution. Lambs mature at an early age.
- * Mature rams and ewes produce 4 kg and 3,5 kg wool respectively over 12 months.
- * Wool is strong (54 - 56's).
- * It breeds throughout the year.

Uses of the Dormer

The Dormer is mainly kept for mutton production and is concentrated in the Winter rainfall area of the Cape Province. It is extensively used for crossbreeding especially with the Merino. There are about 128 registered Dormer Stud breeders in South Africa.

3. CORRIEDALE

The Corriedale sheep breed was developed in New Zealand from a cross between the Lincoln and Merino. It is a dual-purpose breed, which produces strong wool. The breed is polled, with dark nose with white hairs in the face and about the eyes. Black hooves are preferred.

- * The average mature body mass of rams and ewes are 110 kg and 70 kg respectively.
- * Average lambing percentage is 100 to 130.
- * Lambs grow fast, and may yield a carcass mass of 16 to 18 kg at four to five months, without excessive fat.
- * Mature rams and ewes produce an average 14 kg and 5 kg respectively per annum.
- * Wool is strong (50's - 56's) and used mainly for manufacturing of carpets and curtains.

Uses of the Corriedale

This dual-purpose breed is kept for the production of both mutton and carpet wool and is concentrated in Eastern grassveld areas of South Africa. It is also successfully used in cross breeding. There are about 70 stud breeders in South Africa.



4. HAMPSHIRE- AND SUFFOLK DOWN

Both these breeds are small (short in the leg), with no horns and producing short coarse wool. They were developed in the southern parts of England. The Hampshire Down is covered with a dense white fleece, with black wool on the points where it ends on the legs and face. The Suffolk Down is slightly smaller with no wool on the legs or head. These parts are covered with fine lustre black hairs.

- * The live mass of rams and ewes are 115 kg and 85 kg respectively.
- * Lambing percentage is 150.
- * Lambs grow fast and under intensive conditions may reach a live mass of 40 kg at three months of age. Lambs mature at an early age.
- * Mature rams and ewes produce 3 - 4 kg and 2 - 2,5 kg wool respectively. (Higher figures for Hampshire).
- * The wool is strong, more so for the Suffolk.
- * They have a short breeding season.

Uses of Hampshire and Suffolk

Both these breeds are kept in the high rainfall areas for fat lamb production. However, the main use for these breeds is for cross breeding with local adapted breeds in the production of fat lambs. In South Africa there are about 60 Suffolk and 25 Hampshire stud breeders.

5. MERINO LANDSHEEP

The Merino Landsheep, also known as the German Landsheep was developed in Germany for extensive conditions. It is a large (probably the biggest sheep breed in the country), polled mutton breed with a long body, producing white medium to

strong wool. It has characteristic long broad ears, in a slight back and downwards position.

- * Live mass of mature rams and ewes are 110 kg and 80 kg respectively.
- * Lambing percentage is 140.
- * Lambs mature at a relatively late age and under intensive conditions may reach a carcass mass of 20 kg (40 kg live mass) at four and a half months. Under veld conditions, the same body mass could be obtained at 6 to 12 months.
- * Wool production of mature rams and ewes over 12 months are 4,5 kg and 3,5 kg respectively.

Uses of the Merino landrace

Due to the limited number, pure Merino Landsheep sheep are not generally used for slaughter lamb production. It is mainly used in crossbreeding with Merino for the production of slaughter lambs from the veld. Most of the 58 studbreeders are situated in central Free State and Western Transvaal.



6. ILE DE FRANCE

This is a polled, plain type white wool sheep with an open face and outstanding mutton characteristics. It was developed from a cross between the Dishley- and Rambouillet-Merino in France.

- * Mature rams and ewes have a live mass of 110 kg and 90 kg respectively.
- * Lambing percentage is around 150.
- * Lambs grow fast and may reach a live mass of 37 kg at three months.
- * Mature rams and ewes produce 5,5 kg and 4 kg wool respectively over 12 months. Wool on the belly is sometimes absent in mature animals.
- * Wool is strong.
- * It has an intermediate to long breeding season.

Uses of the Ile de France

This breed is an excellent fat lamb producer, but due to the limited numbers in this country, it is mainly used for crossbreeding. There are about 190 stud breeders in South Africa.

7. VANDOR

The Vandor is a hardy, non-fat tailed white wool sheep with a light fleece. This breed was developed from a cross between the Van Rooy and Dorset Horn and S.A. Mutton Merino as a third cross.

- * Mature live mass of rams and ewes are 100 kg and 85 kg respectively.
- * Lambing percentage is 150.
- * Lambs grow fast and under intensive conditions may reach a live mass of 38 kg at four months. Vandoor x Merino lambs on veld can reach a mass of 35 kg at four and a half months.
- * Wool production is 1,5 to 2,5 kg.

Uses of the Vandoor

The Vandoor is mainly used for crossbreeding although it is capable of producing a good slaughter lamb from the veld in the more arid areas of the country. In these areas, Merino farmers often use adapted mutton breeds for crossing in slaughter lamb production off the veld. The Vandoor fulfils this need without contamination of Merino wool. Presently, there are eleven stud breeders in South Africa.

8. AFRINO



The objectives for the development of the Afrino are similar to that of the Vandoor. It was developed from a cross between the Ronderib Africaner, Merino and S.A. Mutton Merino. It is a white wool, hardy breed, adapted to the more arid regions of the country.

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- * Mature live mass of rams and ewes are about 110 kg and 80 kg respectively.
- * Lambing percentage is 150.
- * At four months, lambs weigh 31 kg off the veld.
- * Wool production is about the same as for the Vandoor, namely 3 - 4 kg for ewes.
- * Wool varies from medium to overstrong.

Uses of the Afrino

Same as for Vandoor.

C. NON-WOOLLED MUTTON BREEDS

1. DORPER

The Dorper is a large, non-woolled mutton sheep with a black head and white body. It is a hardy breed, developed for the arid areas of S.A. from a cross between the Blackhead Persian and Dorset Horn (from U.K.). The coat consists of a light mixture of wool and hair (kemp), and short dull black hairs covering the head and face. The white Dorper is without a black head.

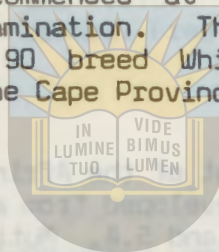
- * Mature body mass of rams and ewes are 110 kg and 80 kg respectively.
- * Lambing percentage is 120%.

- * Lambs grow fast and may reach 30 kg live mass at 3 to 4 months on veld.
- * Cycle and conceive during lactation
- * It has a long breeding season.

Uses of the Dorper

Due to its imbred hardiness and adaptability the Dorper is second to the Merino in terms of numbers in South Africa. It is used, mainly for slaughter lamb production from the veld particularly in the arid, extensive grazing areas, but also in more humid conditions. The lambs grow fast and obtain excellent grades provided they are not kept for too long on a high plain of nutrition, resulting in over fat (especially round the tail) carcasses.

It is also used for crossbreeding with Merino ewes, although this practice is not recommended at all due to the possibility of wool contamination. There are 633 Dorper breeders of which about 90 breed White Dorpers. Most breeders are situated in the Cape Province.



D. FAT-TAILED BREEDS

1. BLACKHEAD PERSIAN

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The Blackhead Persian is a non-woolled mutton breed with a fat tail (rump), white body and black head. The coat consists out of short dull white hairs while the head and face is covered with short lustre black hairs. The fat tail is well attached to the rump which gives the impression of rather a fat-rumped than fat-tailed sheep. The Blackhead persian is eminently adapted to the arid conditions, with excellent walking abilities, light body and unlimited breeding season.

- * Mature body mass of rams and ewes are 80 kg and 50 kg respectively.
- * Lambing percentage is 120.
- * Cycle and conceive during lactation
- * The growth rate of lambs is low and carcasses have localised fat particularly round the root of the tail.

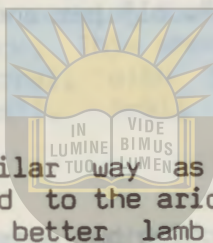
Uses of the Blackhead Persian

It's low maintenance requirement, resistance to heat and Geeldikkop (Tribulosis), walking ability and unlimited breeding season makes this breed extremely suitable for the arid parts of this country. The Blackhead Persian is also noted for its valuable skin, which is used mainly for the production of glove leather and which is known in the trade as "Cape Glover". Today, there are 29 breeders left in the country.

2. VAN ROOY

This is a large, white, fat-tailed sheep, covered with a mixture of wool and hair (kemp). The head, tail underline and legs are covered with short kempy hair. Both rams and ewes are polled, and have a prominent and well-developed chest. The Van Rooy was developed from a cross between Ronderib Africaner and Rambouillet Merino ewes (dual-purpose Merino from France). Blackhead Persian and Polled Wensleydale sheep were also used in later generations.

- * Mature body mass of rams and ewes are 75 kg and 50 kg respectively.
- * Lambing percentage is about 120.
- * Lambs may reach a live mass of 31 kg at four months under extensive conditions, but they normally reach 40 kg when marketed at eighth months of age (weaning at 4 months).
- * It has an unlimited breeding season.



Uses of the Van Rooy

The Van Rooy is used in a similar way as the Blackhead Persian, extremely well adapted to the arid areas of South Africa. However, it produces a better lamb carcass (well fleshed and fat localized on the rump) and the lambs also grow faster than the Blackhead Persian. The Van Rooy is also used with success in crossbreeding with non-fat-tailed breeds. Today there are only 19 breeders left of which most are to be found in the Southern Free State and North Central Cape. It has been used as one of the parent breeds in the development of the Vandoor.

3. RONDERIB-AFRICANDER

The Ronderib Africander, also known as the "Blinkhaar" or "Steekhaar" Africander is a white, relatively large fat-tailed mutton sheep which is covered with silky hairs and a woolly undercoat. It has been developed from the indigenous fat-tailed sheep that belonged to the Hottentots. The tail is broad and flat and the bottom portion curls backwards (coil) for about one third of the tail length.

- * Mature body mass of rams and ewes are 80 kg and 60 kg respectively.
- * Lambing percentage is about 120.
- * Cycle and conceive during lactation
- * Lambs grow slowly and are usually marketed at an age of 10 to 12 months.
- * It has an unlimited breeding season.

Uses of the Africander sheep

The Ronderib Africander is used for mutton production and crossbreeding in the same way as the other fat-tailed breeds. Lambs grow slowly and carcasses is of lower value due to the localization of fat. It has been used in the development of

the Afrino, which together with the Dorper and Vandoer are taking the place of fat-tailed breeds in mutton production in the arid regions of South Africa. Today there are only 20 breeders left.

E. PELT PRODUCERS

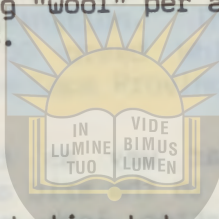
1. KARAKUL

The Karakul is a fat-tailed, hardy breed. The hair covering consists of a long, thick outer coat and an undercoat similar to fine wool fibres. The colour is predominantly black or blue-grey but other colours such as brown and white do occur.

- * Lambing percentage is 120 plus.
- * Lambs grow relatively fast and may reach a live mass of 21 kg at three months.
- * Mature animals produce 2-3 kg "wool" per annum.
- * Breeding season is unlimited.

Uses of the Karakul

It is mainly used for pelt production but a reasonable income is also obtained from both meat and wool which is used for the manufacturing of carpets.



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F. INDIGENOUS NONDESCRIPT SHEEP BREEDS

1. NAMAQUA AFRICANDER

The Namaqua Africander is very similar to the Ronderib Africander, except that considerable colour variation occurs (black or brown heads and piebald animals) and it is also "thinner" than the Ronderib. A flock of Namaqua Africander is kept on the experimental farm at Klerefontein (Carnarvon).

2. PEDI SHEEP

This sheep occurs to the south of the Soutpansberg. The animal has the typical unimproved conformation of our indigenous breeds of sheep, being high on the leg, with a flat, shallow barrel and a long and generally straight tail. The Pedi sheep has an exceptionally easy gait and frequently breaks into a jog trot if it has to move rapidly. Mouse ears (small ears) sometimes also occur, besides the normally long ears.

A variety of colours is encountered but sheep with brown patches and brown heads appear to predominate. A typical flock of these sheep are kept on the farm Stellenbosch in Lebowa.

3. VENDA SHEEP

In contrast with the Pedi sheep the Venda sheep occurs to the north of the Soutpansberg in the area belonging to the Venda people, this sheep being encountered especially in the Mopani veld of the Limpopo valley. Its colour ranges from completely black to pure white, with various colour patterns and other colours, such as reddish brown, between the two extremes. A typical Venda sheep closely resembles the Pedi. It would appear, however, that in the Venda sheep black is a more prominent colour than in the Pedi sheep. Larger extent coloured black than the Pedi sheep.

4. DAMARA SHEEP

The Damara sheep occurs in the drier northern and western areas of S.W.A. and also in Angola. The Damara is a multi-coloured sheep, the pattern ranging from white through various shades of brown to black. This sheep is hairy, has long legs, shallow and narrow barrel, with longish, fairly straight tails ("sjambok tails"). Small ears are very commonly encountered.

The rams generally have large horns, while the ewes have small horns and are also often hornless. A fairly typical flock of Damara sheep is kept on the Omatjene Experimental Farm at Otjiwarongo. The average weight of mature ewes is ± 45 kg and that of rams ± 61 kg.

5. TSWANA SHEEP

This type is encountered in Botswana and in the vicinity of Vryburg and Mafeking (Bophuthatswana). It is a long-legged, hairy and fat-tailed. Variations within the breed in respect of colour, conformation and type are very large.

6. ZULU SHEEP

The sheep of Kwa-Zulu resemble those of the Swazi, and this type is sometimes referred to as the Nguni. They are long-legged and show a variety of colours. The rams are generally horned, but ewes are hornless.

GOATS

A. FIBRE PRODUCERS

1. ANGORA

The Angora is a white goat which produces a large amount of good quality mohair. In full fleece, it appears large (good depth) with mohair covering the legs, head and face. Both rams and ewes have horns.

- * Mature body mass of rams and ewes are 80 kg and 40 kg respectively.
- * Rams and ewes can produce 6 kg and 3 kg hair respectively every six months. Kids produce 0,8 kg hair during the first six months of life which increases up to 1,7 kg during the second six months of the first year. Kid's hair is very fine and the most valuable portion of the Angora farmers clip.
- * Kidding percentage is about 65% (from 40 - 90%).
- * Sexual season is limited to the period between February and June. (best is April-May)
- * Lambs have relatively slow growth.

Uses of the Angora

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The Angora is a producer of a speciality fibre and it is therefore kept mainly for the production of mohair. As a browser, it will not only utilise bush, but it will control it as well. The Angora requires a high level of management due to it's limited breeding season, two shearings per year, relatively low fertility and high incidence of abortion. The Angora is also sensitive to adverse weather conditions during the first six weeks after shearing. Today the Angora is the most important goat breed in South Africa and most of the nearly two million Angora goats are concentrated in the Eastern- and North-Eastern Cape. The Angora is susceptible to high rainfall, cold, diseases and are found in the drier areas mainly.

B. MEAT PRODUCERS

1. BOER GOAT

The Boer goat is a hardy, large white goat with a red or brown head. The coat consists of sort white hair. Both rams and ewes have horns.

- * Mature body mass of rams and ewes are 110 kg and 80 kg respectively.
- * Kidding percentage is 175.
- * Kids grow slowly and reach a live mass of 30 - 40 kg at 8 - 10 months on the veld.
- * Sexual season is unlimited.

Uses of the Boer goat

The Boer goat is used for the production of meat and for the control of bush encroachment. It forms an excellent combination with cattle in the utilization of savanna veld and together with its ability to rear a large number (2,5 - 3) kids per annum under a relatively low level of management, makes the Boer goat a viable proposition in South African farming. It also produces a good-quality skin. Boer goats are found throughout the drier savanna areas as well as in the Karroo.

C. MILK PRODUCERS

SAANEN

This breed originated in Switzerland, from which it has spread over large parts of Europe and Britain as the principal milk goat breed. It is all-white in colour short hair and is usually hornless, although horned animals do occur.

The main outstanding characteristics are: the colour is white, without other colour markings, but it can be creamy-coloured. The bare parts of the nose, eyelids, ears and udder can be without pigment.

TOGGENBURG

This breed originally came from the province of Ober-Toggenburg in Switzerland. The inhabitants of this area were poor and made a living as carpet weavers. They could not afford any cows, and each family kept from one to three milch goats for household use only. In this way the Toggenburg developed into a specialised milch breed.

Toggenburgs were exported to South Africa and Britain early in the twentieth century. In South Africa they rapidly became hybridised as a result of cross-breeding with the common Boer goat, but in Britain they were bred and selected with care, with the result that various countries, including South Africa, now import the breed from England.

The Toggenburg has a dark-brown coloured coat, with white markings on both sides of the face from above the eyes down to the muzzle, round the edges and tips of the ears, from the knees and hocks downwards, on both sides of and under the tail, and along the inner thighs downwards to the hooves.

Variations: White or cream-coloured belly, cream coloured markings instead of white, indistinct facial markings, small white markings on the lower jaw and cheeks.

BRITISH ALPINE

This breed originated in Britain about 1920. The survival of the breed is largely due to its attractive characteristic glossy black colour, with white markings similar to those of the Toggenburg. The Toggenburg, Saanen, French Alpine and Anglo-Nubian were all used at one time or another in creating this breed.

The British Alpine has a black-coloured coat, with white markings on both sides from above the eyes to the muzzle, round the edges and tips of the ears, from the knees and hocks downwards, on both sides of and under the tail, and along the inner thighs down to the hooves.

Variations: (Colour) Rusty black, white belly, cream markings instead of white, indistinct facial markings, slightly white or cream-coloured hair or markings under or on the neck and cheeks.

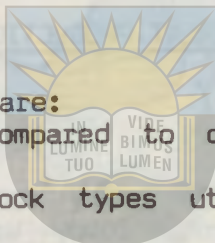


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CHAPTER 4

PRODUCTION SYSTEMS AND REGIONALIZATION OF SMALLSTOCK

In South Africa small stock are kept mainly for the production of fibre (wool, mohair), mutton/meat and pelts. The major advantage of small stock in Southern Africa is their ability to utilize ^{rural} pasture to produce these saleable products. In the drier areas, (semi-desert & karroo) they use land that would otherwise be of little value for agricultural purposes, that is crop production and cattle farming. The same is true for the estimated 40 million ha savanna and bushveld areas in South Africa which cannot be utilized to it's full potential without goats. In the higher rainfall areas small stock does not only fit in as a secondary grazer of veld and pastures, but with it's relatively short production period, + 5 months for fat lambs it is eminantly suitable for intensive meat production on cultivated pastures. The principal role of small stock is therefore as a grazing animal.



Other advantages of small stock are:

- a) higher returns/ha as compared to other livestock enterprices
- b) a combination of small stock types utilyses a wide variety of plants
- c) easy to handle and transport small stock, wool/mohair and pelts
- d) less damage to fixtures (fences, troughs etc.)
- e) sheep tolerate a higher degree of salinity than other species

On the other hand small stock farming do have certain disadvantages i.e.

- a) higher fencing costs
- b) due to the grazing habits of sheep, natural vegetation can easily be damaged if mismanaged
- c) fibre producers (especially Angora goats) require a higher managerial input
- d) predators and tick-borne diseases are much more serious threats to small stock than to cattle

A. REGIONALIZATION OF SMALL STOCK IN GENERAL

In general temperature on its own does not limit small stock farming in Southern Africa. Sheep are found in the coldest and the hottest areas in the country (Fig. 4.2 & 4.3). Sheep can tollerate rainfall quite easily up to 800 mm, provided that the higher rainfall is accompanied with relatively low temperatures (Fig. 4.1, 4.2 & 4.3). Sheep are also excluded from most of the bushveld areas in Southern Africa, except for a small part of the Vryburg/ Mafikeng area, (FIG. 4.5 & 4.3). Goat farming areas are concentrated in the Eastern bushveld parts of the Cape and extend into the Karoo. Goats are also found in the drier bushveld areas of Transvaal.

Competition from other farming enterprices also play a role in the distribution of small stock. Although large areas are suitable for sheep farming (grassveld areas of the OFS and

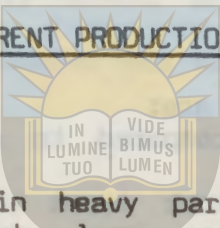
Transvaal and round some major cities) competition mainly from cash crops and dairy farming exclude extensive farming in these areas. In Table 4.1 the estimated sheep and goat numbers in the different provinces are given.

Table 4.1. Estimate of small stock numbers in the RSA, excluding National States.

Province	Sheep (x 1000)		Goats (x 1000)	
	1982	1984	1982	1984
Cape	19 434	16 517	2 479	2 529
OFS	7 318	6 643	75	82
Natal	1 123	973	107	101
Transvaal	2 796	2 610	200	182
Total RSA	30 671	26 743	2 861	2 891

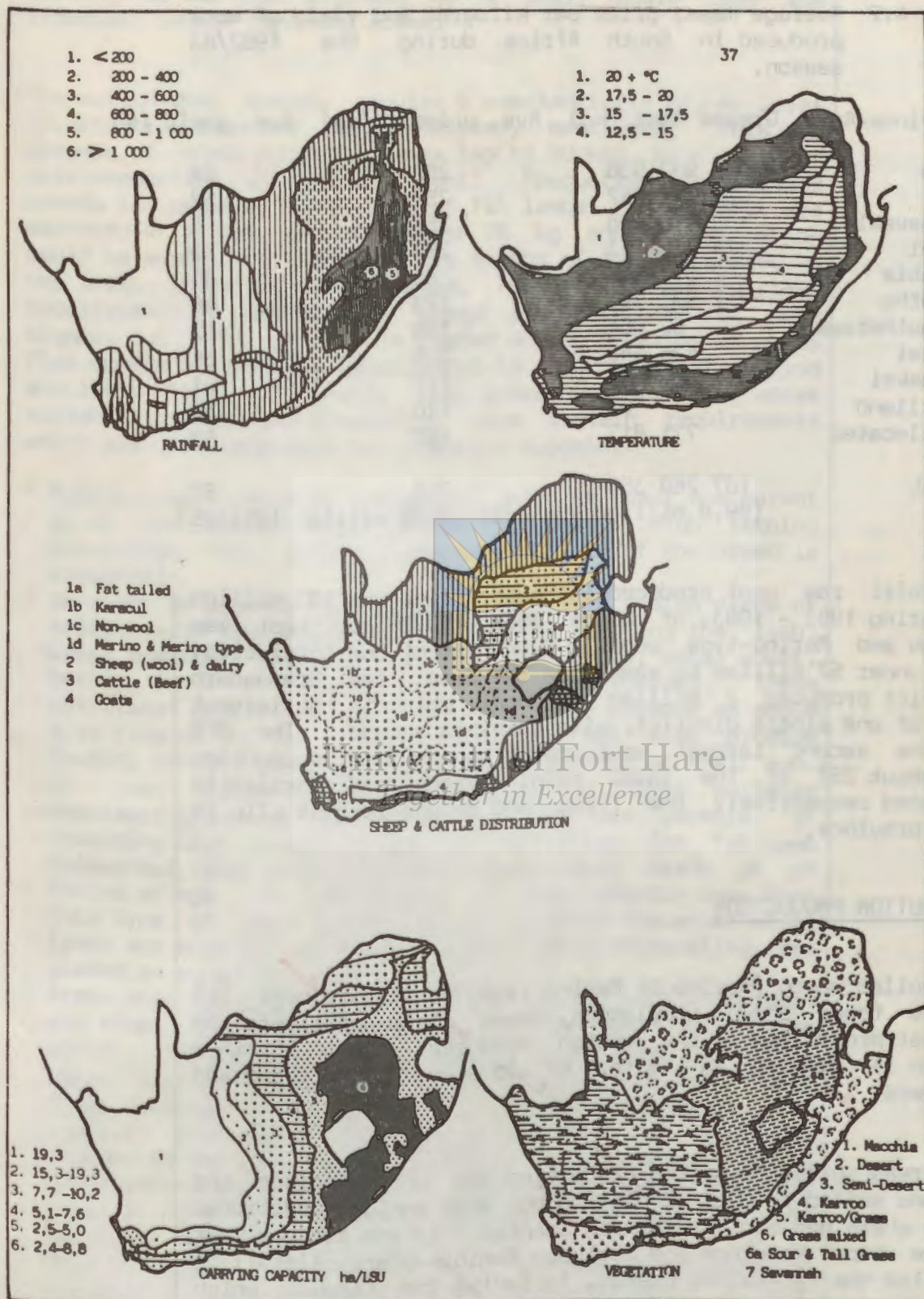
B. REGIONALIZATION OF DIFFERENT PRODUCTION SYSTEMS

1. WOOL PRODUCTION



Hot humid conditions result in heavy parasite infestation, blow fly strikes, fleece rot, lumpy wool, and tick-borne diseases (heartwater). The wool sheep is poorly adapted to these conditions and the farming of wool sheep in these conditions is extremely difficult. However, the adverse effect of high rainfall on wool sheep is counteracted by a lower temperature, such as is the case in the more moist high production sour veld areas. In these areas the Dohne Merino, Letelle, Grassveld Merino, Merino and other fine- and mutton-wool types are well adapted and suited to a more intensive dual-purpose production of both wool and mutton. In addition to hot humid conditions heavily bushed areas are also rather unsuitable for sheep (damage to wool, difficult vermin control, and poor adaptation by sheep). Sheep like short grazing, their heads are narrow and lips mobile. They are therefore able to select very fine plant material and are not coarse feeders of roughage like cattle. For these reasons tall grassveld is also unsuitable for sheep, furthermore certain low summer rainfall grassveld areas contain grass species of which the seed contaminate the wool and may penetrate the skin.

The greater part of the wool sheep production is carried out in the more arid areas (Karoo). Successful wool sheep farming is, however, not possible in the very dry and semi-desert areas of South Africa (North-Western Cape). Wool sheep require a certain minimum amount of nutrients throughout the year for the production of good-quality wool which is additional to the requirements for maintenance and reproduction. This is the reason why the Merino requires about 0,51 kg TDN per day per 45 kg body mass as against the 0,41 kg TDN for the Blackhead Persian. In these very dry and hot areas plant growth is sparse and there is just not enough herbage available for the animals to collect the required amount of dry matter per day, especially during droughts. In the case of Mutton-wool, and dual-purpose fine wool breeds



with much higher nutrient requirements than the smaller Merino, these very dry areas as well as some arid areas where the Merino exists are totally unsuitable.

The Karoo is the main wool producing area of South Africa with important production areas extending eastwards into the high lying, high rainfall areas of the Orange Free State and Cape Province (Fig.4.3). Wool production in the various regions of Southern Africa is given in Table 4.2.

Table 4.2 Average mass, price per kilogram and yield of wool produced in South Africa during the 1982/83 season.

Province/Area	Grease Mass (kg)	Ave. price (c/kg)	Ave. yield (%)
Cape	56 932 936	262	59
OFS	26 291 942	257	57
Transvaal	9 505 588	253	56
Natal	4 337 453	267	59
Namibia	2 513 559	66	61
Lesotho	2 933 722	178	46
Bophuthatswana	52 064	196	52
Ciskei	424 448	206	51
Transkei	3 505 768	117	41
Swaziland	62	110	44
Unallocated	771 817	185	52
TOTAL	107 269 359	248	57
(98,8 million kg, worth R405 million 1984/85)			

The total raw wool produced in South Africa was 107 million kg during 1982 - 1983, of which about 70,8 per cent was Merino and Merino-type wool. Over half of the total clip, just under 57 million kg came from the Cape. The Bredasdorp district produced 2 million kg wool, which is the largest clip of one single district, with Calvinia second. The OFS was the second largest wool-producing province, accounting for about 25% of the total clip. Vrede and Harrismith produced respectively the first and second largest clip in this province.

2. MUTTON PRODUCTION

As woolled sheep (Merino or Merino type) constitute over 76% of the total sheep population, these sheep contribute the biggest proportion of the mutton produced. Most of this mutton is supplied in the form of old ewes, culled sheep and wethers.

The areas suited to mutton production not only include the regions suited to wool production but also include additional areas where non-wool breeds are adapted. In the extreme West of the Cape Province and Southern Namibia where rainfall is very low the fat-tailed breeds, including the Karakul which produces a substantial amount of mutton, do well. These breeds with their relatively low body mass (45 - 60 kg) have the ability to do well on very sparse grazing, are excellent walkers and are adapted to very hot dry climates. Because these breeds are small and do not produce wool their maintenance requirements are lower. This assists survival and production in the arid regions. The Dorper, although it is a large breed (80 kg) with a high growth rate, is adapted to all regions suited to wool production as well as the quite thickly bushed regions of this country and the regions where grass seed presents a problem to wool production. The problem of tick-borne diseases (heartwater) remains a serious one to all small stock farming. However, with frequent dipping it is possible to control this disease and Dorper

farming has now even extended on a small scale into the Transvaal cattle ranching areas.

The mutton-wool breeds require a substantially higher level of nutrition than the breeds already mentioned. This is because of their high body mass (up to 90 kg), high level of milk production, as well as wool. Production from these breeds is usually in the form of fat lambs. These lambs are marketed at a live mass of between 35 kg and 45 kg which could be achieved at three to six months of age, depending on the level of nutrition and breed. The total annual nutrient requirements of mutton-wool sheep is therefore not only higher, but most of it is needed during a period of about five months of the year as compared to a much longer period and lower level of small, slow growing breeds. The areas suitable for fat lamb production have certain requirements which are very important to financial success:

- * Mutton type breeds or crosses of which at least one parent is of the mutton type should be used. High lambing percentage, fast growth, and availability of the breed is essential.
- * In order to promote fast growth in the lamb a high plane of nutrition is required, while the ewe is suckling the lamb. Green grazing, such as Italian rye grass, oats, wheat, barley, lucern or lupins, is normally provided. These nutritious cultivated pastures not only produce an ample milk flow in the ewe (for + 6 weeks) but also provide feeding for the lambs once they start grazing on their own. In good seasons, both the Karoo and other suitable sweetveld areas of the Cape and OFS are capable of providing high enough plane of nutrition for fat lamb (slaughter lamb) production with lambs being ready at +6 months of age. In fact most of our lamb probably come from this type of veld production. In other instances older lambs are sold as fat "young sheep", still unvisseled and graded as super lamb.
- * Areas that are most suited to intensive fat lamb production are those that can provide plenty of food during the winter. This is because the autumn born lamb which is reared during the winter grows the best (provided feeding conditions are good). During this period temperatures are low with the result that parasites are not a serious problem to the growing lamb which is very susceptible to these infections. For this reason the winter rainfall areas or other areas where irrigation is available are most suited to fat lamb production.
- * When the ewe is not suckling a lamb she should be grazed on cheap grazing which does not have to provide such a high level of nutrition. Areas suited to economical fat lamb production should provide this. This in particular applies to irrigation schemes where it would be uneconomical to run ewes on valuable irrigable land for 9 months of the year. Outlying grazing areas are therefore essential for cheap maintenance of the ewe when she is not productive. This necessity for cheap but suitable grazing for the ewe limits fat lamb production to areas which are normally considered suitable for sheep in any case.

3. KARAKUL FARMING

Karakul farming is confined to the drier North West Cape regions and the Southern portions of S.W.A.

The rapid growth of the Karakul industry in S.A. and S.W.A. is attributable to the following factors:

1. Suitable indigenous haired sheep, such as the Afrikaner and Blackhead Persian which were available in large numbers for grading-up with Karakul rams.
2. Karakul sheep are very adaptable to the low and variable nutritional levels of the more arid parts of the country. They can also withstand the cold and heat of these areas but are very susceptible to moist, wet conditions with heavy parasite infection.
3. The stability and comparative profitability of Karakul farming, especially during the depression of the 1930's. Although Karakul farming is heavily dependent on the sale of pelts from newborn lambs, the Karakul is also a wool and mutton producer.
4. Karakul pelts are a non-perishable commodity with the result that transportation presents no great problem in their marketing in production areas.

4. GOAT FARMING

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The goat is pre-eminently a shrub browser and may consequently be kept with advantage for the profitable utilization of higher growing bushes and shrubs which are normally not consumed by other kinds of stock. For this reason goats (Angora and Boer) are mainly confined to bushed areas. However, tick-borne diseases and difficult vermin control tend to exclude most goats from a large proportion of savanna areas in SA. Dense bush may also be unsuitable for Angora goats because of the damage to hair (combing and staining). Goats in full fleece can also get caught in certain types of bushes (Swarthaak). Angora goats are usually not found in large numbers in areas with a large variation in temperature due to the danger of stock losses during the first six weeks after shearing which takes place twice a year. Goats prefer a relatively dry, hot climate and as in the case with sheep, are not adapted to hot humid conditions, (foot-rot, tick-borne diseases - heartwater). Milk goats are very well suited to small farm systems and can be farmed with almost anywhere in the country.

CHAPTER 5

SP ratio
primary follicle
secondary "

5.1 FLEECE WOOL

The fleece does not only protect the animal from extremes of climatic and environmental conditions, but it is also utilized by human beings for protection, comfort, adornment and many other purposes.

5.1.1 Composition of the fleece

When shorn from sheep, wool contains a large amount of impurities e.g.

	<u>Range</u>	<u>Average of good quality wool</u>
Clean wool/fibre	29 - 70	55
Sebum)	8 - 40	18
Suint) Yolk	4 - 20	10
Foreign matter (sand, seeds, paint, etc.)	3 - 22	7
Moisture	4 - 26	10



Yolk: Yolk covers the surface of the wool fibres and stops friction between wool fibres and thus stops the fibres from hooking or felting. The wool from the sheep's back is always drier and more brittle owing to sunlight and weathering. Yolk also protects the wool from bacterial action and it improves handling qualities of wool. Sebum is the wax or fatty substance in yolk. Wool washeries extract the sebum and this is called lanolin. Lanolin is used in cosmetics, milking salve etc. Suint is the water soluble portion of yolk. It is hygroscopic. It also has an unpleasant smell due to stearic acid and salts. Being soluble in water the suint portion of the yolk tends to be washed to the ventral surface of the sheep. Belly wool has therefore much more suint than wool from other parts of the body.

Yield: Yield indicates the percentage clean wool which is obtained from raw wool. Factors which play a role in yield are: (1) Inherited factors (2) feeding and (3) other environmental factors such as dust etc.

<u>Type of wool</u>	<u>Ave. yield in %</u>
Merino	50
Corriedale	54
Southdown	46
Angora goat	85

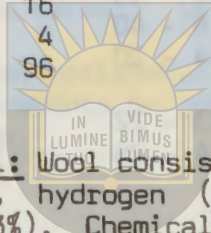
The Southdown has short wool which gets dirtier more easily. The length factor in the Merino also indicates differences in yield i.e.

Long Merino wool	57% yield
Short Merino wool	50% yield

The yield of wool is of utmost importance to the wool buyer who's interest is in the clean wool only. In addition foreign matter such as paint grass seed etc. require expensive factory processing procedures. Grass seeds for instance damage wool in the combing process and those particles which cannot be removed by combing must be removed by chemical means. Because of the importance of yield, buyers are expert at judging yield without recourse to laboratory tests.

The importance of yield in the determination of greasy wool price is indicated in the following table:

Wool character	RxR (%) Voorskot Price	RxR (%) Sale Price
Clean yield	74	45
Fibre diam.	16	38
Staple length	4	1
TOTAL	96	85



Chemical Composition of Wool: Wool consists of five elements which are: carbon (+50%), hydrogen (+7%), oxygen (+23%), nitrogen (+17%), sulphur (+3%). Chemically wool belongs to a group of proteins known as keratin or scleroproteins. For this reason wool is very similar in composition to hair, feathers, nails, horns, porcupine quills etc. As in the case of other proteins keratin is built up from numerous amino acids and to date 18 different amino acids have been isolated from wool. The sulphur containing amino acid, cystine is of major importance and is responsible for the flexible and elastic qualities of wool. Cystine constitutes +12% of the amino-acid content of merino wool. Wool also contains certain other minerals in very small quantities.

