FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS

UNITED NATIONS
ENVIRONMENT PROGRAMME

Conservation of animal genetic resources

PROLIFIC TROPICAL SHEEP

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS

UNITED NATIONS
ENVIRONMENT PROGRAMME

Conservation of animal genetic resources

PROLIFIC TROPICAL SHEEP

by
I.L. Mason
with the assistance of the
United Nations Environment Programme

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome 1980

M - 22

ISBN 92-5-100845-0

TABLE OF CONTENTS

CONTENTS (Cont'd)

ILLUSTRATIONS

Common sheep in Barbados (note variation in colour)
(Photo - John Abbott)

1. INTRODUCTION

In 1973 FAO and UNEP launched their joint studies on the conservation of livestock breeds with a pilot project entitled "Conservation of animal genetic resources". Its report (1975) made a brief survey of livestock breeds throughout the world which were rare, endangered or vulnerable, and made a special study of cattle breeds in Europe and the Mediterranean countries. This species and this region were chosen because it is the native European and Mediterranean cattle breeds which have suffered most by crossbreeding and replacement. Indeed the report showed that only 33 out of 1[illegible] native breeds in this region could be considered stable and not threatened with extinction in the long term.

This decline in local breeds can be summarized as being due to fashion, commercial activity and deliberate policy. As husbandry improves it is possible to keep more productive (but less hardy) breeds. This applies particularly to the dairy breeds. At the same time artificial insemination makes possible a very rapid change-over. The changes in farming structure are also important - the small mountain and upland farmers disappear and with them the local dual- or triple-purpose breeds. Larger farms with improved husbandry no longer use draught animals.

Mediterranean sheep were the subject of the next FAO/UNEP report. "Declining breeds of Mediterranean sheep" by Brooke and Ryder (1978) described 24 breeds (out of a total of about 120) in seven European Mediterranean countries, which are endangered, vulnerable or rare.

In the Western Mediterranean this decline has been due chiefly to crossbreeding with more productive breeds when husbandry could be improved - as for cattle. In the Eastern Mediterranean it is part of a general decline in the sheep industry associated with low returns (e.g. falling wool prices), lack of prestige (hence shortage of shepherds) and spread of tourism on the coasts and in the mountains.

In Europe development has proceeded so far that it is extremely difficult to justify the retention of many disappearing breeds on economic grounds. The big exception is the use of adapted mountain and Mediterranean breeds for commercial crossing with sires of improved breeds (see FAO Report "**Mediterranean** cattle and sheep in crossbreeding", 1977). In the developing countries, on the other hand, indigenous breeds predominate. It is therefore, important that they be studied now before they are endangered by crossbreeding with breeds from temperate countries. The pressure for crossbreeding very often comes from the factors of fashion, commercial pressure and prestige rather than real economic advantage - the much more difficult environments in tropical and subtropical countries are often unsuitable for European breeds and even for their crosses.

Accordingly, in 1976 UNEP and FAO initiated a project on "Conservation of animal genetic resources". Instead of a superficial survey of the whole world it concentrated on developing countries and picked those species, breeds and regions which the pilot survey had suggested were particularly urgent to study because of pressure on local adapted breeds (e.g. Criollo cattle of Latin America, trypanotolerant cattle of West Africa). It also drew attention to neglected local resources. One of these is the sheep of the humid tropics; this is a climatic zone not traditionally associated with sheep but in some of the wet tropics they are extremely important. A special

aspect of a few of these populations is that they show a high reproductive rate. Thus the Pilot Project's recommendation was "A mission should be mounted to study the woolless sheep of north-east Brazil and the Caribbean area with particular attention to the Barbados Blackbelly which is known to be highly prolific but whose population is small. Contact should be established with any other sheep projects in the humid tropics, e.g. West Africa, southern India, Java".

In the current project the aim was enlarged and a coordinating consultant was appointed whose terms of reference were to survey and inventory prolific tropical sheep and other tropical sheep breeds in danger of extinction. This was to be done by a survey of the literature, by visiting the countries concerned, and by recruiting local consultants to help in the collection of information. At the same time a second consultant has been surveying the sheep breeds of Afghanistan, Iran and Turkey and his report is presented separately (see Yalçin, 1979).

As work proceeded it was clear that it is difficult to draw a clear line of distinction between "tropical" and "subtropical". Therefore, some attention was paid to prolific breeds in subtropical regions. It also became apparent that it was impossible to include all the "other tropical sheep breeds in danger of extinction". This would have meant visiting all tropical countries in order to study all sheep breeds on the spot and pick out those in the endangered category. However, some regions could immediately be eliminated from the survey, as follows:

1. North Africa and the Near East, except for prolific breeds, because the sheep of the Arab countries are being surveyed by ACSAD (Arab Centre for Studies on Arid and Dry Lands) and those of Afghanistan, Iran and Turkey by Yalçin (1979).

2. West and west equatorial Africa (except in search of the origin of American hair sheep) since the sheep of the humid zone at least are included in the report of the FAO/ILCA/UNEP study on trypanotolerant livestock (1980).

3. India, since the sheep breeds of India are the subject of a special FAO survey currently in progress.

In addition, eastern and southern Africa were left out because there is no evidence for prolific breeds in this region and no indication that local breeds are in danger of extinction.

This left three main areas to be surveyed in this project:

I. Tropical America. The coordinating consultant visited Barbados, Brazil, U.S. Virgin Islands, Dominican Republic, Haiti, Jamaica, Cuba and Mexico and received reports from local consultants in Trinidad, Colombia, Venezuela and Brazil.

II. Southeast Asia. The coordinating consultant visited Indonesia and Sri Lanka and also received reports from local consultants in these countries.

III. Southwest Asia, and the Mediterranean. The coordinating consultant visited Greece, Morocco and Oman. To complete the picture of this subtropical zone, published accounts of prolific breeds in the same climate zones in the U.S.S.R. and China are also included.

This report takes each of these regions in turn and describes what is known about the prolific breeds. For the two humid tropical regions - tropical America and southeast Asia - it then considers some related or neighbouring breeds and discusses breeding systems and conservation programmes.

The definition of a prolific breed used herein in reference to tropical environments is not so exacting as in Europe. In Europe many breeds have lambing percentages of 150 or more so that it is not until the litter size is over two that a breed is considered to come into the prolific class. In the tropics in general twins are unusual, so that a lambing percentage of over 150 has been chosen as the criterion of prolificacy in this review.

Naturally it was not possible to confine the survey only to known prolific breeds. Related and neighbouring breeds were explored both in the hope of finding other prolific breeds and also to present details of breeds in similar environments which lack the high fertility character. This naturally led to a consideration of the adaptation of sheep to the tropics and particularly to the humid tropics.

The distinction between prolific and non-prolific breeds was particularly difficult to establish among the hair sheep populations of tropical America. Although these sheep are extremely well adapted to their environment and are of vital importance to their owners they have been hithertoo much neglected by research and development services. There is thus comparatively little information available on their characteristics and performance. For these reasons the opportunity has been taken to summarize here all available information about them, not only as a basis for further programmes of research and improvement but also as a source of information for sheep breeders in similar tropical environments elsewhere.

(For references see p. 104).

Note on terminology. A fertile ewe or a fertile mating is one which gives rise to an offspring. Fertility is thus measured as the percentage of mated ewes which produce lambs, i.e. the lambing rate. This may loosely be called the conception rate but in fact it represents the conception rate less any embryonic mortality. In conditions of flock mating where the actual mating may not be observed it is in fact the number of ewes lambing per 100 ewes joined (i.e. put to the ram) which is recorded. Prolificacy is defined as the number of lambs per 100 ewes lambing, i.e. it is another way of expressing the litter size or number of lambs per birth. Fecundity may be used loosely for either fertility or prolificacy. It would be desirable to confine its use to mean number of lambs born per 100 ewes joined i.e. fertility x prolificacy. This may refer to a single lambing season or it may refer to a whole year. In this latter use fecundity = fertility x prolificacy x number of lambings per year.

Although an attempt has been made to use these terms in the ways defined the attempt may not always have been successful because of plurality of authors and quotations from many and varied sources.

2. HAIR SHEEP OF TROPICAL AMERICA

In tropical America there are two quite different types of sheep. In the highlands there is a wooled sheep, called Criollo, which originated from the coarse-wooled Churro imported from Spain during the period 1548 to 1812. It is a small to medium-sized animal producing a small quantity of coarse wool which is important for the cottage wool industry. The males have horns. Colour is often white but coloured and pied animals are common.

This is the principal breed in Mexico, Guatemala, Nicaragua, Colombia, Venezuela, Guyana, Ecuador, Peru and Bolivia. There are also small populations in Haiti and the Dominican Republic. There is a population of wooled sheep in Jamaica, called St. Elizabeth sheep, which also has a European origin but it is not known when or from where their ancestors were introduced.

There do not appear to be any prolific strains among the Criollo sheep so they will not be considered further.

The second type of sheep is a woolless or hair sheep whose colour is commonly tan (red-brown), white, or patterns involving tan. Males lack horns but are characterized by a shoulder and throat ruff of long hair. This hair sheep is found in many Caribbean islands and in mainland countries along the north coast of South America. Populations will be described from Barbados, Virgin Islands, Bahamas, Cuba, Mexico, Dominican Republic, Colombia and Brazil. The hair sheep is of African origin but, in countries where wooled Criollo sheep do not occur (e.g. Cuba), it may be termed "Criollo" which tends to be confusing.