Moisture in wool: The moisture content of wool can vary considerably. This is due to the hygroscopic qualities of the suint. An example of this can be seen in the variation in mass of wool sent down from the dry Karroo to the coast. The moisture laden atmosphere of the coast can result in appreciable increase in wool mass. The more yolk the wool has the more moisture it will absorb as well.

All natural fibres have the ability to absorb moisture from the atmosphere very readily, with wool having the highest regain (moisture present expressed as % of oven dry weight) for equilibrium with an atmosphere of given relative humidity. Wool can thus pick up moisture or loose it - according to the RH of the climate. This means that woollen clothing acts as a considerable buffer to changes of humidity and climate. The action of absorbing moisture also gives off heat. Baled wool that becomes wet can heat up and catch fire. This has happened in wool stores and in ships. This is a very important reason for not shearing wet sheep. In order to cope with rainy weather at shearing time farmers provide shelter. The hygroscopic quality of wool assists with manufacturing processes as moisture absorption makes wool more pliable, with the absorption of colouring matter

and also aids in the felting of wool.

5.1.2 Structure of the fibre

The normal hair fibre consists of a cuticle on the outside, a medulla in the centre and a cortex between these two. Wool in the ideal form consists only of the cuticle and cortex, the presence of a medulla being regarded as highly undesirable.

The cuticle: The cuticle is a thin single layer of cells which form the outer layer of the fibre. In wool these cells are arranged like roofing tiles - one overlapping the other and this gives a scaly appearance. The ridges of the scales all point towards the top of the fibre. These cells are Keratinised or hardened in the root sheath.

The cortex: The cortex is immediate below the cuticle and consists of macrofibrils which are bound by intercellular cement. The macrofibrils are made up of microfibrils in the same way, and the microfibrils of protofibrils. Nine protofibrils are joined in a ring around two protofibrils on the inside (this pattern also in other body tissue such as muscle fibres). The protofibril consists of three Pauling-type α (alpha) helices. These α helices are twisted forms of protein chains.

The medulla: This forms the centre portion of the fibre. It is, however, absent in fine Merino wool. The Medulla is formed last by the papilla and also keratinises last. As the medulla dries and gets harder it shrinks and air spaces are so formed in the middle of the fibre. The product of a follicle is a hair fibre if it has a medulla and a wool fibre if it has no medulla.

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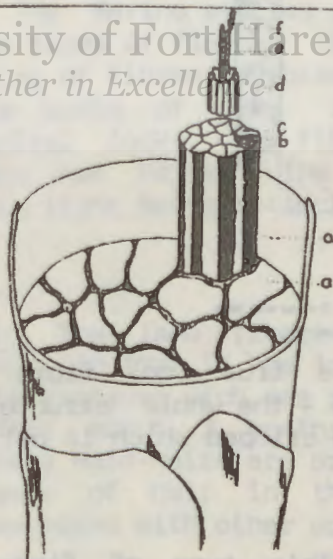


Fig. 5.1. Finer structure of the wool fibre

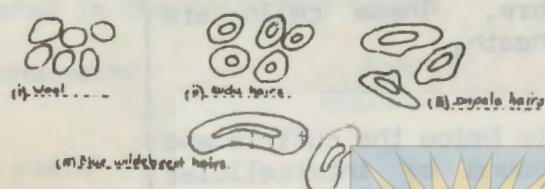
a, b = cortex cells c = macrofibril d = microfibril e = protofibril f = α -helix

5.1.3 Different types of hair/wool fibres

The ancestors of the Merino had an outer layer of long coarse, brittle and medullated fibres (Kemp) while the inner layer consisted of crimped elastic wool fibres. By selection over centuries the fleece of the Merino has been changed completely to that of the inner fleece of shorter fine wool. In other words the primary fibres produced by the primary follicles have become thinner, without medulla and much finer with the result that a uniform wool covering has been produced. In sheep breeds where this selection has not been carried out we still have the primitive fleece e.g. the Blackhead Persian and Karakul.

It has also been found that the same follicle can produce more than one kind of fibre during its lifetime. In the wool sheep the thick kemp fibres in the lambs coat at birth are replaced by wool fibres in the mature sheep. There are exceptions to this and some do not lose this coarse primary fibre. In wool sheep there is naturally strict selection against this characteristics.

A cross section of different fibres shows differences in fibre outline or contour. A symmetrical and round fibre occurs seldom. Wool is oval to elliptical in form. Contour of fibres makes it possible to identify the hair, of different species of animals e.g.



The fibres occurring in the fleece of sheep are classified as follows: 1. True wool fibres (no medulla) 2. Heterotype fibres 3. Doghair fibres 4. Kemp

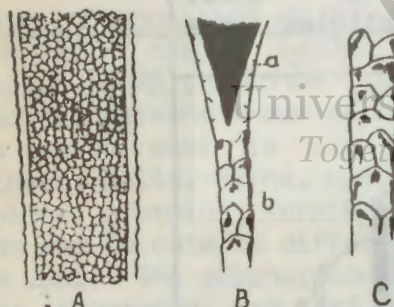


Fig. 1. A = kemp fibre B = heterotype fibre C = true wool fibre
a = kempy phase b = woolly phase

True wool fibres: The true wool fibre consists only of a cuticle and a cortex - the whole structure is solid. The wool fibre is also crimped which is not the case with other fibres.

Heterotype fibres: This type of fibre consists of two portions - a kemp portion on the tip and wool on the root portion. The kemp portion has a well developed medulla. This type of fibre is only present in the fleece of the lamb.

Dog hair fibre: (hondehaar, blinkhaar) This fibre is an intermediate between kemp and wool and has a medulla. It differs from kemp in that it is not so thick or rigid. It is found in the new born lamb as well as in the breaches of mature sheep. It is sometimes referred to as "halo-hair".

Kemp: (Steekhaar) Kemp is a straight, coarse, brittle and non-elastic fibre with an off-white colour. There is a well developed medulla. In the Merino kemp fibres are usually short (12 mm long) and are normally found on the face, between the horns and on the non woolled parts in the groin and armpits. Kemp fibres in the Merino is a

disqualification. The contour is oval or bean shaped. Kemp fibres are not easily dyed. In other breeds Kemp fibres can be red or black in colour. The Angora goat can also have kemp fibres.

5.1.4 Different types of hair/wool covering found in sheep

Double fleece: The fleece is made up of long medullated fibres on the outside and finer wool fibres on the inside. The outside long fibres have a protective function of heat reflection while the inside wool keeps the animal warm. Both types of fibre are shed each year. The long fibres grow out first for the summer and the shorter fibres grow later for protection against the cold. The Blackhead Persian, Karakul, Wild Argali, Mouflon and American Bighorn sheep have this type of fleece. Several British breeds of sheep have a similar type of fleece which is shed once a year. This is called "cotting" while the growth of the new fleece is called the "rise". These sheep do not, however, shed their coats because they are shorn. The Scotch Blackface, Cheviot and Welsh Mountain are examples of these sheep breeds.

Uniform type of fleece: Fleeces falling under this category can vary from the coarse woolled British lustre (shining) wool breeds to the fine wool of the Merino. This wool is always in locks or staples. The Merino staples are much shorter and larger. In all these types of fleeces there is continuous growth and no shedding of fibres. Fibres are of uniform type. The long lustre wools of the Lincoln, Leicester etc. is in long spiral locks. The fibres are coarse and have a medulla but are not hairy. The lustre appearance of the wool is due to light being reflected from the cuticle and medulla.

The fleece of the Merino lamb: The lamb fleece always differs from the fullgrown sheep in that it has long hair fibres. These hairy fibres are heterotypes which are produced by the primary hair follicle. After about 3 months these hairs break off and no more of these halo-hairs are produced. However, because of this presence of hair in the lambs fleece, lambs wool should never be mixed with other wool.

5.2 SHEARING TIMES AND MANAGEMENT

Shearing time for the fibre producer can be compared with harvesting time for the grain farmer. The end product, cultivated over a long period with care and at high cost, must be gathered and prepared for marketing.

5.2.1 Sheep:

In the RSA shearing times vary, usually at 12 months, 10 months, 8 months and 6 months wool growth. The clips can be described as follows:

1. Long wool clips:

- a. 12 months wool growth - length A, but also AA and B lengths.
- b. 10 months wool growth - length mainly B, but also A and C lengths.

2. Medium length clips:

8 months wool growth - length mainly C, but also B and D lengths.

3. Short wool clips:

Six months wool growth - length mainly D, but also C and E lengths.

The time of the year when shearing is to take place depends upon the length of wool on the sheep, climatic and feeding conditions, mating and lambling seasons, etc. Shearing cannot take place during lambing time and during coldest winter months as this may result in considerable losses.

Long wool is usually shorn in parts of the country where grazing conditions are favourable and where supplementary feeding is possible available.

Advantages of long wool clips:

1. Sheep are shorn once a year which means a saving in shearing costs.
2. Management on a sheep farm is simplified and standing arrangements can be made with shearing teams.
3. Long wool clips are easily handled and classed.
4. Longer wool has over a long period claimed a price advantage in the trade.
5. Sheep are less exposed to adverse weather conditions.

Advantages of short wool clips:

1. Drought conditions resulting in poorer wool growth and tender wool also often compel farmers to shear shorter wool.
2. Wool damage by weathering as well as dust penetration is restricted.
3. Short-wool sheep will also thrive better on natural pastures where "steek-gras" and/or bush predominates.
4. External parasite attacks such as blowfly, itch mite, scab-mite, and keds can better be controlled on short-wool sheep.

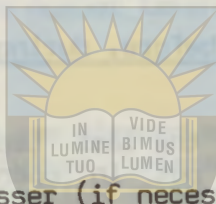
Advantages of Medium length clips over short wool clips:

1. Can be prepared more easily,
2. Enjoy stronger competition because of the better length,
3. Involve lower shearing costs (3 - /2 years: 4 - /2 years)

Disadvantages of short wool clips:

1. Shearing cost are doubled as sheep must be shorn every six months,
2. In the case of sheep with wool of fairly good density and substance, the tip of the wool shorn at twelve months should be less than the collective tip of two six-months clips. This may result in a lower price, mainly as the result of a lower clean yield.
3. Improvement of the flock is largely achieved by regular and careful classing. The best time of classing is when the wool is as close as possible to twelve months. Certain wool characteristics such as bulk, substance, staple formation, tip and yolk change considerable from six months to twelve months growth.
4. Sheep are exposed to danger of weather twice a year.

Management at shearing



Handwritten signature

(i) Preliminary planning:

- (a) A shearing team and a classer (if necessary) should be arranged beforehand to ensure that the sheep are shorn on time.
- (b) The shearing shed must be prepared in good time and the floor thoroughly swept and washed. It is also desirable to thoroughly disinfect. (black-quarter).
- (c) All requisites such as woolsacks, hooks marking material, disinfectants for floors and shears, stencils, etc. must be arranged for betimes.

(ii) Precautionary measures to be taken:

- (a) Clipping of brands: All paint and tar marks should be thoroughly clipped before the sheep are brought onto the shearing floor. (All brands, whether scourable or not, must be clipped off).
- (b) Avoiding of wet or damp wool: It is absolutely essential that the wool on the sheep should be dry before it is shorn and baled. (Wool dries faster on the sheep than it does when shorn). The disadvantages of wet or damp wool are the following:
 - (i) When wet or moist wool is baled the appearance of the wool is adversely affected which in turn influences the price. Under pressure spontaneous combustion can take place, which result in serious fires.
 - (ii) Wool in a damp or wet condition cannot be offered for sale as the buyer cannot possibly estimate its clean yield and determine its value. (not NB during objective sale)
 - (iii) Wet or damp wool necessitates more handling and this incurs extra costs which have to be born by the producer.
 - (iv) In hot wet climates, bacteria and moulds can affect wool.

- (c). Before shearing commences, sort out the different groups of sheep, i.e. lambs, dry ewes etc. to help with the classing of the wool.

5.2.2 Angora goats:

Under normal conditions a well-bred Angora goat will produce 25 mm of mohair per month. In South Africa, Angora goats are usually shorn twice a year at intervals of 6/6 months or 5/7 months. Hair shorter than 125 mm goes to the woollen industry and therefore has a much lower market value. Too long mohair tends to be combed out in dense bush, and stained more easily.

Shearing of pregnant Angora goat ewes is not advisable during the 4th month of pregnancy i.e. from 90 to 120 days of pregnancy.

Management of Angora goats, before, during and after shearing

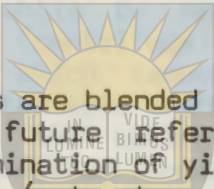
- i. It is advisable that for the last two months prior to shearing, goats should be put in open camps to prevent combing and staining of mohair.
- ii. After 3 - 4 months of hair growth, crutch all the animals to avoid stained mohair.
- iii. Collect stock 12 to 24 hours before they are due to be shorn.
- iv. The animals should never be bunched before shearing, to prevent unnecessary staining.
- v. Do not drive animals along a dusty road to the shearing shed.
- vi. Put the first shearing lot for the following morning under cover, but give them plenty of space. This is to keep the dew off their fleeces. Forty goats for the first lot would be a reasonable total, otherwise shearing may be delayed in winter due to dew.
- vii. Run rams separately for a day or two previous to shearing in the autumn if they are still in rut.
- viii. Graze the shorn animals in a camp in which it is easy to collect the goats. A shed or other suitable shelter is most desirable in the case of bad weather.

5.3 WOOL MARKETING

During 1974 the objective measurement of wool was introduced. Objective measurement of wool is the scientific determination of certain physical properties of the wool fibre. These are fibre diameter, clean yield and vegetable matter. There are, however, other properties such as fibre length, colour and the distribution of vegetable matter throughout the lot that cannot be determined scientifically. These are still evaluated subjectively and that is why a sample of wool must still be displayed for appraisal purposes in order to determine these characteristics.

Traditionally wool was appraised by means of the hand-and-eye method. Subjective assessments can sometimes be very inaccurate due to the great differences that may exist between the visual values and objectively measured values for the same parameters.

Upon receipt of the wool at the store, wool samples are taken from each independent lot. The minimum required mass to make out an independent "lot" is 440 kg, or 4 bales. (The minimum bale mass is 110 kg). If the total mass of a certain wool type from a farmer is less than 440 kg it is then combined with other wool of the same line (subjective) and then treated as a full lot for objective measuring. Two types of samples are taken per bale. The first is a grab sample for subjective assessment which is done by a mechanical arm forced into the bale, extracting a sample. The number of grab samples per bale depends on the size of the lot. The second sample is a core sample which is taken with a sharp core tube (± 22 mm dia.) and the number taken per bale also depends on the size of the lot.



In the laboratory core samples are blended and sub-sampled. One sample is stored away for future reference while the other are used for the determination of yield or wool base through treatment with alcohol (extract residual grease), NaOH or caustic soda (to determine vegetable matter), and ashing (to determine sand content). A further sample is carded and used to determine fibre diameter in the air-flow meter.

5.3.2 Economical importance of fleece characteristics

Until recently, the relative contribution of the various physical characteristics of wool to the quality of the end product and hence the sale price of greasy wool was not fully realized. Physical characteristics include fineness, length, yield, seed content, staple crimp, style, tensile strength, weathering, colour and presence of coloured fibres which all have an effect on the quality and amount of the end product of fabric. Of these characteristics, mean fibre diameter is of overwhelming importance in determining yarn and fabric properties, followed by fibre length and staple crimp. In a recent survey (Australia) it was found that the major variation in clean wool price was due to variation in average fibre diameter. On the South African wool market, the general trend is that for each micron less than 25 microns fibre diameter, the price paid per kilogram clean fleece wool increases by 30 cents plus, other characteristics being equal. For mohair, the price premium for fineness is even larger. A change of 1 micron in fibre diameter generally has a greater effect on the yarn properties than a change of 10 mm in fibre length.

Tender wool, as well as severely weathered wool (back wool) brake easily during processing and result in a higher percentage noil (comb waste) and is therefore penalised and should be packed separately. Presence of vegetable material affect yield as well as the amount of noil. In certain cases

the amount and type of vegetable matter may require carbonization which result in higher processing cost and hence lower sale price. It is therefore advisable to remove as many seeds possible prior to shearing and/or prevent the grazing of harvested lands. It is also important to remove most of the seeds from the main fleece line during classing of the wool (skirting of the fleece). Staple crimp has a direct effect on the spinning performance of the wool as well as on other characteristics of the fabric. Presence of coloured fibres as well as other colour markings (paint) and stained (urine) fibres causes a severe price penalty. The presence of coloured fibres should be identified during shearing and paint or other markings should also be removed before shearing. Stained wool must be packed separately.

The relative importance of some of the physical characteristics of wool on the fabric properties is presented in Fig. 5.6.

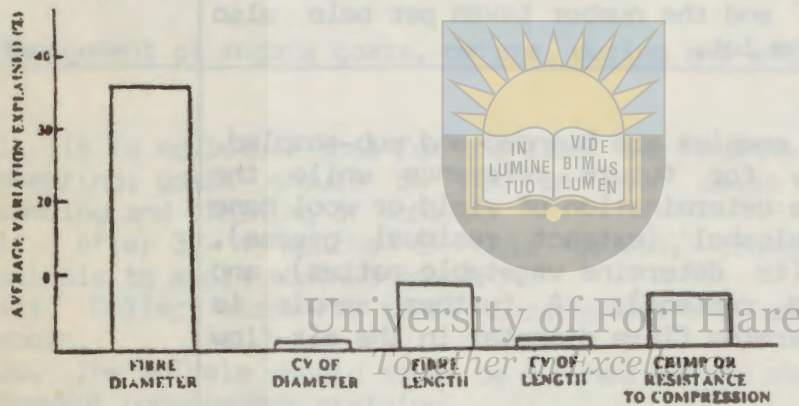


Fig. 5.6 - Percentage contribution of the various fibre properties towards explaining the observed variations in fabric physical properties (averaged over the properties of both knitted and woven fabrics).

5.4 Wool processing: (sorting, blending, scouring, drying and carbonizing)

5.4.1 Sorting and blending: Raw wool has to be sorted when it arrives at the factory. Although the fleeces were classed in the shearing shed according to length and fineness, further sorting is necessary. Quantities of wool of different qualities are blended for the manufacture of particular types of cloth. The different qualities are piled one on top of the other in horizontal layers and lots are removed vertically for processing.

5.4.2 Wool scouring: The sorted wool is as dirty as when it was removed from the sheep's back and contains impurities such as natural wool grease and suint, sand, seeds, grass, twigs and leaves. Before further processing can commence it has to be washed. The wool is delivered to the hopper feeder from where it is transported by a series of harrows or rakes through the scouring bowls containing either warm soapy water and soda ash or a warm neutral detergent solution. After thorough rinsing the excess water is removed by squeeze rollers. In a new type of wool scouring machine a jet system sprays the scouring liquor into the wool which is transported by means of conveyer belts or perforated cylinders. With this method less felting of the wool occurs than in the conventional scouring process.

Wool grease is sometimes removed from the raw wool by a "dry cleaning process" in which the wool is washed in an organic solvent. The solvent is recovered for re-use by distilling it under reduced pressure.

5.4.3 Drying: The wet scoured wool has to be dried and this is done in a large unit called a drier. The wool is transported through the machine on lattice aprons or by means of perforated cylinders while air heated over steam pipes is forced through the machine.

5.4.4 Carbonizing: The wool is now clean and white but may still contain a considerable amount of vegetable matter such as seeds and burrs. If it is very seedy it has to be carbonized. Small amounts of vegetable matter can be removed during the carding and combing processes but large amounts of seeds and burrs will result in extensive machine damage. The wool is immersed in a bowl of diluted sulphuric acid and the excess acid is removed after a while by means of squeeze rollers or in a hydro-extractor (centrifuge). The expressed wool is then dried in an oven which removes water only, leaving behind a more concentrated acid which carbonizes the vegetable matter present during the baking process. The carbonized matter is then pulverized under a set of heavy rollers and shaken or blown out of the wool. The carbonized wool is often first rinsed in water and then in a soda solution in order to neutralize the remaining sulphuric acid. Due to the extra handling of wool as well as the chemicals required during carbonization, processing cost of seedy wool is much higher than wool which is relatively free from vegetable matter. Furthermore, both the tensile strength and colour deteriorates during carbonization, hence seedy wool fetches lower prices.

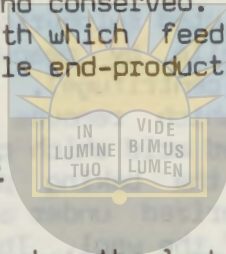
CHAPTER 6

NUTRITIONAL ASPECTS OF SMALL STOCK FARMING

Feeding has long been the most valuable tool by which man manipulates productivity in his domestic animals, and small stock is no exception. The cost of feed in some way accounts for the major cost of small stock enterprises, although in more extensive systems this is often indirectly reflected through the cost of land (interest) or rent. It is therefore understandable that one of the major objectives in small stock farming is to optimise the feeding system for maximum profit. This can be obtained by optimising

1. The production of feed per unit of land
2. The degree to which supplementary feeds complement roughage, fresh and conserved.
3. The efficiency with which feeds are converted by sheep into saleable end-products.

6.1 NUTRITION OF THE LAMB



Until the age of three weeks, the lamb can be regarded as a non-ruminant and is totally dependent on milk from which it obtains all its nutrients. Most if not all of these nutrients are to be found in the butterfat, casein and lactose. The new born lamb has sufficient energy reserves in the form of body fat (abdominal) to survive for two to three days under normal conditions without milk. When these reserves are exhausted the lamb dies. To stay alive, the lamb must receive colostrum as soon as possible after birth. Furthermore, it is essential that the lamb should get colostrum during the first 2-3 days of life from which it obtains immune antibodies for protection. From three to eight weeks which is called the transition period, measurable quantities of solids (roughage and/or concentrates) are consumed and digested in the developing rumen of the lamb. (Creep feed, if used, should therefore be provided from three weeks onwards). At eight weeks and older, the lamb is regarded as a ruminant. This is the earliest practicable age of weaning under semi-intensive and extensive conditions in South Africa. However, weaning at this age should be accompanied by a high level of nutrition, either in the form of cultivated pastures or creep feeding.

Growth: A typical growth curve is presented in Fig. 6.1(a). It shows how growth accelerates in the first few months, then slows down towards puberty and continues to decline progressively as maturity is reached. As the lamb increases in mass and age, the mass of the carcass relative to the non-carcass components* increases. The carcass itself is made up of bone, muscle and fat. As the lamb grows, the proportion of muscle and bone decreases as the proportion of fat increases. The ratio of muscle to bone also increases (see Fig. 6.1 b).

↑ carcass : non-carcass
muscle : bone / fat ↑
muscle ↑ bone ↓
growth rate ↑
+ muscle : fat ↓

* tripe, trotters & skin.

The rate of growth and the proportion of fat to muscle laid down are both affected by the level of nutrition. On a high level of feeding, lambs grow faster and fatten at lower body mass than on a low level of feeding. Faster growth is accompanied by a greater rate of fat deposition in relation to muscle. A lamb that grows fast could be slaughtered both earlier and at a lower mass with the same degree of fatness than a slower growing contemporary.

Energy requirements: The lamb needs energy both to maintain its body and to grow. The amount of energy needed for maintenance increases as it gets bigger so that still more feed is needed to grow at the same rate at a higher livemass. Furthermore, as the lamb grows it lays down progressively more fat in relation to muscle. The energy content of fat is far greater than that of muscle and in addition fat free muscle contains about 75% water, so more energy is needed per kilogram gain as the lamb gets bigger.

Protein requirements: Unweaned as well as early weaned lambs need high quality protein such as casein in milk to sustain fast growth. Animal protein (fishmeal, milk powder etc.) is excellent for this purpose, but usually expensive as well. Cheaper plant proteins e.g. soyabean meal, supplemented with fishmeal or other animal protein is a much more viable and economical proposition in rations for lambs in the pre-ruminant stage. The crude protein (CP) content of these rations should not be lower than 16%, although 18% seems to be optimum. The concentration of feed protein required by lambs decreases with an increase in body mass, more so for slow growing lambs.

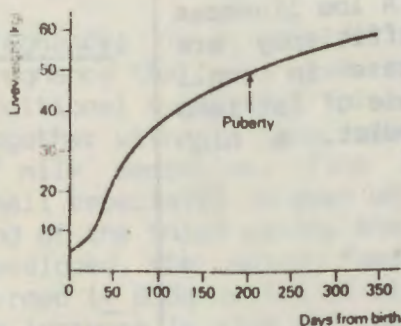


Figure 6.1(a) Typical growth curve of Suffolk cross lamb

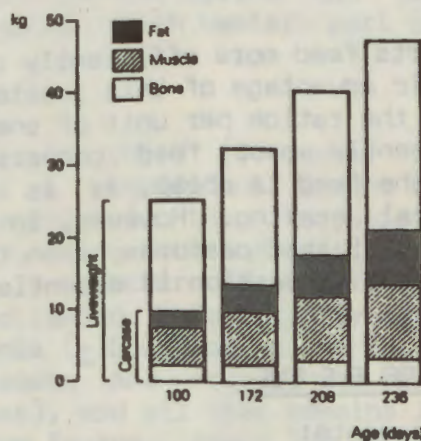


Figure 6.1(b) Changes in the composition of lambs with increasing age and liveweight

Older lambs can use NPN sources such as urea because the rumen microbes are capable of synthesising protein from NPN. However, urea can be poisonous and should not constitute more than 1% of the complete ration. The microbes require energy for protein synthesis from NPN and a high-energy (cereal and/or molasses) supplement must be fed together with urea to allow effective utilization.

Mineral requirements will be discussed in section 6.3

Feeding strategies of the lamb:

If the lamb is fed a high-energy diet to appetite, it grows fast. Less of the total feed is required for maintenance because it takes fewer days to reach the desired livemass compared to a lamb on a lower energy intake. More feed is available for gain. If the amount of diet is restricted or the energy content of the diet reduced, there is less energy available for gain and the lamb, grows slowly, takes longer to reach the desired livemass and a much higher proportion of the feed is consumed for maintenance. Table 6.1 shows how the amount of feed needed to increase in livemass by a given amount (20 kg) increases progressively as the energy content of the diet and the rate of gain are reduced.

Table 6.1. The effects of different dietary energy concentrations on livemass gain and feed conversion efficiency of lambs fed to appetite between 20 and 40 kg livemass.

ME content of the diet (MJ/kg DM)	Livemass gain (g/day)	Growing time from 20-40 kg (days)	Feed conversion ratio (kg DM/kg gain)
9	100	200	11,6:1
10	150	135	8,1:1
11	200	100	6,3:1
12	250	80	5,0:1
13	300	65	4,2:1
14	350	55	3,5:1

The lamb converts feed more efficiently on high-energy diets, but the economic advantage of this greater efficiency depends on the cost of the ration per unit of energy. A low livemass gain and apparently poor feed conversion efficiency are acceptable if the feed is cheap, as is the case in small stock on natural grazing. However, in the case of fat lamb production on cultivated pastures or in the feedlot, a high efficiency of feed conversion is essential.

6.2 NUTRITION OF THE EWE

Nutrient requirements:

Like all animals the nutrient requirements of the ewe are by no means static and are determined by factors such as body size (maintenance) and state of production. Production can be any one or combination of the following major functions: pregnancy, lactation and wool production. A schematic presentation of the nutrient requirements of a ewe is given in Fig. 6.2.

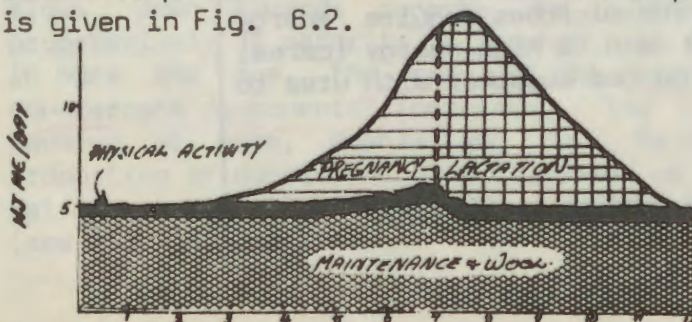


Fig. 6.2. Schematic presentation of the requirements of a ewe.

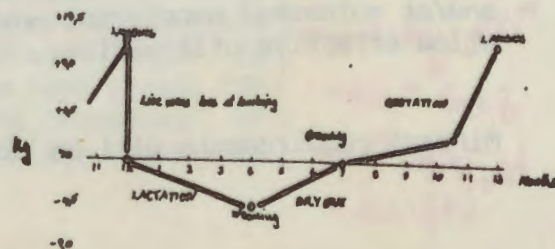


Fig. 6.3. Live mass change of a 10 kg ewe with lambs.

Maintenance: The primary nutrient required for maintenance is energy and is related to the bodymass of the animal. The heavier the animal the more energy is required to maintain it and vice versa. Fig. 6.3 shows a normal change in livemass of a 70 kg ewe rearing twins.

Physical activity: Under normal conditions the amount of energy used for standing, walking and grazing does not contribute a large proportion of the total energy expenditure. Under normal grazing conditions, physical activity makes out 24% of the maintenance requirement. However, in some instances, e.g. drought, grazing activities of sheep have been reported to result in increases of up to 70% in their daily energy expenditure.

Wool production: Wool growth also increases the nutrient requirement of sheep as indicated in Table 6.3.

Table 6.3. Nutrient requirement for wool production.

Breed	Wool Yield	Kg TDN/100 kg live mass
Black Head Persian	-	0,93
Dorset Horn x Merino	XX	1,04
Merino	XXX	1,11

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This data demonstrates that increased wool growth increases nutrient requirements which explains why the Merino can not be farmed successfully in the barren North Western part of the country.

Pregnancy: It is only during the last third (6 weeks) of pregnancy that the ewe requires a significant amount of additional nutrients for the growth of the foetus(es) together with the requirement for udder growth and initiation of milk secretion, (the latter two factors are relatively small especially in ewes which had lambed before). By the end of the third month, the placenta ($\pm 500\text{g}$ /foetus) is fully developed, the major foetal tissues and organs have been formed ($\pm 600\text{g}$ or 14% of birth mass), and all that remains is an increase in size and mass of the foetus. About 72% of the foetal growth takes place during the final six weeks of pregnancy.

The increase in nutrient requirement over the last six weeks starts earlier and is more pronounced the greater the number of lambs carried or the heavier the foetus. It is suggested that a multiplying factor of 1,5 for single lambs and 2 for twin lambs times maintenance is used to derive the energy requirement during the last 6 weeks of pregnancy.

Lactation: The requirements during peak lactation are approximately three times those of a dry ewe, depending on the level of milk production and milk composition. Several factors influence milk yield in the ewe. One such factor is

requirements, increase with an increase in the number of lambs born as well as the suckling load. This trend is indicated in Fig. 6.4 (a). The age (see Fig. 6.4 (b)), breed or cross, and body mass of the ewe is also important in relation to milk yield.

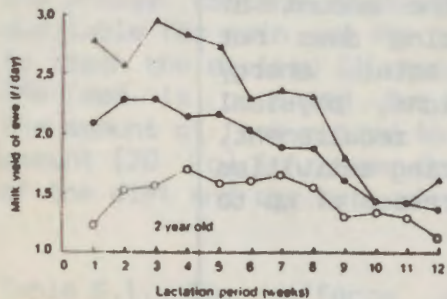


Figure 6.4(a) Lactation curves of single (o—o), twin (o—o) and triplet suckled (Δ—Δ) ewes

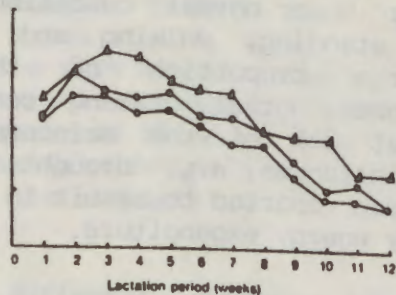


Figure 6.4(b) Lactation curves of 2 yr (o—o), 4 yr (o—o) and 6 yr old (Δ—Δ) ewes with twins

The nutrient requirements are also dependent on the quality of the milk produced. The Blackhead Persian for instance produces milk of greater nutrient content than the Merino and therefore requires more nutrients to produce a given amount of milk, eg.

Table 5.4 The effect of quantity and quality of milk produced on nutrient requirements.

Type of ewe	Milk prod. (kg)	TDN for milk prod. (kg)	% BF	Total solids (%)	TDN per kg milk (kg)
Blackhead Persian	,45	,21	8,4	19,2	0,47
Merino	,67	,28	6,7	18,4	0,41

Feeding strategies of the ewe:

There are certain times of year when adequacy of diet and body condition (in other words, meeting the full requirements) are critical, and other times when controlled livemass loss and reduction in condition are acceptable or even desirable. Ewe condition and vitality* at mating affect the number of eggs shed, hence the number of lambs born. (See Table 6.5).

For high lambing percentages, ewe should therefore be in good condition and/or be flushed, starting at three weeks prior to mating until about 80% of the ewes have conceived. It should be mentioned however, that there are breed differences in the response to flushing. More prolific breeds and crosses respond less dramatically or not at all to flushing. The plain of nutrition or ewe condition will also have an effect on flushing performance as indicated in Table 6.5.

*A ewe that is gaining in condition usually possesses more vitality than either one that is losing condition or one that is maintaining the same live mass.

Table 6.5 Influence of livemass and vitality on lambing % in Merino.

Merino ewes*	Lambing %
Heavy ewes gaining condition	168
Heavy ewes losing condition	149
Light ewes gaining condition	159
Light ewes losing condition	142

*All ewes were fed over the flushing period.

Flushing is usually done through supplementation of 200-300 g of whole maize/ewe per day during the last three weeks, prior to mating, then reduced to $\pm$ 100 g at the start of mating, for another three weeks. Any feed, however, can be used for flushing as long as the ewes would gain in livemass. For this reason natural (spring) flushing or spare camps are equally suitable for flushing.

To sum up for flushing, good condition at mating, achieved by providing good grazing or supplements in the period before and during mating, is the target for all levels of sheep production if maximum lamb production is to be achieved.

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Maintenance of condition during the first month of pregnancy is important to embryo survival while in mid pregnancy, the ewe may be permitted to lose some body mass, provided the health is not affected.

From Fig. 6.1. it is apparent that during late pregnancy (last 6 weeks), the nutritional requirements in protein and energy of the ewe almost doubles. Maintenance or sub-maintenance feeding level during this period could easily and usually does result in abortion or low foetal growth rate and consequently a low birth mass which will inevitable lead to an increase in mortality rate of the lambs. This situation can only be rectified if the heavily pregnant ewe is put on excellent grazing (not always available) or if she possesses over - sufficient body reserves which she can mobilize. However, the last option could result in the collapse and possible death of the ewe due to "twin lamb disease" (pregnancy toxemia) which is caused by the rapid breakdown of fat in the body. This disease will also result under stress conditions e.g. transportation or sudden nutritional changes of the heavily pregnant ewe. It is therefore clear that during the last six weeks of pregnancy the ewe should be on good grazing, disturbed as little as possible, and already be in good condition. If the natural grazing does not provide this level of nutrition, ewes should be supplemented with at least a good source of energy. *Here*

Livemass and condition loss will usually occur during early lactation, that is besides the loss due to lambing. This is so because body reserves are used during peak lactation. Feeding during early lactation has the greatest effect on

milk production and should therefore be as close to optimum as possible, especially in multiple suckled ewes. Performance of sheep ewes and lambs on a high (H) or low (L) plain of nutrition during pregnancy followed by a high (H) or low (L) plain during lactation is given in Table 6.6.

Table 6.6. Performance of ewes and lambs on different plains of nutrition during pregnancy and lactation.

Treatment during preg./lact.		Birth mass (kg)	Milk prod. (ml/day)	At 16 weeks (kg)	At 108 weeks* (kg)*
H	H	4,34	1400	18,6	53,2
H	L	3,54	910	10,3	48,1
L	H	2,59	1250	15,8	48,5
L	L	2,00	710	8,6	44,3

*All lambs were weaned at 16 weeks, followed by a high plain of nutrition for all groups.

The loss in body condition during early lactation should be recovered as soon as possible if mating has to commence shortly after weaning. Under normal veld conditions, lactating ewes should start to regain bodymass from about 6 - 8 weeks post lambing. If mating takes place once a year, the ewes have another 2 - 4 months after weaning during which they can make major recoveries before coming round to mating again. The reproduction cycle of a ewe is summarized in Fig. 5.6.