Among the hair sheep the Barbados Blackbelly has long been famous for its high prolificacy. More recently the white sheep of the Virgin Islands has been shown to rival the Barbados in this respect. A report from Bahamas (Peritz, 1978 personal communication) suggested that the Bahama native sheep could produce three lambs per year under good conditions which would put it in the prolific class. In fact the average is much lower.

The other populations are described for completeness since there has been no previous comprehensive account of them. Furthermore, they are closely related to the prolific populations and presumably the same genes are available for selection. Indeed high litter sizes have been reported in some flocks of the Brazilian hair sheep (see Section 2.8).

2.1 BARBADOS BLACKBELLY SHEEP by R.K. Rastogi, H.E. Williams and F.G. Youssef

The island of Barbados. Barbados is the most easterly of the West Indian islands. Its area is only 4,300 square kilometers but its population is 248,000. The climate is equable with temperature ranging between 22°C and 30°C. Annual rainfall is 1520mm, most of which falls between June and December. Unlike most other Caribbean islands, which are volcanic, Barbados is a coral island.

Arable crops, chiefly sugar cane, cover 77 percent of the land area and pasture only 9 percent. This pasture is chiefly rough grazing with native tropical grasses. According to FAO (1978) its livestock population consists of 49,000 sheep, 38,000 pigs, 26,000 goats, 18,000 cattle and 5,000 equines.

Origin and history of the Barbados Blackbelly. It is generally agreed that these hair sheep were introduced into Barbados from West Africa. They have existed in Barbados for well over three hundred years. Ligon in "A True and Exact History of the Island of Barbados" (1657) wrote (on p. 59) "We have here, but very few /sheepe/; and these do not like well the pasture, being very unfit for them; a soure tough and saplesse grasse, and some poisonous plant they find, which breeds diseases amongst them, and so they dye away, they never are fat, and we thought a while the reason had been, their too much heate with their wool, and so got them often shorne; but that would not cure them, yet the Ews bear always two Lambs, their flesh when we tried any of them had a very faint taste, so that I do not think they are fit to be bred or kept in that Country: other sheep we have there, which are brought from Guinny and Binny, and those have haire growing on them instead of wool; and are liker Goates than Sheep, yet their flesh is tasted more like mutton than the other".

"Guinny" is clearly Guinea, the Gulf rather than the present country of that name. "Binny" may be Benin, or Benny on the Niger Delta. (For further discussion about West African sheep and the possible origin of the Barbados Blackbelly and the other hair sheep of tropical America, see Section 2.9).

On an earlier page (p. 23) Ligon records that there were no domestic animals, except pigs, on the island when Sir William Curteens landed there in 1624. The two kinds of sheep must have been introduced between 1624 and 1657. It is clear that wool sheep did not thrive; nothing is said about the thrift of the hair sheep. The curious thing is that the high fertility is attributed to the wool sheep whereas it is now the hair sheep which exhibit this characteristic. Could this have been a result of crossbreeding combined with selection? A hundred years later the wool sheep had apparently died out since Hughes (1750) wrote: "The Sheep that are natural to this climate and are chiefly bred here, are hairy like Goats. To be covered with Wool, would be as prejudicial to them in these hot Climates as it is useful in Winter Countries for Shelter and Warmth".

Numbers. At present the Ministry of Agriculture estimates that there are something over 30,000 sheep in Barbados; about one-third are purebred Blackbelly (see Plates 1-3), another one-third are grade Blackbelly (off-type in colour or with white spots) and the remaining are "others" (see Frontispiece). The last category includes hair sheep of other colours such as, white, tan,

black or pied, and crosses with Blackhead Persian and wool sheep (mainly Wiltshire Horn). In fact in or around 1950, simultaneous importations of Wiltshire Horn sheep from the U.K. occurred in Barbados (Patterson, 1976), Tobago (Trinidad and Tobago, 1953) and Guyana (Devendra, 1975) with the objective of improving the quality of local sheep by crossbreeding. It has been estimated in Barbados that about 10 percent of the lambs born from woolless sheep at present are more or less woolly and these are not kept for breeding.

The Blackbelly was the commonest breed on the estates surveyed by Patterson and Nurse (1974). Sixty-three percent had only this breed and on the others the dominant type was Blackbelly crossbred. A few farms kept Wiltshires. The Blackbelly was the dominant breed on all the small farms in the survey; Blackbelly crosses were next in importance and Wiltshires were present on only 12 of the 97 farms surveyed.

Export and present distribution. Because of the high prolificacy of these sheep (as opposed to one lamb per lambing for most of the tropical sheep breeds), they have been in great demand from many countries. As early as 1902 they were exported to St. Lucia and from there to Antigua. In 1903 there was a report of a Blackbelly ewe on Tortola (British Virgin Islands) giving birth to five lambs (Patterson, 1976). They are now widely distributed throughout the Commonwealth Caribbean (the Bahamas, Jamaica, the Leeward and Windward islands, Trinidad and Tobago, and Guyana), the French Antilles (Guadeloupe and Martinique) and the Netherlands Antilles (Curaçao and Aruba).

Blackbelly sheep (along with West African and Blackhead Persian) were imported into Venezuela in 1961 from Trinidad and Tobago and from Barbados by the Sección de Zootecnia del Centro de Investigaciones Agronomicas at Maracay (Bodisco, Duque and Valles, 1973). These "West African" sheep are described by Reverón et al.(1976) as uniform light brown with paler belly, face and inner surface of the legs. Some are darker in colour. They are also called "West African" in Trinidad but in Barbados would be described as an off-colour variety of the Blackbelly.

Blackbelly sheep have also been exported to Mexico, Panama and Taiwan. A consignment sent to Canada was slaughtered on arrival because the sheep were found to be positive for blue-tongue antibodies (Moe, 1975, cited by Williams, 1975), although the disease has not manifested itself clinically in Barbados.

Four yearling ewes and one ram of this breed were originally introduced into the U.S.A. by the U.S.D.A. in 1904 (Rommell, 1904) and were stationed at Bethesda, Maryland (Patterson, 1976). Flocks of these sheep are now located at North Carolina State University (Prof. Lemuel Goode), at Texas A & M University Experiment Station (at least until recently) (Dr. Maurice Shelton), and at Dixon Ranch, California (Prof. G.M. Spurlock) (see Plate 4); more recently, a small flock of crossbred Blackbelly sheep has been located at Ohio State Agricultural Experiment Station (Dr. Charles Parker) as part of a cooperative research programme with the International Sheep and Goat Institute, Utah (Foote, 1977).

In central Texas, and particularly on Edward's Plateau, there is a large population of hair sheep. These are descended from the Blackbellies

introduced at the beginning of the century. Later, about 25 years ago, they were crossed with European mouflon in order to put horns on the males and now they are bred primarly as game animals. There has also been some crossing with Rambouillet (Shelton, 1976; Foote, 1977). The colour of these sheep is now very variable. It may be tan, tan with pale belly, tan with black belly, black or pied. The males all carry horns which may be of the mouflon type or the Rambouillet type (Spurlock, 1974; Mason, 1978). There used to be upwards of a quarter of a million of these hair sheep in Texas. Now the numbers are much less, possibly something over 100,000. Predation by coyotes is one of the causes of this decline, also slaughter and export (mostly to Mexico).

The rams of such flocks, which are semi-feral, are commonly used for hunting on game ranches in Texas and have been shipped to other states for this purpose. Most of the California Blackbelly flocks are either for meat for domestic consumption, or the animals are kept as pets or as game for hunting (Spurlock, 1974, 1976). These sheep in the U.S.A. are called by various names such as mouflon-Barbados, Black Bellied Barbados, West Indian Blackbelly, Barbados, Barbadol, Barb, or most commonly Barbado.

In an attempt to build up numbers a ban on exports from Barbados was imposed in June 1974. Since it did not have the desired effect it was lifted in July 1976.

Colour. Body colour varies from light to dark reddish-brown (tan) with very conspicuous black underparts. The black colouration covers the lower jaw, the chin, throat, breast, entire belly, axillary and inguinal regions, and inner sides of the legs, and extends as a narrow line along the underside of the tail nearly to the tip. On the outer side of each leg the paler colour persists dorsally only as a restricted and more or less broken stripe. The inner surface of the ear is black, and there is a conspicuous black stripe on the face above and anterior to each eye and to the tip of the muzzle. In the adult male the occipital area immediately behind the horn bases is also black. Where the hair is short, as on the breast and belly, the black area is sharply delimited, but in the longer hair of the outer sides of the thighs and on the mane of the male the transition from black to pale colour is more gradual. The colour of the back and sides is reddish-brown, which becomes paler on the face, the sides of the neck, and the flanks. A white spot is found below and slightly in front of each eye and sometimes another smaller white spot above it. The tip of the tail may occasionally be white.

The black belly pattern is termed badger-face by geneticists whether the back is white or tan. It is in the agouti series and appears to be recessive to self-colour white or tan but dominant to black (Lauvergne and Adalsteinsson, 1976).

Appearance and size. Johnson (1944) has given a good description of the colour and appearance of these sheep. They differ from what is considered a desirable mutton type in being far too narrow-bodied, long-necked, and angular. Patterson (1976) called them "decidedly leggy"; however, Johnson (1944) indicated that these sheep are less leggy than some other of the African types. The ears are of medium size and do not droop (i.e. they are carried horizontally). The dorsal outline of the muzzle is not conspicuously

convex as it is in the Dorset or Suffolk, but there is a slight tendency towards Roman nose in the rams. There is no unusual deposit of fat on the rump or tail which reaches to the hocks. The breed is normally hornless but occasionally rams are scurred and even less often they carry small bluish-grey horns that describe only about half a spiral. On the other hand, the rams of present-day Barbado sheep in the U.S.A. are almost entirely horned and horns curl backwards and outwards, or may describe a full spiral.

The hair of the body averages about 2.5 cm long and in texture resembles that of a domestic goat. The hair of Barbado sheep is much longer, perhaps as protection against lower temperatures. Gallagher and Shelton (1973) reported the mean fibre diameter for Barbado sheep and non-Angora meat-type goat (Spanish goat) as 49.0 and 32.4 microns respectively and concluded that the Barbado showed an abnormal extension towards coarse fibre type. Any sign of wool on Blackbelly sheep in Barbados is believed to be due to past crossing with the Wiltshire Horn and is selected against. The male carries a throat ruff and a well developed mane of hair 10 to 15 cm long.

In size and general proportions, they resemble the medium-sized breeds. The average height at withers varies from 60 to 70 cm in the ewes and 75 to 81 cm in the rams. The adult rams weigh from 50 to 70 kg and ewes weigh from 32 to 43 kg (Maule, 1977; Mason, 1978). The average weight for mature Barbado sheep has been reported as 45 kg for ewes and 48 to 57 kg for rams (Spurlock, 1974).

Adaptability, behaviour and temperament. Barbados Blackbelly sheep are hardy and well adapted to a semi-arid tropical environment in which they have been reared for at least three centuries in close association with man. They seem to tolerate moderate variations in environmental temperatures quite well and at times show some degree of physiological adaptation. For example, one of the sheep that was imported into the U.S.A. in 1904 developed a considerable amount of wool on its shoulders presumably as a reaction to the cooler Maryland climate (Patterson, 1976). In the Caribbean, these sheep can be seen grazing at high noon.

Patterson (1976) has noted that the ewes show good maternal behaviour and normally make excellent mothers. Their milk production is good and they can easily rear up to three lambs if adequately fed. Poor mothering ability is sometimes apparent among young, nervous mothers, particularly those in their first lambing. Sometimes an ewe may allow the lambs born first to suckle while ignoring the others. Ewes will almost never accept strange lambs so that fostering orphan lambs is not possible; one must resort to artificial rearing of lambs in excess of three per litter.

The fact that these sheep have traditionally been reared in small flocks in close association with man has rendered them intelligent, gentle and docile. In fact, they make good pets. On the other hand, Dr. Reverón at Maracay (Venezuela) described them as having a nervous temperament.

Barbado sheep in the U.S.A. have also been described as of wild temperament (Shelton, 1976; Foote, 1977). However, Spurlock (1974) has made the following observations:

"These sheep, though reared as feral stock or from their progeny, become extremely gentle with close handling. They are, however, quick to

react to strange people or new surroundings but adjust well after a short period. They appear to be quite intelligent as compared to other sheep, make excellent pets, and at least some individuals reared off their mothers are able to recognize their individual names.

"Observation indicates that while they withstand heat or cold well, part of this adjustment to extremes is behavioral rather than physiological. For instance cold wind or warm sun rather quickly results in a flock finding refuge in some shelter under conditions when wooled sheep remain in the open. They are extremely reactive to strange dogs or cats, usually acting as though wishing to flee. In a close corral and in defense of young, less timid individuals show protective behavior, raising a front leg as though warning off the predator and occasionally bristling the hair on top of the neck and even jumping at the animal to strike with the forefeet. Ewes with very young lambs show protective behavior to a high degree. Some individual rams will charge dogs repeatedly with little or no provocation.

"Mating behavior is similar to that of other sheep but heat in the females appears to be more evident. The ewes adopt a mating stance in front of the ram and look back over the shoulder to the ram. They stand steady on mounting. In the mating stance the ewe shakes her tail quickly from side to side and this behavior appears to excite the ram which mates repeatedly, at short intervals over the mating period of approximately 48 hours. Rams start chasing ewes approximately 48 hours prior to standing heat. If one or more ewes are not in heat or coming in, the ram will perform rape on any ewe in any convenient crowded situation".

Boyd (1978) noted that Barbado rams would mount other rams when in multisire groups.

Management. Sheep farming in Barbados is normally a secondary interest and as such a backyard operation. Traditionally, sheep have been kept by peasant farmers as a ready source of cash or of meat for special occasions. About 80 percent of the sheep population in Barbados exists in flocks of 5 to 10 sheep. After having recognized the export value of these sheep, farmers have now joined under the umbrella of the "Barbados Sheep Farmers Association" formed in 1975. There are about 60 members controlling about 20 percent of the total sheep in the country (Rastogi, 1975). Apart from a few large flocks kept by estates, the only sheep "farm" is the Government experimental farm at Greenland and more recently at Sedge Pond.

The larger flocks on the estates are reared under an extensive system whereby sheep are allowed to graze during the day and are penned during the night to guard against predators and larceny. Some estate farmers supplement grazing, especially in the dry season, with waste vegetables or with sugarcane tops ensiled with molasses and urea. Small farmers, however, follow the tethering system of management whereby 3 to 5 sheep are grazed in a group along the roadsides. Thus, children or cheap family labour is made use of to manage the sheep.

The majority of farmers deworm their sheep routinely every 3 months (Patterson and Nurse, 1974). Lambs are normally allowed to run with and suckle their mothers as long as the ewe will permit; if they are to be sold lambs are weaned at 8 weeks. Castration of young lambs is almost never practised in Barbados.

Health. The health status of any sheep population is affected to a great extent by the degree of rainfall and humidity. In Barbados, most sheep are located in the drier coastal areas and are normally free of any major diseases. It has been claimed that they exhibit high tolerance or possess natural resistance to internal parasites (Shelton, 1976; Thompson, n.d.). Yazwinski, Goode and Moncol (1976) reported from North Carolina that Barbado sheep and their crosses are more resistant to gastro-intestinal parasites (primarily Haemonchus contortus) than purebred Dorsets and Suffolks. Barbado and their crosses had lower faecal egg counts, higher haemoglobin levels, higher haemoglobin concentrations per haematocrit and higher white blood cell counts than Dorsets and Suffolks. On the other hand, Mansfield et. al., (1977) found no significant difference in resistance to infection with H.contortus larvae between lambs sired by Targhee and by Barbado rams.

Prof. Thompson, working at Texas Technical University, stated that the Barbado seemed to be healthier and sturdier in confinement than the Rambouillet.

Notwithstanding the above, gastro-intestinal parasites have been identified as the major health problem. Most important of these is Haemonchus although coccidiosis is also observed. Ungria (n.d.) diagnosed the presence of a new species of coccidia (Eimeria granulosa) and consequently he advised that all imported sheep be treated with sulphonamides in addition to the routine anthelmintic treatment.

Other diseases mentioned are mange, footrot, pink eye, tick fever, pneumonia, mastitis, and metritis. Nevertheless, Patterson and Nurse (1974) report that sickness is very uncommon among sheep in Barbados. Footrot and pneumonia are more prevalent among exotics and their crosses. In Venezuela, myiasis has been identified as the major problem when sheep are on pasture under poor weather conditions but not so if confined indoors. Recently, there was high mortality among older ewes towards the end of pregnancy, particularly if they were carrying three or more foetuses (Reverón, 1978). In Guyana, enterotoxaemia has been suspected to be the major cause of high mortality among lambs. Recently, adult Blackbelly sheep at Ebini in the Intermediate Savannahs, Guyana, have been suffering from weakness of the hindquarters (not white muscle disease) or staggers, the cause of which has not yet been identified in spite of help from PAHO experts (Nurse, 1978).

Prolificacy. One of the most outstanding qualities of Blackbelly sheep is their high prolificacy; multiple births (twins and triplets) are common. The survey of Patterson and Nurse (1974), which covered 167 ewes on 18 estates and 369 ewes on 97 small farms revealed that two was the most frequent litter size on estates but there were a few producers who had litters of three. On small farms the average litter size was stated to be two. This estimate for litter size is confirmed by the figures given in the report of Patterson (1978) and quoted in Table 1. Litters of five or more lambs have occasionally been recorded (Johnson, 1944; Patterson, 1976). Similar figures emerge from the records reported by Laurie (1978) on two private farms in Barbados totalling about 100 ewes. Litter size averaged 2.0 and births were distributed as follows: single births 30 percent, twin births 45 percent, triplet births 24 percent, quadruplet births 1.5 percent, quintuplet births 0.4 percent.