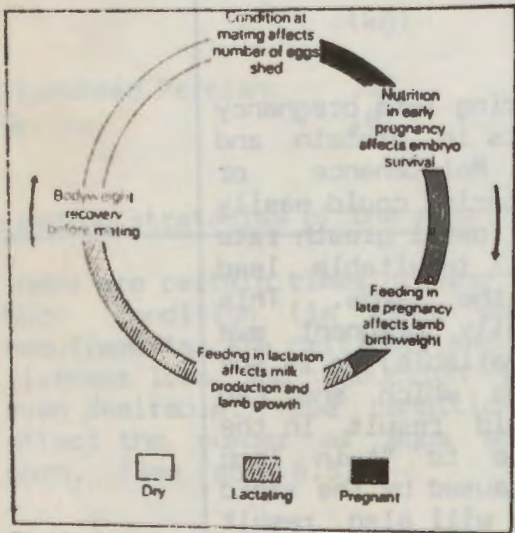


Figure 6. 4. The annual cycle of nutrition and production of the ewe

Problems will arise when an imbalance occurs in this cycle. For example, ewes in good condition (flushed) at mating will produce more twins but, if condition is allowed to decline in late pregnancy and feeding is inadequate, small non-viable lambs will be born. Under most veld conditions, the nutritional level is such that twin suckling ewes cannot rear their lambs successfully. The end result is usually high mortality rates and slow growing lambs. These twin-rearing ewes may further be unable to regain body mass sufficiently

to achieve ovulation at all at the next mating.

For wool production a fairly constant level of nutrition is required throughout the year. Sheep that are allowed to lose too much condition i.e. during a drought (some areas during winter as well) do so at the expense of their fleece. Wool grown under such conditions cannot recover, but is reflected in light and tender fleeces (wool fibres are much finer), frequently showing a "break". The fleece may even be partly or entirely shed. Underfeeding can cause a 30% reduction in wool yield. On the other hand there is very little difference in wool yield between high and very high levels of feeding.

6.3 SMALL STOCK ON NATURAL GRAZING

The nutritive value of natural pasture varies considerably, not only during seasons and from one place to another but also as a result of different management practices. At its peak, well managed veld usually provides enough energy and protein to satisfy the requirements of a productive animal. However, if the period during which requirements of the animal are high (e.g. lactation) does not coincide with a period of high veld production, the natural pasture may not be adequate and feed supplementation may therefore be necessary. (See Fig. 5.6). Obviously, unfavourable conditions will further decrease the provision of nutrients by the natural pasture and vice versa.

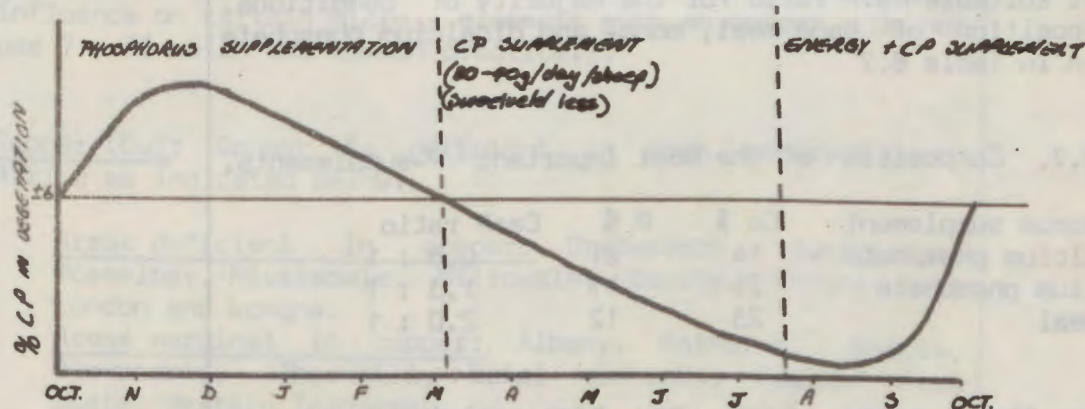


Fig. 5.5. *Crude protein status of natural grazing.*

The cheapest way to rectify protein deficiencies on the veld is through urea containing licks or blocks which usually has molasses as a basis. Urea in licks is usually included at a rate of 8%. Urea (1 kg) dissolved in 10 - 15 kg molasses and further diluted with water could be sprayed over veld grass hay and other roughages.

The incidence of occasional energy deficiencies in natural pastures is the most serious limiting factor of growth, production and reproduction. A shortage in energy is usually the result of seasonal or periodic droughts and bad veld management. The best indicator for an energy deficiency is to monitor the condition of the animals. When circumstances demand it, supplementation, with high energy feeds should be considered as a means of maintaining optimal production.

Pasture analysis throughout South Africa indicated reasonable quantities of potassium, calcium, iron and iodine (except in Natal midlands & Langkloof valley for I). Deficiencies in phosphorus, manganese, magnesium, copper, cobalt, zinc and selenium were identified in various regions. However, in some areas certain minerals may appear to be adequate, but their absorption can be affected by certain other minerals which are present in either too great or too low quantities. Under certain small stock management practices (mainly intensive) calcium and magnesium should also be considered as possible deficiencies.

Phosphorus (P): The phosphorus level in most of S.A. soils and pastures is low. Although the phosphorus level of the grazing during summer in the Western Transvaal, Northern Cape and Karoo seems adequate, high calcium levels will interfere with the utilization of this element.

Supplementation: - Under extensive conditions phosphorus is usually supplied in the form of a lick. [Licks containing P should also contain protein/NPN as well as an energy source (maize/molasses) for best results]. The most widely used level of phosphorus in licks is 6% but in some cases sheep may do well on 4%. It should further be noted that veld grazing provides adequate levels of calcium all year round and in some areas (as mentioned above) calcium levels are very high in soil and water. Because of the negative effect of high calcium levels on phosphorus utilization it is generally advisable to use monocalcium phosphate which has the most suitable Ca:P ratio for the majority of conditions. The composition of bone meal, mono- and dicalcium phosphate is given in Table 6.7

Table 6.7. Composition of the most important P-supplements.

Phosphorus supplement	Ca %	P %	Ca:P ratio
Monocalcium phosphate	14	21	0,6 : 1
Dicalcium phosphate	21	17	1,3 : 1
Bone meal	23	12	2,0 : 1

NS: For those areas where very high calcium levels are known, monosodium phosphate should be used. Also, molasses is low in phosphorus.

The effect of phosphorus supplementation in a mineral lick to sheep is illustrated in results obtained in the sourveld at Dohne.

Table 6.8. The effect of phosphorus supplementation on sheep.

	<u>Control</u>	<u>Phosphorus supplementation</u>
Mortality in ewes %	32,3	25,0
Mortality in lambs %	69,9	36,8
Wool production/ha (kg)	27,3	34,0
Av. live mass of ewes (kg)	31,8	35,2

Sodium (Na) and Chlorine (Cl): Although requirements for salt have not yet been established, the inclusion of salt in licks and other supplements has three main functions.

(1) To supplement possible deficiencies of sodium and chlorine and to satisfy the craving animals have for salt.

(2) To encourage intake of licks which will contain less palatable, but very important supplements such as phosphates and protein supplements (urea).

(3) To limit and control intake of supplementary feeds such as fish meal and maize meal. Although grazing animals have high tolerances for excessive quantities, too much salt in a lick will also limit intake and thus control the amount of supplement being supplied. (For limiting intake of licks, from 10% to 15% salt may be added).

Sulphur (S): The addition of sulphur to the feed of grazing small stock is usually unnecessary but care should be taken with sheep and goats producing wool or mohair on urea supplemented diets. Sulphur is the main constituent of the amino acid cystine which is partly responsible for the elasticity in wool. The inclusion of 1 - 2% sulphur in licks has been found to reduce the possibility of Prussic acid poisoning (Geelsiekte) during the summer months. (NB: Sulphur excess is toxic and exercises a serious depressing influence on certain micro - elements such as copper. Do not use 7 - 8% which was common practice!).

Copper (Cu): Copper is deficient in some areas of South Africa as indicated below:

Areas deficient in copper: Bredasdorp, Swellendam, Mosselbay, Riversdale, Willovale, George, Knysna, East London and Komgha.

Areas marginal in copper: Albany, Bathurst, Peddie, Alexandria, Thornhill, Natal midlands, Eastern Free State, Western Transvaal.

North-Eastern Transvaal. A deficiency of copper results in straight or steely wool. Copper plays a role in the keratinization of wool and hair and the loss of crimp is one of the first symptoms of a copper deficiency.

Supplementation: In supplementing copper there is always the danger of copper poisoning and the following guide lines should not be altered without professional advice. In deficient areas 500 g of copper sulphate are required per 100 kg lick. In marginal areas 250 g per 100 kg lick are recommended and for the remainder of the country, except the Karoo & Namibia, 100 g per 100 kg lick is likely to be adequate. (See Table 6.10.). Alternatively, dose with cobalt bullets. Alternatively, dose with copper bullets.

Cobalt (Co): This element is an essential component of Vit. B12 which, in ruminants, is synthesised by the rumen bacteria. The requirement for Vit. B12 is likely to be increased if non-protein nitrogen is fed. Positive responses (livemass gain) to cobalt supplementation in copper deficient areas (Southern Coastal belt) have been obtained. In areas suspected of being deficient, or marginal deficient areas (high - lying) 50 - 100 g cobalt sulphate per 100 kg lick should be adequate (See Table 6.10).

Manganese (Mn): Most veld types in South Africa are marginal in manganese but it may be deficient in leached coastal areas or where there are calcareous soils (containing calcium carbonate) such as the Western Transvaal. Manganese deficiency of stock in the Transvaal has been reported and there seems to be a sound basis for supplementation of manganese. Supplementation: - see Table 6.10.

Selenium (Se): Low Se levels are usually synonymous with acid soils, such as coastal areas.

Supplementation: Can be toxic at extremely low levels (0,5 ppm). Supplement with Vit. E (injections).

Zinc (Zn): Deficiencies may occur under high levels of Ca, Fe, Cu, and rations based on wheaten bran.

Examples of licks:

Phosphorus, Copper, Manganese and Cobalt, either alone or in various combinations form the nucleus of possible deficient minerals under South African range conditions.

Examples of licks which can be used under various conditions in South Africa are given in Tables 9.6 and 6.10.

Table 9.6. Phosphate, salt and trace mineral licks.

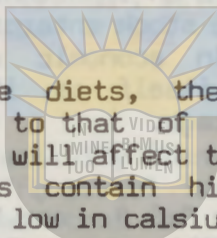
% P in lick	Ingredients	kg/100 kg lick
4	Monocalcium phosphate	20
	Salt	75
	Molasses	5
	Trace minerals	See table 6.7
6	Monocalcium phosphate	30
	Salt	65
	Molasses	5
	Trace minerals	See table 6.7

Table 6.10. Trace minerals g/100 lick.

Ingredient	Areas		
	Deficient	Marginal	Other
Copper sulphate	500	250	125
Manganese sulphate	500	250	125
Cobalt sulphate	125	60	30

Licks are not taken readily in coastal areas (high salt content of water) and sheep can therefore be dosed with Cu and Co bullets/bomb and Vit. E injection for Se deficiency. Also in the drinking water with kelated Cu and Co compounds which do not flocculate and preprecipitate out, (also possible with certain P compounds).

INTENSIVE FARMING CONDITIONS:



In animals on high concentrate diets, the calcium and phosphorus ratio will be opposite to that of veld grazing, namely high P and low Ca. This will affect the utilization of both minerals. Cereal grains contain high levels of phosphorus and are usually very low in calcium. Additional calcium should therefore be added to most rations of sheep in feedlots, drought feeding (whole maize) and also rams fed for show or sale. The latter group may develop urinary calculi: Small grains, used as cultivated pastures in high rainfall areas may also lack in sufficient levels of calcium.

Sheep grazed on small grain - green feed and certain other crops during the late winter or early spring probably should be supplied with a supplemental source of Magnesium (Mg).

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CHAPTER 7

REPRODUCTION

Here

Apart from the direct economic advantage of a large lamb crop, the reproductive efficiency of a flock affects several aspects of selection and flock improvement, as well as the efficiency of feed conversion and ram cost per lamb:- A reproductive rate of 60% or less totally rules out any ewe selection, in a closed flock as all the female lambs that reach the two-tooth stage are needed for replacements. The efficiency by which feed is converted to lamb carcass improves with an increase in reproduction rate. A ewe that rears one lamb requires 48% more food to produce 1 kg of carcass than a ewe with twins. Ram cost per lamb is directly proportional to the reproduction rate - the more lambs produced per ram, the lower the ram cost per lamb. Although, reproductive efficiency plays an important and integral part in the success of any small stock enterprise, the overriding factor is survival rate. An economic value can only be attached to a lamb when itself or its product reach a marketable or replacement stage.

The current situation in the R.S.A. and National states are as follows: In the R.S.A. the average lambing percentage of Merino's, which makes out the largest proportion of the national flock is only 71%. In this survey (1983), 2 629 sheep farmers from all parts of South Africa were interviewed. Of these 19,3 per cent have a lambing percentage of 40 and less and 28,3 per cent are between 40 and 60 per cent. This means that 48 per cent of those interviewed have a lambing percentage of 60 or less. The mortality from birth to weaning averages 15%, and from weaning to the two-tooth stage 3,7%. Furthermore, only 40-45% of South Africa's national flock consisted of breeding ewes, compared to a normal commercial flock of 76% ewes.

The situation in the National states is even worse, represented by a study done in the Transkei. The reproduction efficiency for sheep and goats is given in Table 7.1

Table 7.1 Reproduction, mortality and flock/herd turnover during 1979.

Efficiency factor	Sheep	Goats
Lambing/Kidding %	64,06	67,93
Weaning %	44,84	50,34
Lamb/Kid mortality %	30,17	21,50
Flock/Herd mortality %	20,44	21,26
% ewes in flock/herd	60,00	60,00
Turnover %	11,62	11,35

A definite attempt should therefore be made to raise lambing percentage and lower lamb mortality after birth and this chapter considers the relevant aspects thereof.

7.1 FACTORS AFFECTING REPRODUCTIVE EFFICIENCY

(1) Sexual season The sexual season of the ewe is closely related to the changes in day light time from season to season. In contrast to most other farm animals, sexual activity in small stock is stimulated by a decrease in daylight. Therefore sexual activity usually increases when the days become shorter and reaches a peak during April/May. Other factors, such as level of nutrition, livemass, weaning time and the presence of rams may also affect the beginning of oestrus.

Considerable variation in sexual activity (length of season) exists between different breeds. The sexual season of the British mutton breeds as well as that of the Angora is limited to the autumn months in South Africa. Therefore they have a restricted sexual season compared with the intermediate and long sexual seasons of the Merino and Blackhead Persian respectively. Sheep and goats can be divided into three types according to length of breeding season.

Long breeding season
(Virtually throughout
the year)

Intermediate
breeding season

Short breeding
season

Blackhead Persian, Dorper
Boergoat

Karakul
Merino
German Merino
Dorset Horn

British mutton-
wool sheep
(Southdown
Suffolk etc.)
Angora goat.

Due to the restricted sexual season of the British breeds, they will never play a significant role as pure breeds for fatlamb production in the Republic. An exception to the rule is the Dorset Horn or Polled Dorset which exhibits a somewhat longer intermediate sexual season.

The mating seasons of spring and autumn each have their advantages and disadvantages:

Autumn mating season

* Advantages: Sexual activity of the ewe is highest in the Autumn and this results in higher lambing percentages in spring.

There is usually green grass available for the ewes which lamb in the spring

When 15 month - old spring born lambs change their teeth (wissel) there is normally good veld grazing available.

The danger of cold weather and lamb losses at lambing time in spring is not such a serious problem as the Autumn period.

- * Disadvantages: The growth of autumn born lambs (winter reared) is much better than the spring lambs (less parasites, heat and moisture). In Natal for example it is very difficult to rear spring lambs due to the warm and moist conditions of the spring and summer.

There is always the danger of a spring drought. In the sourveld areas early spring rains are more dependable than other areas.

Lambs born in spring cannot be protected against bluetongue during the first summer.

Spring mating Season

- * Disadvantages:

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Sexual activity of the ewes is lower during the spring mating season and this can result in a lower lambing percentage.

If lambs are born a little late there is always the possibility of losses due to cold.

Lambs are born as the nutritional value of the natural veld is rapidly declining.

This state of affairs is of major importance in the summer rainfall sourveld regions. Therefore, in order to lamb in autumn in these regions it is essential to provide feed for the ewe and lamb. This is normally done by planting green feed such as oats, wheat, barley, rye grass, root crops etc.

- * Advantages: If feeding is available the autumn lamb does much better than the spring lamb.

Lambs are weaned in the spring when natural feeding conditions are rapidly improving.

After puberty, sheep and goat ewes show regular sexual cycles throughout the breeding seasons. These cycles are marked by a heat period (oestrus) every 17 days in sheep and 19 to 21

days in goats (this is also called the oestrous cycle). During the oestrus or heat period the ewe will attract or seek out the ram and display active signs of heat, such as the sporting of the tail. The duration of the oestrus period is approximately 30 hours and this is the only period when the ewe will permit copulation. Ovulation occurs towards the end of oestrus when one or more ova (egg cells) are produced. Sperm retains its fertilizing ability in the female reproductive tract for a maximum of 48 hours after service, which means that fertilization can result if ovulation occurs within this period. If mating fertilization and conception are not accomplished, another oestrus period will follow in 17 - 21 days.

Anoestrus (seasonal) does not form part of the oestrous cycle but separates the sexual seasons. (Either at the beginning or end of the sexual season it sometimes happens that ovulation occurs without the expression of heat. This phenomenon is known as silent heat). Apart from seasonal anoestrus, reproducing ewes experience another type of anoestrus, namely post-partum anoestrus, (except for Blackhead Persian, Africander, and Dorper). It is almost certain that the ewe will not exhibit true oestrus within the first month or two after lambing. The period of post-partum anoestrus varies from 43 to 114 days, depending on the season as well as nutritional level and breed.

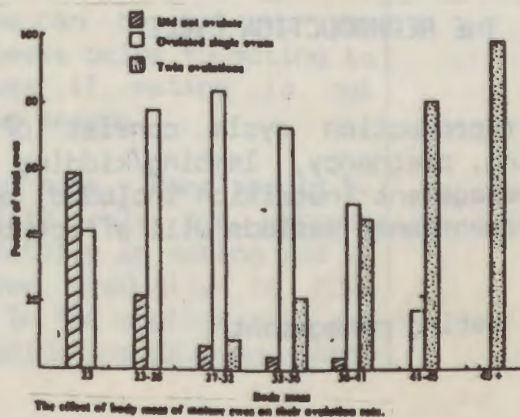
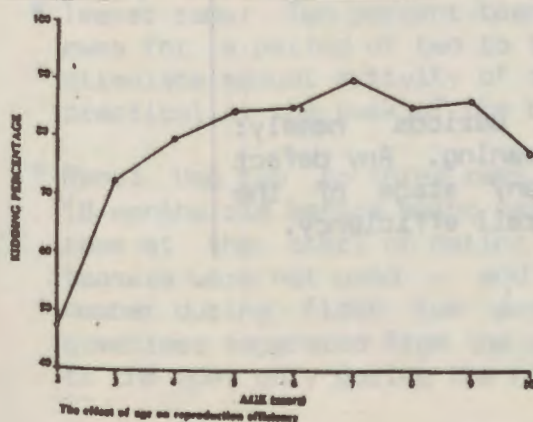
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(2) Nutrition

This factor has been dealt with in the previous chapter.

(3) Body mass

The effect of body mass on reproductive efficiency has been discussed in the previous chapter, however, the effect of body mass of "first lambers" on reproduction has to be considered. The less ewes weigh, the smaller the chances of conception and therefore it follows that the rate of conception will increase with increasing body mass. In Fig. 7.1 (a) and (b) the effect of body mass at first mating on the reproduction efficiency of ewes in their first and subsequent breeding seasons is shown.



From these illustrations it is clear that ewes with a low body mass and reproductive inefficiency at two-tooth stage also tend to retain a handicap in these aspects in the years that follow. The generally accepted lower limit of live mass at which two-tooth ewes can be expected to conceive is given in Table 7.2

Table 7.2 Estimated lower limit of live mass for two-tooth and mature ewes at mating

Breed	Minimum live mass (kg)	
	Two-tooth	Mature
Angora goat	25	35
Boer goat	35	50
Merino	33	38
S.A. Mutton Merino	45	55

It should, however, be noticed that age is not a limiting factor, since females from most small stock breeds which have grown well can conceive at as early an age as 8-12 months. As a general rule, age at first mating should not be less than 12 months for well grown animals and not less than 18 months for most females under extensive conditions.

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(4) Age

Reproductive rate in all small stock increases with age up to an optimum at 4-7 years, and then decreases gradually. Worn teeth and not age is usually the major reason why older ewes are culled due to low reproductive rate. When sheep are 7 to 10 years old the teeth are usually completely worn off - depending on grazing conditions.

(5) Heredity

This factor will be discussed in Chapter 8.

7.2 THE REPRODUCTION CYCLE

The reproduction cycle consist of four periods namely: mating, pregnancy, lambing/kidding and weaning. Any defect in management (nutrition included) during any stage of the abovementioned periods will affect the overall efficiency.

(1) Mating management

Good management during the mating period should consist of making the optimum use of all factors which may lead to the maximum rate of conception in the ewes. The best response may be expected from a ewe with a high body mass on a high energy diet (flushing) and which is mated during the peak of the sexual season. Although several other aids may be introduced (teaser rams, small camps, etc.) deviation from these basic requirements will decrease conception and thus kidding rate.

Mating can be carried out as (a) mass or flock mating (b) group mating or (c) individual or hand mating which include artificial insemination.

There are however, a few basic requirements with which all mating systems must comply. The most important are the following:

- * It must fit in with existing management practices on the farm or its introduction should occur without any serious disruption to other farming activities.
- * It must promote high lambing percentages.
- * Rams must be used as effectively as possible in order to keep the ram cost per lamb as low as possible.

a) Flock mating

With flock mating rams are put in with the ewes and left there until the mating season is over. In extensive sheep farming this is normal practice. An improvement on this method is to keep introducing fresh rams while taking others out for a rest.

- * Size of ewe flock: Preferable not more than 200 or at the most 300 ewes, should be mated in one flock.
- * Separating age groups: It is advisable to mate two-tooth ewes separately from adult ewes.
- * Teaser rams: Two percent teaser rams can be put to the ewes for a period of two to three weeks prior to mating to stimulate sexual activity of the ewes if mating is not practical at the peak of the breeding season.
- * Rams: Use two to three rams per 100 ewes. Rams should be 18 months old before being used. Join only one percent rams at the start of mating - especially in spring and if teasers were not used - and increase gradually to full number during first two weeks. In hot weather rams are sometimes separated from the ewes during the day and joint to the ewes only during the night.

- * **Mating :** Rams should be kept with the ewes for a period of 5 to 6 weeks to allow for two heat periods.

(b) Group mating

Where numerous camps or paddocks are available one ram can be placed with a small group of 40-60 ewes. Where ewes are ear marked this allows for exact knowledge of the parentage of each lamb born. This type of mating is usually practiced by stud breeders in order to be able to assess the breeding potential of each ewe and ram.

- * **Size of ewe groups and number of rams:** The number of ewes in a mating group will be determined by several factors such as size of camps, topography (level or mountainous), sexual drive and the mating potential of a specific ram. Practically spoken one ram should easily settle a group of 60 to 80 ewes. When rams are joined at night time only in small mating camps, even a 100 can be allowed per ram.

- * **Teaser rams:** Not always practical. [see (a)]

- * **Advantages :** When the mating groups included 60 or more ewes, less rams are required than in normal flock-mating and the ram cost per lamb is considerably reduced.

The breeding potential of a ram can be estimated which is not possible in flock-mating. (It will, however, necessitate the separation of lambs with the aid of eartags for identification when grading takes place at the age of 18 months.

- * **Disadvantages:** If a ram is sterile or becomes sterile during mating, no lambs will be born. (In flock-mating where 2% or more rams are used it is unlikely that this will happen.)

Because several groups are mated separately, management can be interfered with. (If, however, a number of small camps is available there should be no practical problems.)

Under all circumstances, however, it should be advisable to put teaser rams, fitted with mating harnesses, with the flock at the termination of mating to record if ewes were served successfully. If a ram was sterile or if no ewes were served successfully, this can result in considerable financial loss to the farmer.

- * **Mating period:** Same as for flock mating.

(c) Individual Mating

Individual mating can be carried out by hand mating of individual sheep or by artificial insemination. Raddle marks

from teaser rams on the ewes identify the ewes which are on heat. These ewes are then hand mated with specific rams or inseminated with the semen of specially selected rams. Both methods spare the energies of the valuable stud ram and a much greater number of ewes can be mated. These methods involve a considerable amount of work and handling of the ewe flocks. Special kraals are sometimes built for this purpose (hand mating) where it is practiced on a large scale.

* Rams: This system is very suitable for studs but can also be applied on a large scale in commercial flocks. Although individual rams can serve 150 or more ewes over a period of 5 to 6 weeks, one ram per 100 ewes is a more practical approach. With A.I. a single ram could cover over 400 ewes within three weeks.

* Teaser rams: It is essential for both hand mating and A.I. to detect ewes on heat. Two to three percent teaser rams should be available at the onset of mating.

* Advantages: Fewer rams are required which facilitates the buying of better quality rams. Progress within the flock should therefore be attained at a faster rate than with flock-mating.

If rams are purchased within the same price range as for flock-mating, a considerable saving can be achieved and consequently the ram cost per lamb will be reduced significantly.

The mating potential of individual rams can be recorded and those which lack in sexual drive can be eliminated. This is especially important in stud breeding in order to prevent this undesirable characteristic being spread throughout the stud.

The possibility of rams being injured are reduced. Valuable rams are often lost or injured in fights which is a common feature of flock-mating.

Individual rams can be progeny tested and those with the best performance can be used extensively.

Since every ewe is served under supervision, all ewes that skipped can be culled.

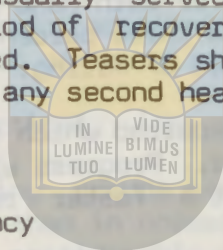
* Disadvantages: If a ram possesses any undesirable recessive characteristics, such a ram can produce a great number of inferior lambs. However, buying rams from a stud with a sound genetic background and not allowing a ram to serve more than 80 to 100 ewes during his first mating season, is a method through which this disadvantage can be overcome to a large extent. (In the case of flock-mating, however, rams are not tested beforehand and individual rams can also produce a large number offspring.)

It demands the personal attention of a responsible person.

If a ram is used over long a period, inbreeding can be dangerous. Where 10 rams are used per 1 000 ewes and ewes are served at random, it is unlikely that inbreeding will be of any significance. Inbreeding, however, can be avoided by not mating a ram with his own progeny.

Veld grazing around the mating unit can be damaged by trampling.

- * Method: Ewes that were detected to be on heat in the morning (raddle marks) should be served (hand mating or AI) in the afternoon of the same day and those on heat in the afternoon should be mated early the following morning. One ewe on heat is placed with a penned ram. After only one copulation the ewe is removed and another ewe is joined. The first two ewes are usually served without any time lapse, but thereafter a period of recovery (differs from ram to ram) should be allowed. Teasers should be kept with the ewes for detection of any second heat periods of ewes that were mated.



(2) Management during pregnancy

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Generally, ewes may be kept on natural pastures without special attention during most of the pregnancy period. Ewes should be crutched and hooves trimmed well in advance of lambing. However, level of nutrition and fluctuations thereof, during the last third of pregnancy may have an affect on the health of the ewe, birth mass and hence survival rate of the lambs and milk production which will again affect growth rate of the lamb.

Chasing by dogs, crowding through gateways, and all other forms of rough treatment are to be avoided. Care is also needed when catching heavy in-lamb ewes, and they should not be turned up to have their feet dressed.

Large variations in feeding level or undernourishment of the heavily pregnant ewe may lead to abortion (especially in Angoras) or pregnancy toxemia. The latter is an acute metabolic disorder occurring during the last few weeks of pregnancy. Susceptible ewes are generally in good condition, are carrying twins or triplets or have a particularly large single lamb which are on good grazing and not receiving much exercise. Sudden change in grazing, or any stress factors will increase the occurrence of pregnancy toxemia and ewes which become fat during the first three months of pregnancy are especially susceptible.

(3) Management at lambing/kidding

Lambing or kidding can be arranged to take place in pens, small camps, on cultivated pastures or in large camps on natural veld, with or without supplementation. Furthermore, it may take place over a short period of time ($\pm$ 7 days with synchronised ewes) or it may be extended over a much longer period (usually 6 weeks) depending on the length of the mating season. There are however two basic requirements or objectives with which any of the above mentioned practices must comply. Firstly, it must assure a high survival rate of lambs. (It cannot be over-emphasised that although many factors may affect the efficiency of reproduction, the overriding factor is survival rate). Secondly, it must fit in with existing management practices on the farm. A management strategy at lambing should therefore be based on practical measures to cut down on lamb/kid losses.

According to a recent survey, an average of 15% of the South African Merino-lamb crop (total $\pm$ 9 million) falls under the mortality category between birth and three months of age (pre-weaning). Most of these deaths occur shortly after birth, in fact, as much as 80% of lambs that died prior to weaning died within 2-3 days after birth. Starvation and dystocia* accounted for the majority of deaths with 56-62% and 21-24%, respectively. Only a small percentage of the deaths were attributed to diseases and other causes.

* problems experienced during birth - suffocation, injury or haemorrhaging.

Lambs that die due to starvation are usually small, weak lambs with low body mass (below 3,5 kg) as well as lambs from ewes with poor mothering abilities. Other reasons include mastitis and too much wool around the udder. Heavier lambs are more likely to die at birth due to dystocia. (See Table 7.3).

Table 7.3. Lamb mortality from birth to weaning within the different birth mass groups.

Birth Mass (kg)	Mortality Rate (%)
1 - 1,4	70
1,4 - 1,8	65
1,8 - 2,3	40
2,3 - 2,7	30
2,7 - 3,2	17
3,2 - 3,6	9
3,6 - 4,1	4
4,1 - 4,5	10
4,5 - 5,0	20
5,0 - 5,5	50

For Merino's the ideal birth mass of the lamb should be between 3,5 and 4,0 kg, as indicated in table 7.3. Amongst the factors affecting birth mass are nutrition of the ewe (most important), litter size, breed, size of the ewe (age) and season (temperature) during pregnancy. The most effective way of increasing birth mass is through correct nutrition during late pregnancy.

Practical measures towards lowered mortality of lambs should therefore include optimum level of nutrition during late pregnancy as well as good stockmanship during lambing.



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Table 7.3. Lamb mortality from birth to weaning (kg)

1	3.5 - 4.0
1.8 - 2.3	4.1 - 4.6
2.3 - 2.7	4.7 - 5.2
2.7 - 3.2	5.3 - 5.8
3.2 - 3.7	5.9 - 6.4
3.7 - 4.2	6.5 - 7.0
4.2 - 4.7	7.1 - 7.6
4.7 - 5.2	7.7 - 8.2
5.2 - 5.7	8.3 - 8.8
5.7 - 6.2	8.9 - 9.4
6.2 - 6.7	9.5 - 10.0
6.7 - 7.2	10.1 - 10.6
7.2 - 7.7	10.7 - 11.2
7.7 - 8.2	11.3 - 11.8
8.2 - 8.7	11.9 - 12.4
8.7 - 9.2	12.5 - 13.0
9.2 - 9.7	13.1 - 13.6
9.7 - 10.2	13.7 - 14.2
10.2 - 10.7	14.3 - 14.8
10.7 - 11.2	14.9 - 15.4
11.2 - 11.7	15.5 - 16.0
11.7 - 12.2	16.1 - 16.6
12.2 - 12.7	16.7 - 17.2
12.7 - 13.2	17.3 - 17.8
13.2 - 13.7	17.9 - 18.4
13.7 - 14.2	18.5 - 19.0
14.2 - 14.7	19.1 - 19.6
14.7 - 15.2	19.7 - 20.2
15.2 - 15.7	20.3 - 20.8
15.7 - 16.2	20.9 - 21.4
16.2 - 16.7	21.5 - 22.0
16.7 - 17.2	22.1 - 22.6
17.2 - 17.7	22.7 - 23.2
17.7 - 18.2	23.3 - 23.8
18.2 - 18.7	23.9 - 24.4
18.7 - 19.2	24.5 - 25.0
19.2 - 19.7	25.1 - 25.6
19.7 - 20.2	25.7 - 26.2
20.2 - 20.7	26.3 - 26.8
20.7 - 21.2	26.9 - 27.4
21.2 - 21.7	27.5 - 28.0
21.7 - 22.2	28.1 - 28.6
22.2 - 22.7	28.7 - 29.2
22.7 - 23.2	29.3 - 29.8
23.2 - 23.7	29.9 - 30.4
23.7 - 24.2	30.5 - 31.0
24.2 - 24.7	31.1 - 31.6
24.7 - 25.2	31.7 - 32.2
25.2 - 25.7	32.3 - 32.8
25.7 - 26.2	32.9 - 33.4
26.2 - 26.7	33.5 - 34.0
26.7 - 27.2	34.1 - 34.6
27.2 - 27.7	34.7 - 35.2
27.7 - 28.2	35.3 - 35.8
28.2 - 28.7	35.9 - 36.4
28.7 - 29.2	36.5 - 37.0
29.2 - 29.7	37.1 - 37.6
29.7 - 30.2	37.7 - 38.2
30.2 - 30.7	38.3 - 38.8
30.7 - 31.2	38.9 - 39.4
31.2 - 31.7	39.5 - 40.0
31.7 - 32.2	40.1 - 40.6
32.2 - 32.7	40.7 - 41.2
32.7 - 33.2	41.3 - 41.8
33.2 - 33.7	41.9 - 42.4
33.7 - 34.2	42.5 - 43.0
34.2 - 34.7	43.1 - 43.6
34.7 - 35.2	43.7 - 44.2
35.2 - 35.7	44.3 - 44.8
35.7 - 36.2	44.9 - 45.4
36.2 - 36.7	45.5 - 46.0
36.7 - 37.2	46.1 - 46.6
37.2 - 37.7	46.7 - 47.2
37.7 - 38.2	47.3 - 47.8
38.2 - 38.7	47.9 - 48.4
38.7 - 39.2	48.5 - 49.0
39.2 - 39.7	49.1 - 49.6
39.7 - 40.2	49.7 - 50.2
40.2 - 40.7	50.3 - 50.8
40.7 - 41.2	50.9 - 51.4
41.2 - 41.7	51.5 - 52.0
41.7 - 42.2	52.1 - 52.6
42.2 - 42.7	52.7 - 53.2
42.7 - 43.2	53.3 - 53.8
43.2 - 43.7	53.9 - 54.4
43.7 - 44.2	54.5 - 55.0
44.2 - 44.7	55.1 - 55.6
44.7 - 45.2	55.7 - 56.2
45.2 - 45.7	56.3 - 56.8
45.7 - 46.2	56.9 - 57.4
46.2 - 46.7	57.5 - 58.0
46.7 - 47.2	58.1 - 58.6
47.2 - 47.7	58.7 - 59.2
47.7 - 48.2	59.3 - 59.8
48.2 - 48.7	59.9 - 60.4
48.7 - 49.2	60.5 - 61.0
49.2 - 49.7	61.1 - 61.6
49.7 - 50.2	61.7 - 62.2
50.2 - 50.7	62.3 - 62.8
50.7 - 51.2	62.9 - 63.4
51.2 - 51.7	63.5 - 64.0
51.7 - 52.2	64.1 - 64.6
52.2 - 52.7	64.7 - 65.2
52.7 - 53.2	65.3 - 65.8
53.2 - 53.7	65.9 - 66.4
53.7 - 54.2	66.5 - 67.0
54.2 - 54.7	67.1 - 67.6
54.7 - 55.2	67.7 - 68.2
55.2 - 55.7	68.3 - 68.8
55.7 - 56.2	68.9 - 69.4
56.2 - 56.7	69.5 - 70.0
56.7 - 57.2	70.1 - 70.6
57.2 - 57.7	70.7 - 71.2
57.7 - 58.2	71.3 - 71.8
58.2 - 58.7	71.9 - 72.4
58.7 - 59.2	72.5 - 73.0
59.2 - 59.7	73.1 - 73.6
59.7 - 60.2	73.7 - 74.2
60.2 - 60.7	74.3 - 74.8
60.7 - 61.2	74.9 - 75.4
61.2 - 61.7	75.5 - 76.0
61.7 - 62.2	76.1 - 76.6
62.2 - 62.7	76.7 - 77.2
62.7 - 63.2	77.3 - 77.8
63.2 - 63.7	77.9 - 78.4
63.7 - 64.2	78.5 - 79.0
64.2 - 64.7	79.1 - 79.6
64.7 - 65.2	79.7 - 80.2
65.2 - 65.7	80.3 - 80.8
65.7 - 66.2	80.9 - 81.4
66.2 - 66.7	81.5 - 82.0
66.7 - 67.2	82.1 - 82.6
67.2 - 67.7	82.7 - 83.2
67.7 - 68.2	83.3 - 83.8
68.2 - 68.7	83.9 - 84.4
68.7 - 69.2	84.5 - 85.0
69.2 - 69.7	85.1 - 85.6
69.7 - 70.2	85.7 - 86.2
70.2 - 70.7	86.3 - 86.8
70.7 - 71.2	86.9 - 87.4
71.2 - 71.7	87.5 - 88.0
71.7 - 72.2	88.1 - 88.6
72.2 - 72.7	88.7 - 89.2
72.7 - 73.2	89.3 - 89.8
73.2 - 73.7	89.9 - 90.4
73.7 - 74.2	90.5 - 91.0
74.2 - 74.7	91.1 - 91.6
74.7 - 75.2	91.7 - 92.2
75.2 - 75.7	92.3 - 92.8
75.7 - 76.2	92.9 - 93.4
76.2 - 76.7	93.5 - 94.0
76.7 - 77.2	94.1 - 94.6
77.2 - 77.7	94.7 - 95.2
77.7 - 78.2	95.3 - 95.8
78.2 - 78.7	95.9 - 96.4
78.7 - 79.2	96.5 - 97.0
79.2 - 79.7	97.1 - 97.6
79.7 - 80.2	97.7 - 98.2
80.2 - 80.7	98.3 - 98.8
80.7 - 81.2	98.9 - 99.4
81.2 - 81.7	99.5 - 100.0

CHAPTER 8

ASPECTS OF BREEDING AND SELECTION IN SMALL STOCK

The general aim of animal breeding is increased production. In small stock, the produce may be any one or combination of fibre, mutton/meat or pelts. Although it is important to provide optimal environment for animal production, animal breeding is aimed at providing optimal genotypes for the available environment. This process could be summarised as follows: Firstly, the objective or type of animal has to be defined. Secondly, means on how to appraise or measure the important features of the ideal animal have to be decided on. Thirdly, the breeding stock, rams and ewes, are selected from all animals available, and finally, it is decided on which rams to mate with which ewes. All this is made possible by variation that exists between animals. No two animals are exactly alike except for identical twins. Variation is therefore the raw material which the breeder has available for herd and flock improvement. Variation is at once the hope and despair of the breeder: the hope since, because it is present, and therefore offspring which are better than their parents may be produced, the despair because after animals have been improved greatly, they may, and often do, vary again toward mediocrity.