Table 1 Reproductive performance of Blackbelly sheep on three Government stations in Barbados

Station	Years	No. of ewes	No. of litters	No. of lambs	Average litter size	Lambing interval (months)
Six Cross Roads	1972-75	271	731	1432	1.96	8.34
Central Livestock Station	1975-78	61	176	405	2.30	9.0
Greenland	1976-77	156	172	357	2.07	-
Total		488	1079	2194	2.03	8.48

	Single	Twin	Triplet	Quadruplet	Quintuplet
Birth type (%)	26.8	47.3	22.1	3.4	0.4

Source: Patterson, 1978

Figures on prolificacy from published data recorded elsewhere are given in Table 2. The average litter size varied from 1.45 to 1.75 per lamb crop. These values are lower than those reported by Patterson (1978) in Barbados. This may be due to the fact that accelerated lambing rhythm (three lamb crops every two years) lowers the litter size per lamb crop. Further, it has been observed that sheep produce larger litters when raised in small flocks and in close association with man (which Barbados Blackbelly sheep are traditionally accustomed to) than in large flocks (Turner, 1976). Thus Mr. Kent of Craigston Estate (Carriacou, Grenada) has reported average litter size of 2.0 for a small flock of 10 foundation ewes that were imported from Barbados.

Spurlock (1978) has selected his Barbado flock for frequent lambing, with some emphasis on body size and multiple births. His remaining flock of 10 mature ewes averaged 1.9-2.0 lambs per birth during 1976 and 1977. Goode (1978) reports that in later years his Barbado ewes have averaged about 1.6 lambs per birth when lambing in August-September but about 1.8 when lambing in January-February.

Table 2 Summary of prolificacy figures for Blackbelly outside Barbados compared with other tropical breeds.(Litter size = lambs born per lambing)

	Blackbelly	West African	Criollo	Country and reference
Ewes lambing	195	277	277	Venezuela
Litter size	1.45	1.43	1.13	(Bodisco et al.,
Single births %	61	59	88	1973)
Twin births %	33	39	11	
Triplet births %	6	2	1	
Ewes lambing	12	15	14	Venezuela
Litter size	1.75	1.66	1.40	(Mazzarri et al., 1973)
Ewes lambing	52	85	40	Venezuela
Litter size	1.66	1.55	1.27	(Mazzarri et al., 1976)
Ewes lambing	145			Guyana
Litter size	1.68			(calculated from Devendra, 1977)
Single births %	41.4			
Twin births %	48.3			
Triplet births %	10.3			
			Barbado	
Ewes lambing			101	U.S.A., California
Litter size			1.68	(Spurlock, 1974)
Ewes lambing			34	U.S.A., N.Carolina
Litter size			1.56	(Goode and Tugman 1975)

Other aspects of female reproduction. In the experiment of Mazzari et al. (1976), for which litter size has already been quoted, the percentage of ewes coming into heat after treatment with fluorgestone in vaginal sponges was 98.5 for the Blackbelly compared with 94.9 for West African and 76.9 for Criollo. The percentage of these ewes lambing was 73.9, 73.9 and 67.1 respectively. Goode and Tugman (1975) have shown the high fertility of Barbado and Barbado cross ewes (see Table 3). These figures have been confirmed by data from two additional lamb crops (Goode, 1978).

Table 3 Reproductive performance of ewes mated to Suffolk rams in summer and early fall breeding at North Carolina State University, Raleigh, 1974-75

Ewe breed	No. of ewes	Ewes lambing (%)	Lambs born per ewe lambing	Lambs alive at 30 days	Mortality to 30 days (%)
Dorset	59	62.7	0.98	0.66	32.7
Barbado	36	94.4	1.56	1.44	7.2
Dorset x Barbado	41	97.6	1.83	1.56	14.7
Barbado x Finnish (young ewes)	18	94.4	1.67	1.50	10.0

Source: Goode and Tugman (1975)

Barbado ewe lambs can be bred first at the age of 5-8 months (Spurlock, 1978). According to Mason (1978) in Barbados under good conditions ewes can lamb first at 12-13 months but 14-15 months is the more common age at first lambing. In contrast, Patterson (1978) gives 16.8 months as the age at first breeding and 21.6 months as the age at first lambing for ewes at the Six Cross Roads sheep multiplication station. However, he also states that Blackbelly replacement ewes usually enter the breeding flock at 9-11 months of age. Average gestation periods recorded are 150 days (Spurlock, 1974) and 151 days (Reverón and Garcia, 1975).

Apart from their high prolificacy, another important characteristic of these sheep (and of most other tropical breeds) is their ability to breed throughout the year, or at least to have more than one breeding season. Spurlock (1974) reported that Barbado ewes dropped lambs in all months of the year; however, the winter period (January-February) was favoured. To exploit the phenomenon of the year-long sexual season, breeders have attempted to breed their ewes with a view to having three lamb crops every two years, that is, an interlambing period of 8 months. However, provided the flock is maintained at a high plane of nutrition and level of management, it is possible to obtain two lamb crops per year though such an accelerated lambing rhythm cannot be maintained indefinitely due to its adverse effects

on litter size, lamb viability, and the general condition of the ewe herself. Boyd (1978) referred to one original ewe in his research flock of ten that had lambed eight times during a period of slightly over 4½ years (April 1974 to November 1978), produced 14 lambs and weaned all of them at 60 days of age. This ewe was never assisted at birth nor placed in a lambing pen for any period of time. Wallace et al. (1977) quoted observations by Allen (1976) and Reel (1976) that many 'pure' Barbado ewes showed outward signs of coming in heat and would stand for the ram three days after parturition. Patterson and Nurse (1974) reported that on estates in Barbados the most frequent lambing rate was twice per year while on small farms there were at least 1.5 lamb crops per year. Table 1 shows 8.3 and 9 months as the average intervals on two Government farms.

Foote (1977) alluded to the ability of Barbado ewes to return to fertile breeding within about one month after lambing, which established a rather short postpartum interval and made it possible to produce two lamb crops per year. Spurlock (1974) found interlambing period in his selected line during 1971-73 to be 214 days (range 174-321 days) or about 7 months, giving 1.72 lambings per ewe per year. Cull ewes averaged 258 days. By 1978 the lambing interval had been reduced to 6½ months (Spurlock, 1978). The earlier figures represent a period of 64 days (range 24-71) between lambing and subsequent conception. The longer intervals were from ewes with 3-4 lambs which appeared to retard return to breeding. Thompson (n.d.) noted that the Barbado will lamb every 9 months on the range and every 9 months or less in confinement. Goode and Tugman (1976) were able to get three lamb crops in 18 months using Blackbelly crossbred ewes. McPherson (1975) found that at Ebini the mean interlambing period for 1-2, 2-3, 3-4 and 4-5 year-old ewes was 247, 206, 190 and 213 days respectively.

Lamb mortality. Patterson and Nurse (1974) indicated that mortality is not a major problem on estates in Barbados; 40 percent of respondents had never experienced deaths. On the other hand, 43 out of 53 small farmers had recently suffered losses. The experimental report of Bodisco et al. (1973) is summarized in Table 4. Pre- and postweaning mortality was higher in Blackbelly lambs than in West African and Criollo lambs. Thus, only 65.5 percent of Blackbelly lambs survived to 6 months of age compared with 74.3 and 79.2 percent for West African and Criollo lambs respectively. As expected, mortality was higher among multiples (32.4 and 36.7 percent in twins and triplets, respectively) than singles (21.6 percent). However, no general conclusions should be drawn from this report since lamb viability is dependent on so many environmental factors such as size and health status of the flock, level of management, and whether the climate is arid or humid. Thus, when Blackbelly sheep were first introduced at Ebini (Guyana) in 1974, lamb mortality was as high as 45 percent; however, it has since been brought down to 25 percent (McPherson, 1976). In the flock of approximately 100 ewes at Craigston Estate (Carriacou), Mr. Kent indicated that lamb mortality was not much of a problem and varied from 5 to 10 percent. Mason (1978) reported that lamb mortality at the Government Farm in Barbados was 12 percent but that with poorer management it could go up to 25 percent. Thompson (n.d.) reported that, in a Barbado sheep flock, of 56 lambs born 49 were weaned, giving a mortality rate of 12.5 percent.

Table 4 Percent lamb mortality data for four breeds at Maracay, Venezuela

Breed	Birth to weaning	Weaning to 6 months	Birth to 6 months	Litter size at 6 months
Barbados Blackbelly	19.1	15.4	34.5	0.95
West African	15.8	9.9	25.7	1.06
Blackhead Persian	21.0	13.6	34.6	0.89
Criollo	10.8	10.0	20.8	0.84

Source: Bodisco et al., 1973

Growth. Available records of body weight and rate of gain of lambs of Blackbelly compared with other tropical breeds are summarized in Table 5. It is apparent that Blackbelly lambs grow as well as those of the other tropical breeds. This is of special importance if one realizes that more than 60 percent of the Blackbelly lambs are born as multiples. The fact that Barbado lambs (Spurlock, 1974) grew faster (190 g from birth to 6 months) than Blackbelly lambs indicates that there is tremendous scope to improve growth rate in tropical breeds by proper nutrition, management and selection.

The report by Chacon et al. (1970) is the only one that compares feed conversion efficiency among lambs of various tropical breeds including Blackbelly type (see Table 5 for various breeds involved); the amount of food required per kg gain ranged from 8.1 to 9.2 kg and the differences among breeds were statistically not significant.

Shelton et al. (1973) reported that maintenance requirements for Barbado sheep, when expressed as a function of body size (TDN in lb per lb body wt), were higher than for the Rambouillet (0.0163 vs 0.0126).

Wallace et al. (1977) reported that the Barbado-sired lambs had an acceptable rate of gain and feed efficiency under feedlot conditions when compared with halfbred Finnish Landrace lambs. The lambs were fed either 10, 20 or 40 percent roughage in a pelleted ration. Average pounds of feed per pound of gain were 5.4, 5.4 and 6.9 respectively. However, the Barbado-sired lambs grew at the greatest rate on the higher roughage ration (40 percent).

Table 5 Summary of lamb growth records of Blackbelly compared with other tropical breeds

Breed	Body weight (kg) at: Birth	Weaning 12 wks	6 mos	Daily gain (g): Pre-wng	Post-wng	Overall	Country and reference
Barbados Blackbelly	2.86	11.8		110			Barbados(Patterson, 1976; Pigden, 1974)
Barbados Blackbelly	2.55	9.24[a]					Barbados(Patterson, 1978)
Barbados Blackbelly	2.54	12.1	20.4	106	77	90	
West African	2.78	12.5	18.2	107	49	77	Venezuela(Bodisco et al., 1973)
Blackhead Persian	2.49	10.2	15.2				
Criollo	2.76	12.1	16.4	103	30	66	
Barbados Blackbelly	3.1	13.8		127			
West African	2.9	14.9		141			Trinidad(Rastogi et al., 1979)
Blackhead Persian	3.0	14.4		136			
Barbados Blackbelly	Castrated and				149		Venezuela(Chacon et al., 1970)
West African	intact males				154		(Gain from 8 to
Criollo	"	"			148		11 months of age)
BB x Criollo	Castrated males				153		
WA x Criollo	"	"			138		
Barbados Blackbelly		13.9					
West African		14.3					Venezuela(Rios, 1968)
Blackhead Persian		13.0					
Criollo		11.6					
Barbados Blackbelly	2.6			95			Guyana(Devendra, 1975)
BB x Creole	2.6			100			
Barbado	Ram lambs only					190	USA-California(Spurlock, 1974)

a/ Age at weaning not given (? 8 weeks)

BB = Barbados Blackbelly

WA = West African

BP = Blackhead Persian

Crossbreeding. Most of the reports are from U.S.A. and have been summarized in Tables 6-9.

Table 6 Results of accelerated lambing programme at Raleigh, North Carolina (1971 - 73)[a]

Trait	Ewe breed			
	Dorset	Dorset x Barbado	Dorset x Finnish	Rambouillet x Finnish
No. of potential lambings	19	32	30	20
Ewes lambing (%)	100	100	85	100
Lambs born/ewe bred	1.42	1.56	1.30	1.90
Lambs at 30 days/ewe bred	0.95	1.50	1.10	1.65
Mean lambing date	Dec. 12	Dec. 1	Jan. 18	Jan. 6
Gestation period (days)	143	146	144	144
Lamb birth wt (kg)[b]	2.9	3.7	3.0	3.1
Mortality up to 30 days (%)	33.3	4.0	15.4	13.2

[a]Figures in the table are averages over 2 lamb crops in 18 months.

[b]All lambs were sired by Suffolk rams.

Source: Goode, 1973.

Table 7 Results of accelerated lambing programme at Upper Mountain Research Station, Laurel Spring, North Carolina (1974 - 75)[a]

Trait	Ewe breed		
	Dorset x Barbado	Dorset x Finnish	Rambouillet x Finnish
Ewes bred	47	47	47
Ewes lambing (%)	96	94	7
Lambs born/ewe lambing	1.93	2.14	2.21
Lambs marketed/ewe lambing	1.69	1.68	1.89
Age at 45 kg mkt wt (days)	164	165	164
Lamb wt /day of age (g)[b]	272	272	272
Mortality up to mkt wt (%)	12.3	21.3	14.6
Total lambs marketed per ewe lambing	4.84	4.71	4.46

[a]Figures in the table are averages over 3 lamb crops in 18 months.
[b]All lambs sired by Suffolk rams.

Source: Goode and Tugman, 1975,1976.

Table 8 Results of accelerated lambing programme (continuous lambing) at San Angelo, Texas[a]

Trait	Ewe breed	
	Finnish x Rambouillet	Barbado x Rambouillet
No. of ewes	38	27
Ewe years	70	49
Lambings per ewe/year[b]	1.28	1.63
Lambs born per lambing[b]	1.70	1.68
Lambs surviving (%)	69.3	80.4
Lambs weaned per year	1.51	2.21
Kilograms lamb weaned per year[c]	28.6	43.1

[a]Preliminary results and should be interpreted with caution.
[b]Ewes lambed on the range, and it is likely that some lambs were lost before being recorded.
[c]Early weaning weights (60–90 days).

Source: Shelton, 1976.

Table 9 Results of accelerated lambing programme at Mississippi Agricultural and Forestry Experiment Station[a]

Trait	Ewe breed		
	Barbado	Barbado x Dorset	Dorset
No. of ewes	15	14	15
No. of exposures to the ram	45	42	43
Ewes lambing (%)	95.5	90.5	67.4
Lambs born/ewe lambing	1.49	1.24	1.14
Lambs weaned/ewe lambing	1.46	1.13	0.90
Av. lambs/year/ewe	2.13	1.68	1.10
Av. lambs weaned/year/ewe	2.10	1.54	0.87
Av. lamb birth wt (kg)[b]	3.31	4.04	3.84
Av. 60-day wt weaning (kg)	14.5	19.0	20.2

[a]Figures in the table are averages over 3 lamb crops in 2 years.
[b]All lambs sired by Suffolk rams.

Source: Boyd, 1976.

Finnish Landrace and Barbados Blackbelly breeds were introduced into the U.S.A. with a view to improving fertility and prolificacy of traditional mutton breeds by crossbreeding. The resulting crossbred ewes were to be used in the southern parts of the country or in mild temperate regions like North Carolina. Further, the possibility of using these crossbred ewes in accelerated lambing systems, as opposed to the traditional one lambing per year, was to be determined. In such programmes, Suffolk has always been used as the terminal sire breed.

The report of Boyd (1976) compared the reproductive performance of pure Barbado ewes with that of Barbado x Dorset and Dorset ewes. Barbado ewes were superior in all respects except lamb body weights at birth and at 60 days. Barbado ewes weaned 1.46 lambs per ewe per lamb crop or 2.13 lambs per year.

The following conclusions can be drawn from the work in North Carolina:

- Dorset x Barbado and Dorset ewes bred and lambed earlier than the Finnish Landrace crosses;

- Finnish Landrace cross ewes were more restricted in the length of their sexual season, thus Barbado cross ewes appeared to have more potential in an accelerated lambing programme;

- in birth weight and survival the lambs out of Dorset x Barbado ewes were superior to those out of Dorset and Finnish Landrace cross ewes (see Tables 3, 6 and 7);

- Dorset x Barbado ewes exhibited higher levels of tolerance to heat and parasites;

- in lambs born, alive at 30 days, or marketed, the Dorset x Barbado ewes were second only to Rambouillet x Finnish Landrace ewes;

- there was almost no difference in postweaning gain or in age at market weight (45 kg) among lambs of the three crossbred ewe groups.

The work at Laurel Springs also demonstrated that the crossbred ewes could be rebred while still nursing and that it was possible to obtain three lamb crops in 18 months.

In Texas, Barbado x Rambouillet ewes and their lambs were clearly superior to Finnish Landrace x Rambouillet ewes (Table 8).

A planned commercial crossbreeding experiment is presently underway in Barbados at the Government Farm, Greenland. Suffolk and Dorset rams were imported from the U.K. to be used on Blackbelly ewes for the production of crossbred market lambs (see Plate 5). More recently, another importation of Suffolk and Dorset rams and ewes from the U.S.A. has occured. A few crossbred lambs were born in 1977 and these were 12 - 14 months old in July, 1978, while another lamb crop was obtained in January, 1978. The Dorset crosses are white or sun-tan in colour with the characteristic Dorset face. The Suffolk crosses are grey-brown and always black-faced. None of the crosses showed the black belly pattern.

Experiments in Venezuela showed that crossing native Criollo ewes with Barbados Blackbelly, West African or Blackhead Persian rams increased lamb weights, significantly so at 6 months (see Table 10) (Reverón et al., 1978 a and b).

Table 10 Body weights of crossbreds between Barbados (BB), West African (WA), Blackhead Persian (BP) and Criollo (Cr) in Venezuela

Breed or cross	Body weight(kg) at: Birth	Weaning (12 weeks)	Six mos	Daily gain(g) birth to 6 months
BB x Criollo	2.67	13.6	18.1	
BB x (BB x Cr)	2.67	12.4	16.7	
WA x Criollo F_1	2.65	14.3	19.7	
WA x (WA x Cr)	2.81	11.8	16.9	
BP x Criollo F_1	2.78	13.1	17.0	
BP x (BP x Cr)	3.01	13.9	19.3	
BB + WA	2.53	14.2	21.0	103
BB x Cr + WA x Cr	2.45	14.0	19.8	96

Source: Reverón et al., 1978 a and b.

Carcass characteristics of crossbreds. The data are summarized in Tables 11 and 12.