Observable variation in animals, or more correctly, phenotypic variation is which an animal exhibits depends firstly on the animal's genotype and secondly on the environment in which the animal has grown, both before and after its birth. It includes an animal's external appearance, measures of its productivity, and its physiological characteristics. The genotype, on the other hand, means the total complement of genetic factors, or genes, which the animal inherits from its parents. The genotype is relatively stable, or fixed, and is the direct link between parent and offspring.

8.1 Response or breeding progress in respect of selection

The formula for measuring breeding progress per annum is:

$$R = \frac{h \times S}{I}$$

and for measuring breeding progress per generation is:

$R = h \times S$ where:

S = selection differential

h = heritability of the specific trait or character

I = generation interval

The formula shows that the higher the heritability of a trait and the bigger the selection differential and the smaller the generation interval, the more rapid breeding progress will be.

8.1.1 Selection and selection differential

Selection is an important means of re-arranging genetic material to obtain better individuals for various purposes. It can be defined as the retention of desirable animals for breeding and the rejection or culling of the remainder. Selection cannot create new genes. It is applied to increase the frequency of desirable genes in a population and to reduce the frequency of undesirable genes.

There are two methods of selection, namely natural selection which is controlled by nature and where survival and reproduction of the fittest individuals apply, and artificial selection which is done by man. The methods of selection which the breeder can apply include individual selection, progeny testing and selection within families, of which only the first method will be discussed.

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Individual selection on each animal's own phenotype - no account is taken of the relationship of any animal with any other, and therefore neither sires nor dams need be known. It is the cheapest method, and should be used unless there are good reasons for using another. A character of high heritability (over 30 percent) is deemed to have a high heritability. In selection for a character of high heritability little or no advantage will accrue from attention to the production of relatives, and selection on the animals own phenotype is the most economic method to use. Any advantage following the evaluation of the phenotypes of half-brothers or half-sisters is likely to be offset by the additional time and costs involved.

Selection for more than one character at a time. If a breeder should be selecting for one character only - an unlikely situation - he would firstly list his animals of each sex in decreasing order of excellence in the character, and then select enough replacement for his breeding flock, the rest would be culled. A result of selecting for one character only is that the greatest degree of selection pressure is applied to it. In practice, however, a breeder selects for more than one character. In doing so, he automatically reduces the amount of pressure which he can apply to each character, the selection differentials become smaller. A character should therefore be of undoubted importance before it is included in a selection programme.

A selection index is generally used if more than one character is selected for at the same time. If an index is used, each animal is given a score in which two or more characteristics are considered together and weighted largely according to their economic worth and their heritability.

Selection differential or selection advantage is the amount by which animals selected for breeding are superior to the average of the population from which they were selected (drop) in any given character. Their superiority could be measured in a single character or over a number of characters combined together in one index or measure of excellence.

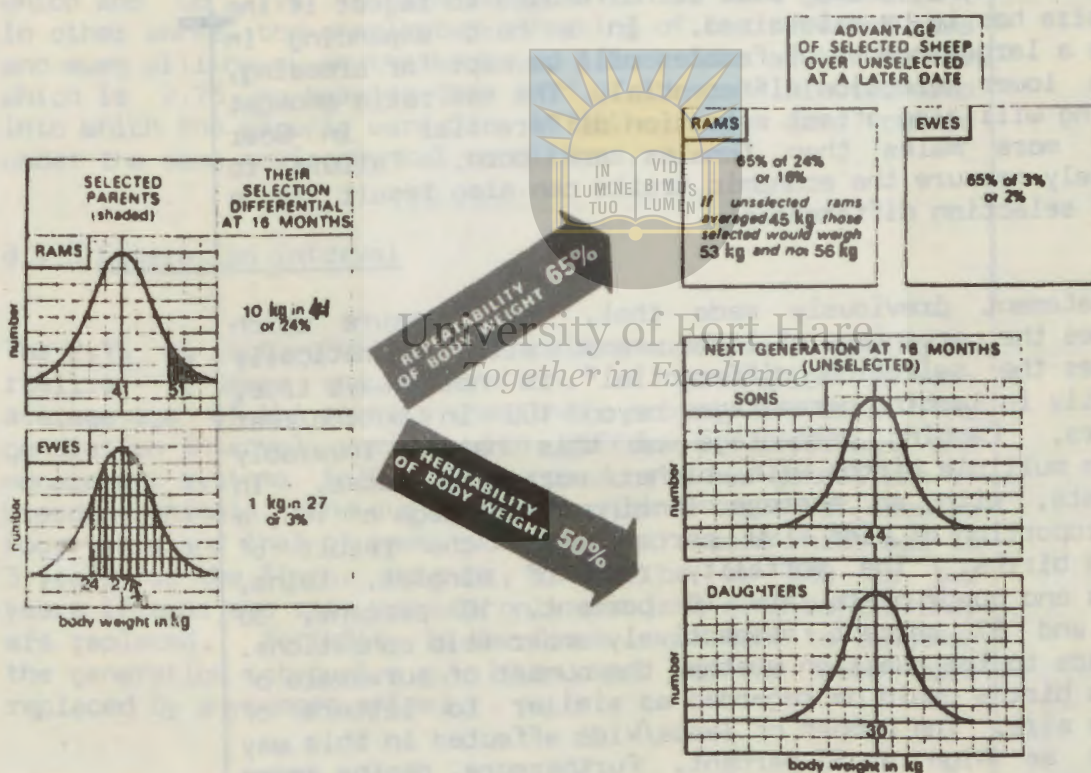


Fig. 8.1 A "smoothed-out" presentation of body mass of male and female Merino's at 16 months of age. (See 8.1.2; 3; & 4.)

The selection differential in a flock can be very much greater among rams than among ewes because many fewer rams than ewes are retained.

In Fig. 8.1 the average body mass of all ewes before selection was 27 kg. If 80 percent had to be retained for breeding and if selection were on body mass alone, the culling level would be at 24 kg, with heavier ewes being retained and lighter ewes rejected. The average body mass of the retained ewes would then be 28 kg, giving a selection

differential of 1 kg. The unselected rams from the same flock averaged 41 kg, but if those retained for breeding constituted 5 percent of the rams available, the sires would average 51 kg, giving a selection differential of 10 kg.

Any measure which increases the percentage of lambs weaned or selection for as few characteristics as possible in a flock automatically increases the selection differential - the actual number of rams and ewes ultimately selected as breeding replacements does not vary, but more animals are available from which to make the selections. On the other hand, the selection differential of the ewes will be zero or very small if the lambing percentage is less than 60, only half of all lambs born are females, and with a pre-wean mortality rate of up to 10 percent and 20 - 25 percent replacement ewes, there will be no females to reject if the flock size has to be maintained. In a herd expanding in numbers a larger number of females will be kept for breeding, hence a lower selection differential. The sex ratio amongst offspring will also affect selection differential - in Boer goats, more males than females are born. Failure to accurately measure the economic traits can also result in a smaller selection differential.

The statement previously made that, "any measure which increases the percentage of lambs weaned will automatically increase the selection differential" is not always true, especially in lambing percentages beyond 100 in mutton/meat producers. Lambing percentage of this nature invariably includes multiple births with higher mortality rates. In Boer goats, with an average lambing percentage of 160, a large proportion of kids (90 percent) are the result of multiple births. The mortality rate of singles, twins, triplets and quadruplets are 10 percent, 10 percent, 30 percent and 57 percent respectively under veld conditions. This leads to the question whether the number of survivals of multiple births could be regarded as similar to litters of the same size. The number of lambs/kids affected in this way could be as high as 50 percent. Furthermore, deaths among multiple births occur over a fairly long period of time. Milk production is affected by litter size during the pre- and post partum stage. It seems, therefore, that increased selection differential due to more lambs being available, will be cancelled out by the inaccurate measurement of growth rate during the pre-weaning period. Post-weaning growth rate and wool production may not be affected.

8.1.2 Heritability

The degree to which an animal of superior phenotype will transmit to its offspring the advantage which it displays in any character has been termed the heritability of the character. If for example the heritability of body mass at 16 months in Merinos is 50 percent, then this means that on

average a ram with a selection differential of 10 kg would tend to pass 50 percent or his advantage, of 5 kg, to his offspring. Similarly, a ewe of superior body mass and a selection differential of 1 kg will also transmit 50 percent or 0,5 kg, to her offspring.

From the example in Fig. 6.1, the total gain expected in the next generation is therefore:

$$= (0,50 \times 10) \times 50\% = 2,5 \text{ kg from the rams and}$$

$$(0,50 \times 1) \times 50\% = 0,25 \text{ kg from the ewes}$$

which add to 2,75 kg gain expected in the next generation. In other words, the unselected offspring of the selected rams and ewes will have, on the average, a body mass at 16 months which is 2,75 kg heavier than that of the unselected drop into which the parents were born if both groups were reared under the same environmental conditions.

8.1.3 Generation interval

The 2,75 kg improvement takes more than one year's mating to realize - it takes one generation. A generation is the average age of the parents when their progeny are born. The generation interval varies with different breeding and management systems followed to produce a new generation of breeding animals. The average generation interval of ewes is four years and that of rams two and a half years which add to 3 years for the flock. However, it can be as low as two years if ewes and rams produce only one lamb crop before they are replaced. Mortality in the flock would tend to lengthen the generation interval e.g. if a dead ewe or sire were replaced by a younger animal.

The annual breeding progress for body mass at 16 months would therefore be 0,8 kg if the environment remains the same:

$$R = \frac{2,75}{3} = 0,8$$

8.1.4 Repeatability

Repeatability reflects the degree of reliance which one can place on an animal's current expression of a character as an indicator of its future expression of the same character.

In the example of Merino body mass at 15 months (Fig. 8.1), selected rams were 10 kg heavier than the unselected rams whose average body mass was 41 kg. This is a 24 percent advantage. A full 24 percent advantage, will not, however,

be repeated at later ages. It will become smaller as the animals reach mature mass. The amount which is retained of the original advantage is termed the repeatability. If half of the advantage is retained, repeatability is 50 percent. The repeatability of body mass at 15 - 16 months of age in Merino's is 65 percent. This means that 65 percent of the 24 percent advantage, or 16 percent body mass advantage will be found to remain with the selected rams. In other words, the mature selected rams will be 16 percent and not 24 percent heavier than the mature drop from which they were selected.

A knowledge of repeatability estimates for the various traits may be used in selecting for future performance. When the repeatability for a trait is high, culling on the basis of the first record should be effective in improving the over-all record of flock the next year.

Table 8.1 Estimates of the percentage of HERITABILITY and REPEATABILITY of traits in small stock.

Character	Heritability Repeatability	
	(range)	(range)
REPRODUCTION		
Lambs born/ewe	19(3-35)	13(5-24)
Lambs weaned/ewe	8(3-15)	10(5-17)
BODY MASS AND GROWTH		
Birth mass	33(12-61)	32(27-36)
Weaning mass	33(7-77)	43(22-76)
Post weaning daily gain	71(58-84)	-
Yearling body mass	43(29-59)	73(71-78)
Body mass	38(30-70)	70(67-80)
Condition score	12(4-21)	29(20-37)
CONFORMATION		
Body type	12(6-20)	33(26-40)
Body folds	44(35-50)	59(48-69)
Neck folds	25(8-39)	58(54-62)
Face cover	39(29-52)	54(36-76)
FIBRE PRODUCTION		
Greasy-fleece mass	41(28-66)	68(7-74)
Clean-fleece mass	40(3--62)	64(59-69)
Clean yield (%)	48(39-52)	62(54-80)
Staple length	38(22-73)	67(57-75)
Fibre diameter	46(30-62)	54(53-66)
Fibre density	30(24-62)	48(46-50)
Crimp count	39(9-57)	55(34-71)
Definition of crimp	37(32-42)	-
Handle	22(10-30)	-
Colour	41(30-63)	-

CharacterHeritability/Repeatability

MILK PRODUCTION (goats)

Milk yield/lactation	38(25-64)	51(18-78)
Fat yield	37(30-49)	56(51-61)
Protein yield	59-	-
Fat (%)	41(29-62)	73(64-85)
Protein (%)	59	75
Lactose (%)	38	38
Flavour intensity in milk	27	-
Milking time (machine)	67	-
Age at first kidding	54	-
Interval 1st & 2nd kidding	15	5

Table 8.2 GENETIC CORRELATIONS between different characters.

	Clean Scoured Yield	Clean Wool Weight	Staple Length	Fibre Diameter	Fibre Number per Unit Area	Crimps per Inch	Body Weight	Wrinkle Score	Birth Coat	Number of Lambs Born	Number of Lambs Weaned
Greasy Fleece Weight	J +0.11 T -0.10	+0.84 +0.81	+0.39 +0.30	+0.06 +0.15		-0.33 -0.21	+0.15 +0.36	+0.33 +0.28 n s +0.35 b	— +0.15	C +0.09 T -0.09*	+0.03 -0.12*
Clean Scoured Yield		+0.56 +0.49	+0.32 +0.25	+0.02 +0.07		-0.36 -0.26	+0.02 +0.09	0.03 0 -0.11	— 0	-0.14*	0
Clean Wool Weight			+0.49 +0.39	+0.05 +0.14		-0.45 -0.32	+0.13 +0.37	+0.22 +0.20 +0.33	— +0.16	0 -0.06	+0.02 -0.08*
Staple Length		R. positively related		-0.10 +0.03		-0.36 -0.22	+0.05 +0.10	-0.25 -0.21 -0.18	— 0	+0.09 -0.03	+0.06 +0.03
Fibre Diameter			+0.35			-0.21 -0.30	+0.11 +0.15	+0.12 +0.08 +0.01		+0.10*	+0.09
Fibre Number per Unit Area			0.35	-0.40						-0.19*	+0.08
Crimps per Inch							0 +0.05	+0.05 +0.09 +0.04	— -0.13	+0.06 +0.05	0 +0.06
Body Weight		Positively related						-0.09 -0.14 -0.07	— +0.05	+0.12* +0.07	+0.15* +0.06
Wrinkle Score									0.01	-0.23*	-0.22*
Face Cover										0	-0.08

n = neck, s = side
b = breech

8.2 Important characters in small stock

Small stock produce mainly mutton/meat, fibre, pelts and milk. Besides quantity and quality of commercial products to satisfy his market, the breeder is concerned with the animal's ability to produce in a given environment at minimum cost. He is, therefore, interested in many characteristics, but must keep the number low to obtain greatest genetic progress in improving them.

The main characteristics important in small stock production are:

Mutton/meat production: Reproduction rate
Body mass
Early high growth rate

Wool production: Reproduction rate
Clean wool mass per head and per ha
Average fibre diameter
Fibre quality
"Easy care" features

Milk production (goats) Reproduction rate
Milk yield
Milk composition
"Easy care" features

8.2.1 Reproduction/fertility

Selection for reproduction performance is hampered by the sex limited nature of the trait, and by the limited and discrete range of possible states an animal may have e.g., born as a single or twin, a ewe having zero, 1 or 2 lambs. This discrete nature of the trait is probably partly responsible for the low heritability and repeatability of fertility characters. This situation, however, does not change the importance of reproduction in the efficiency of small stock.

The number of lambs/kids raised per ewe is the major criterion in reproduction. The percentage of lambs weaned depends firstly on the percentage of ewes which lamb, secondly, on the percentage of multiple births and finally on the survival rate of lambs to weaning. To improve the percentage of lambs weaned by ewes in future generations we may consider selection against dry ewes, selection for twinning and selection for ability to rear a lamb or lambs from birth to weaning.

The culling of dry ewes is of little value in increasing the reproduction rate in future generations. However, culling of dry ewes or ewes which failed to rear lambs in two consecutive lambing seasons will have a positive effect on the reproductive rate of the present flock as a whole, in that the % of dry ewes is reduced.

Selection for number of lambs born per ewe, which often means twinning rate, is not effective in "first lamber" but heritability of this trait may be as high as 35 percent in 3-year and older ewes. Gains of 3 percent per annum in twin-

bearing ability has been obtained in Merino flocks in which rams were used whose female ancestors had dropped the greatest number of lambs. Rams selected for high twinning rate will not necessarily result in a high percentage of twins, but their daughters will have a high twin-bearing potential.

The ability to rear lambs from birth to weaning is not highly heritable (3 - 15 percent in Table 6.1). However, this figure includes the ability to lamb plus the ability to have multiple births. It could, however, be expected that this trait is of medium heritability in older ewes.

In practice, selection for high reproduction rate may be feasible in flocks where mutton/meat production is of primary concern but nutrition is usually much more effective in achieving high reproduction rates. Furthermore, multiple births are not always desirable, especially under extensive conditions.

Characteristics of interest in indirect selection for fertility are adult body mass, face cover (woolled sheep) and body and neck folds (woolled sheep). All these characteristics are highly heritable. The genetic correlation between face cover and lambs born, or lambs weaned, is negligible and would therefore not be expected to cause an increase in fertility in the following generation. Culling against this trait will, however, have a positive effect on fertility in the present flock of wool sheep.

A negative genetic correlation exists between wrinkle score and fertility. Highly wrinkled rams have been shown to produce low quality semen under high atmospheric temperatures. Selection against heavily wrinkled animals in both sexes should improve reproduction rate in present and future generations.

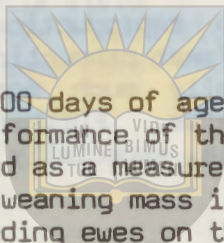
Genetic correlation between adult body mass and lambs born is positive but low (0,2) and indirect selection for fertility will be low for this reason as well as for the increased generation interval.

8.2.2 Body mass and growth

Body mass is of major concern in small stock farming. Heavy animals indicate a heavy carcass and usually a heavy fleece. Although heavy animals often sell at a premium, body mass on its own gives little information on carcass value. Body mass per age which is an indicator of growth rate is probably the most important character second to reproduction, in mutton/meat animals.

Birth mass influences the survival rate of young lambs - very heavy lambs as well as very light lambs suffer increased death rates. Autumn born lambs are lighter ($+ 1\%$) than Spring born lambs (probably due to the high temperatures during Summer), and multiples are much lighter than singles.

Selection for increased birth mass which is highly heritable (33 percent) could assist lamb survival with an Autumn lambing flock. The opposite effect might, however, be obtained with a Spring lambing flock. Similarly, increased birth mass could be an advantage in a poor nutritional environment and a disadvantage in a good nutritional environment. Increased birth mass may also be beneficial to twins but may adversely effect the survival rate of singles in the same flock.



Weaning mass (usually at 100 days of age) can be taken as an estimate of the general performance of the ewe as a mother. It can also be considered as a measure of milk production. Since the repeatability of weaning mass is high, (43 percent) it is feasible to cull breeding ewes on the basis of a single record. However, corrections have to be made for litter size, age of lamb and age of dam. Weaning index is therefore a relatively expensive measurement because detailed records are required - date of birth, birth mass (although not essential), single or twin identification and age of the ewe.

Although the heritability of weaning mass is high (33 percent), selection for increased weaning mass in future generations should rather be indirectly than directly. The genetic correlation between weaning mass and two-tooth body mass is very high ($+ 0.97$). Heritability of two-tooth body mass is high (60 percent) compared to (10 - 30 percent) for weaning mass. For this reason, fastest progress in weaning mass would be to select, not for that character itself, but for two tooth body mass.

Post-weaning mass gain (usually from 100 to 240 day of age). Since both yearling mass and post-weaning mass gain are highly heritable (43 percent and 71 percent respectively), selection for these traits should result in satisfactory progress. Less detailed records than in the case of weaning mass are required, which makes this character one of the most important to select for in mutton/meat producers.

The basic routine programme for mutton/meat producers consists of:

- (i) Identify all lambs born in the flock by means of ear mark, ear-tag, tattoo or other means.
- (ii) Establish some system of record-keeping for all

individuals in the flock. Record the reproductive performance of each ewe in the flock (date of lambing, litter size, sex of lambs) and growth performances of each lamb (body mass at (+) 100 days and (+) 240 day of age).

(iii) Adjust weaning mass, post-weaning gain and 240 day mass of each lamb for age, sex, litter size and age of dam where necessary and record. Reproductive performance of the ewe and growth performance of her lamb(s) are recorded on the proposed record card (Fig. 8.2). In flocks with a low incidence of multiple births, space allowed for multiples on record can be use for other records such as wool production.



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No.	Born: / /	Breed:	☐ Single ☐ Twin ☐ Triplet ☐ Quadruplet							
Sire:		G-Parents:		General:						
Dam:		G-Parents:								
PERFORMANCE DAM (INDEX)				100 Days		Post weaning		240 days		
Born	Kid	KID 1	Wean Index	KID 2	Wean Index	KID 3	Wean Index	KID 4	Wean Index	AWI
1/10										
2/10										
3/10										
4/10										
5/10										
6/10										
7/10										
8/10										
9/10										
10/10										
Remarks :										

Fig 8.2. Example of record card for mutton/wool producers. (Currently used in breeder flock at University of Fort Hare).

The top portion is used for information on the ewe: ear number, date of birth, litter size, parents and grandparents, as well as her own record as a lamb/kid. The bottom portion is used for her reproductive as well as the growth performance of her progeny. Information required in the columns from left to right are: lambing date, litter size, ear number of lamb/kid, sex, weaning index for each lamb/kid in the litter. A.W.I., means average weaning index of all the lambs/kids in the litter. Remarks include deaths and date when died.

(iv) Cull ewes that have a poor record of fertility, have obvious defects, or wean light lambs (A.W.I). Replace them with ewe lambs that rank highest on the basis of post-weaning, and 240 -day index, and which do not have any obvious defects. Make out cards for every ewe lamb that enters the flock.

8.2.3 Fibre production

The total annual production of woolled sheep is about 20 percent from wool and 80 percent from lambs and culls marketed (50 percent weaning and 20 percent replacement). With a three fold price difference ((+) R3-00/kg greasy wool and (+) R1-00/kg live mass) wool production becomes a primary economic characteristic in fibre producers.

Greasy - fleece mass is one of the most important measurements in woolled sheep breeding as it determines each sheep's economic return from wool. The question remains, however, what proportion of greasy-fleece mass may have been a direct result of excessive body pleats, low clean yield or course fibres. It is therefore important to consider the last mentioned characters together with greasy-fleece mass in a selection programme.

The basic routine of recording greasy-fleece mass consists of:

- (i) Primary culls (closed face, body pleats, and conformation faults) are removed by fault classing - not more than 10 percent in the ewe flock.
- (ii) The remaining sheep after primary culling are identified (if not done at birth). Identification can be done with ear tags or a number can be written on the shorn animal, using a bag marking pen loaded with spirit ink - do not use permanent ink.
- (iii) The fleeces without belly wool are weighed and recorded in the shearing shed. The simplest and cheapest device for weighing the fleece is a milk weighing scale equipped with a large balance pan. (Fleece-weighting skirting tables are also available.)
- (iv) The wool classer records the bin into which each fleece is classed. He also records faults such as fleece rot, kemp, pigmentation, colour and handle. Although most sheep with black wool will have been eliminated at the fault culling, sheep with individual black staples can only be identified readily by the shearers.

A consideration of greasy-fleece mass and classer's bin (length, finess, condition, etc) enables a breeder to place an economic value on a fleece. In order to eliminate the effect of age of lamb on fleece mass, lambs are sheared after weaning and again 9 to 12 months later at an age of 13 to 16 months when fleece mass is recorded.

Information on fleece mass and yield at 4 and 8 months of wool growth of young rams is possible through using the display or shoulder strip techniques. In the first instance, half the sheep is shorn which will reveal fleece mass and conformation to the classer. The shoulder strip technique

leaves the animal apparently intact and provide a fairly accurate estimation on greasy-fleece mass (only possible with machine shears).

Percentage clean yield can be obtained from samples taken from the side of rams and then analysed. Staple length can also be measured on the sheep by laying three or four staples against a scale on the mid side - care should be taken not to press the ruler etc. in between ribs.

Clean-fleece mass is a more accurate measure of wool production than greasy-fleece mass. It is also highly heritable (40 percent) and will probably result in fastest gains in wool production. Increments of 20 percent and 13 percent in clean-fleece and greasy-fleece mass respectively had been obtained after 10 years of selection for clean-fleece mass in Merino's. However, animals with high fibre diameter and skin wrinkle score were culled. Percentage clean yield, body mass, fibre density and staple length increased during the same period. Neither fibre diameter nor wrinkle score increased (due to culling), but number of crimps/inch decreased. Clean-fleece mass is only practicable in the selection of rams where an accurate measure of economic traits is required.

Theoretically it is possible to select simultaneously for both reproduction rate and clean wool mass effectively in woolled sheep. In essence it amounts to using the highest cutting rams born as twins, and to breed from all ewes born as twin plus the highest cutting ewes (greasy-fleece mass) born as singles.

Selection practice for ewes and replacements under extensive veld conditions

Adaptability, as measured in terms of weaning mass and fleece mass per ewe per annum as well as ewe livemass, is probably the major selection criteria in woolled sheep under extensive conditions. A practical selection index for ewes under these conditions is:

$$\text{Ewe productivity} = \frac{(\text{Fleece mass} \times 3,4 + 140 \text{ day} - \text{lamb mass}) \times 100}{\text{Ewe live mass}}$$

The fleece mass is multiplied by a factor of 3,4 which is a close approximation of the average wool:mutton price ratio. As previously mentioned, the contribution from mutton to the overall production of woolled sheep is considerable (80% of total mass produced and about 50% in terms of income). The live mass of the ewe as divider provides an optimum size for production under specific selection environments. Through this method, it seems possible for the farmer to keep the optimum number of breeding ewes, capable of weaning a lamb each year and still produce a reasonable fleece with the

minimum supplementation (mainly minerals) on the veld.

The current selection index for replacement Merino ewes applied by the Breed Society for Performance Tested Merinos is as follows: traits are measured at the age of 18 months: body mass in kg (A), clean fleece mass for rams and greasy fleece mass for ewes in kg (B), fibre diameter in microns (C) and wrinkle score (D). These values are incorporated in the following selection indexes:

$$I = 1A + 7B - 1C - 1D \text{ for rams and}$$

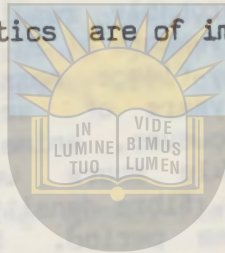
$$I = 1A + 4B - 1C - 1D \text{ for ewes.}$$

here

8.2.4 Wool quality

The following characteristics are of importance to both the breeder and manufacturer:

- Average fibre diameter
- Average fibre length
- Clean yield
- Fibre strength
- Coloured fibres and kemp



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Average fibre diameter. Fibre thickness or micron count is the most important property of Merino wool and it is the major factor determining how it will process. Reports show a high correlation between price paid for greasy wool and average fibre diameter (fibre diameter contributes 80 percent of variation in prices of Merino wool. For each micron less than 25 microns fibre diameter, the price paid per kilogram clean wool may increase by 30 cents (other characteristics being equal). For fabrics of identical structure, fibre diameter is the major factor affecting handle of wool and quality of the end product.

Although fibre diameter is of major concern and also highly heritable (43 percent), selection based on this character is only practicable in rams due to the cost involved in laboratory testing. Crimp count is the only practical method available through which the breeder can estimate fibre diameter. However, crimp itself is unimportant in processing except in a few special circumstances. Furthermore, crimp has a high negative genetic correlation (-0,56 to - 0,87) with fleece mass and attempts to raise fleece mass while maintaining crimp will greatly hinder selection response. If crimp is the only means through which fibre diameter can be estimated, special attention should be given to handle. Softness of scoured handle is so closely associated with fineness of wool fibres that it amounts to a cheap and reliable aid together with crimp in estimating fibre thickness. This means that if a breeder cannot get fibre thickness measured, then he can achieve satisfactory results by giving attention to both crimp and softness of handle.

Average fibre length. In general, increased fibre length tends to improve spinnability and strength of the resultant yarn, although there are limits beyond which problems can occur in drawing. Staple length will, on the average, increase with an increase in clean-fleece mass. An animal with high fleece mass but below average staple length should be regarded with suspicion as the heavy fleece may be the product of thick fibres, excess skin fold and low yield (greasy-fleece). On the whole, fibre length or staple length, within the limits, do not have much of a price advantage.

Clean yield, although highly heritable (48 percent) is difficult to measure and would in any case be included in clean-fleece mass used for ram selection.

Fibre strength or tensile strength has obvious importance to the buyer, but environment plays a major role.

Coloured fibres and hair fibres. Wool colour (white to yellow) is of little importance in processing except in a star lot but coloured fibres or kemp are a serious fault and such animals should be culled.

8.2.5 Conformation

Heritability of body conformation is very low, less than 20 percent. However, skeletal or bone faults are highly heritable and are of major concern in the marketing of breeding stock.

Head and jaws. Small heads or faulty jaws rarely affect productivity in small stock, but since this condition is rare, unsightly and highly heritable it seems sensible to cull such animals.

Horns. Faulty horns in sheep may cause shearing problems and fly strike. In goats faulty horns can result in leg injuries.

Backline. Small stock with irregular-shaped backlines, high loose shoulders, devils grip etc. seem to do quite well. However, the fact that these faults are highly heritable and important marketing value characters, it seems sensible to cull obviously deformed animals.

Legs and pasterns. The legs of small stock may show all sorts of twisted bones:- weak pasterns, x - legs, cow hocks, etc. Weak pasterns which deteriorate with age are probably the most important leg fault to cull against. Other conditions which result in feet pointing in or out, or legs being close or far apart, or cow hocks seem to cause the animal little trouble.

8.2.6 Skin fold

This is an important characteristic of wool producers because it influences wool production, wool quality, constitution and fertility. Skin fold is affected by breeding and nutrition - twins have less folds at weaning than singles and better levels of nutrition produce more folds. Body wrinkles or folds also change with age, reaching a maximum at weaning and gradually decreasing in prominence over the next 12 months to give the level maintained during maturity.

Increase in skin fold is associated with a moderate increase in greasy-fleece mass and birth mass but with a drop in clean yield. On the negative side, skin folds may increase the incidence of blow fly-strike and may have an effect on shearing time per sheep. Constitution tends to be weak and incidence of difficult births is high amongst developed sheep. Heavily wrinkled rams produce poor quality semen in hot climates and cause lower incidence of twinning as well as a lower conception rate. The most important disadvantage of body pleats is that it affects fertility. Plain type ewes produce significantly more lambs than wrinkled ewes.

8.2.7 Face cover

The best time to score face cover is 3 to 6 months after shearing and if possible in Winter or early Spring. There exists a moderate and negative relationship between face cover and productivity. Lambs from muffled ewes have a 5 - 10 percent slower growth rate. Face cover may also aggravate grass seed penetration of the eyes.

8.2.8 Carcass properties

Heritability of carcass traits in sheep is medium to high. However, these traits can only be measured after the animal is slaughtered, making it impossible to measure this trait in animals to be used for breeding purposes unless the semen of rams can be successfully stored and further test matings are made from which progeny can be slaughtered and carcass tested.

*All p 369-369 Lasley
Genetics of livestock improvement*

8.3 Group Breeding

Group breeding is the co-operation of a number of farmers (commercial or stud - usually sharing a common interest and environment) with the objective to produce superior and better-adapted sires at a more realistic cost for use in participating flocks and herds. Essentially, group breeding involves the screening of large populations to identify accurately the most efficient animals in terms of commercially important traits.

The co-operating breeders concentrate their highest producing females in a jointly-owned nucleus breeding unit. Here, further detailed recording and intense selection takes place, the best young animals being retained as replacements in the nucleus. Selected males including the nucleus replacements once they have served their term, are used in the contributing flocks and herds as replacement sires. The nucleus is kept open to the annual introduction of top females from the contributors - hence the name "OPEN-NUCLEUS".

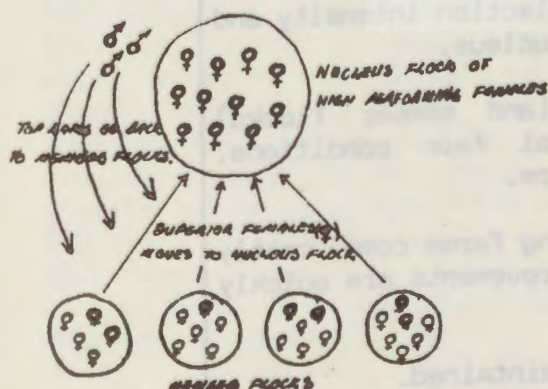


Fig. 8.3. Schematic presentation of a group breeding scheme.

In practice, the nucleus contains between five and 10% of all the females in the unit as a whole. Initially, each member donates a number (usually 20) of his young ewes and one ram, which were selected on live mass and greasy fleece mass, to the central (nucleus) flock. The offspring from the nucleus flock are classed at weaning when 10% of the lambs are culled on conformational faults. At six months they are shorn and again at 18 months when live mass and greasy fleece mass form the basis for selection. About 20% of annual nucleus female replacements should be from the members' flocks and 80% from the nucleus progeny. Hogget rams are usually evaluated on

clean fleece mass, fibre diameter, body wrinkle score and reproductive performance of their mothers. Superior rams and ewes are retained in the nucleus flock as replacements. Participants, however, have second choice of rams and each member selects his entitlement from the remaining rams as well as nucleus replacements at a rate of one ram for four to five donated hogget ewes from the member flocks. Any rams not selected are available to other members (four ewes or cash) or other interested persons.

Advantages of the system

- a) In theory, the rate of improvement in group breeding schemes should be about 10% to 20% greater than in conventional systems.
- b) The intense selection of initial females and annual replacements ensures that the nucleus is of a far higher average standard for the traits under selection than are the contributing flocks. (Depends largely on the accuracy of evaluating traits). Much of the value comes from the system's concern with commercial traits, performance recording, and good selection methods.
- c) The annual inflow of superior material from member flocks, facilitates a far greater selection intensity and shorter generation interval in the nucleus.
- d) Animals entering the nucleus flock (and member flocks) have been evaluated under practical farm conditions, where their progeny will later perform.
- e) Replacement sires for the co-operating farms come mostly from the nucleus, and therefore improvements are quickly spread throughout the group.
- f) A rapid generation turnover can be maintained.
- g) Little or no inbreeding takes place.
- h) Discussion and solutions of common managerial problems are done on a group basis.
- i) Facilities are shared at reduced cost.

PRACTICALS, DEMONSTRATIONS AND VISITS

This practical involves a demonstration (as well as active participation by students) of:

- (i) Herding of Sheep
- (ii) Catching
- (iii) Holding
- (iv) Casting
- (v) Controlled movement
- (vi) Foot trimming
- (vii) Dosing *
- (viii) Inoculation *
- (ix) Identification *
- (x) Castration *
- (xi) Docking *
- (xii) Pole operation *

* will be demonstrated at a later date. It is in with farm management, however, similar to the above as well as equipment will be demonstrated during this practical.



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Although sheep tend to be nervous and "flighty" at times, they are generally docile and quite easy to handle. When sheep become excited or start to take a warning signal they stamp with the front foot. When moving sheep, their flocking instinct must be borne in mind and should be utilised to provide an easy flow of stock. Normally, if one of the leaders can be directed in the desired direction, the rest of the flock will follow quite readily. This also can work to your disadvantage if you are moving a flock of sheep and one or two escape. This generally means you will have to regroup the entire flock.

Sheep should not be struck or prodded with sticks, nor should sheepdogs be permitted to bite them. If some inducement is necessary to get the sheep to move, rattling a plastic fertilizer sack near them is effective.

(ii) CATCHING

Sheep must never be caught or held by the wool as this leads to bruising of the underlying muscle and weakening of the wool. Similarly sheep should never be caught below the hock as it may either slip free or break a leg while struggling. The proper method for catching a sheep is to approach it from the rear and grasp it round the neck with the left hand and the side of the flank with the right. Horned animals should be caught by the horns or hind leg.

PRACTICAL 1

SMALL STOCK HANDLING

This practical involves a demonstration (as well as active participation by students) of:

- (i) Herding of Sheep
- (ii) Catching
- (iii) Holding
- (iv) Casting
- (v) Controlled movement
- (vi) Foot trimming
- (vii) Dosing *
- (viii) Innoculation *
- (ix) Identification *
- (x) Castration *
- (xi) Docking *
- (xii) Mules operation *

* Will be demonstrated at a later stage, to fit in with farm management. However, simulating procedures as well as equipment will be demonstrated during this practical.

(i) HERDING OF SHEEP

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Although sheep tend to be nervous and "flighty" at times, they are generally docile and quite easy to handle. When sheep become excited or want to make a warning signal they stamp with the front foot. When moving sheep, their flocking instinct must be borne in mind and should be utilised to provide an easy flow of stock. Normally, if one or two leaders can be directed in the desired direction, the rest of the flock will follow quite readily. This also can work to your disadvantage if you are moving a flock of sheep and one or two escape. This generally means you will have to regather the entire flock.

Sheep should not be struck or prodded with sticks, nor should sheepdogs be permitted to bite them. If some inducement is necessary to get the sheep to move, rattling a plastic fertiliser sack near them is effective.

(ii) CATCHING

Sheep must never be caught or held by the wool as this leads to bruising of the underlying muscle and weakening of the wool. Similarly sheep should never be caught below the hock as it may either kick free or break a leg while struggling. The proper method for catching a sheep is to approach it from the rear and grasp it round the neck with the left hand and the skin of the flank with the right. Horned animals should be caught by the horns or hind leg.

(iii) HOLDING THE ANIMAL

When holding a sheep, stand on its left side and place the left hand under its jaw, keeping the right hand free to place behind it should the animal try to run back. (Do not try to stop it running back by pulling on the head or wool). Horned animals should be held by the horns to avoid personal injury and to give better control, the holder standing in front of it or with legs astride the neck.

(iv) CASTING

For most operations the sheep is not laid on its side, but is placed on its rump with its back to the operator. The procedure for casting a sheep is as follows:

- * Catch by the right flank with your right hand and move the sheep around so you are standing facing its left side with your feet about 30 cm apart between the sheep's front and hind legs.
- * Grasp the sheep under the throat with the left hand.
- * Lift and turn the sheep in one smooth motion to place it on its rump. Be sure the hind legs do not touch the ground while you are doing this. If one leg does touch the ground, the sheep will kick and you will be unable to place it properly. If this happens replace it on its feet and start over again.
- * Allow the sheep to lean back against your legs. If necessary, some pressure can be applied to the tops of the shoulders with the inside of your knees to confine the animal. Fat-tailed sheep should be allowed to tilt slightly to one side so they are not resting directly on their tails.

Fig. 9.1(a) Method of holding a sheep. The right hand should reach well under the sheep's belly.

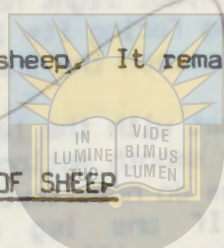
Fig. 9.1(b) Turning (casting a sheep)
The fore legs are lifted first and the sheep is suspended off the ground before being lowered.

When holding a sheep, stand on its left side and place the left hand under its jaw, keeping the right hand free to place behind it should the animal try to run back. (Do not try to stop it running back by pulling on the head or wool). Handed animals should be held by the horns to avoid personal injury and to give better control. The holder standing in front of it or with legs across the neck.

(iv) CASTING

For most operations the sheep is not held on its side, but is placed on its rump with its back to the operator. The procedure for casting a sheep is as follows:

Fig. 9.2. Turning up a sheep. It remains resting against shepherd's knees.



(v) CONTROLLED MOVEMENT OF SHEEP

There are several ways of moving a sheep after it has been caught.

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- a) Legging the sheep. The sheep is caught by the hind leg, and, with the other hand on the back of the sheep, it is dragged backwards.
- b) Turning the head, dropping the sheep on its side, and then dragging it by the front legs, only if surface is smooth. Only used during shearing - not recommended.
- c) The modern and correct back stepping method. In this preferred method the sheep is caught under the throat by the man standing directly behind it with one foot on either side of the sheep's hind feet. With a upward lift of the arm the sheep's fore end is raised off the floor, and the man walks back quickly keeping the sheep held out at a forty-five degree angle on its hind legs. In trying to sit down, it will move its hind legs and walk out of its own accord. One naturally needs practice at this. Recommended for shearing.

(vi) FOOT TRIMMING

The hooves of sheep grow continually, especially at the toe and along the sides. Sheep on natural grassland suffer more wear on their feet than those on irrigated pasture or other soft ground. As a result the former are less prone to the splitting and injury which often result from overgrown hooves. Whenever splitting and injury occur or when the sheep begin to walk improperly and before the rams are put into the breeding flock, the hooves should be trimmed. It is important that sheep are not allowed to walk on bad hooves as this may lead to crooked pasterns.

For trimming, the sheep should be positioned as shown in Fig. 9.2. Using a knife or hoof trimming shears, carefully trim away all excess hoof. Be careful not to cut too deeply or bleeding may result. Carefully check the bottoms and inner sides of the hooves for pockets in which dirt or manure may accumulate. These pockets should be opened and thoroughly cleaned. A hoof pick is a convenient instrument for cleaning and probing the hoof.

It is desirable that the hoof be trimmed so that the sheep is forced to walk on the front part of the hoof. This is accomplished by trimming the side wall flush with the bottom of the hoof and by shortening the tips of the toes. Be careful that the two tips are even.

After the feet are trimmed, the flock should be put through a footbath of copper sulphate or formalin solution which will disinfect any open wounds which might have resulted from trimming too close.

(vii) & (viii) DOSING AND INNOCULATION

Figure 9.1(a) shows one method of holding a sheep for dosing (drenching). The sheep could be caught and backed into a corner of the fence. If the operator then straddles the sheep, he can hold it, lift its head and deliver the remedy. Drenching or inoculation can also be done with sheep in the sitting position described above or standing when packed into a crush which is the fastest method when large numbers of sheep are treated at one time.

(ix) IDENTIFICATION

In any progressive small stock operation, identification of individual animals is absolutely necessary for keeping livestock records, selection programmes and health programmes. There are numerous methods of identifying small stock, the most commonly used methods are ear marks, metal or plastic eartags, tattoos and brands on the horns or hoofs. It is also useful to combine several methods. For instance, ear marks at birth for permanence of identification, combined with eartags which make it easy to read. Whatever method of identification is used, it is essential that some sort of numbering system be used which is flexible and in which the numbers will not be repeated within at least three years. (The use of different coloured tags makes any system much simpler). Furthermore, due to the limited size of tags, the numbering system should not have more than three digits.

(x) CASTRATION

Castrating and docking lambs generally requires two people, one to hold the lamb and the other to perform the operation. The holder should hold the lamb on its back in his lap, or in front of him with the lamb's right front and hind legs in the holder's right hand and the left front and hind legs in the left hand.

- a) Using a knife: Before castrating, the operator's hands, the instruments and scrotum should be cleaned and sterilised. (Instruments boiled, hands washed with soap followed by rinsing with tincture of iodine. Rinsing instruments, hands and tissues between operations).

The bottom third of the scrotum is removed. The testes are then pulled out by teeth or blunt side of knife blade. The testes can also be pulled out to the white membranous sheath and the cords scraped off. The wound should be treated with tincture of iodine, stockholm tar or antiseptic.

As with the other classes of livestock, castration should be done as early as possible to minimise the growth check due to the stress of the operation. Some lamb producers use the elastrator band on the scrotum before the testes descend to make what are known as "short-scrotum" lambs. Because the testes are kept within the body cavity no sperm are produced but the production of the male hormone by the testes will continued and accelerate the growth rate.

- b) Using a Burdizzo: This instrument is essentially a large clamp that is used to crush the blood and nerve supply of the testes.

Pull the testes into the scrotum. It is often not possible to crush one cord at a time due to size of testes, although it is preferable.

Position the Burdizzo over the cord(s) and clamp it shut. Hold for 30 seconds and release. Make sure the sigmoid flexure of the penis does not get caught. Do not store the instrument in the closed position and check it for proper adjustment. It should cut a piece of twine folded in paper without cutting the paper.

- c) Using an elastrator: The elastrator is an instrument used for stretching a strong rubber ring which is then placed around the scrotum above the testes. The ring cuts off the blood supply to the testes and scrotum and results in their eventually sloughing off. It causes, however, pain to the animal over a long period of time.

(xi) DOCKING

Docking, also known as tailing, is the procedure of removing the tail of young lambs to help prevent fly strike. Docking may also make service by the ram easier. The tail may be removed using a knife, elastrator rings or hot chisel.

When docking with the knife, the skin of the tail should be pushed toward the body and the tail severed at the root or one or two vertebrae down. The skin should then be allowed to slide down to cover the cut end. Although this is a one man procedure some bleeding may result so some sheepmen cauterise the wound with a hot iron. Painting the wound afterwards with Stockholm tar or antiseptic is advised.

There are two methods of docking using the elastrator. The easiest is to place the rubber ring at the base of the tail where the two folds of skin join the tail and leave it until the tail drops off. This method, however, provides great potential for infection. Alternatively, the ring may be left on the tail for 36 hours after which that portion of the tail below the ring (and the ring) are removed with a knife. No bleeding should result. The wound should be treated with Stockholm tar or antiseptic.

When a hot chisel is used, the chisel or chisel blade (see Fig. 9.4.) is heated red hot which is then used to cut the tail off. This method gives the least bleeding of any of the cutting methods of docking but healing may be somewhat slower.

Fig. 9.4. Chisel-blade and gas equipment for docking.

(xii) MULES OPERATION

PRACTICAL 2

HANDLING FACILITIES - SHEEP YARD AND PENS

Generally, the sheep yard is the basic unit for all sheep/goat handling. Facilities need to cope with some or all of the following operations:

- * shedding
- * identification (ear tagging)
- * docking, castration, mulesing, weaning, drenching, inoculation dipping, foot bathing and foot paring
- * shearing and crutching
- * selection, classing and weighing

Before designing yards to handle all these operations, the list should be examined to see which practices are essential in the yard, if any.

2.1. FACILITIES REQUIRED

Depending on the requirement, the following facilities are required:

1. Collecting and dispersal pens
2. Holding pens
3. Working pen
4. Forcing pen
5. Race
6. Shedder
7. Footbath
8. Dip

2.1.1. Collecting and dispersal pens

- * There must be a wide (2,8 m) entry gate from the field into a pen which holds the maximum number that are regularly brought in, and a similar-sized area to turn them into after the work is completed. (0,5 m ewe plus 0,2 m /lamb).
- * The collecting/dispersal pens should be oblong rather than aquire to facilitate herding (maximum width 5 - 6 m).
- * Water should preferably be provided.
- * The collecting and dispersal pens should be easily accessible from the main sheep traffic ways through the property.

2.1.2 Holding pens

- * A number of holding pens (minimum of two) are needed to hold different groups of animals, e.g. ewes separate from lambs or male lambs separate from female lambs for the purpose of selection, castration, docking and weaning. N.S. Ewes should always be separated from lambs prior to any operation to prevent tramping and injuries of lambs.
- * Altogether, the holding pens should have about the size as the collecting pen.

- * Some or all the holding pens may be used as dispersal pens.

2.1.3. Working pen

- * The working pen can be regarded as the nerve centre of the handling unit. It consists of a race-like pen 1,0 m wide and 6 m long which can hold about ten (10) ewes at a time. The size allows the operation to be done without the sheep getting past or double treated, and when finished the treated sheep can be kept separate from the untreated. It is used for drenching, inoculation, foot paring, castration, docking and mulesing as well as a rapid shedder.
- * A halfway gate is sometimes useful and it may be possible to have two pens side by side which allows one pen to be filled while working in the next.
- * A shelf for equipment and medicines can be fitted to the side.
- * Guillotine gates at the end, operated by rope and pulley, allow the shepherd to let in or out from the other end.
- * The floor of the pen should be free-draining and non-slip. (Slattered floors are the cleanest).
- * Open sided construction is preferable.
- * Roofing not only makes working conditions more pleasant but enables materials and equipment such as drenching equipment to be stored within easy reach.
- * A drafting-shedding gate is useful for rapid separation if incorporated into the exit.

2.1.4. Forcing pen

- * This may be a smaller rectangular pen with the exit at a corner, a funnel or a circular pen. Groups of sheep can be forced round from the entrance point to an exit at another point into the dipper, race, footbath, shedder or working pen.
- * The forcing pen should hold a maximum of 20 - 30 ewes.

2.1.5 & 6. Race and shedder

- * The sides of the race and/or shedder should be 0,375 - 0,50 m apart. These may be combined and used separately from the working pen or replace the working pen altogether for dosing, vaccination, making, etc. as well as for sorting and shedding.
- * It should have smooth, sheeted sides and sheep should be able to see out only through the exit gate.
- * There may be a fold-down rail in one part to allow access for treatment.
- * A gap at the bottom (0,075 - 0,10 m) provides a toe gap for checking feet and prevents young lambs suffocating.
- * May be provided with footbath and/or long-swim or side-entry dipper, floored over when not in use.
- * Shedding arrangement may allow for two - or three - way shedding (shedding gates 0,9 m).

2.2. GENERAL PRINCIPLES

- * The layout should be as simple as possible, compatible with the work that must be done, and it should be possible to complete the various tasks with the minimum movement and labour.
- * The site should be convenient for access both to the sheep and shepherd and preferably near to water supplies. It should be free-draining and possible sheltered.
- * Gates and catches should be easily operable and all surfaces must be smooth, with no sharp edges. The ground surface must be non-slip and concrete (or slattered floors) is needed for the working area.
- * Height of drafting and dosing passages: 0,9 to 1,0 m and of crush and other pens, 1,1m.
- * The choice of materials is between wire fence, wood, metal tubing and bricks or concrete blocks with cost increasing in that order. Recently, some well-designed, semi-portable metal equipment has become available that has proved efficient in practice but is rather expensive, especially for the larger layout. A compromise is to use this for the race, shedder and gates and to construct the collecting/holding pens and perimeter fencing from wire fence.
- * For the best results, the following behavioural factors should also be taken into account:

- (i) The front of the race should be open so that the sheep do not approach a dead end.
- (ii) Strong contrasts in light should be avoided. Sheep can be led more easily from a dark area into the light but the reverse can cause problems. The first animals in the flock (leaders) is much more affected than the rest by the level of illumination. Sheep also do not readily move towards direct sunlight, particularly when it is low upon the horizon. It is therefore obvious that sheering sheds should be as well lit as possible and races/ shedders should be in a North-South direction.
- (iii) In contrast with general belief, small stock preferred to move on the flat and run better on the level than they do up a slope.
- (iv) Sheep prefer to move towards other sheep, rather than into an empty race. But whether the sheep at the far end were moving or stationary had little effect. Decoy pens at the far end of a race or shedder should therefore advance the movement of oncoming sheep. Sheep leaving the race should be penned directly ahead of it. On the other hand, stationary sheep in an adjacent race or pen have the effect of slowing down the movement of the mob.
- (v) Many modern sheep yards are built with curved layouts, based on the belief that sheep move better round corners than straight ahead. However, much depends on the width of the race. In wide races, sheep were found not to flow better around corners,

in fact, their movement become progressively slower as the angle become more acute.

- (vi) Sheep are hesitant to move through confined spaces. Movement is faster through a wide race than through a narrow one. Obviously wide races should be used wherever possible when large numbers of animals are to be moved in the shortest possible time.
- (vii) Sheep should always be moved in the same direction if possible. Once they had become accustomed to a particular pattern of movement, they are unwilling to change.
- (viii) When dipping or handling a mixed flock, sort the ewes from the lambs and dip the ewes first, leaving the lambs penned ahead, and vice versa.



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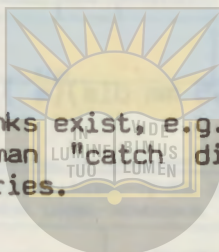
PRACTICAL 3

DIPPING-TANKS FOR SMALL STOCK

External parasites that cause severe problems in small stock are ticks, mites, keds, lice and blowflies. Most of these parasites can be controlled through regular dipping. In regard to the method of treatment: dipping-tanks for complete submersion or a spray-race/shower pen can be used, (the latter is not suitable for sheep scab treatment). If a small number of animals has to be treated, they can best be sprayed with a specially designed sheep-dip-applicator, a locust spray pump or a knapsack sprayer. Localized parasites (ears, legs, under the tail) are effectively controlled by the use of a footbath or with tick greaser or oil.

3.1 Dipping-tanks

Various types of dipping-tanks exist, e.g. long-swim dipper, circular dipper and one man "catch dip", equipped with walk-in, side- or float entries.



3.1.1 Basic requirements

- * Ensure that the chemicals are safely disposed off. Select a location on the farm which is best suited, preferably on a slope, or on the level but not in a low lying area.
- * Know the capacity of your tank, do not guess or rely on your memory. Use a calibrated dipstick (200 l interval).
- * Do not dip wet sheep - dilution of dipping mixture.
- * The whole operation should be carried out gently and quietly.
- * When dipping a mixed flock, sort the ewes from the lambs and dip the ewes first, leaving the lambs penned ahead.

3.1.2 Tank construction

Build according to drawings P/24/79 and P/25/79 paying particular attention to dimensions for correct capacity, anti-splash facilities and entrance and exit requirements. Floor foundations, (also drainage area) entrance ramps and exit steps must be of concrete and all walls should have double-brick layers. (Glass fibre dips are also available on the market). Floor, side walls and exit steps should be reinforced.

For scab control, dip should be equipped with control gate in order that sheep are contained in dip wash for at least one minute.

The circular tank design will afford better all round control and management in scab control. The working volume for conventional replenishment of this tank is 4346 litres at a depth of 1300 mm. For the longitudinal plunge dip it is 3321 litres. The depth of both dips should never be allowed to fall below 1000 mm.

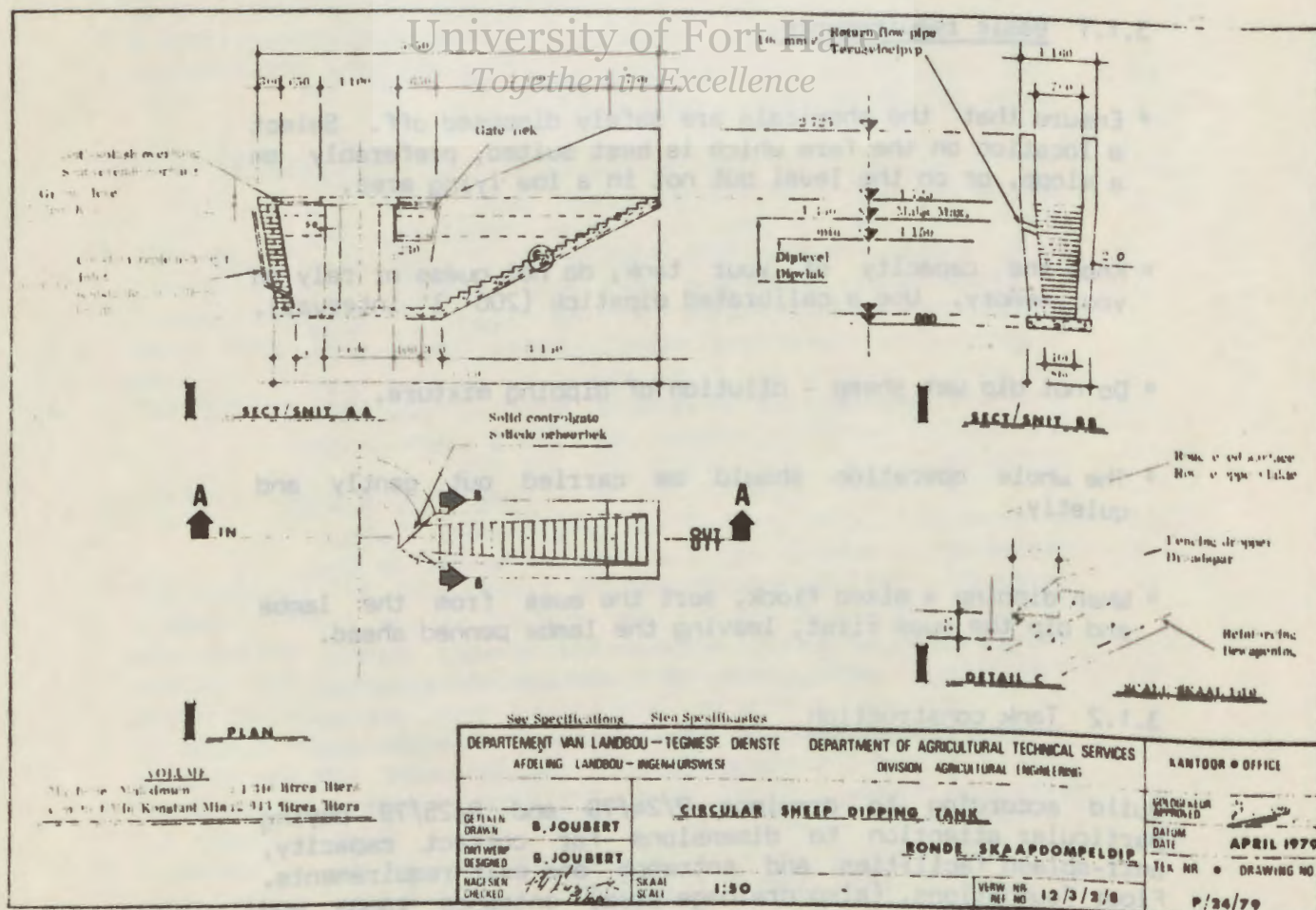
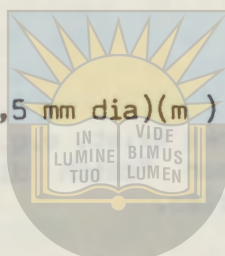
Material List

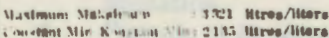
P/24/79

P/25/79

Quantity

Bricks (215 x 103 x 65)	2100	2000
Cement (50 kg pockets)	20	19
Sand (m)	2,5	2,3
Stone (19 mm)(m)	1,25	1,3
Brickforce (m)	300	300
Weld mesh (100 mm x 100 mm x 3,5 mm dia)(m)	25	25







F.1 SHEARING SHED AND FACILITIES

by P. SCHUURMAN
Glen College of Agriculture

For the proper and effective preparation of the clip for marketing the following should be kept in mind in the design and planning of a shearing shed:

- The basic principles of shed design and utilisation
- Purpose to be served
- Providing for the necessary equipment.

1. PRINCIPLES

- 1.1 Labourers and classers must be able to carry out their work easily and efficiently. Sufficient space must be provided.
- 1.2 The wool must be kept *clean* and *dry*.
- 1.3 Labour must be *saved* and available labour employed as efficiently as possible.
- 1.4 The *division* of the shearing-shed area should be so planned that all the processes from the catching pen follow each other logically. This can also lead to a saving of labour.
- 1.5 Supervision of all activities should be possible.
- 1.6 Utilisation costs of the building and facilities should be kept low.

2. PLANNING OF THE SHEARING SHED

- 2.1 **Shearing shed and/or barn?** For the sake of turning costs to good account it is perhaps advisable to plan a dual-purpose shed that can also be put to other uses outside shearing times. If the barn is to be used for the storage of implements, etc., the slatted floors and pens should be removable, the wool bins should be foldable while the floor should also be very firm. A cement floor will then, be preferable.

2.2 Good natural light that can be let through large windows and skylights is essential for proper classing, handling of wool and shearing of sheep.

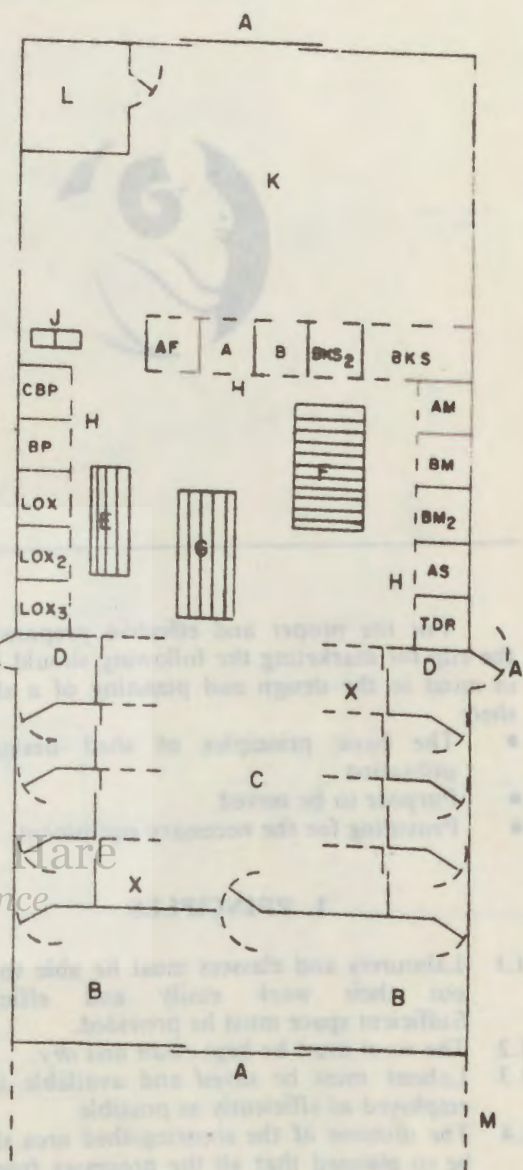
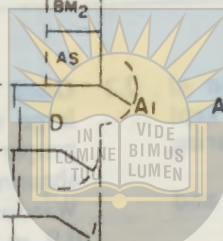
Windows, measuring approximately 1,524 x 0,9 m (5 ft x 3 ft) for light and air, are necessary and should be built in approximately 1,5 m (5 ft) above floor level. *Subdued roof lights*, preferably on the south side, are particularly desirable. The "factory type" roof with window construction on the south side will provide effective and uniform light throughout the day and is therefore strongly recommended.

- 2.3 **Good ventilation** enables labourers and classers to do their work easily and efficiently. This should not facilitate dust penetration however. Cross-ventilation, especially through the entrances, is desirable. Entrances should, however, not be built facing the prevailing winds.

- 2.4 The floor can either be a firm wooden floor, or should preferably have a smooth cement surface where the shearing shed is also used as a barn. It is, however, important that it should have a firm surface that can be *washed* and easily *swept*.

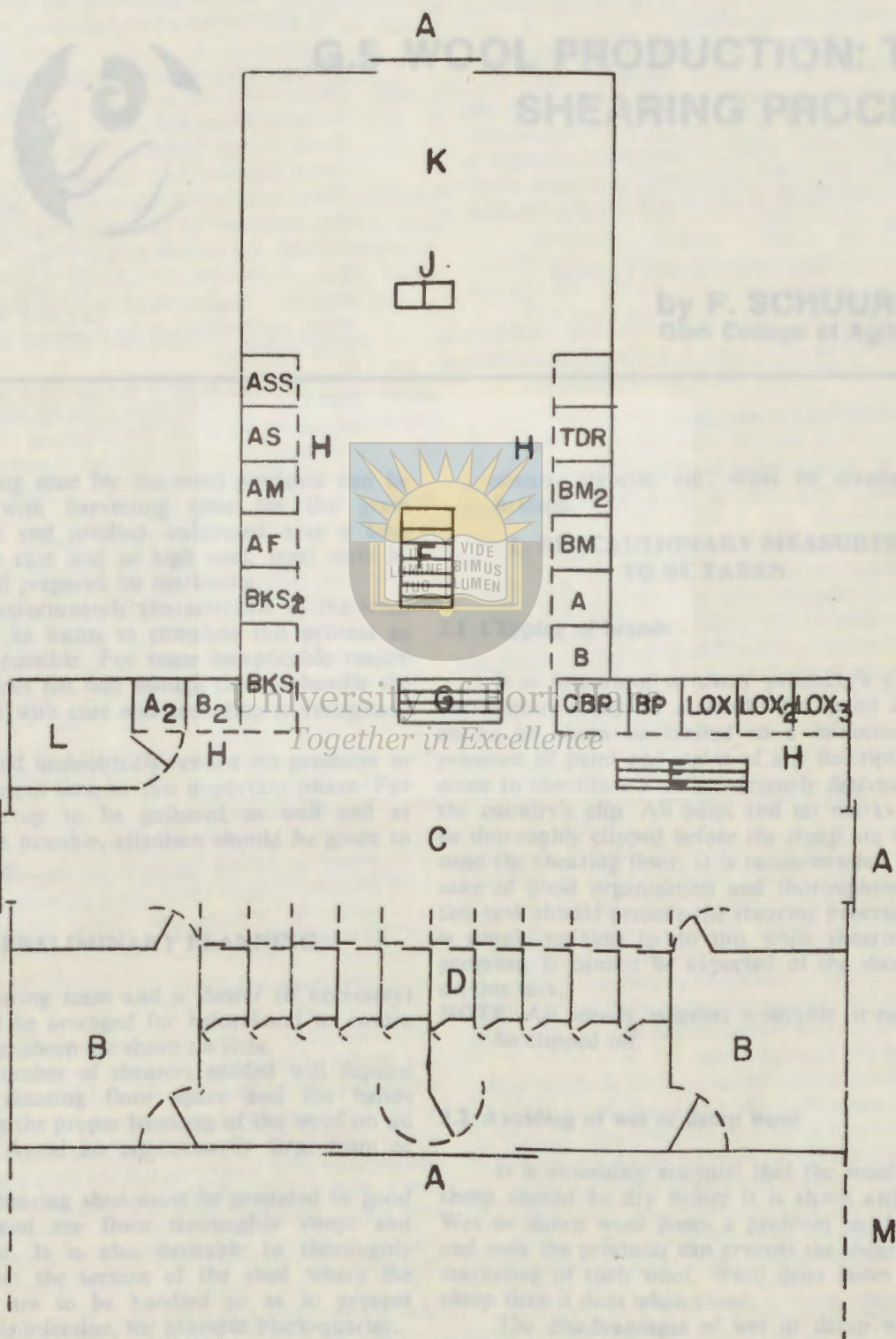
In a more expensive construction a wooden floor on *pillars* can be provided and the space below the floor area used for keeping sheep dry.

- 2.5 **Pens** in the shed should be provided with slatted floors to prevent staining by urine and dung. Good drainage must be provided particularly where slats are based on cement floors.



- (A) Entrances to catching pens and other outside doors
- (A1) Doors for driving out shorn sheep and also for ventilation of the shearing floor
- (B) Receiving pens on slatted floors from which shearing pens can be filled
- (C) Shearing floor with "X" as shearing place for every shearer, measures approximately 1.524 x 1.524 m (5 ft x 5 ft)

- 2



(L) Small storage room for shearing requirements, etc and

(M) Wing fencing - facilitates the driving in of sheep



G.5 WOOL PRODUCTION: THE SHEARING PROCESS

by P. SCHUURMAN
Glen College of Agriculture

Shearing time for the wool producer can be compared with harvesting time for the grain farmer. The end product, cultivated over a long period with care and at high cost, must now be gathered and prepared for marketing.

It is unfortunately characteristic of the wool farmer that he wants to complete this process as quickly as possible. For some inexplicable reason he simply does not find enough time to handle the end product with care and according to recognised standards.

It would undoubtedly reward the producer to devote sufficient time to this important phase. For the year's crop to be gathered as well and as effectively as possible, attention should be given to the following:

1. PRELIMINARY PLANNING

- 1.1 A shearing team and a classer (if necessary) should be arranged for beforehand to ensure that the sheep are shorn on time.

The number of shearers needed will depend upon the shearing floor space and the hands available for the proper handling of the wool on all the tables. Avoid an unnecessarily large team of shearers.

- 1.2 The shearing shed must be prepared in good time and the floor thoroughly swept and washed. It is also desirable to thoroughly disinfect the section of the shed where the sheep are to be handled so as to prevent possible infection, for example black-quarter.

The wool bins, slatted floors, tables, brooms, etc., must be placed in readiness. Other facilities such as catching pens, gates, etc., must be checked for serviceability.

- 1.3 All requisites such as woolsacks, hooks, marking material, disinfectants for floors and

shears, stencils, etc., must be arranged for betimes.

2. PRECAUTIONARY MEASURES TO BE TAKEN

2.1 Clipping of brands

It is important to every producer's clip and the country's clip as a whole that paint and tar marks on sheep be limited to a minimum. The presence of paint and stains of any description has come to constitute a defect seriously detrimental to the country's clip. All paint and tar marks should be thoroughly clipped before the sheep are brought onto the shearing floor. It is recommended, for the sake of good organisation and thoroughness, that this task should precede the shearing process. There is simply no time to do this while shearing is in progress. It cannot be expected of the shearers to do this task.

NOTE: All brands, whether scourable or not, must be clipped off.

2.2 Avoiding of wet or damp wool

It is absolutely essential that the wool on the sheep should be dry before it is shorn and baled. Wet or damp wool poses a problem in the trade and only the producer can prevent the shearing and marketing of such wool. Wool dries faster on the sheep than it does when shorn.

The disadvantages of wet or damp wool are the following:

- 2.2.1 When wet or moist wool is baled the appearance of the wool is adversely affected which in turn influences the price. Under pressure spontaneous combustion can take place, which can result in serious fires.

2.2.2 Wool in a damp or wet condition cannot be offered for sale as the buyer cannot possibly estimate its clean yield and determine its value. Buyers therefore usually refuse to buy damp wool and insist on it first being dried in the sun.