Table 11 Carcass traits in lambs sired by Suffolk rams (in Mississippi)

Trait	Ewe breed		
	Barbado	Barbado x Dorset	Dorset
No. of observations	18	16	10
Live weight (kg)[a]	42.3	46.4	42.3
Carcass weight (kg)	22.5	24.0	21.6
Dressing %	53.1	51.7	50.9
Slaughter age (days)[a]	220	226	200
Weight per day of age (g)	191	196	220
Carcass wt per day of age (g)	102	106	110
USDA quality grade (15 = Prime +)	12.9	13.8	13.4
Leg score (15 = Prime +)	12.4	13.2	13.2
Rib-eye area (cm^2)	13.6	13.8	13.6
Back fat thickness (mm)	9.5	8.7	7.4
Hind saddle (%)	45.6	45.8	46.8
USDA yield grade[a]	3.92	3.55	2.96
Percent kidney and pelvic fat[b]	5.48	4.14	2.92

a Significant ($P<0.05$) breed differences.

b Significant ($P<0.01$) breed differences.

Source: Boyd, Rogers and Chapman, 1976.

Table 12 Influence of breed of sire on certain carcass characteristics of slaughter lambs born to grade Rambouillet ewes (Texas)

Trait	Sire breed			
	Suffolk	Finnish	Barbado	Navajo
Number of carcasses	18	16	17	11
Mean carcass wt (kg)	23.4	23.4	22.0	23.0
Dressing %[a]	56.8	56.9	55.7	57.4
USDA quality grade[b]	12.2	11.8	11.6	11.6
USDA yield grade	3.42	3.45	4.29	3.60
Estimated % boneless cuts	44.7	44.6	43.2	44.4
Estimated % total consumer cuts	82.9	83.3	82.2	83.0
Ribeye area (cm^2)	12.5	12.0	11.0	11.6
Ribeye area per 22.7 kg carcass	12.1	11.7	11.4	11.5
Tenderness shear (kg)	3.2	4.4	4.4	4.4
Backfat thickness (mm)	5.8	4.8	6.2	5.7
% kidney and pelvic fat	3.57	4.65	6.17	4.28
% trim from tail and dock	0.67	0.60	0.95	0.52
Fat colour score[c]	2.89	2.72	2.82	3.00
Fat firmness score[c]	3.89	3.27	3.94	4.09

a Based on slaughter live weight after a 100-mile haul and an 18-hour shrink.

b USDA quality grades assigned the following numerical values; High Prime-15. Av. Prime-14, Low Prime-13, High Choice-12, Av. Choice-11, Low Choice-10.

c The higher values (1-5 scale) represent a firm white fat cover, the lower values a soft oily carcass.

Source: Shelton and Carpenter, 1972.

The following conclusions can be drawn:

- lambs out of Barbado or Barbado-cross ewes or sired by Barbado rams grew more slowly and took longer to reach acceptable market grade which varied between average choice and low prime;

- percent kidney and pelvic fat and backfat thickness were distinctly higher in Barbado-cross carcasses though fat was whiter and firmer than that in the lamb carcasses sired by Suffolk and Finnish Landrace rams;

- leg score was slightly lower in lamb carcasses out of Barbado ewes;

- dressing percent was slightly superior in lambs out of Barbado ewes; it was still higher in lambs out of Rambouillet ewes though breed of sire effects were not important.

Chacon et al. (1970) slaughtered lambs of four breeds, viz. Blackbelly, West African, Criollo x Blackbelly and Criollo x West African, at an approximately equal live weight of 34 kg with dressing percentages of 44.0, 45.6, 44.8 and 47.2 respectively.

Spurlock (1974) commented on carcass traits of Barbado lambs as follows: "Carcass studies of male lambs sent to slaughter show that those lambs 5 to 7 months of age have much less body fat than do other comparable sheep. Fat over the rib-eye muscle (longissimus dorsi) at the 12th rib averages 1.5 to 2 mm as compared to similarly reared Suffolk or Dorset crosses which have 5 to 6 mm. Kidney and kidney fat as a percentage of carcass weight is 0.75 to 1 percent as compared to 2.5 to 3 percent or more for Suffolk and Dorset crosses. Marbling in the rib-eye muscle and feathering between ribs (intra-muscular fat) is less evident than in regular market lambs. Since USDA is strongly influenced by feathering, these carcasses tend to grade medium to high good rather than choice. Muscling is less well developed than in improved meat breeds of sheep but rib-eye areas per 50 pounds (23 kg) carcass weight of the longissimus dorsi at the 12th rib are above those of the average market lamb. These measure 2.0 to 2.4 square inches (12.9 - 15.5 cm^2) in surface area. Part of this advantage is due to small carcass weight, commonly 30 to 40 pounds (14-18 kg) and to lower percentage of fat in the carcass. Flavor of meat is excellent, being milder than in our usual market lambs. This is probably due to lesser fatness, since the characteristic flavor of lamb meat is primarly concentrated in the fat". The excellent flavour of the meat is confirmed by the experience of the senior author.

Summary and Conclusion. The Blackbelly sheep are very hardy and well adapted to the tropical climate of the Caribbean. They show year-round fertility; however, it is not known if there are peak cycling periods. They are much more prolific than most other tropical breeds of sheep although apparently not as prolific as has often been claimed. Venezuelan West African sheep possess the same qualities as do the Blackbelly and in fact, Venezuelan workers at Maracay expressed preference for the West African breed. In any experiment designed to evaluate the performance of Blackbelly sheep, cognisance must be taken of the fact that these sheep are traditionally accustomed to be managed in small flocks and that their performance may deteriorate under large scale farming.

It is obvious that there is a paucity of information on the performance of Blackbelly sheep and its crosses under West Indian environment; until very

recently the only objective data came from Venezuela and the U.S.A.

Recognizing the Blackbelly sheep as a unique regional resource and its special importance in raising the living standard of Barbados sheep farmers, Rastogi (1975) proposed the following action plan in order to satisfy increased demand in the export market and to improve mutton supply to the home market:

- Breed evaluation. Performance recording of sheep for most economically important traits of ewes and lambs with a view to establish Breed Standards , followed by selective registration by a Breed Society . This should help raise prices in the export market. The Breed Society should actively participate in organizing performance recording and in disposing of the export orders.

- Genetic improvement by selection. Mainly to supply the export market and local needs for replacement stock. The criteria for selection should be growth rate and body conformation with simultaneous monitoring of performance with respect to ewe fertility and prolificacy.

- Crossbreeding for market lamb production. Only part of the Blackbelly population be devoted to this effort. Market lambs can be either 3- or 2-breed crosses. The production of 3-breed cross market lambs requires stratification of the sheep industry into three kinds of breeder organizations:

  i. The breeder of purebred (exotic) meat breeds. This breeder primarily sells rams that will be used to sire market lambs;

  ii. The producer of purebred and crossbred Blackbelly sheep. F_1 ewes are sold to the commercial producers of market lambs while F_1 ram lambs are sold for slaughter;

  iii. The commercial producer crosses the F_1 Blackbelly ewes with a third breed of ram (bought from the breeders in step i.) to produce 3-breed cross lambs all destined for slaughter.

We believe that sheep farmers in Barbados are not yet ready to accept such a stratified system of sheep production. What is needed is to first demonstrate to the farmer the dollar profit that they stand to make by cross-breeding. This can be done by producing 2-breed cross lambs destined for slaughter and it should serve as a better solution for the immediate future. Meanwhile, the need to improve upon the present systems of management, feeding and health care to the benefit of the exotic breeds and crosses should be stressed to the farmers. As the benefits of crossbreeding and improved level of husbandry begin to gain acceptance with the farmers, the production of 3-breed cross lambs for market can be introduced gradually on a phased basis.

The Suffolk should be the breed of choice for the production of 2-breed cross lambs while for the production of 3-breed cross lambs, Dorset can be used to produce F_1 ewes to be mated to Suffolk as the terminal sire breed.

This plan was put forward four years ago. In view of the small numbers of the pure Blackbelly on the island, its remarkable adaptation to its environment, its proved prolificacy and the interest in the breed oversease, it is now considered that the major improvement effort should be devoted to the genetic

improvement of the pure bred. This should be designed to improve mutton conformation and feed efficiency without losing adaptation or prolificacy. It should be based on the performance recording of pedigree flocks and on the experimental and development flocks. In this connection it is very satisfactory to learn (Laurie, 1979) that three sheep breeding stations are going into operation in Barbados, namely those of the Ministry of Agriculture, the Agricultural Development Corporation and the Caribbean Council.

It is hoped that crossbreeding will occupy a minor place in the programmes of all three stations. While any crossbreeding suggested here is for commercial crossing, i.e. with slaughter of all F_1 or back-cross lambs, it is very tempting for a farmer to be misled by the hybrid vigour in the cross and to continue to use the crossbred females for breeding in the hope that their superiority will be maintained. Genetical theory and past experience with wooled sheep in Barbados indicates that this is a forlorn hope.

References

Bodisco, V., Duque, C.M. and Valles, A.S., 1973. Comportamiento productivo de ovinos tropicales en el período 1968-1972. Agronomía Tropical, 23 (6): 517-540.

Boyd, L.H., 1976. Frequency and lambing rate in sheep. Journal of Animal Science, 42 (1): 250 (Abstr.).