2.2.3 Wet or damp wool necessitates more handling and this incurs *extra costs* which have to be borne by the producer.

2.2.4 In cases where an abnormally high moisture content occurs and wool is sold in that condition, subsequent drying causes a loss of mass leading to claims by the buyer.

Because of these serious disadvantages it is important for every producer to ensure that the wool on the sheep is absolutely dry at the time of shearing.

3. THE SHEARING FLOOR

Good or bad work in the shearing shed begins on the shearing floor and it is therefore important to devote attention to the following aspects:

3.1 Preparations for shearing

It is most important that before shearing commences the shearers be made thoroughly aware of their duties.

Emphasis must be placed on the *neat shearing* of the sheep, with as few *skin cuts* and *second clippings* as possible. The correct shearing method should preferably be demonstrated to them. The shearers "lootjie" system should be discouraged and preference rather given to a bonus awardable for neat shearing. Try to secure the confidence and co-operation particularly of the leader or foreman of the shearing team.

3.2 The correct shearing method

The preparation of wool starts with the shearing of the sheep. Slipshod and over-hasty shearing of sheep frustrate the effective skirting and preparation of wool. Fleeces should not be deposited on the floor in an unmanageable condition as such fleeces are difficult to throw properly on the skirting table for efficient handling; locks are then encountered all over the fleece when it arrives on the skirting table.

Over-hasty shearing also results in sheep being badly cut and in a large amount of second clippings. Second clippings have become an evil as they make for great variation in the length of fleece wool lines. It is in the interest of every producer to closely supervise the shearers and the shearing methods applied. Where labourers are trained as shearers the following principles must be observed:

3.2.1 The shears must cut correctly

The cutting edges of the shear blades must be fairly wide and sharp. The points must come closely together and end in a flat point so that cut and poke wounds are eliminated. If the blades tend to fold over each other instead of cutting, the

blades of the open shears should be "bent" over each other.

Keep the shears flat on the skin in order to shear as short as possible, to avoid skin cuts and to keep second clippings to a minimum.

3.2.2 Start aright and facilitate the work of the fleece thrower and skirter

The correct procedure is as follows:

- (a) Begin with the belly wool. Urge the shearers to take the greatest care not to nick teats or penis. Fleece wool on the sides must not be shorn together with the belly wool.
- (b) Then follows the shearing of the crutch and the removal of all short wool and locks around the exposed parts, that is top knot and cheek wool, forelegs and behind the shoulder blades, back legs and flanks. Long clean wool must not be removed together with such clippings.
- (c) To ensure that the shearing floor is kept clean and that all small pieces, locks, dust and dung are removed from the shearing floor one or two sweepers with suitable brooms should be on duty while shearing is in progress. Before the fleece is opened all the shearing places must be swept thoroughly clean.
- (d) The fleece must be opened at the points of the neck folds, that is, from the knob on the shoulder bone to behind the ear. This ensures that neck folds are not encountered on both sides of the skirting table but in one piece only viz on the left or right-hand side of the table according to whether the shearer is left or right-handed.
- (e) The fleece must be regarded as a single unit. The shearer must not tread on the fleece and the legs of the sheep must be kept away from the loose parts of the fleece. Do not allow the sheep to stand upright during the shearing process. Shear short on the back and rump parts to prevent the fleece tearing in the throwing process.

3.2.3 The sheep must be held at ease

The most comfortable position for the sheep is a sitting position or laid on its side. The knees are used to hold the sheep in position. Sheep are inclined to struggle or to stand erect if their legs are folded under or the head laid on the floor. By bending the neck to one side (even between the legs of the shearer) the furthest areas can be reached with ease without moving the sheep from its original position. The shearer must move *around* the sheep.

3.2.4 Wool must always fall away from the shearer

This is assured by -

- (a) shearing from right to left (left to right for left-handed shearers).
- (b) shearing from top to bottom.

(c) shearing away from the shearer's body.

3.2.5 *Shear only on a flat or curved surface - not in a hollow*

Straighten out the skin with the nonshearing hand and bend the body of the sheep so that it presents a curved surface. Do not pull at the wool with the free hand as this results in skin cuts.

3.2.6 *Shear only where it is possible to see and not around corners*

When trying to shear around the corner the point of the shears usually lifts and the wool is then clipped well above the skin. This causes disparate lengths in the fleece and especially in the backs which forms the second cuts if clipped again later.

4. USE OF SHEARING MACHINES

Shearing machines appeared in South Africa already at the beginning of the century. The early machines were, however, very clumsy in comparison with the modern shearing machine.

The reasons for the slow change-over from manual to machine shearing in South Africa are *inter alia* the following:

- Until recently many skilled manual shearing teams were available and no trouble was experienced in obtaining their services.
- On the other hand it was difficult to secure machine shearers and there was no encouragement to acquire machines.
- Many wool farmers lack the necessary practical knowledge for the effective and economical use of shearing machines.
- A shortage of trained machine shearers and the lack of training facilities as well as the lack of knowledge regarding the use and maintenance of shearing machines prevented a speedier change-over.
- Although many farmers possess shearing machines shearers still present a problem. This can largely be attributed to our migrant labour system. Shearers have continually to be trained. Moreover a poor manual shearer can still do a better job, especially considering second clips, than can a poor machine shearer.

Because of a change in the Non-White labour pattern in South Africa the old familiar shearing teams are becoming more and more scarce. This will possibly compel the wool producer to switch over to machines.

Considerably improved shearing machines are already commercially available, such as the air-pressure type which is expensive but considerably more efficient than the older conventional types.

5. LABOUR IN THE SHEARING SHED

The aim of every classer should be to immediately prepare all wool as it comes from the

shearing floor for every line drawn. To achieve this the following guidelines should be observed:

5.1 Work demarcation

Organisation in the shearing shed must not only be carefully planned but every labourer must be made fully aware of his particular duties.

The principle of *work demarcation* can successfully be applied. Each labourer is made responsible for a specific task, and for control and checking purposes by the classer the work of each labourer should preferably be performed separately. A high standard can thus be achieved.

Adequate labour will prevent wool accumulation. Wool which is allowed to pile up makes sorting more and more difficult.

The wool must at all times be kept clean.

5.2 Picking up and throwing of fleeces

A fleece which has been properly shorn can be picked up easily and thrown like a blanket on the skirting table without breaking.

Skirting is a specialised job which can be done satisfactorily only if the fleece is properly thrown. Before the fleece is picked up, its position must be determined by the characteristics of the fleece parts. Fleeces are mainly picked up from the britches as these are the only parts that lie open after the shearer has shorn the sheep. Fleeces may also be picked up neck first, especially when the fleeces are torn or if they are very large as is the case with ram fleeces.

Fleeces may be picked up according to one of two methods, viz. the *folding method* or the *packing method*. The *folding method* is usually used in practice to pick up fleeces quickly. The fleece is picked up from the britch side in the position as it was left on the floor by the shearer. In each hand a britch is grabbed firmly and folded like a belt round the rest of the fleece and the fleece is pressed together and picked up.

The *packing method* is used where fleeces are large and spread out. Here the fleece thrower stands astride the fleece at the britch end and faces the britches. With the forefinger and thumb of each hand as much wool as possible of each britch is grabbed. Thereafter all wool is pressed together between the hand palms and lifted to approximately knee height while the thrower takes one step backwards. All wool between the hands is then packed neatly on the wool before the feet, but the grip on the britches is still maintained. This procedure is repeated till all wool on the floor is packed and ready to be picked up.

The packing method can naturally also be applied from the neckfolds, which can serve as a belt.

The wool is held in front of the chest, but away from the body, without loose hanging points, and is carried to the table. Stand about a metre from the head of the table with one foot forward. Make sure that no points are hanging out. The wool between the hands is then pushed forward to

- (1) Thorough skirting of all pieces and skirtings to remove locks - divide locks into LOX and LOX 2.
- (2) Division of well-skirted pieces and skirtings into CBP and BP.

FLEECE THROWER

- (1) The fleece thrower should pick up the fleeces quickly and throw them open on the skirting table in such a way that skirting can be done immediately and efficiently.
- (2) The fleece thrower may also assist with the skirting of the fleece at the side of the skirting table from which the fleece is thrown.
- (3) For effective skirting the fleece must be thrown with the shearing side (white side) underneath.

SKIRTING TABLE

The classer, assisted by two skirters, is responsible for:

- (1) *Skirting of the fleece:* Thorough removal of all skirtings (all short and deviating pieces of wool) from a fleece. One of two procedures may be followed here, namely:
 - (a) Fast removal of locks (sweat wool) before the skirtings are removed from the fleece. This procedure ensures that the locks are immediately removed from the skirtings and taken directly to the LOX line. This will facilitate the work at the "piece-picking table" where the skirtings must be further divided.
 - (b) Removal of the skirting strip as a whole for transfer to the "piece-picking table" where the LOX are removed and the

skirtings further divided into CBP and BP.

- (2) *Division of fleece:* The fleece is divided into different lines, namely:

- (a) *Broken fleece* - this is necktold wool (necks), britch wool (stronger, shorter or seedy) and seed-containing wool (sides) which must be removed and placed directly in the broken fleece line according to length and appearance.
- (b) *Backs* - this is dusty or noticeably weathered and/or tender backs that must be removed from the fleece wool and directly classed in the lines BKS or BKS2 (crow's nests; shorter and heavier backs.)
- (c) *Fleece wool* - this is the part remaining after locks, belly wool, skirtings, broken fleeces and backs have been removed. The fleece wool must be correctly typed and classed in the main fleece lines or cast fleece lines of the clip.

PRESSED BALES

As the shearing progresses the wool in the different lines must be pressed.

- (2) Bales should be firmly pressed (140 to 145 kg per bale), neatly closed and correctly marked.
- (3) Well-classed clips firmly pressed into bales and correctly marked, ensure the highest income for the producer, and efficient handling, marketing and shipment of wool. Such organization will ensure that all lines of wool have been properly classed at the close of each day's shearing.

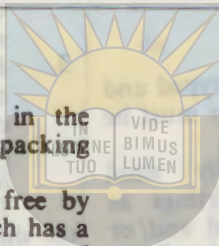


G.6 COMPOSITION AND PREPARATION OF A MERINO FLEECE

by P. SCHUURMAN
Glen College of Agriculture

Merino wool is defined as follows in the regulations governing the classification, packing and marking of wool:

Merino wool is white wool which is free by nature from kemp fibres and hair and which has a fibre thickness of not more than 25 microns and shows the typical characteristics of the wool of the Merino sheep.



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Shankings
Short top knots and cheek wool
Second cuts
Sweepings
Hard sweaty pieces (excluding dags)

LOX, consists mainly of urine-stained wool

TYPES OF MERINO WOOL

The following types (lines) of wool are usually shorn from a Merino sheep:

Locks
Belly wool and skirtings
Broken fleeces
Backs
Fleece wool

1. Locks: Regulation 6(f)

Locks must be packed separately from all other wool types.

Three lines of locks are recommended, namely LOX, LOX₁, and LOX₂.

Irrespective of the quantity it is advisable always to pack the inferior locks (LOX₂ and LOX₃) separately.

LOX consists mainly of:

Sweat wool (sweaty edges)
Matted brisket wool
Wool defiled by dung
Long top knots
Any pieces too inferior for inclusion in the BP line.

LOX₂, consists mainly of:

2. Bellies and pieces: Regulation 6(e)

Belly wool and pieces (skirtings) must be packed separately.

Three lines can be made namely CBP, BP, and CB if this is justified by the quantity of the better classes:

CBP: Well skirted long (45 mm and longer) light and attractive belly wool and pieces are packed together.

BP: The shorter (less than 45 mm), heavier and less attractive belly wool and pieces are packed together. All locks and very short edges should be thoroughly skirted.

CB: If the quantity of well skirted and selected long (45 mm and longer), light and attractive belly wool justifies it a special line can be packed separately.

3. Broken fleeces: Regulation 6(c)

(a) Well skirted deviating parts of the fleece such as neck folds (necks), britch wool and seedy or burry wool should be removed from fleece wool, and if the quantity justifies it a separate line can be made as "broken fleeces."

(b) Where broken fleeces are thus packed separately they should be baled and marked

according to length as required by the regulations:

the fleece remaining after all the locks, skirtings, belly wool, broken fleeces and backs have been removed.

Symbol	Average Length	
	mm	ins
AA	90+	3½
A	82.5	3¼
B	67.5	2¾
C	52.5	2
D	37.5	1½
E	22.5	1
EE	15-	¾

SKIRTING OF FLEECES

Effective preparation of the fleece for the market depends mainly on careful skirting of the fleece.

Why skirting is essential

- (c) The regulations also require that the fineness of the broken fleeces line should be not more than 25 microns or 58'S spinning count. When the quantity of broken fleece wool does not justify the making of a line (1 bale) or when such wool is too short, too heavy or too unattractive for the existing broken fleece line or lines in a clip this wool can be worked in with the CBP or BP line.

Important

As the broken fleeces line is to be typed and bought by the trade as fleece wool this line must be kept as light and attractive as possible.

Belly wool, wool with a belly wool appearance (watery wool), ordinary skirtings as well as wool resembling backs (weathered and/or dusty) should not be packed with a broken fleece line.

1. Inconstancy of wool in competition with the uniformity of the synthetic fibre. In every fleece there are differences in respect of the properties of length, fineness, quality, condition and appearance. Careful skirting of fleeces ensures the achievement of the highest degree of uniformity in the fleece wool and outsort lines.
2. Government regulations governing the classing, packing and marking require the sub-division of fleeces in the different lines.
3. Because of the greater uniformity within the different lines the buyer places greater confidence in what he buys, and he is prepared to pay the highest price for a specific line of wool.

The skirting of fleeces and bellies as well as the different types of wool obtained therefrom are diagrammatically shown in the accompanying sketches.

In the case of unskirted bellies the sweaty pieces, urine stained and matted brisket wool are first removed. It is then divided into light long (45 mm and longer) bellies and short belly wool.

On the skirting table the *skirted strip* should as far as possible be removed from the fleece in an unbroken strip.

The *broken fleeces* (neck fold wool, britch wool and seedy wool) are then removed and divided according to length.

The *backs* are then removed and the crow's nest and rump wool removed if necessary. The last-named are best removed by folding over the ends of the backs and removing only the parts where the sand shows on the butt end and where the rump wool is very short (C-length and shorter in an A-clip).

The remaining fleece wool is then rolled up, typed and classed in the respective fleece lines.

4. Backs: Regulation 6(d)

All dusty or noticeably weathered and/or tender backs must be removed from the fleece and packed separately.

It is further laid down in the regulations that two lines of backs should be made, namely:

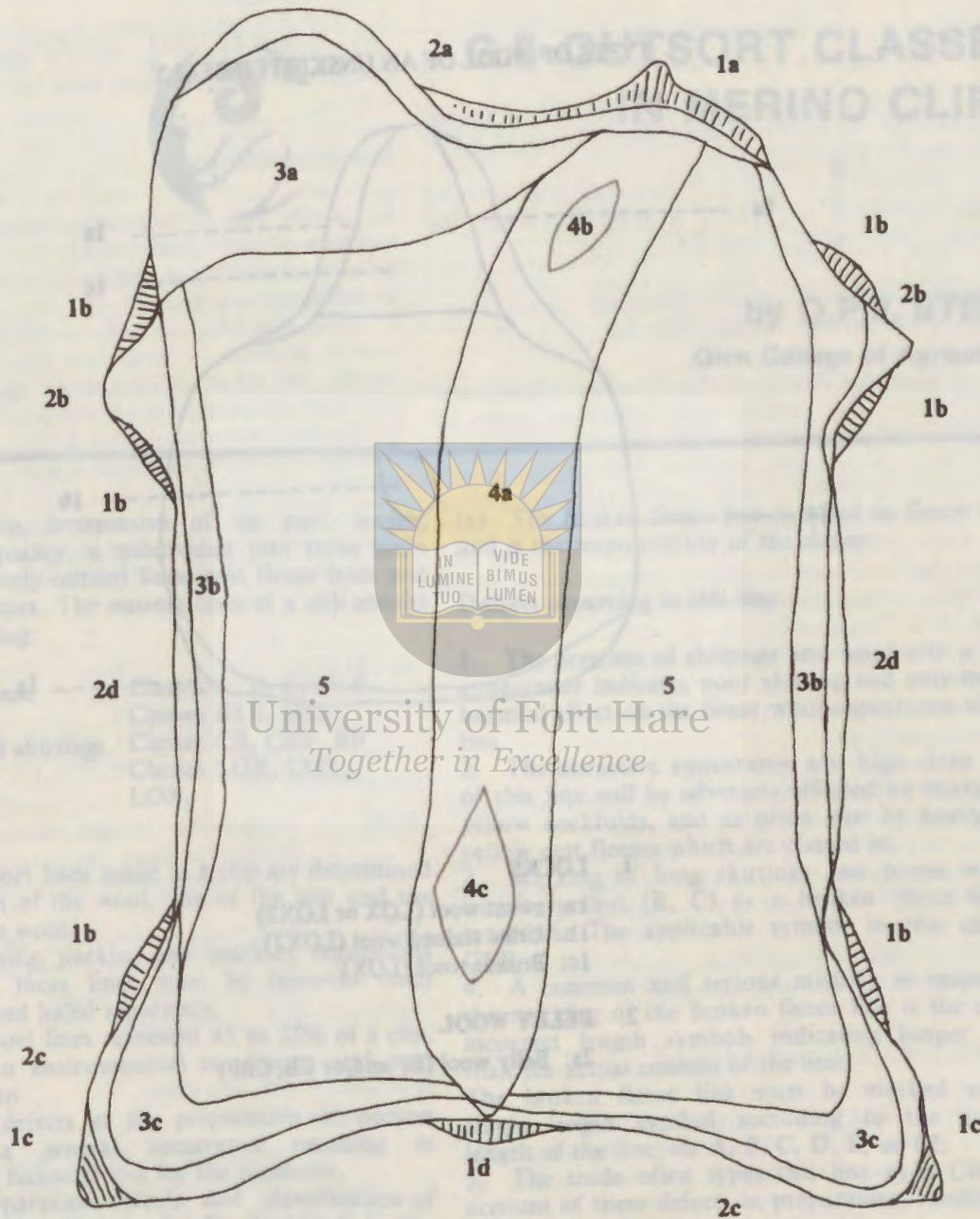
BKS: Inferior backs containing the badly weathered, shorter, heavier and less attractive backs such as, for example, the crow's nest and rump wool parts.

BKS: The more attractive and longer backs.

5. Fleece wool: Regulation 6(a)

Fleece wool, from a live sheep, is that part of

SKIRTING OF A FLEECE



1. LOCKS

- 1a: top knots
- 1b: sweat locks
- 1c: shankings
- 1d: urine & dungstained wool

2. SKIRTINGS

- 2a: neck & head skirtings
- 2b: shoulder wool
- 2c: britch skirtings
- 2d: watery wool (belly wool)
- (skirting strip: 1 + 2)

3. BROKEN FLEECE

- 3a: neck wool
- 3b: seedy wool
- 3c: britch wool

4. BACKS

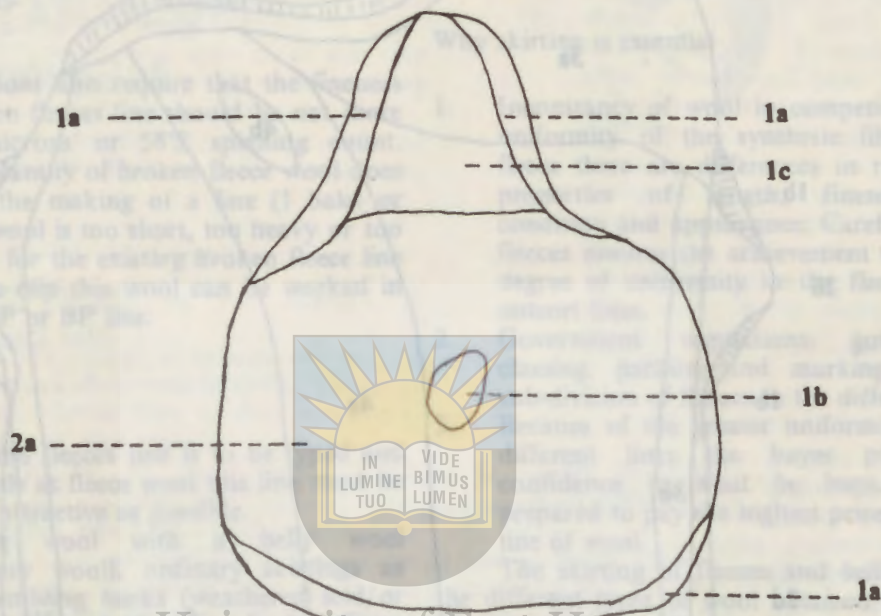
- 4a: ordinary backs
- 4b: crow's nest
- 4c: rump wool

5. FLEECE WOOL

SKIRTING OF BELLIES

The sweat wool and urine-stained wool of the belly are skirted with the sheared or white side downwards. For further classification and determining of appearance, condition and length the belly must be judged with the sheared side upwards.

TYPES OF WOOL OF AN UNSKIRTED BELLY



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1. LOCKS

- 1a: sweat wool (LOX or LOX2)
- 1b: Urine stained wool (LOX2)
- 1c: Briquet wool (LOX)

2. BELLY WOOL

- 2a: Belly wool (BP and/or CB, CBP)



G.8 OUTSORT CLASSES IN MERINO CLIPS

by O.P.J. STEYN

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Any clip, irrespective of its size, length, fineness or quality, is subdivided into three main divisions, namely outsort lines, cast fleece lines and main fleece lines. The outsort lines of a clip consist of the following:

Broken fleece : Classes A, B, C, D, E
 Backs : Classes BKS, BKS,
 Bellies and skirtings : Classes CB, CBP, BP
 Locks : Classes LOX, LOX,
 LOX,

(c) The broken fleece line is typed as fleece wool and is the responsibility of the classer.

Defects occurring in this line

1. The outsort lines made in a clip are determined by the length of the wool, size of the clip and the quality of the wool.
2. The classing, packing and marking regulations require that these lines must be removed from fleece wool and baled separately.
3. The outsort lines represent 45 to 55% of a clip, depending on environmental conditions and seed contamination.
4. Serious defects in the preparation of outsort lines are a general occurrence resulting in considerable financial loss for the producer.

The preparation, defects and classification of outsort lines in clips are briefly discussed in this leaflet.

1. The presence of skirtings and wool with a belly appearance indicates poor skirting and may have a harmful effect on the fleece wool appearance of this line.
2. The attractive appearance and high clean yield of this line will be adversely affected by heavy and yellow neckfolds, and as often also by heavy and yellow cast fleeces which are classed in.
3. Marking of long skirtings and pieces with a length symbol (B, C) as a broken fleece line is incorrect. The applicable symbol in this case is CBP.
4. A common and serious mistake in respect to the marking of the broken fleece line is the use of incorrect length symbols indicating longer wool than the actual content of the line.
 The broken fleece line must be marked with a single length symbol according to the average length of the line, viz A, B, C, D, E, or EE.
5. The trade often types this line as a CBP on account of these defects in preparation, resulting in financial loss for the producer.

Recommendations

1. BROKEN FLEECE

- (a) Broken fleeces amongst others include the following: Neckfolds that are too strong or not uniform in spinning count, britch wool which is stronger and shorter than the fleece and long seed-contaminated edges of the fleece.
- (b) Uniform length with attractive high yielding appearance are the most important requirements for the broken fleece line.

1. For most clips one broken fleece line is recommended, marked according to shearing length (12 months - A; 10 months - B; 8 months - C and 6 months - D).
2. In the case of large clips (more than 40 bales) where there is a sufficiently large amount of broken fleeces of a shorter length, a second line of shorter length can be made - for example an A and B broken fleece line in a twelve-months-clip.

3. If, however, the shorter broken fleeces are not enough for a class, these can be blended with the CBP and/or BP classes.

4. In a small clip where the broken fleeces do not warrant a class (1 bale) the small quantity can be blended with the CBP and/or BP.

2. BACKS

(a) All dusty, noticeably weathered and/or tender backs must be removed from the fleece and baled separately from other wool.

(b) Backs are typed as a "fleece line" and it is the responsibility of the classer to class backs into the correct lines viz BKS and BKS₂.

The following shortcomings are often encountered in the classing of backs

1. With the removal of backs, where fleeces are thrown with the shearing side uppermost, parts of the weathered backs are often left with the fleece. In many clips this practice results in length variation in fleece lines, lower yielding and a weathered appearance.

2. Great length variation in BKS lines. Short and heavy backs should be packed separately to avoid extreme length differences in this line which is typed as a "fleece line".

3. Overstrong backs must be baled and sold separately.

Recommendations

1. It is recommended that in all clips two classes of backs viz BKS and BKS₂ be made

2. A second line of backs, BKS₂, can be made containing the shorter and heavier backs as well as parts full of twigs and leaves such as the crow's nest.

3. In the case of short wool clips (6 months) only a BKS line is made when necessary.

3. BELLIES AND SKIRTINGS

Three classes can be made of belly wool and skirtings namely CB, CBP and BP. The length and size of a clip will mainly determine whether all these classes can be made.

Defects that frequently occur in these lines

1. The presence of sweaty wool and locks in the CBP and BP classes are serious faults against which producers frequently have to be warned. They indicate that proper control over the sorting and classing of this wool is not being exercised in the shearing shed.

2. Devote careful attention to the removal of all locks during the shearing process and on the locks and piece-picking tables.

3. The marking of well-picked long skirtings and pieces with a length symbol (B, C) as a broken fleece line is totally incorrect. This practice results in the value of the broken fleece lines, which should contain wool with a fleece wool appearance, being seriously impaired.

4. The presence of heavy yellow, very watery and inferior belly wool in the CB class which should contain only well-picked long belly wool of good quality.

Recommendations

1. In the case of large long wool clips where the quantity of well-picked long, light and attractive belly wool justifies a special class such a class may be made and marked CB.

2. The blending of belly wool and skirtings is usually justified as these two types correspond in quality and occur in such small quantities in most clips that separate lines are not justified.

3. In most long wool clips a CBP class consisting of long attractive and well-skirted belly wool and skirtings, is recommended.

4. In all clips a BP line consisting of short and/or unattractive belly wool and pieces is applicable.

5. Only a BP line is made in short wool and small clips.

4. LOCKS

Locks must be removed from all other wool and baled separately. Three classes are recommended for all clips, viz:

LOX - Sweatlocks, matted brisket wool, wool defiled by dung, long top knots and any pieces too inferior for inclusion in the BP line.

LOX₁ - Sweepings, second cuts, shankings, short top knots and cheek wool and hard sweaty pieces (excluding dags).

LOX₂ - All urine-stained and/or dung-stained wool.

Outsorts in different sizes and lengths of clips

In the accompanying tables, recommendations are made as regards the outsort lines and classes to be made in clips of different sizes and lengths of wool. From these it is clear that:

1. The outsorts as recommended for an approximately 20 bale clip must be regarded as standard.

2. As clips become larger more outsort lines may advantageously be made.

3. In small clips certain outsorts will have to be omitted because of too small quantities.

4. A BKS and BKS₂ line is recommended for all clips except short wool clips (6 months' wool growth).

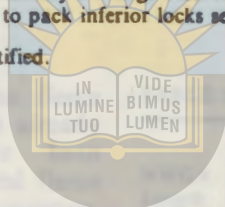
5. It is recommended to make a LOX, LOX₁ and LOX₂ class in all clips.

Recommendations for outsort lines

Clip	± 12 months				± 10 months				± 8 months				± 6 months			
Length of wool	Bulk A length				Bulk B length				Bulk C length				Bulk D length			
Size of clip	60 bales and over	± 40 bales	± 20 bales	± 10 bales and over	60 bales and over	± 40 bales	± 20 bales	± 10 bales	60 bales and over	± 40 bales	± 20 bales	± 10 bales	60 bales and over	± 40 bales	± 20 bales	± 10 bales
Broken fleece	A	A or A and B	A	B*	B	B or B and C	B	C*	C	C or C and D	C	D*	D	D or D and E	D	E
Backs	BKS	BKS	BKS	BKS	BKS	BKS	BKS	BKS	BKS	BKS	BKS	BKS	BKS	BKS	BKS*	BKS*
Bellies and Pieces	CB* CBP BP	CBP BP	CBP BP	CBP* BP	CBP BP	CBP BP	CBP BP	CBP* BP	CBP BP	CBP BP	BP	BP	BP	BP	BP	BP
Locks	LOX LOX, LOX,	LOX LOX, LOX,	LOX LOX, LOX,	LOX LOX, LOX,	LOX LOX, LOX,	LOX LOX, LOX,	LOX LOX, LOX,	LOX LOX, LOX,	LOX LOX, LOX,	LOX LOX, LOX,	LOX LOX, LOX,	LOX LOX, LOX,	LOX LOX, LOX,	LOX LOX, LOX,	LOX LOX, LOX*,	LOX LOX, LOX*,

REMARKS

- Broken fleece : If the quantity of broken fleece wool does not warrant a separate line, this wool should be classed into the CBP or BP lines.
 - Backs : Backs must, irrespective of quantity, always be packed separately as BKS. It is advisable always to pack inferior backs separately as BKS₂.
 - Bellies and pieces : If the quantity of CBP does not warrant a separate line, this wool should be packed together with BP. Belly wool and ordinary skirtings must not be classed in with any broken fleece line.
 - Locks : It is advisable always to pack inferior locks separately - mark LOX₂, LOX₁.
- * In some clips these lines may not be necessary or justified.



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G.9 CLASSING OF FLEECE WOOL - MAIN FLEECE CLASSES IN MERINO CLIPS

by O.P.J. STEYN
Glen College of Agriculture



The fleece wool is that part of the fleece remaining after the other lines of wool, as already described under "Outsort-lines", have been removed. The classing of thoroughly-skirted fleece wool is determined by the following characteristics, each of which plays a role in the determination of the price per kilogram wool:

1. SOUNDNESS

A tension test is made with the fingers; if the wool (staple) does not break, it is considered sound and suitable for the fleece lines made in a clip. If the wool breaks, the fleece wool is described as "tender wool" and kept apart as "TDR" or treated as cast fleece wool.

2. LENGTH

The regulations regarding the classing, baling and marking of wool require that -

1. fleece wool be classed and marked according to length
2. the difference in length between the shortest and longest wool baled be not more than 29 mm. Uniformity of length in a fleece line is therefore very important,
3. each bale be marked with the appropriate length symbol indicating the minimum length of wool in the container.

According to the NWGA classing standards, the length grades in Table 1 with the symbols for marking of bales, must be used.

The use of length symbols indicating longer wool than the actual content of the classes is one of the most serious defects in wool classing. Producers should devote serious attention to the use of correct length symbols.

TABLE 1 - NWGA Length Classes

NWGA Length Classes	Length Classes		Trade length in months
	Millimetres	Inches	
AA	90+	3½ +	12 14
A	75-90 (Ave. 82,5)	3-3½ (Ave. 3½)	12
B	60-75 (Ave. 67,5)	2½-3 (Ave. 2½)	10 12
C	45-60 (Ave. 52,5)	1½-2½ (Ave. 2)	9 11-8 10
D	30-45 (Ave. 37,5)	1½-1 (Ave. 1½)	7 9-6 8
F	15-30 (Ave. 22,5)	¾-1½ (Ave. 1)	6-4 6
EE	Less than 15	Less than ¾	4 6

3. FINENESS

This property refers to fibre thickness and is determined in practice according to the size of the crimp. The smaller the crimp the finer the wool and vice versa. Uniformity of fibre fineness in a fleece line is very important.

The grades of fineness with the appropriate NWGA symbols are indicated in Table 2.

Most clips consist primarily of medium and fine wool. The quantity of fine wool (70^µ and over) as a rule determines whether the two fineness grades are baled separately or together. It is essential, however, that strong and overstrong wool should not be classed with fine or medium fleece wool in any clip.

TABLE 2 - NWGA Fineness Classes

Description	NWGA Symbol	Spinning count (Minimum)	Micron thickness (Maximum)
Supertine	FI	70 ⁺	Less than 19
Fine	F	70	19
Medium	M	64-70 ^s	19-21
Strong	S	60-64 ^s	21-23
Overstrong	SS	58-60 ^s	23-25

NWGA Type

The NWGA type symbol, which indicates the contents or classes of fleece wool, is obtained by prefixing the correct length symbol to the appropriate fineness symbol, for example AF, BS, CM, etc.

4. QUALITY

This property, which is basically associated with uniformity of fibre thickness, is judged by taking into account the definition of the crimp, the handle of the wool and the presence or absence of deviating (noticeably coarse or hairy) fibres. A lack of definition or harsh handle of the wool indicates excessive variation in fibre diameter. The grades of quality are *good*, *fair* and *poor* (common). It is important that fleeces noticeably deviating in quality should not be classed with the fleece lines but be treated as cast fleeces.

5. CONDITION

Condition or comparable clean yield is determined by taking into account the amount of impurities such as yolk, dust, seed, etc. present in the wool. Three grades of condition are used, namely *light*, *medium* and *heavy*.

APPEARANCE

Appearance is determined by taking in consideration the colour of the yolk, the staple formation and the tip of the wool. The grades of appearance are *good*, *fair* and *poor*.

There is a close relationship between the various grades of appearance and those of condition or yield. Inclusion of noticeably heavy and unattractive fleeces with light and attractive fleece lines must be avoided as such wool has a harmful influence on the yield and thus on the price per kg wool.

Main fleece classes in clips

The fleece classes that should be made in a clip are determined by the size, average length and fineness of any clip, with the object of avoiding the making of unnecessarily small lines. It is mainly the length and fineness of the fleece wool comprising the bulk of a clip that determine what main fleece classes can be made

The following principles in respect of main fleece classes in clips should be taken into consideration.

(1) Uniformity

Ensure the highest degree of uniformity in respect of length, fineness and yield in main fleece classes by -

- thorough skirting of fleeces and removal of neckfolds (necks), britch wool and weathered backs, and
- the removal from main fleece classes and separate baling of cast fleeces that are tender, too short, overgrown, too heavy, matted or of poor quality.

(2) Main lots

Big lots ensure stronger competition and have decided handling and cost advantages. Adjacent fleece wool classes should be grouped judiciously in respect of length and fineness to make *bigger classes*.

(3) Star lots

Lots of one or two bales of high quality, known as speciality wools, are offered for sale as one and two-bale lots. Otherwise one and two-bale lots are as far as possible eliminated by blending with similar types of other producers in order to build bigger lots.

(4) Grouping of main fleece classes

To prevent overclassing and as far as practically possible to eliminate the making of one and two-bale lots in the main fleece classes, it is essential to apply grouping of adjacent classes for length and for fineness.

The following rules can advantageously be used as a guide-line for establishment of effective classes (main lots) in a clip. The terms "higher" standard and "lower" standard are here used in a relative sense. The rules are accordingly also applicable to any of the properties mentioned if the terms in question are replaced by the corresponding grades of the properties, namely sound and tender wool, long and shorter wool, fine and medium wool, wool of a good and of poorer quality, light and heavier wool, attractive and less attractive appearance.

Maintain the following grouping rules in respect of quantities.

- A large quantity of "higher" standard and a small quantity of a "lower" standard - *Keep separate*.

EXAMPLES:

For fineness

AF - 12 bales
AM - 4 bales

For length

AM - 10 bales
BM - 3 bales

- (b) A small quantity of "higher" standard and a large quantity of a "lower" standard - *Class together (group)*.

EXAMPLES:

For fineness

AF - 3 bales
AM - 12 bales

For length

AM - 2 bales
BM - 8 bales
10 BM

- (c) Approximately equal quantities of "higher" and "lower" standard.
(i) Large quantities of each - *Keep separate*.

EXAMPLES:

For fineness

AF - 10 bales
AM - 15 bales

For length

AM - 8 bales
BM - 6 bales

- (ii) Small quantities of each - *Class together (group)*.

EXAMPLES:

For fineness

AF - 2 bales
AM - 3 bales

For length

AM - 1 bale
5 AM
BM - 2 bales
3 BM

The term "small quantity" denotes a quantity of approximately the same as a "star lot" or a quantity of wool that in proportion to the main classes is insufficient to make any worthwhile contribution to the income from the clip.

Farmers, remember - A well-classed clip is still the best guarantee of the highest price per kilogram wool.



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G.10 CLASSING OF CAST FLEECES - CAST FLEECE LINES IN MERINO CLIPS

by O.P.J. STEYN
Glen College of Agriculture

Cast fleeces, that is fleece wool which deviates in one or other aspect from the fleece lines in a clip, occur in smaller varying quantities in each clip. These deviations will mostly be fleeces that are tender, too short, too strong, matted, too heavy or too unattractive and will therefore not fit in with the main fleece lines.

The inclusion of such deviating fleece wool (cast fleeces) in the normal fleece lines of a clip has an extremely harmful effect on the price per kilogram wool. It is in the interests of the producer always to see to it that a small quantity of deviating and inferior fleece wool is not classed with a larger quantity of wool of good standard.

The following principles apply in the making of cast fleece lines and the classing of cast fleeces in clips:

- (b) *Overgrown wool* (too long) should be packed separately.

FINENESS (SPINNING COUNT)

Deviation - too strong

1. *Strong wool* (60^S - 23 microns)

- (a) If strong wool is sufficient for the making of a line (one bale or more) - keep separate and mark according to NWGA classing standards, e.g., AS, BS, CS, etc.

- (b) Odd fleeces - class with RAM, BROKEN FLEECES or with overstrong wool (SS).

2. *Overstrong merino wool* (58^S - 25 microns)

- (a) Overstrong Merino wool of good quality must be packed separately - mark ASS, BSS, etc.
(b) Odd fleeces of overstrong merino wool can be classed in with RAM or XM.

3. *Overstrong wool* (56^S - 26 microns and more)

Pack separately, is regarded as cross-bred wool - mark XM or XS.

QUALITY

Deviation - noticeably poorer quality than the average of the clip.

- (a) *Fair quality* - Fleeces of fair quality can be classed with a fleece line of a lower spinning count or with the broken fleece line provided they fit in other respects, if not then with an outsort line such as BKS, BKS₂, CBP or BP - wherever they match best.
(b) *Poor quality* - Fleeces of poor quality (without hair) are packed with XM.
(c) *Hairy wool* - Wool containing hair should be packed separately - mark XX.

CONDITION

Deviation - too heavy

SOUNDNESS

Deviation - tender wool

- (a) If the whole clip, or the major portion thereof, is tender, the clip is treated and marked in the usual way as a sound clip.
(b) If only a portion (one bale or more) of a clip is tender a cast fleece line is made and marked TDR. Fine, medium and strong wool fleeces (60[#]) are classed together. Maintain uniform length and remove overstrong wool from this line.
(c) If only a few fleeces in a clip are tender or a few fleeces do not fit in the TDR line (e.g. too short, etc.) such fleeces must be broken up and classed in one or other outsort line where they fit best. Such fleeces are usually worked in with BKS, BKS₂, CBP or BP.

LENGTH

Deviations - too short and/or overgrown wool

- (a) *Too short* for the already determined length lines of a clip: As such wool is usually too small a quantity to justify a line (one or more bales), fleeces are broken up and blended with shorter broken fleeces line BKS₂, CBP or BP.

APPEARANCE

Deviation - too unattractive

It is important that heavy and unattractive fleeces are not packed together with the light and attractive fleece lines.

- (a) If heavy and/or unattractive fleeces are sufficient for making of a line (one bale or more) keep these separate and mark according to content followed by the figure 2, e.g. AM₂, BM₂, CM₂.
- (b) A few heavy and/or unattractive fleeces - class with RAM or one or other outsort line (BKS, BKS₂ or BP) where they match best.
- (c) A few dusty and/or weathered fleeces are classed with BKS or BKS₂.
- (d) Fleece wool with a poor staple formation (watery wool) is unattractive with a belly appearance and should be worked in with CBP or BP.

AN ALTERNATIVE

All cast fleece wool with the exception of coarse "overstrong" and "too short" wool can be packed together as a cast broken fleece line. Cast broken fleeces (yellow or heavy) that are not too short or overstrong can also be included in such a line. Mark with a single length symbol followed by figure 2, e.g. B2, C2, etc., to distinguish from the light and attractive broken fleece lines.

MATTED WOOL

All matted fleece wool *must* be packed separately - mark MAT.

RAM'S WOOL

- (a) Ram's wool *must* be packed separately from other fleece wool lines - mark RAM.
- (b) If the quantity justifies it, shorter, heavier or less attractive ram's wool can be packed separately - mark RAM₂.
- (c) Odd strong wool fleeces (60⁸), overstrong wool (58⁸) and heavy or unattractive wool can also be classed with RAM.

SEEDY WOOL

This is wool infested with clover, burr or other seed. The presence of seed in wool to a large extent determines the trade type and this must be borne in mind in the skirting and classing of wool.

- (a) If a clip is infested with seed to such an extent that the fleece wool cannot be rendered "free" by skirting, the seed should be ignored and the clip treated in the usual way as a "free" clip.
- (b) If seed is present in such quantity that the fleece wool can be rendered practically free by

skirting, the seedy skirtings must be packed and blended in with the BROKEN FLEECE, CBP or BP.

- (c) When seed (fleece wool, bellies and skirtings) is present only on a certain number of sheep (part of a clip) such wool should not be mixed with the "free" lines but be treated as a separate clip.

COLOURED WOOL

Coloured wool - black or brown sometimes also found in some Merino sheep, should on no account be classed with other Merino wool. Keep separate and Mark - C & C.

KEMPY WOOL

Merino wool contaminated with loose kempy fibres *must* be packed separately and marked with the contents symbol prefixed by the letter K, e.g. KBM, KBP, KLOX, etc.

SKIN WOOL

Wool removed in any manner from the skin of a slaughtered animal *must* be packed separately and the container marked VEL.

DEAD WOOL

- (a) Wool removed in any manner from a dead animal (other than slaughtered) *must* be packed separately and its container clearly marked ... PLK.
- (b) In no circumstances should dead wool be baled with other wool as it can possibly be the carrier of infectious diseases.

ODD

Merino wool not complying with the requirements prescribed for the above-mentioned classes such as, for example, lumpy wool or wool damaged by Australian itch, etc., can be packed separately and marked ... ODD.

BIN

It is sometimes difficult to avoid making quarter or half bales. Different types and or classes of wool can in such cases be packed in the same bale provided the different types are *properly partitioned* off and the bale is marked "BIN". The contents of the bale can then be indicated under the letters "BIN" according to NWGA classing standards.

Example: BIN
 BKS₂ LOX
 BP

Farmers, remember: Badly classed wool bales cannot be offered for sale but must be reclassified. Reclassing costs are 7 cents per kilogram wool.

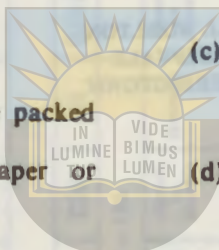


G.21 BALING OF WOOL AND MARKING OF BALES

by O.P.J. STEYN
Glen College of Agriculture

WOOL PACKS

- The regulations require that wool be packed in:
- (a) new fast-top or loose-top jute, paper or polyethylene woolpacks, or
 - (b) undamaged grain bags.



- (c) each bale or bag of wool must be clearly marked with the name or registered trade mark as well as the address of the owner, and
- (d) the class of wool packed in the bale must be indicated by the appropriate class symbol.

PRESSING OF BALES.

Bales must be neatly and tightly pressed. Tightly pressed bales result in reduced costs, are more easily handled, present a neat appearance and occupy the minimum space with transportation. Maintain more or less the same mass in fleece-wool lines, viz. 135 kg (300 lb) per bale. Take care that the mass of bales is not less than 115 kg (253 lb) as such bales have to be repacked and do not qualify for export.

CLOSING OF BALES

Containers must be closed securely and uniformly with glazed undyed sewing twine or metal clips. Similarly only glazed, undyed sewing twine may be used for repairing holes in containers.

MARKING OF BALES

- (i) Use letter stencils and mark neatly.
- (ii) According to the regulations -
 - (a) all marks on bales or bags should be of letters at least 38 mm high;
 - (b) bales must be marked on the end opposite the openingflap and in the case of grain bags, on the side of the bag;

SMALL BAGS OF WOOL

The packaging of wool in small bags should as far as possible be avoided. Different classes of wool may be packed in the same bale provided the different types are properly partitioned off and the bale marked "BIN". The contents of the bale are then, according to the NWGA classing standards indicated under the letters "BIN".

REDUCED RAILAGE

In order to qualify for the reduced railage the consignment note must be endorsed as follows: "Raw wool consigned directly to a seaport in the Republic of South Africa for auction there".

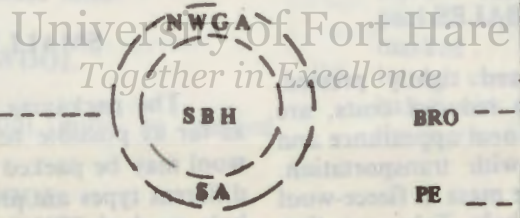
PRODUCER'S LETTER OF ADVICE

The producer should see to it that his letter of advice in regard to the classing and packaging of the clip reaches the agent or broker in good time for the wool to be entered in the catalogue. Unnecessary expenditure on handling and reclassing can thus be avoided.

MARKING OF BALES

G-2 BAILING OF WOOL AND MARKING OF BALES

Classer's registration number SA 1423		Code of dispatching station prefixed with letter "S" S403	
Producer's number 150150	Name and address of owner H.J. WOOLTON SHEEPVALE MERINOTOWN		Code of dispatching station prefixed with letter "S" S403
Description of contents AM	Number of bale 10		Code of dispatching station prefixed with letter "S" S403
Springbok Head Brand SBH	Broker's Reg. Mark BRO		Code of dispatching station prefixed with letter "S" S403
PORT (Code of destination) PE		Code of dispatching station prefixed with letter "S" S403	



CAPE MOHAIR CLASSING STANDARDS 1978

KIDS

SYMBOL	ASFK	AFK	ASK	AK	BSFK	BFK	BSK	BK	CSFK	CFK	CSK	CK	DSFK	DFK	DSK	DK	EFK	EK	FMK	MK
LENGTH (mm)	Over 150				125 – 150				100 – 125				75 – 100				50 – 75		Variable	
STYLE AND CHARACTER	Good to Super	Average	Good to Super	Average	Good to Super	Average	Good to Super	Average	Good to Super	Average	Good to Super	Average	Good to Super	Average	Good to Super	Average	Average		Mixed to poor	
FINENESS (min)	7s	7s	6s	6s	7s	7s	6s	6s	7s	7s	6s	6s	7s	7s	6s	6s	7s	6s	7s	6s
MICRONS (max)	28	28	30	30	28	28	30	30	28	28	30	30	28	28	30	30	28	30	28	30

YOUNG GOATS

SYMBOL	ASYG	AYG	BSYG	BYG	CSYG	CYG	DSYG	DYG	EYG	MYG
LENGTH (mm)	Over 150		125 – 150		100 – 125		75 – 100		50 – 75	Variable
STYLE AND CHARACTER	Good to Super		Average		Good to Super		Average		Average	Mixed to poor
FINENESS (min)	5s		5s		5s		5s		5s	5s
MICRONS (max)	34		34		34		34		34	34

ADULTS

SYMBOL	ASFH	AFH	ASH	AH	BSFH	BFH	BSH	BH	CSFH	CFH	CSH	CH	DSFH	DFH	DSH	DH	EFH	EH	FMH	MH
LENGTH (mm)	Over 150				125 – 150				100 – 125				75 – 100				50 – 75		Variable	
STYLE AND CHARACTER	Good to Super	Average	Good to Super	Average	Good to Super	Average	Good to Super	Average	Good to Super	Average	Good to Super	Average	Good to Super	Average	Good to Super	Average	Average		Mixed to poor	
FINENESS (min)	4s	4s	3s	3s	4s	4s	3s	3s	4s	4s	3s	3s	4s	4s	3s	3s	4s	3s	4s	3s
MICRONS (max)	36	36	39	39	36	36	39	39	36	36	39	39	36	36	39	39	36	39	36	39

OUTSORTS

SYMBOL	YRAM	RAM	AR	BR	CR	KSTN	YGSTN	STN	KLOX	LOX	KSDY	YGSDY	SDY	VEL	PLK	MOH
LENGTH (mm)	Variable		Over 150	125 – 150	100 – 125	Variable			Variable		Variable		Variable		Variable	
STYLE AND CHARACTER	Good to Super	Mixed to Poor	Mixed to poor			Vegetable and/or kraal stained			Heavy dung and urine stained		Seedy hair		From slaughtered skins		From dead animals	Very poor hair
FINENESS (min)	3s	Shorn from rams	Stronger than 3s			6s	5s	Variable	6s	Variable	6s	5s	Variable	Variable		
MICRONS (max)	39		Over 39			30	34	Variable	30	Variable	30	34	Variable	Variable		

BKB

Telephone 41-3265 (Technical)
P.O. Box 729 41-2101 (Admin.)
Port Elizabeth

CROSSBRED

SYMBOL	XFK	XK	XYG	XFH	XH	GREY	XSTN	XLOX	XSDY	XMOH
DESCRIPTION	Fine white kempy kids	Poor white kempy kids	White kempy young goats	fine white kempy	Poor white kempy	Containing coloured fibres	Kempy vegetable and/or kraal stained	Kempy Heavy dung or urine stained	Kempy and seedy	Very poor kempy

- N.B. (a) Mohair contaminated by paint or other branding material shall not be marketed.
(b) All mohair shorter than 50 mm must be packed separately and marked MK, MYG or MH, according to fineness.



E.4 METABOLIC DISEASES

by G.F. BATH

Middelburg, C.P.

METABOLIC DISEASES

These are diseases which result from a malfunctioning of the normal chemistry of the body, in which the equilibrium of metabolism is disturbed. There are three important metabolic diseases encountered in sheep.

PREGNANCY TOXAEMIA

This disease is also known as domsiekte, twin lambing disease and pregnancy ketosis.

CAUSE

An imbalance occurs between feed intake and energy requirements of the body. As a result the body mobilises the fat deposits but at the same time forms large quantities of by-products known as ketone bodies.

The blood sugar falls to a very low level and this is believed to be the cause of the typical symptoms encountered. Liver damage occurs secondarily.

CONDITIONS UNDER WHICH IT OCCURS

Although sheep of either sex and of any age and condition can be affected, the disease is most commonly encountered in animals in good condition, particularly heavily pregnant ewes and especially those carrying twins or triplets.

An outbreak is precipitated by keeping such animals on feed not sufficient for their requirements, or else any sudden change or procedure which causes the sheep to stop eating for some time. Examples of these are dipping, dosing, kraaling, shearing, changing camps and transport, either on the hoof or mechanically. Lack of water, sudden weather changes and other diseases may also precipitate pregnancy toxemia in susceptible animals.

SYMPTOMS

Affected animals become less alert, lose their appetite, stand alone, or wander aimlessly, and if they encounter an object such as a fence in their way they prop themselves against it. They do not attempt to run away when approached. Eventually they go down and die after a variable period.

POST-MORTEM EXAMINATION

The liver is a very pale tan colour and appears fatty. Rumen contents are dry and intestines are almost empty. Fat in the abdomen contains very white chalky-looking speckles. The adrenal glands are enlarged.

DIAGNOSIS

Fresh urine or preserved blood, or else the liver in 10 per cent formalin, can be examined by a laboratory to confirm the diagnosis.

TREATMENT

In advanced cases no treatment is effective. Early cases should be dosed with $\frac{1}{2}$ - 1 cup sugar or molasses plus 2 - 3 cups water. They should be given a mealie-meal/molasses lick and placed in a paddock with good grazing. Valuable animals should be treated by a veterinarian. (See also the treatment of Hypocalcaemia).

PREVENTION

Prevention is far more effective than treatment. Heavily pregnant ewes should not be disturbed in any way during the last two months of pregnancy, and plenty of high-quality feed is essential. A lick of mealie-meal and molasses and salt (e.g. 75:5:20) is beneficial to supplement energy. Stock should not be allowed to become too fat and sudden stresses causing them to stop eating must be avoided.

HYPOCALCAEMIA

This disease is also known as parturient paresis and milk fever (Melkkoors).

CAUSE

Heavily pregnant ewes or ewes suckling lambs have to supply large amounts of calcium via the blood. Much of this comes from the bones but some must also come from the feed. Anything causing an interruption of food supply will therefore cause a lowering of blood calcium, and if the level drops too low the muscles of the body are unable to function.

CONDITIONS UNDER WHICH IT OCCURS

Sudden changes (such as those causing pregnancy toxæmia) which stop the ewe eating. The disease occurs virtually exclusively in pregnant ewes or suckling ewes.

SYMPTOMS

The sheep may be seen to be weak or walk with a wobbly gait, but usually they lie down very soon and are unable to rise. They appear alert and may still eat if offered food. Later they become dull, turn the head towards the flank and may lie on their side. Death follows soon after.

POST-MORTEM

No characteristic changes can be seen at post-mortem examination.

DIAGNOSIS

Preserved blood can be analysed for confirmation. The disease is frequently accompanied by pregnancy toxæmia, and the two diseases can be confused.

TREATMENT

80 ml of calcium borogluconate should be injected under the skin or into the abdominal cavity. Because the two diseases occur under the same conditions, and are often found to occur together, the sheep should also be treated for pregnancy toxæmia.

Stresses causing pregnant ewes to stop eating must be avoided. (See Pregnancy Toxæmia).

GRASS STAGGERS

This disease is also known as grass tetany and hypomagnesaemia.

CAUSE

The exact cause is unknown, but affected sheep grazing on very lush pastures show a dramatic drop in blood magnesium levels. Once the level drops too low the muscles twitch and go into spasm.

CONDITIONS UNDER WHICH IT OCCURS

Very highly fertilised, lush green pastures of especially wheat and oats are most commonly involved. The disease is most prevalent in pregnant or suckling ewes but can occur in wethers or dry ewes as well.

SYMPTOMS

Animals are at first very excitable and alert, and shiver uncontrollably. They stagger when chased and may go into convulsions. Periods of apparent normality are interspersed with periods of spasms and convulsive seizures. The course of the disease is usually short.

POST-MORTEM

No characteristic changes can be seen at post-mortem.

DIAGNOSIS

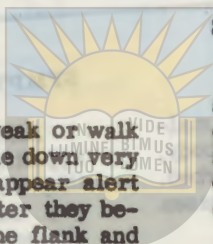
Blood can be analysed for magnesium content to confirm the diagnosis.

TREATMENT

100 - 200 ml of a 10 per cent magnesium sulphate solution should be injected subcutaneously in affected sheep.

PREVENTION

Avoid over-fertilisation of pastures or else ensure that sheep do not graze exclusively on such pastures.



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E.3.3 EXTERNAL PARASITES: ACARINA

by C.J. HOWELL
Onderstepoort

The Acarina, i.e. ticks and mites, are members of the class Arachnida. These are not true insects from a scientific point of view, although in everyday speech we often refer to them as such. They are the group of eight-legged animals that includes spiders, scorpions and various other creatures as well as ticks and mites. However, only the ticks and mites, are of importance for purposes of this study.

Ticks are divided into two families, viz. the common hard ticks, belonging to the family Ixodidae, and the soft ticks or tampsans, belonging to the family Argasidae. Ticks are distinguishable from insects by their undivided body (in which the thorax and abdomen are fused together), their eight legs (except the larval stage, where only six are present), and their sucking mouth parts. They are all blood-suckers. After the eggs have hatched, three stages of development may be distinguished. The first stage, the larvae or "pepper ticks", resemble the adult female, but are much smaller than it and have only six legs. Although a few species are completely immobile and do not feed, others search most energetically for a host on which to feed. The larvae moult into nymphs, developing an additional pair of legs, are slightly larger and also look like the adult female. However, their reproductive organs have not yet developed and their genital openings are still lacking. Having fed they moult again into males and females. These, after mating and usually feeding again, start the whole cycle once more.

During their lives, hard ticks pass through a larval, one nymphal and then the adult stage. A meal of blood is necessary at each stage before further development can take place. The three stages may all develop successively on a single host, or two or even three different hosts may be needed for the completion of the life-cycle of a particular species. Hard ticks are therefore classified as one, two or three-host species. It is important to know which group a particular species belongs to when considering a method of control.

The life-cycle of tampsans corresponds in broad outline to that of hard ticks but not all species feed at each stage of their development and,

in addition, they pass through up to five or six nymphal stages.

All ticks are resistant to starvation and can survive without food for long periods. They are very sensitive to environmental factors, such as rainfall, temperature and vegetation, and these may determine their presence or absence in particular areas. Some ticks, for example, are adapted to tropical conditions with a high rainfall and high temperatures while others flourish only in arid desert areas. Others again are able to withstand a variety of conditions and are widely distributed.

ARGASIDAE

The soft ticks, or tampsans, have a tough leathery skin which appears wrinkled in the unengorged parasite and has a surface covered with small protuberances and depressions. Neither the male nor the female has a shield on its back and the mouth parts are visible from above in the immature stages but not at all in the adults. The females lay several small batches of eggs after successive feeds.

Tampsans are in most cases inconspicuous and relatively difficult to find. Most feed very quickly and are seldom seen, although others remain on the host for a long time.

Only one species is of importance in the present connection.

(a) *Otobius megnini* (spinose ear tick)

The larvae and nymphate of this parasite are found exclusively in the ears of their host and are not particularly host-specific: they attack sheep, goats, horses or cattle, and even dogs or man, indiscriminately. The adults are non-parasitic and conceal themselves in crevices or little holes in the kraal or stable walls. They are dark grey in colour and slightly fiddle-shaped, with many small depressions in the surface of the skin.

The female lays her eggs in these sheltered spots and after three to eight weeks the larvae

hatch. The latter, which have long, well-developed mouth parts, are very active and continually search for a host, although they can survive unfed for as long as two to four months. When they find a suitable host, they attach inside the ear and engorge in five to ten days. The larvae suck lymph out of the tissues and when engorged are pear-shaped, approximately two mm in length and yellowish-white in colour. At this stage they closely resemble eggs, since their legs are then very short in proportion to their size. The larva moults inside the ear into a first stage nymph, which is yellowish-white in colour to start with. It moults into the second-nymph, which looks very much like the adult tick, having assumed a fiddle shape and a bluish-grey colour. The outstanding characteristic of both nymphal stages is that they are covered with fine yellow spines, hence the name "spinose ear tick". The nymphs remain in the host's ear from one to seven months and grow eventually to a length of six to seven mm. They then leave the ear and creep into a suitable hiding place, where they moult into adult ticks. These in due course continue the life-cycle.

The spinose ear tick likes arid and semi-arid areas. It was introduced into South Africa in 1898, has established itself firmly and is still spreading slowly. Empty kraals or stables may remain infested for two years or longer and shorter periods of disuse are therefore worthless as a control measure.

Disease conditions caused

These ticks transmit no disease. However, heavily infested animals are restless, feed poorly and lose condition rapidly. The ticks' bites may lead to infection of the middle ear and ultimately even to encephalitis and cerebral meningitis.

Control measures

Consult your local veterinarian about the most effective control measures.

IXODIDAE

The hard ticks are a large group of over 150 species in Africa. They are characterised in the male by a hard, chitinous plate or shield extending over the entire dorsal surface. In the female and immature stages the shield takes the form of a small plate just behind the capitulum or "head" on the antero-dorsal surface of the body. The mouth parts are visible from above in all stages. A single nymphal stage is universal. The hard ticks feed slowly and remain on their hosts for long periods. Different species feed on a variety of animals, and one, two or three hosts may be required by a single species to enable it to complete its life-cycle. Environmental conditions have a marked effect on the life-cycle, and the incidence and activities of these parasites are closely related to these factors.

Adult female hard ticks ingest a tremendous quantity of blood before they drop off their hosts, and at this stage are enveloped in a tough skin which affords them considerable protection against acaricides. Some species become very large indeed

and range in colour from blue to bluish-grey or brown. Each female lays a single large batch of eggs, up to 18 000 in some species, and then dies.

(a) *Ixodes* species

(i) *Ixodes rubicundus* (Karoo paralysis tick)

As its name indicates this tick is an inhabitant of the Karoo, being found particularly in camps on ridges where the besembos (*Rhus erosa*) and suurpol grass (*Danthonia disticha*) occur. Following the deterioration of the veld and the encroachment of these plants this tick is gradually spreading northwards in the Orange Free State.

The Karoo paralysis tick is a small rusty reddish-brown species with long mouth parts. The females become slate-blue when engorged. This tick is characterised by the tendency of its long, slender legs to be grouped together further forward than in other species. It is a three-host tick. The larvae and nymphs feed on small veld mammals, e.g. the red mountain hare and the elephant-shrew, whereas the adults prefer sheep and cattle. These ticks are active in winter and are found from February to November. Their life-cycle takes two years; they are relatively inactive during summer, which they spend as engorged nymphs, adults or eggs. On cattle these parasites are found on the legs and lower parts of the body. On sheep they prefer woolly areas on the legs and abdomen.

Disease conditions caused - These ticks are the only members of the genus *Ixodes* which cause paralysis in animals in South Africa. Presumably only the females are capable of causing paralysis by their bite and the resultant secretion of certain toxins. Initially the sheep merely walk stiffly but the condition progressively worsens till all four legs are paralysed and the animal can walk only short distances, if at all. It becomes obvious which sheep are affected when the flock is driven. Initially the appetite is not affected but as the paralysis spreads it affects the respiratory system and causes the animal's death. There is no temperature reaction and if the ticks are removed from the host early the animal may recover.

Control measures - A footbath 457 to 559 mm (18 to 22 inches) deep for sheep, through which the animals walk every three to four weeks, will keep the infestation under control. Consult your local veterinarian regarding the most effective dip to be used in this case.

It is important to keep animals off ridge grazing during the active period of the ticks, i.e. from February to May. Such action is usually effective if it is accompanied by good veld management and, where possible, the extermination of the red mountain hare and elephant-shrew.

(ii) *Ixodes pilosus*

This species is called the "sourveld tick" because it is found mainly in the sourveld and other parts of the country. At one time it was called the "sheep paralysis tick" but it is now



FIG. 1 - *Ixodes rubicundus* (Karoo paralysis tick - male)

known that it is not responsible for any form of stock paralysis. It is not a host-specific parasite and may be found on any domestic animal at all stages of its development. It is easy to confuse it with *I. rubicundus*, since they are similar in many respects. However, it is not an important tick and causes no problems.

(b) *Hyalomma* species (Bont-legged ticks)

The bont-legged ticks are large, dark in colour (almost black) with yellowish bands on their legs. They are found under the tail as well as on the feet and legs of the host. When they occur on fat-tailed sheep they are inclined to attach to the tail itself. They are two-host ticks, with the immature forms feeding largely on terrestrial birds and on hares, and the adults on larger animals. In summer, after a meal of blood lasting seven to 14 days, the female lays 10 000 to 15 000 eggs which hatch into larvae a month or more later. Later in the year the female may winter for as long as eight months before laying. Adults may survive unfed for periods of up to two years. These ticks are widely distributed in South Africa. There are three species, as follows:

(i) *Hyalomma truncatum* (formerly called *H. transiens*)

This is the small bont-legged tick, which is widely distributed in South Africa except for the eastern coastal strip and the Highveld areas with a high rainfall.

(ii) *H. rufipes* (large bont-legged tick)

This tick is also widely distributed except, again, along the coastal area, the high rainfall parts of the Highveld and the Winter Rainfall Region.

(iii) *H. turanicum* (the pale-legged bont tick)

This species is found only in the Karoo and in parts of South West Africa.

Disease conditions caused - *H. truncatum* causes sweating sickness in calves in the northern Transvaal. The other two species are not known to transmit any disease. They are mainly harmful because of the bites they inflict with their long mouth parts. These may form large wounds which easily become infected with bacteria, causing foot rot and lameness in sheep.

Control measures - Consult your local veterinarian regarding the most effective control measures.

(c) *Rhipicephalus* species

(i) *Rhipicephalus evertsi* (red-legged tick)

This tick is medium in size with a dark brown shield and red legs; the engorged female is bluish with a brown tinge. It occurs fairly generally in South Africa except in the drier parts of the Karoo, Bushmanland, Little Namaqualand and South West Africa. A sub-species (*R. evertsi mimetica*), which replaces it in South West Africa, resembles *R. evertsi* itself closely except that it has transversely banded legs and is well adapted to dry areas. The red-legged tick is a two-host species; the immature stages usually occur on the same hosts as the adults, but are found deep in the ears of the animals, whereas the adults usually occur under the tail and on the hairless parts of the body.

The female lays from 5 000 to 7 000 eggs in a crack or tuft of grass after spending six to twelve days on the host, sucking blood. In summer she may start laying five days after feeding, but this period may be extended to a month or more in winter. In summer the larvae hatch 30 days later and in winter about two months later. The larval-nymphal period on the host's ear lasts about a fortnight and the nymphs moult into adults after three to four weeks. These ticks are active throughout the year, particularly during the summer.

Disease conditions caused

1. In some Highveld areas the red-legged tick may cause a condition known as spring paralysis of lambs.
2. They are also carriers of *Theileria ovis*, the causal organism of benign Theileriosis in sheep and goats.
3. They cause Spirochaetosis in sheep, goats and cattle.

(ii) *Rhipicephalus foliis*

This brown tick occurs in mountainous parts of the eastern Karoo. It is found on the hoofs of sheep and goats and may cause painful lameness.



FIG. 2 - *Amblyomma hebraeum* (bont tick) - male

(iii) *R. glabroscutatum*

This tick is found in the low-lying areas of the Karoo. It also tends to attach itself to the feet, between the claws, and causes lameness. The life-cycles of both these species are imperfectly known.

Control measures

1. Foot-bath, hand dressage or dip should be utilised as circumstances demand.
2. Consult your local veterinarian regarding the most effective control measures.

(d) *Amblyomma hebraeum*
(Bont tick)

This bont tick is an essentially South African Bushveld or Lowveld species. It is distributed from the Magaliesberg northwards into Rhodesia and westwards into Botswana. It also occurs southwards along the eastern side of the Drakensberg from the Eastern Transvaal to Port Elizabeth. It has a predilection for the Bushveld and does not occur in grassveld.

Bont ticks have a striking, characteristic black and brown pattern on a yellowish background, sometimes tinged with copper or green on their backs and banded legs. They prefer to feed on the lower, bare parts of the host's body and are easy to see and to distinguish from all the other genera. These ticks have long mouth parts and inflict wounds that easily become infected. The males may remain attached to their host for periods of up to three months. As a rule the females feed for seven to ten days before dropping off engorged. In the summer they start to lay within three weeks and may produce up to 18 000 eggs. Later in the season egg-laying may be delayed for up to two months.

The period taken by the eggs to hatch depends on the season; it may be as short as four weeks or as long as two months. They are three-host ticks and the young stages are usually found on small veld animals and certain birds, but also sometimes on large animals. Unengorged young stages can survive unfed for six to nine months and adults for as long as 14 months. Although the immature stages can feed and moult within four to six weeks, the process may take much longer. The entire life-cycle may be completed in a few months or may take almost two years. Bont ticks are far more active in summer than they are during the cold winter months, although the males may still be found attached in winter.

Disease conditions caused

Bont ticks are the vectors of heartwater. The organism causing this disease does not pass through the eggs to the next generation. It may be picked up by the larvae feeding on an infected animal and then transmitted by the subsequent nymphal and adult stages, or picked up by the nymphae and then transmitted by the adults. A nymph does not lose the infection if it feeds on a non-susceptible host, such as a horse. Wounds caused by the bite of these ticks easily become infected with bacteria. The blowfly, *Chrysomya bezziana*, may lay eggs in them and their maggots soon aggravate the lesions. The bont tick can also cause tick-bite fever in humans by transmitting the parasite *Rickettsia pyperi*.

Control measures

1. For the control of bont tick dipping or inoculation is the only effective measure.
2. The recommended control measure against heartwater is immunisation by means of heartwater blood.
3. Consult your local veterinarian regarding 1 and 2 above.

E.3.2 EXTERNAL PARASITES IN WOOLLED SHEEP: INSECTS



by C.J. HOWELL
Onderstepoort

(Replaces E.3.2/1976)

The class Insects includes a series of moist or watery vleis and water furrows but Orders having certain characteristics in some species breed even in wet horse or common. In all insects the body of the adult cattle manure in the veld. is divided into three parts, namely the head, thorax and abdomen. It is six-legged. The immature stages differ to a greater or lesser extent from the adults, sometimes in size only and sometimes completely.

The adults of the group, the flies, nearly all lay eggs which hatch into larvae. One or 2 species give birth to living larvae, which are called grubs or maggots. The larval stage is followed by the quiescent or pupal stage, which in turn develops into the adult. Sheep keds also belong to the Diptera, although their parasitic mode of life has caused them to lose their wings. They produce living larvae. Lice, however, belong to a different group of insects and the immature stages, which hatch from eggs, look exactly like the adults except that they are smaller.

(a) *CULICOIDES* SPECIES (Biting midges or punkies)

These tiny midges, which are only 1 to 3 mm long and can easily pass through wire gauze, are the vectors of bluetongue in sheep as well as of horsesickness. They are dark grey, have dark, lightly spotted wings and mouth parts adapted for sucking blood. About 22 species are known in South Africa and all of them are active only between dusk and sunrise. These midges are not particularly host-specific, but the source of their food is of importance in the transmission of disease to animals. During the cold winter months they are almost completely inactive, but with the coming of rain and warm weather in summer they reappear in large numbers. They breed in



FIG. 1 - *Culicoides* (biting midges, punkies)

resume their development only when the weather becomes favourable again.

Disease conditions caused

Bluetongue in sheep is caused by a virus transmitted by infected female midges when they feed again. Cattle display symptoms of disease only in exceptional cases but may carry the causative virus in their system and may serve as a source of infection when the midges feed on the animals and later attack susceptible sheep.

Control measures

1. There is no effective method of controlling the midges, since they are strictly nocturnal and may travel several kilometres from their breeding grounds.
2. Sheep kept in a stable or shed at night, may escape infection because the midges do not as a rule enter buildings.
3. The only effective method of controlling the disease is by the use of bluetongue vaccine. This preparation enables the animals to build up a partial immunity to the disease. Consult your local veterinarian for more particulars.

(b) *SIMULIUM SPECIES* (Black flies, Buffalo gnats)

Black flies or buffalo gnats are found solely in the vicinity of large or strongly flowing rivers, where their numbers may increase enormously with the passage of time. Since they flourish only in swiftly flowing water containing stones or vegetation their distribution in South Africa is limited by our lack of such rivers. These small, grey, hump-backed flies have hairy bodies and transparent wings. The females have well-developed mouth parts adapted for bloodsucking. They lay several hundred eggs below the surface of the water and the larvae attach themselves to stones or vegetation under the water by means of a sucker-like organ armed with hooks situated at their posterior end. These aquatic larvae need plenty of oxygen. They obtain their food from the water by means of a system of mouth brushes.

The larvae feed and increase in size, moulting six times, and the adult larvae spin cocoons which house the pupae. Adult flies emerge from the pupae and reach the surface of the water in air bubbles. It is believed that the females may fly 13 km or more in search of a bloodmeal and will attack animals, poultry or man. They may irritate animals to such degree that they become restless and do not graze properly. These parasites usually attack bare surfaces such as the eyelids, nose, lips and teats and their bites give rise to warty

papules or to vesicles, which later burst open and take several weeks to heal.

Disease and conditions caused

Black flies are not known to transmit any pathogenic agents in South Africa, though the benign skin-infesting filarial worm *Onchocerca* has been found in cattle. However, the flies sometimes occur in such large numbers that their attacks interfere with the grazing of animals, which lose condition. In Europe they transmit infectious agents to animals, which agents have caused epidemics in the past.

Control measures

1. The use of insecticides with a long residual action may be of value locally for the protection of animals.
2. As the young stages are aquatic they can be destroyed in the water by means of insecticides. This treatment is undertaken by the State; it would be a difficult task for a private individual. Consult your local veterinarian for more particulars.