Boyd, L.H., 1978. Personnal communication.

Boyd, L.H., Chapman, H.D., Cain, M.F. and Taylor, C.L., 1978. Multiple lambing performance of Barbados, Dorset and crossbred ewes. Livestock Field Day, Mississippi Agricultural and Forestry Experiment Station, April, 1978, pp. 199-201.

Boyd, L.H., Rogers, R.W. and Chapman, H.D., 1976. Lamb carcass values from exotic, domestic and cross ewes. Journal of Animal Science, 42 (1): 250.

Chacón, E., Chicco, C.F., Shultz, T., Ríos, C., Colvés, P. and Bodisco, V., 1970. Engorde comparativo y valores hematicos de corderos de tres razas de ovinos tropicales y algunos de sus cruces. Agronomía Tropical, 20 (3): 163-172.

Devendra, C., 1972. Barbados Blackbelly sheep of the Caribbean. Tropical Agriculture, Trinidad, 49 : 23-29.

Devendra, C., 1975. Sheep and goat production in Guyana. Zeitschrift für Tierzüchtung und Züchtungsbiologie, 92 : 305-317.

Devendra, C., 1977. Sheep of the West Indies. World Review of Animal Production, 13 (1): 31-38.

FAO, 1978. Production Yearbook, Vol. 31, 1977. Rome.

Foote, W.C., 1977. Personal communication.

Gallagher, J.R. and Shelton, M., 1973. Fiber traits of primitive and improved sheep and goats. Texas Agricultural Experiment Station, PR-3190.

Goode, L., 1973. Reproductive performance of Blackbelly and Landrace crossbred ewes. Journal of Animal Science, 37 (1): 234 (Abstr.).

Goode, L., 1978. Personal communication to I.L. Mason.

Goode, L. and Tugman, D., 1975. Performance of crossbred Barbados Blackbelly and Finnish Landrace ewes. Mimeo. 5 pp.

Goode, L. and Tugman, D.F., 1976. Multiple lambing by Landrace and Blackbelly crossbred ewes. Journal of Animal Science, 43 (1): 217.

Hughes, Griffith, 1750. The Natural History of Barbados. London: printed for the author.

Johnson, D.H., 1944. Quintuple lambs of woolless domestic sheep. Journal of Heredity, 35 : 251-253.

Laurie, C.K., 1978. The economics of prolificacy. A case for keeping the Barbados Blackbelly sheep pure. Paper for Second Regional Livestock Meeting, 27-28 September 1978, Barbados.

Laurie, C.K., 1979. Personal communication.

Lauvergne, J-J. and Adalsteinsson, S., 1976. Gènes pour la couleur de la toison de la brebis corse. Annales de Génétique et de Sélection Animale, 8 (2): 153-172.

Ligon, Richard, 1657. A true and exact History of the Island of Barbados. London, printed for Humphrey Mosely at the Prince's Armes.

Mansfield, M.E., Todd, K.S. and Levine, N.D., 1977. Haemonchus contortus infections in Targhee cross and Blackbelly Barbados cross lambs. Illinois Agricultural Experiment Station, DSAC 5, pp. 275-277.

Mason, I.L., 1978. Prolific tropical sheep. Report on a visit during 4th January - 14th February 1978 to Barbados, St Croix, Dominican Republic, Haiti, Jamaica, Cuba, Mexico, U.S.A. Mimeo, FAO, Rome, Italy.

Maule, J.P., 1977. Barbados Blackbelly sheep. World Animal Review, 24 : 14-23.

Mazzarri, G., Fuenmayor, C.E. and Duque, C.M., 1973. Control del ciclo estral mediante el uso de esponjas vaginales impregnadas en acetato de Fluorogestona en ovejas. Agronomia Tropical, 23 (3): 315-321.

Mazzarri, G., Fuenmayor, C.E., Reverón, A.E. and Arriojas, M., 1976. Sincronización y fertilidad en ovejas tropicales en diferentes epocas del año e intervalos entre parto y servicio. Instituto Investigaciones Zootecnicas, Maracay, Venezuela, Mimeo, 7 pp.

McPherson, V.O., 1975. Achievement in sheep and goat programmes during 1975 and plans for 1976. Mimeo, 25 pp.

McPherson, V.O., 1976. A review of activities of the sheep and goat sector, Ministry of Agriculture, Ebini, Guyana, 1973-1976. Mimeo, 19 pp.

Nurse, G., 1978. Personal interview, Ministry of Agriculture, Guyana.

Patterson, H.C., 1976. The Barbados Black Belly Sheep. Ministry of Agriculture, Science and Technology, Bridgetown, Barbados. 19 pp.

Patterson, H.C., 1978. The importance of Black Belly sheep in Regional agriculture. Paper for second Regional Livestock Meeting, 27-28 September 1978, Barbados.

Patterson, H.C. and Nurse, J.O.J., 1974. A survey on sheep production in Barbados, 1972. 37 pp. Ministry of Agriculture, Science and Technology, Bridgetown, Barbados.

Pigden, W.J., 1974. Derinded sugarcane as an animal feed - a major breakthrough. World Animal Review, 11 : 1-5.

Rastogi, R.K., 1975. Some thoughts about Blackbelly sheep farming in Barbados. Paper presented at the 1st Regional Livestock Meeting held from 21-25 September 1975, University of the West Indies, Trinidad, Mimeo, 6 pp.

Rastogi, R.K., Youssef, F.G., Keens-Dumas, M.J. and Davis, D., 1979. Note on early growth rates of lambs of some tropical breeds. Tropical Agriculture, Trinidad (submitted for publication).

Reverón, A.E., 1978. Personal interview, Maracay, Venezuela.

Reverón, A.E., Bodisco, V., Arriojas, M. and Quintana, H., 1978 a. Productive behaviour in two filial generation of tropical sheep. Proceedings of the IVth World Conference on Animal Production, Buenos Aires, Argentina, August 1978. (Abstr.).

Reverón, A.E., Bodisco, V., Arriojas, M., Chicco, C.F. and Quintana, H., 1978 b. Growth of tropical lambs. Proceedings of the IVth World Conference on Animal Production, Buenos Aires, Argentina, August 1978. (Abstr. + tables).

Reverón, A.E. and Garcia , I., 1975. Comportamiento en el tropico de tres razas Africanas de ovejas y sus mestizas con la oveja Criolla. Biblioteca, CENIAP, Maracay, Venezuela. Mimeo, 24 pp.

Reverón, A.E., Mazzarri, G. and Fuenmayor, C., 1976. Ovejas tropicales productoras de carne. Ministerio de Agricultura y Cria, Bogotá. 18 pp.

Rios, C.E., 1968. Behaviour of Persian Blackhead, West African, Barbados Blackbelly and native Criollo sheep at the Centro de Investigaciones Agronomicas, Venezuela. Proceedings of the 2nd World Conference on Animal Production, Univ. of Maryland, 1968 : 504 (Abstr.).

Rommel, G.M., 1904. Barbados sheep. The Breeders Gazette, 46 (19) : 845.

Shelton, M. and Carpenter, Z.L., 1972. Feedlot performance and carcass characteristics of slaughter lambs sired by exotic breeds of rams. Texas Agricultural Experiment Station, PR 3024.

Shelton, M., Huston, J.E., Gallagher, J.R. and Calhoun, M.C., 1973. Efficiency of fiber production of various types of sheep and goats. Texas Agricultural Experiment Station, PR 3189.

Shelton, M., 1976. Sheep breeds for south and southwest. Texas Agricultural Experiment Station.

Spurlock, G.M., 1974. Application to National Institute of Health. Animal Science Extension, University of California, Davis, California. Mimeo, 5 pp.

Spurlock, G.M., 1976. Personal communication.

Spurlock, G.M., 1978. Personal communication to I.L. Mason.

Thompson, L., n.d. Increasing production with Barbado crossbreds. National Wool Grower, p. 16.

Trinidad and Tobago, 1953. Administration Report of the Director of Agriculture for the year 1952. Trinidad Government Printing Office, ix + 65 pp.

Turner, H.N., 1976. Personal interview.

Ungria, C.D., n.d. Problemas de investigación en ovejas. Biblioteca, Facultad de Ciencias Veterinarias, Universidad del Zulia, Venezuela. Mimeo, 4 pages.

Wallace, M.H., Lewis, J.M., Hinds, F.C. and Mansfield, M.E., 1977. Barbados Blackbelly potential. Illinois Agricultural Experiment Station DSAC 5, pp. 136-139.

Williams, H.E., 1975. Animal health limitations within the region. Paper presented at the Seminar on the Utilization of Local Ingredients in Animal Feeding Stuffs, Jamaica.

Yazwinski, T.A., Goode, L. and Moncol, D.J., 1976. Breed resistance to ovine gastrointestinal parasites. Journal of Animal Science, 43 : 225 (Abstr.).

2.2 WHITE VIRGIN ISLAND SHEEP

The decision to visit the Virgin Islands was based on the following extract "the dominant type seen over the Islands is still a white faced, white bodied sheep with a very light, fine, short fleece. A few sheep of this type have been seen on other islands and it has been assumed that they were the descendants of imported European breeds of sheep. These are similar to the white sheep seen on the British Virgin Islands which are also found in some numbers on St. Croix and in smaller numbers on St. Thomas..." **(Faulkner, 1962).**

U.S. Virgin Islands

The only published reference to sheep in the U.S. Virgin Islands reads as follows: "In the Virgin Islands, as almost throughout the West Indies, the principal breed is the West African wool-less sheep. This breed is so well adapted to our conditions, that it overcomes every attempt at cross-breeding, and after a few generations is back in essentially pure form, no matter what it has been crossed with.