(c) *STOMOXYS CALCITRANS* (Stable fly)

The stable fly is a cosmopolitan species, being found throughout the world. It looks remarkably like the house fly, from which it may be distinguished by its piercing proboscis, projecting forwards from under the head, and by the presence of three black spots on the dorsal surface of the abdomen on the second and third segments. Both the male and female are vicious biters: their tapering mouth parts are long, thin, hard and horny and are specially adapted for blood sucking. The flies are especially numerous in the middle and later part of summer and live for about a month in the natural state. They thrive on air and sunshine and will not enter dark buildings or stables, except in rainy weather and sometimes in autumn. However, stable flies do not hesitate to enter well-lit stables and may then be a tremendous source of irritation to animals or people.

The female prefers to lay her eggs in moist, decaying vegetable matter such as hay, lawn clippings or compost, but will readily breed in sufficiently aerated horse or cattle manure. Kraals where straw or chaff is fouled by pigs or cattle are ideal breeding places. The female lays from 25 to 30 eggs at a time, with a total of 800 or more. The eggs are dirty-white to grey, about 1 mm long, and bear a longitudinal groove on one side. They hatch in 1 to 4 days. The larvae feed on the material in which they live, moult twice in 14 to 24 days and then pupate. The pupal stage is passed in the drier parts of the material and the adult flies emerge after about nine days.

The adult females are ready to lay eggs after a further 9 to 10 days and, in favourable weather, the entire life-cycle may be completed in about a month.

Although stable flies are strong, swift fliers, they do not travel long distances and keep to the vicinity of their breeding grounds. A stable fly takes 3 to 4 minutes to have a meal and has a habit of changing hosts frequently during the course of a single meal. This is an important factor in the mechanical transmission of diseases from one animal to the next. Disease transmission in this way has been experimentally proved to be possible. They often attack human beings, especially round the ankles, where they bite through heavy clotting. When resting on walls they are distinguishable from house flies by their habit of sitting head upwards with wings slightly apart. The house fly sits with its head downwards and wings partly folded.

Stable flies are particularly troublesome with recently shorn sheep and young lambs. The animals are savagely bitten along the back and the resulting wounds easily become infected by bacteria or fungi. Where such conditions are left untreated, infection may result.

Disease conditions caused

Stable flies do not as a rule transmit any disease, although they may play a part in the mechanical transmission of certain conditions, e.g. lumpy wool. However, the bites of these flies are very irritating and their continual attacks lead to disturbances in the food intake of the animals and subsequent loss of mass.

Control measures

1. Treatment of waste materials such as straw and grass near stables and kraals. These materials may be treated with chemicals or turned regularly so that their moisture content is too low for fly breeding.
2. Spraying or dipping of animals.
3. Spraying of walls and stables with insecticides with a long residual action.
4. Consult your local veterinarian regarding the most effective treatment for 2 and 3 above.

(d) *HAEMATOBIA THIROUXI POTANS* (Horn fly)

Horn flies are small, grey, inconspicuous flies, about 4 mm long, with dark stripes on the thorax. When sitting on the host they hold their wings apart and projecting upwards at a slight angle to the body; when resting on other objects they sit with wings folded. These small flies closely resemble the much larger stable fly (*Stomoxys*) and in large numbers

may be just as troublesome. They are adapted to warm, humid climatic conditions, usually becoming a problem only when cattle graze near rivers and streams. They will also attack sheep grazing in such areas in the company of cattle.

The flies prefer to remain on the same host for several days at a stretch, feeding at intervals. When the animal defecates the female flies leave it briefly and dart swiftly to the ground to lay some eggs in the fresh manure. The larvae live, grow and moult in this manure and then, as in the case of other members of the fly family, pupate in sand or loose soil. The adult flies emerge after 6 to 8 days.

Disease conditions caused

The flies do not transmit any disease but their bites irritate animals, especially around the base of the horns, behind the withers and around the root of the tail where they may cause superficial damage to the skin.

Control measures

1. Cattle and sheep should not be grazed together.
2. Consult your local veterinarian about the dip and vaccine to be used against these flies.

(e) *CULEX AND AÆDES SPP.* (House and bush mosquitoes)

The mosquito is probably the best known human and animal parasite, occurring in all inhabited areas of the world, from the tropics to the polar regions. About 2 000 species are already known. At least four human, three animal and two avian diseases are transmitted by mosquitoes. Any still body of water, whether fresh or salt, clean or dirty, is a potential breeding ground for some species or other, because the immature stages are aquatic. This is important from the point of view of control, especially on a large scale.

Mosquitoes are slender, grey insects with long legs, long, narrow wings and mouth parts well adapted for the sucking of fluids. Only the females are parasitic; they need a meal of blood for their ovaries to ripen. The male lives on plant juices. The *Aedes* lay their eggs singly on wet surfaces or on water and both the larvae and pupae are free-living in water. The pupae, however, are less active than the larvae. Both the immature stages breathe above the surface of the water, which they do by piercing the surface film periodically with the end of their respiratory siphon. When oil is poured on the surface of the water they are unable to breathe and can thus easily be destroyed in this way.

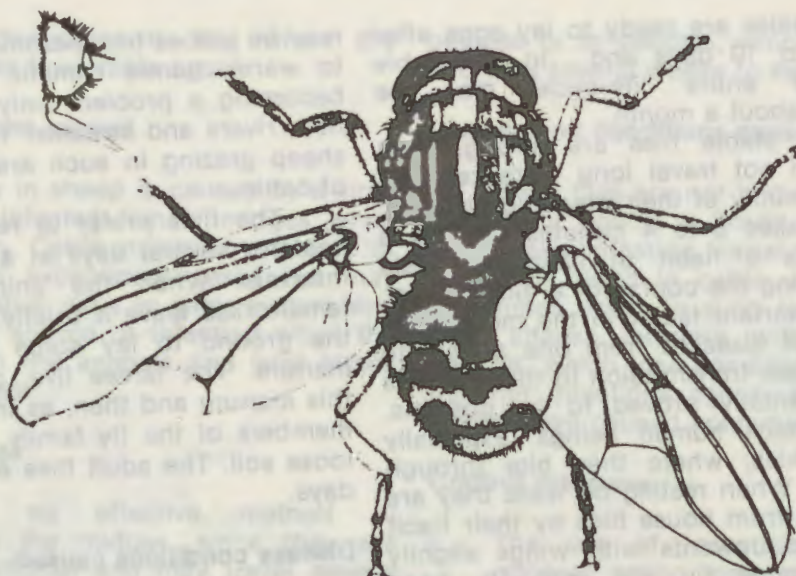


FIG. 2 - *Stomoxys calcitrans* (stable fly)

The *Aedes* species, which is probably also the vector of Wesselsbron disease in sheep, attacks both man and animals and both are susceptible to Rift Valley fever. The breeding places of this species are low-lying grassy areas that are periodically inundated. These mosquitoes never use permanent sources of water since they breed during the dry period between inundations.

Culex species breed mainly in still waters and their life cycle does not vary much. A period of exsiccation of the eggs is, however, not applicable and they make use of

permanent bodies of water. They are also carriers of Rift Valley fever and Wesselsbron disease. Both species of mosquito are capable of reasonable movement from breeding places.

Disease conditions caused

Both Rift Valley fever and Wesselsbron disease are probably transmitted by these parasites. Serious outbreaks of these diseases do occur, but are infrequent except during years of excessive rains.

Control measures

Effective vaccines against the above-mentioned diseases are available. Consult your local state veterinarian.

(f) *OESTRUS OVIS* (Sheep nasal fly)

Sheep nasal flies give rise to a slimy, yellow, ropy discharge from the noses of sheep, which is easily seen especially when the animals are gathered in the kraal. This slimy material results from the irritation produced by the larvae of the sheep nasal fly.

An infestation of this sort, in which dipterous larvae feed on the tissues of the host, is termed "myiasis".

This fly, which is widely distributed throughout the world wherever sheep are kept, is an obligatory parasite that cannot complete its life-cycle away from its host. The adult fly is non-parasitic, and in fact does not feed at all but the various larval stages can develop only in a host. Sometimes abnormal hosts are infested and, especially in Europe where the human population density in proportion to sheep flocks is very high,

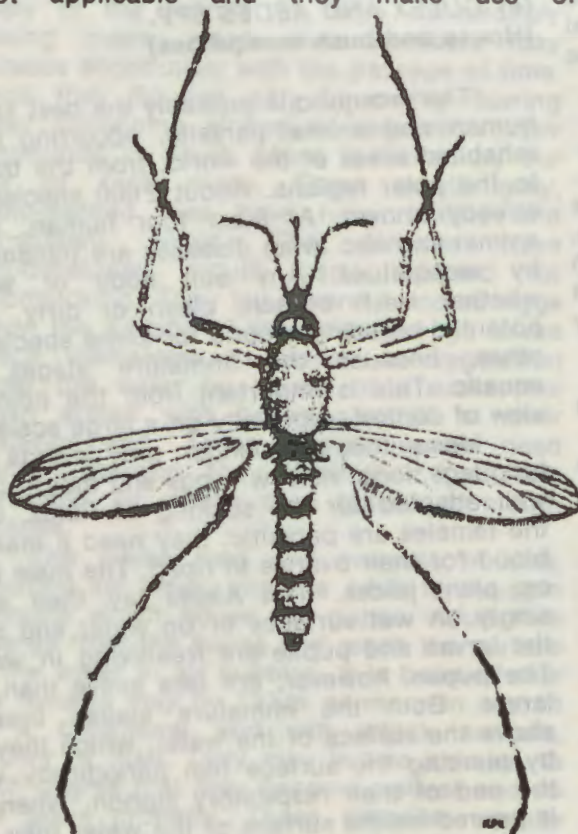


FIG. 3 - *Aedes caballus* (Rift valley fever-mosquito)

infection of humans frequently occurs. This condition has been observed in South Africa in cases where female flies have deposited larvae in the eyes of humans.

Sheep nasal flies are dark grey and their bodies are densely covered with yellow to light-brown hair. Black spots occur on the thorax and the abdomen is mottled. Their mouth parts are completely undeveloped and non-functional. They like sunshine and are very active in warmer weather. The females which are exceptionally swift and nimble fliers, dart in at lightning speed and deposit from one to a few dozen living larvae on the nostrils of a sheep. The larvae immediately crawl up the nasal passages and, depending on the weather, remain there from 5 to 6 weeks to as long as several months. Initially they are only 1 to 2 mm long but they grow and moult twice, into second and third-stage larvae, and ultimately reach an average length of 12 mm. The larvae have spines on the ventral surfaces of their bodies that irritate the mucous membranes of the animal and cause a profuse discharge of mucus.

When they have completed the third larval stage they are darker in colour, with dark transverse bands. They are often found at this stage when sheep are slaughtered and their heads are cut open. A severe infestation with these larvae will cause the host to lose its appetite and become emaciated. Sometimes the larvae, when they grow larger, are trapped in the cavities in the nose and the sinuses and are unable to get out through the small openings. Such larvae die there and serious infection and consequent inflammation are caused by their decomposition. Normally the adult larvae eventually crawl out of these cavities, or are sneezed out, and drop to the ground where they pupate in the sand. They emerge later as adult flies.

Disease conditions caused

1. Discharge of large quantities of mucus from the animal's nostrils.
2. Processes of inflammation and irritation of the nasal and sinusal mucous membranes, followed by emaciation and even the death of the host.

Control measures

You are advised to consult your local veterinarian about the latest control measures.

(g) GEDOELSTIA SPECIES (Tuberculous nasal botflies)

Specific oculo-vascular myiasis in sheep, a disease that has long been known, occurs in the dry areas of South West Africa, the Kalahari and Botswana. However, it was only in 1963 that the cause was found to be flies.

These flies, which belong to the genus *Gedoelestia* and are related to the sheep nasal fly, were described as long ago as 1915 but because their natural hosts are various species of game animals, their connection with specific oculo-vascular myiasis in sheep was not suspected. The life-cycle of the *Gedoelestia* species is very similar to that of the sheep nasal fly, except that the young larvae of the former generally commence their parasitic existence in the eyes of their host and not in its nostrils. However, the life-cycle of these flies has not yet been fully investigated and the description given here is not definitive. As far as our sheep breeds are concerned, the following three species are of importance:

(i) *Gedoelestia hässleri*

This is the smallest of the three species and its normal host is the blue wildebeest. After being placed in the eye, the larva migrates into the ocular cavity and enters the circulatory system, through which it is transported to the brain. From there migration to the nasal cavity takes place (probably through the turbinal plates of the nose) and thence to the sinuses, where the larva reaches maturity. It finally crawls out of the nose, drops to the ground, pupates and develops into an adult fly, which eventually emerges.

(ii) *Gedoelestia cristata*

The normal host of this species is the hartebeest. The route followed by the larva is presumably also from the eye to the circulatory system, through which it reaches the lungs. It migrates from there to the nasal cavity via the trachea and thence to the sinuses.

(iii) *Gedoelestia cristata* var. *gigantica*

This is the largest of the three species and is in all probability a hybrid of the first two. It occurs in both the blue wildebeest and hartebeest and the larval migration pattern follows that of either of the two species already mentioned.

The average *Gedoelestia* fly is fairly large, reaching a length of 12 to 18 mm. It resembles the sheep nasal fly but differs from it in having two tubercles on the dorsal side of the abdomen. The body is dark grey with yellowish-brown hair, and some species have black, slightly raised chitinous plates on the thorax. The flies are strong fliers and may, in their association with different kinds of antelopes, cover great distances. It is clear from the nature of their unusual life histories and the lengthy migrations of their larvae through the tissues of the host, that a variety of disease complexes may result from the flies



FIG. 4 - *Oestrus ovis* larva (sheep nasal fly)

activities. The following symptoms in livestock indicate the presence of these flies:

1. Eye conditions

Since the life-cycle of the larvae probably always starts in the eye, this organ will be the first to show signs of the parasites. Typical reactions may vary from a low-grade eye infection to extremely severe ophthalmia, i.e. swelling of the eyes accompanied by a strong flow of tears. Complete blindness in one or both eyes may follow.

2. Nervous affections

Different parts of the nervous system may be affected and the ensuing nervous symptoms will vary accordingly. Examples are an unbalanced gait, walking in circles, abnormal leg movements, complete inability to walk and complete paralysis. In such cases eye lesions may also occur.

3. Heart failure

When the circulatory system is affected there may, apart from eye lesions, be practically no detectable symptoms initially. The animals simply die suddenly, as would be expected in cases of heart failure.

It is also possible for more than one of these disease complexes to occur simultaneously.

Disease condition caused

The disease caused is known as specific oculo-vascular myiasis ("bulging-eye disease") and includes all the above conditions.

Treatment of animals

The treatment of affected animals will have to be symptomatic and will depend on the particular form taken by the disease.

Control measures

The use of systemic insecticides may suffice. Consult your local veterinarian.

(h) *LUCILIA* AND *CHRYSOMYA* (Sheep blowflies)

Blowfly infestation in sheep developed as the wool industry grew and the initially small stock population increased in numbers and in importance. It is doubtful whether blowflies are still such a great problem now that effective insecticides are available and new and improved farming practices are applied. They are troublesome insects only if the necessary precautions to control them are not taken.

These insects, which have a bright metallic sheen, have been known from very early times. The development of the wool breeds of sheep provided them with an ideal host on which to complete their life-cycle when insufficient carrion was available. Five species of blowfly are normally encountered, only two of which are of importance on account of the dominant part they play in blowfly attacks on sheep. The other species, with which they may be confused because of similarity in appearance, play a part only in the consumption of carcasses. The two blowflies that are important sheep pests are the green blowfly (*Lucilia cuprina*) and the banded blowfly (*Chrysomya albiceps*). Of these only the green blowfly is liable to attack unaffected sheep, but the presence of its larvae on the host produces suitable conditions for infestations by the banded blowfly as well.

(i) *L. cuprina*

The green blowfly averages 10 mm in length and is a brilliant green with a coppery tinge. Its legs are black, except for the femurs of the first pair, which are also green. This fly is very active, likes sunlight and is not often found in the shade or inside buildings. The females lay from 2000 to 3000 eggs when they breed on carcasses under natural conditions, but rarely more than 100 to 200 on living animals. In fine weather the eggs may hatch in about 8 hours, but hatching may be delayed for anything up to 3 days in cold weather. The little larvae are active as soon as they emerge from the elongated, cream-coloured eggs and begin feeding

immediately. They moult twice and may become adult larvae within 3 days. On reaching this stage they leave the host to pupate in the soil. The pupal stage lasts about 8 days and the adult blowflies then emerge to repeat the life-cycle. In this way several generations may be produced in a single season.

(II) *L. sericata*

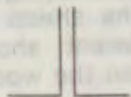
This blowfly, which is not such an important parasite, resembles *L. cuprina* closely, except that its legs are completely black.

(III) *C. albiceps*

The banded blowfly is slightly larger and broader than *L. cuprina* and has black transverse bands on a green background on each abdominal segment. It has a bluish sheen and darkbrown to black legs. The life-cycle is the same as that of *L. cuprina*, although the larvae look different because they have fleshy outgrowths on most of the segments, which give them a rather "hairy" appearance. It is easy to tell whether larvae are those of *L. cuprina*, which are smooth, or those of *C. albiceps* which are "hairy".

(IV) *C. chloropyga*

The copper-tailed blowfly is a fairly large fly that is easily recognised by its copper-coloured abdomen, contrasting with its green thorax. In addition it has a characteristic black pattern on the ventral side of the thorax in the form of two capital L's placed back to back, thus:



The life-cycle of the copper-tailed blowfly follows the usual pattern; the fly mostly breeds in carcasses and rarely attacks live sheep.

(V) *C. marginalis*

This is the well-known "bluebottle", a big, clumsy, noisy blowfly, bluish-green to dark blue in colour with black fore-margins to its wings, and much larger than any of the other blowflies. It also has reddish-brown eyes and a yellow face. Its life-cycle is similar to that of the previously described species and it is important because, owing to its size and the fact that it lays a large number of eggs over a long period as the carcass decomposes, it is a strong rival to the larvae of the other blowflies and may dominate the scene to the disadvantage of the other species. It never attacks live sheep.

Breeding habits of blowflies in carcasses

Since the incidence and breeding habits of blowflies differ under natural conditions and in living animals, it is necessary first to understand clearly the conditions in nature. When a fresh carcass is exposed putrefaction of the material takes place, the first phase being one of autolytic and bacterial decomposition. This stage in the process is very attractive to certain species of blowfly and the earliest arrivals are *L. cuprina*, *L. sericata*, *C. marginalis* and *C. chloropyga*. These species are consequently called primary blowflies.

As decomposition of the carcass progresses, it passes through a phase of liquefaction, speeded up by the presence of the primary larvae which by the excretion of a proteolytic enzyme, reduce the material in which they subsist to a thick soupy mass. These conditions are very favourable for the secondary blowfly, *C. albiceps*, which now lays its eggs in this material. From these eggs the hairy secondary larvae hatch. The importance of these secondary larvae lies in the fact that they may feed on the smooth primary larvae, especially when food becomes scarce. However, the large larvae of *C. marginalis* play an important part by reason of their size and great liveliness since the total number of larvae that hatch from eggs laid in a carcass by all the blowflies together is usually far larger than can subsist on the available food.

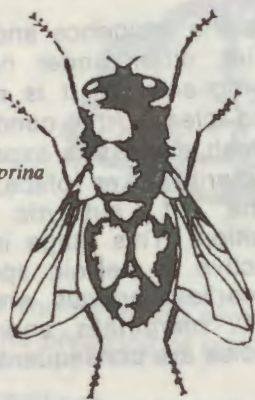
During the summer months *C. marginalis* is very active, possibly so much so that very few green blowflies are ever able to hatch from a carcass. But when the weather becomes cooler the "bluebottle" is absent and the others can flourish. The pupae drop to the ground but the flies do not emerge until warm weather occurs early the following summer, when they suddenly appear in a great wave. *L. cuprina* may also be active during the winter months, but the other species only rarely occur at this time. During summer *L. cuprina* finds a highly suitable breeding place in living sheep and it is then that attacks occur.

Attacks on sheep

L. cuprina is the only blowfly that will attack living sheep and such an attack will depend on conditions on the animals themselves. Blowfly attacks take place only on soiled or wet wool, wounds, folds in the skin, etc., where favourable conditions for bacterial decomposition exist in the wool and superficial skin layers. When decomposing these materials liberate gases that are very attractive to blowflies.

After the green blowflies have attacked, their maggots create suitable conditions for the secondary blowflies to follow them up.

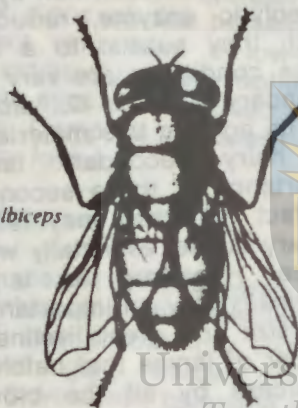
1. *Lucilia cuprina*



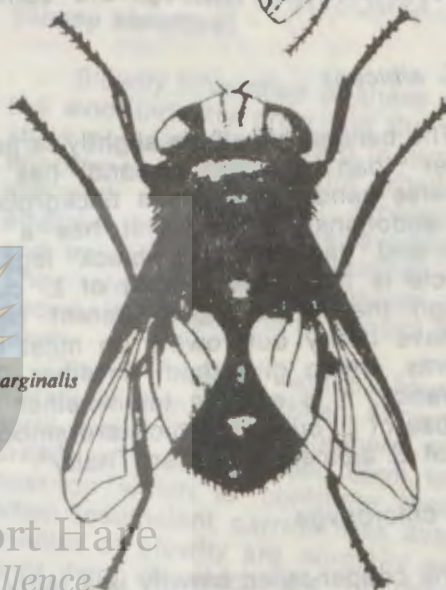
2. *Chrysomya chloropyga*



3. *Chrysomya albiceps*



4. *Chrysomya marginalis*



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FIG. 5 - Sheep blowflies

Such magot-infested sheep may be badly damaged by the numerous larvae crawling into their tissues and inflicting large, deep wounds. There is also a possibility of bacterial infection of the wounds accompanied by a form of poisoning (septicaemia), resulting from the putrefactive process to which the maggots give rise. This condition may lead to the death of the animal.

Control measures

The prevention of blowfly attacks on sheep is a far better policy than the treatment of already affected animals and there are several suitable methods of achieving this. So far as the sheep itself is concerned, animals with multiple skin folds should be segregated because such folds are vulnerable to blowfly attacks. In addition, care should be taken when young lambs are docked or when sheep are castrated or shorn lest unnecessary wounds be caused, since these are attractive to blowflies. The wool round the tail and crutch should be kept short to prevent soiling.

The best results are obtained by treating those parts of the body most susceptible to blowfly attacks with insecticides having a long residual action. Such parts are the crutch,

vulva and, in the case of rams, the horns as well. The insecticides may be applied by hand or with a power-spray, during August. This will protect the sheep until shearing time. A second treatment should be given about February, when the wool is about 25 mm long; this will protect the sheep until the cold weather commences and blowfly occurrence decreases. Consult your local veterinarian regarding the most effective treatments.

(I) *MELOPHAGUS OVINUS* (Sheep ked)

The sheep ked is a well-known permanent parasite of sheep that cannot exist away from its host; if removed it dies within a few days. Its occasional occurrence on other animals and even on human beings is purely accidental; it can complete its life-cycle only on sheep.

The adult keds are 6 to 7 mm long, leathery, wingless, yellowish-brown and covered with yellowish hairs. The body is dorso-ventrally flat. The abdomen is sac-shaped and grey, but has a red or blue sheen after the parasite has had a blood meal. Its mouth parts are clearly visible, long and slightly curved. Its legs are sturdy, with

clawed feet. Keds move slowly and many are removed when the sheep are shorn. They die easily when exposed to the sun. They occur mainly on the neck and abdomen of their hosts, but may be found anywhere on the body.

During her life-time of 4 to 5 months the female ked produces a larva every 10 to 12 days, with a total of 12 to 15. The new-born larvae, which are immobile and glued to the sheep's wool with a sticky fluid, are oval, yellowish in colour and have two spiracles situated laterally. They look very egg-like and do not feed. About 12 hours after birth the larva begins to change into a small brown barrel-shaped object, the pupa. It remains in this condition for 3 to 4 weeks, depending on the weather, after which the adult ked emerges and begins to feed immediately. Three to 4 days later these new keds are ready to repeat the life-process, so that new larvae appear after 2 to 3 weeks. Pupae also hatch in shorn wool, consequently infested wool should be left to lie for about a month, by which time the keds will have died.

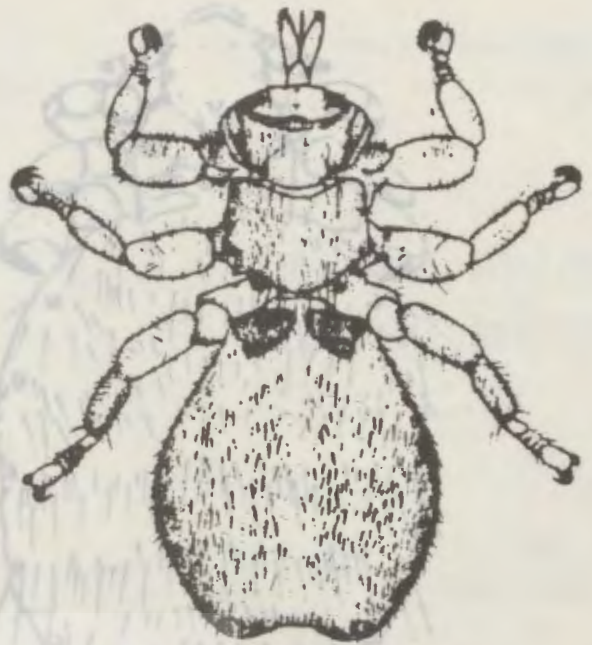


FIG. 6 - *Melophagus ovinus* (sheep ked)

Disease conditions caused

1. Sheep keds are vectors of a harmless blood parasite, *Trypanosoma melophagium*.
2. Their bites are irritating and make the sheep scratch, thereby damaging the wool.
3. Heavy infestations cause anaemia.

Control measures

Consult your local veterinarian regarding the most effective control measures.

(j) ANOPLURA (Sucking lice)

The lice that occur on animals may be divided into two groups, namely sucking and biting species. This distinction is based on their external appearance as well as differences in their manner of feeding: the sucking lice have an elongated head and mouth parts adapted for the sucking of blood, whereas the biting lice have a blunt head and are not bloodsuckers. They are all permanent parasites that cannot live for more than a few days away from their hosts, and are characteristically host-specific, i.e. they do not transfer from one kind of animal to another.

The *Anoplura*, which are active blood-suckers, are small and wingless, have dorso-ventrally flattened bodies and are roughly elongated-oval in shape. They are tough and leathery and difficult to squash. Their usual colour is slate-grey, but this changes to blue after a blood meal.

The female lays small yellow ovoid eggs (nits) that are glued to the wool or hair of the host with a cement-like fluid and hatch after 8 to 9 days. There is no metamorphosis between the young stages and the adults - they look exactly alike differing only in size. The small nymphs feed and moult three times before becoming adults, which are capable of laying eggs 14 days after hatching. Thus the whole life-cycle from egg to egg may be completed in 2 to 3 weeks. The infestation spreads from one host to another by contact or may be mechanically transmitted by a person handling the animals.

The most important blue or sucking lice found on sheep and goats in South Africa are the following:

(i) *Linognathus africanus*

This parasite is called the "African blue sheep louse". It may occur anywhere on a sheep's body. Emaciated or weak animals are particularly susceptible to attack and when severely infested the animals may be literally covered with lice. They suck the animals' blood, and can produce severe anaemia. They cause irritation leading to wool damage, since the sheep scratch or bite the fleece, which becomes ragged-looking. This species prefers hairy or cross-bred sheep to woolled sheep.

(ii) *Linognathus pedalis*

The foot louse occurs on the legs of sheep, just above the hoofs, and may cause lameness or paralysis.



FIG. 7 - *Linognathus pedalis* (sheep foot louse)



FIG. 8 - *Damalinia ovis* (red tick)

(iii) *Linognathus stenopsis*

These are lice that are found particularly

on goats, mainly in the north-western Cape Province. Their distribution is, however, limited.

(iv) *Linognathus ovillus*

The head louse is sometimes found on the heads of sheep, but it is a rare species.

Disease conditions caused

Sucking lice do not transmit any disease and affect only emaciated animals, causing anaemia, irritation, etc. The wool or hair frequently falls out, leaving large bare patches on the animal. These lice are particularly troublesome during the winter when the animals are weak.

Control measures

Good use may be made of foot-bath dips and ordinary dipping tanks. Consult your local veterinarian about the most effective control measures.

(k) MALLOPHAGA (Biting lice)

Biting lice occur on the skin of the host, where they feed on the superficial epithelial layers of the skin, hair, etc. They have a broad, blunt head and mouth parts adapted for chewing, with well-developed mandibles. These lice are non-blood-suckers. They are normally slate-grey in colour but sometimes appear red, owing to the colour of the head and thorax. Their life-cycle and mode of dispersal, namely by contact, is the same as that of the sucking lice. The following are important species of biting lice:

(i) *Damalinia ovis*

This parasite, called the "red louse" of sheep, may occur anywhere on the sheep's body.

(ii) *D. perigrina*

This louse occurs only in South West Africa and is found mainly on fat-tailed sheep.

(iii) *D. caprae*

This is a parasite of goats.

Disease conditions caused

These lice do not transmit any disease.

Control measures

Consult your local veterinarian regarding the most effective control measures.

E.3.4 EXTERNAL PARASITES: MITES



by C.J. HOWELL
Onderstepoort

Mammalian mites are minute, eight-legged parasites that are usually difficult to see. They live permanently on their hosts and, because they are so small, the average layman knows nothing about them. They are not easily associated with the conditions they cause; indeed, some are so difficult to find on the host that it is only fairly recently that scientists have succeeded in collecting and describing them. They cause diseases in sheep and goats called scab, itch and mange - conditions long known to stock farmers.

This is an irritating skin condition. The parasite lives on the surface of the skin, without actually penetrating it, and causes a profuse exudation of serum. This exudate forms yellow crusts or scabs accompanied by slight thickening of the skin, loss of wool and severe itching. Woolled sheep in particular are affected usually on the shoulders and sides of the body. Hairy sheep are normally infested on the back, sternum and dorsal part of the tail. Scab is controlled by the State. If the correct methods of control are applied scab is easy to eradicate.

Mating takes place and the females then moult again before laying. Having taken about nine days to reach this stage, they continue to live on the host for a further 30 to 40 days, laying about five eggs a day with a total of up to 100.

The parasites suck lymph from the host's tissues, causing an irritating inflammation of the skin followed by the exudation of serum. The hosts bite and scratch these lesions, which become hairless and encrusted with scabs. Such areas are unsuitable for the mites and they move outwards along the edges of the lesions, thus continually enlarging them. After several infestations large areas of the body may become hairless and scabby.

(b) PSOROPTES COMMUNIS VAR. CAPRAE

This mite occurs in the ears of goats and Karakul sheep. It is indistinguishable from the

(a) PSOROPTES COMMUNIS VAR. OVIS (Sheep scab mite)

This mite, which causes body scab, is large enough to be observed with the naked eye, although it can only be specifically identified with the aid of a microscope. It is oval and has long legs furnished with suckers and/or bristles.

The small, oval, cream-coloured eggs are laid on the skin of the host and usually hatch in one to three days. They feed for two to three days and then become quiescent for 12 hours before moulting into nymphae. After a further three to four days, including a 36-hour quiescent period, the nymphae moult into males and pubescent females.

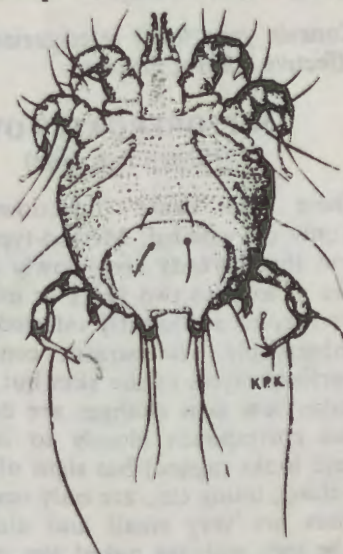


FIG. 1 - *Psoroptes ovis* (sheep itch mite) - male

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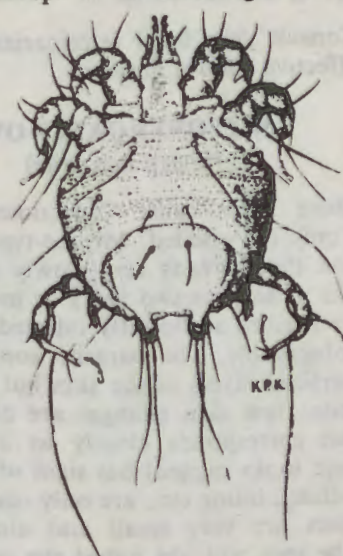


FIG. 1 - *Psoroptes ovis* (sheep itch mite) - male

sheep scab mite but occurs solely in the ears, where it causes tremendous irritation.

(c) CHORIOPTES CAPRAE (Itchy leg mite)

This parasite causes itchy leg or goat mange and is found in certain areas such as the Transkei and the vicinity of Jansenville in the Cape Province. It can sometimes be very troublesome, especially in Angora goats which are frequently attacked on the body as well as on the legs. Sheep are sometimes affected. The lesions cover the legs, which become thickened and irritated.

Diagnosis

1. Sheep scab

- The appearance of the skin, irritation and loss of wool.
- The presence of the mites, which are visible to the naked eye, though they can only be identified specifically with the aid of a microscope.

2. Itchy leg

- Thickening of the skin of the legs. Angora goats are frequently attacked on the body also.
- The presence of the mites, which are visible to the naked eye; they differ microscopically from the Psoroptes.

Control measures

1. Sheep scab

As mentioned above this disease is controlled by the State. Any outbreaks or suspected outbreaks must immediately be reported to the local State Veterinarian or stock inspector.

2. Itchy leg and ear mange

Consult your local veterinarian regarding the most effective control measures.

(d) PSORERGATES OVIS (Sheep itch mite)

These mites cause "infectious itch", which occurs only on woolled, Merino-type sheep. It is a condition that spreads very slowly on the host: it may take as long as two years or more for a single sheep to become sufficiently infested for symptoms to be observable. The parasite concerned lives in the superficial layers of the skin but even in severe infestations few skin changes are observable. The condition corresponds closely to lice infestations (the fleece looks ragged) but signs of irritation such as scratching, biting etc., are only occasionally seen. The mites are very small and almost spherical, cannot be seen with the naked eye and are difficult to find even with the aid of a microscope. The



FIG. 2 - *Psorergates ovis* (sheep itch mite) - female)

parasites were first described fairly recently and the life-cycle is completed in about five weeks.

Diagnosis

- The condition, as already indicated, looks very much like a louse-infestation, the fleece being tufted and ragged-looking. There is, however, only mild irritation. The skin is rather lead-coloured and has characteristic cord-like wrinkles in it.
- The mites can be observed only by examining skin scrapings microscopically. It is best to call in the help of a veterinarian.

Control measures

Consult your local veterinarian regarding the most effective sheep dip against these mites.

(e) SARCOPTES SCABIEI (Mange mite)

This is the parasite responsible for sarcoptic mange, a condition which is not very important in sheep but is frequently found in goats. Although the parasite is host-specific to a certain extent, it can migrate from one kind of animal to another and will attack most animals.

Mange is also controlled by the State and is a notifiable condition where it has been diagnosed. The parasite penetrates deeply into the skin, which becomes tremendously thickened, dry and wrinkled. A serous exudate is produced, which forms crusts on the skin, and the hair falls out. All the bared parts of the body may be attacked and the parasites cause their hosts much misery and irritation. Animals in poor condition are most liable to infestation and, if untreated, may become progressively emaciated and even die.

Although *Sarcoptes scabiei* is larger than the itch mite it is difficult to distinguish with the naked

eye. The mange mite is roughly circular in outline and has short legs, of which only the first two pairs project beyond the margin of the body. These mites resemble scab mites closely in their life-cycle but they burrow much deeper into the skin, where they live in tunnels. The infestation usually occurs on the head and along the groin of the host. It is usually confined to goats.

Diagnosis

As microscopic investigation of skin scrapings

are called for the assistance of a veterinarian should be sought.

Control measures

1. If kraals are kept empty for three weeks or longer any mites present will die out.
2. Consult your local veterinarian regarding the most effective control measures.



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