"Our 'native' sheep have two great advantages: 1) they almost always have 2, 3 or even 4 lambs at a time; and 2) they will breed at almost any time of the year and if well enough fed, will often bear 2 'litters' a year.

"They also have a disadvantage: they are so slender that they don't produce much meat. First crosses with European breeds are meatier, but breed only once a year, and produce only single lambs (or very rarely twins). Their heavy wool keeps them too hot, and they grow slowly, and do not thrive.....

"A few years ago, one of four native ewes produced two litters of 4 lambs within a 12 month period. Obviously 8 thin lambs will carry more meat than 1 fat and chunky one, and probably even twin native lambs will outweigh the meatiest single that can be produced here. The Barbados Blackbelly, **which** is just a colour variation of our 'native' breed, has been known to produce and raise 5 lambs at one birth!" (Bond, 1975).

The author's observations would support the conclusion of Bond that the White Virgin Island sheep is a hair sheep of West African origin related to other such populations in the Caribbean. It is sometimes called "Creole" which is confusing since most Creole (Criollo) populations elsewhere are wooled sheep.

According to the FAO Production Yearbook 1977 there should be 7,000 sheep in the British Virgin Islands and 4,000 in the US Virgin Islands. In St Croix there used to be about 3,000 sheep. Now they are reduced to 1,500 - 1,000 due to the depredations of dogs and drought. There are about four large flocks and the rest are on small holdings. The author visited five flocks whose sizes (breeding ewes) were 500, 100, 70, 14 and 10 respectively.

The typical local sheep is a white hair sheep polled in both sexes (see Plates 6 and 7). Pale tan - self colour or in patches - is a common variant. Occasional

sheep are brown or brown with black belly or tricolor - brown and white with black belly. Some sheep have a little wool on the back. Any considerable amount (and also black face) is attributed to crossing with Suffolk in the recent past. The males have a throat ruff and a slightly convex facial profile. The tail hangs to the hocks. The ears are short and horizontal. The eyelids are black. The general impression is of a sheep with a better mutton conformation (less rangy) than the Barbados Blackbelly. Six ewes on one of the small farms averaged 63½ cm (range 59½-67) in height at wither which is actually lower than the Barbados sheep. On another farm a 16-month male weighed 150 lb.

Sheep are mostly grazed on rough pastures; the better managed flocks have access to improved pastures of Guinea or Pangola grass and may be given a grain supplement. They are brought back to pens at night to protect them from stray dogs and from theft.

The chief ailment is due to helminth worms. Drenching is a necessity - every 3 months is desirable; twice a year (after lambing) is the minimum. Footrot does not appear to be a problem. Boophilus ticks carrying Babesia were brought in from Texas in 1937 so exports have to be quarantined. Tetanus is also present.

Some breeders confirmed the observations of Bond (quoted above) that purebred temperate breeds do not survive and crossbreds have a high mortality. The chief cause of death is worms, especially in the lambs.

Ewes lamb first at 14 months of age and can lamb every 6 months thereafter. In the five flocks visited litter size (based on reports or actual number of lambs) averaged 1.4, 1.5, 1.0, 2.0 and 1.3 respectively. These figures were said to be lower than normal owing to drought in 1977.

Sheep production in St Croix is in decline. In the past St Croix had the reputation for a white, prolific breed of hair sheep. Now the sheep are said to be smaller in size, less fertile, more variable in colour and mixed with wool breeds. There is no organization for sheep breeding and marketing. There is no official campaign against the menace of predatory dogs. The small producer cannot guarantee a uniform supply so they sell to private consumers (especially Moslems) while the supermarkets are supplied by large scale imports of mutton from U.S.A. and New Zealand. Easter and Christmas are the commonest times for slaughter at ages of 6 and 9 months.

This lack of support for the pure breed is unfortunate since the White Virgin Island is the only hair breed for which the same high prolificacy as the Barbados Blackbelly is claimed. A programme of conservation, purebreeding and selection is urgently needed.

Virgin Island sheep have been exported from St Croix for a cooperative research programme at Utah State University, Logan; Florida State University, Gainesville; and the Ohio Agricultural Research and Development Centre, Wooster. The small flock at Wooster has exhibited a younger age at puberty than contemporary Barbados Blackbelly, a higher litter size at birth and a lower lamb mortality. The St Croix sheep are also heavier and have a higher growth rate (Parker, 1978).

The original 24 animals were obtained in 1975 and now the total flock at 4 locations (including Pomona, California) numbers about 20 adult and 20 young males 60 adult and 30 young females. All are white and polled. Adult males average 60-75 kg and females 40-55 kg. 18% of births are singles, 50% twins, 21% triplets and 5% quadruplets giving a prolificacy of 213% (Foote, 1979).

British Virgin Islands

David Smith (1979) writes as follows:

"It is doubtful whether there are more than 7,000 sheep in the B.V.I., at present, although it is extremely difficult to get accurate figures. On Tortola, itself, the average flock size is around 25. There are only, in fact, two farmers with flocks of over 100. Sheep are grazed mainly on the hills on guinea grass, pangola or local bush. No supplementary feed is fed except on very rare occasions. All animals are penned at night and killer dogs are our greatest problem. Worms were a major problem but, for the past year, I have been dosing all the sheep with Panacure. The results have been dramatic and lamb mortality has nearly disappeared. I am still waiting to hear from a laboratory in America as to the exact types and species of worms. I have seen no Boophilus ticks on the sheep, or goats for that matter while in the B.V.I."

"I still believe that the white sheep must have some Wiltshire Horn in them. Horns are not uncommon in the rams on the island, at present, although they only develop to two or three inches."

".....the white sheep in the B.V.I. are expanding and I would expect that the whole of the national flock will be entirely white after five years although we still show signs of the Black Head and the Barbados Black Belly. The whites appear to breed true. In our own flock we have had only two off-whites in a three year period and this may have been caused by a ram-lamb. It is the Government's policy to encourage the production of sheep as there was a big decline when the tourist-oriented policy started in the late 1960s. The worming of the sheep is a free service and a guaranteed market for all stock produced is assured once the abattoir comes into operation, sometime towards the end of this year."

"There are definitely two litters a year or at least five in three years. Our male breeding rams weigh between 180-190 pounds (80-85 kg). Our better ewes are now weighing 120 pounds (55 kg)."

Sale weights of 17 rams averaged 30 kg at 224 days of age. Weaning used to be at 4 months but is now 3 months; 10 ewes averaged 23 kg at an average weaning age of 118 days; a later group of 10 rams averaged 25 kg at an average weaning age of 109 days.

"The Department of Agriculture, here on Tortola, has for the last three years been trying to improve the Virgin Island White Sheep by selection....."

"We have just imported two pedigree Wiltshire Horns from England and we are hoping to produce a lamb with better carcass conformation. We will decide from observation what form our management will follow. At present, we have our flocks divided into two, keeping one flock pure indigenous and the other with the Wiltshire Horn. The resultant crossbred ewes will be divided into two with one lot put onto the other Wiltshire ram and the other lot returned back to the indigenous. From this, we hope to discover whether the twinning and two litters a year factor are lost in the F_2 cross."

In a later letter it is reported that 87 lambs were born in 46 births giving an average litter size of 1.89 lambs per birth.

Katahdin breed

In 1957 Mr. Michael Piel of Abbot Village, Maine, imported one ram and two ewes (all triplets) from St Croix with the purpose of forming a new woolless meat breed. He crossed them with various British breeds but eventually discarded all crosses except those from the Suffolk. Later Wiltshire Horn blood was introduced. Intense selection for growth rate, mutton conformation and prolificacy and against wool and horns produced the Katahdin breed, named after the highest mountain in Maine (see Plates 8 and 9).

The Katahdin breed has a hairy coat with an undercoat of fine wool which is shed in spring. White is the commonest colour but "tan, brown, speckled, sprockle face, pie-bald, skewbald, roan and blackbelly occur". Ninety percent of the animals are polled. The tail is 20-25 cm long. Mature weight of rams is 68-90 kg and of ewes 55-73 kg.

Ewes can be bred from the age of 6 months. They can breed round the year but in Maine they are bred to lamb during January to April. A fertility of 85 percent includes ewe lambs. Prolificacy is up to 200 percent for well fed adult ewes in good seasons. The average has been 168 percent for all ages and years. This is made up of 45 percent single births, 42.5 percent twin births, and 12.5 percent of triplet births (including one quadruplet set). Dystocia is very rare and newborn lambs thrive without assistance even in winter. Milk yield is sufficient for ewes to feed twins or triplets.

In 1976 the 76 ewes over one year old had 147 lambs surviving to be weaned at 90 days of age in early July. They averaged 19.5 kg in weight with a range from 26.7 kg for single ram lambs to 17 kg for triplet ewe lambs; twin ewe lambs averaged 18.9 kg.

Katahdins are good flocking sheep and they graze in a compact mass. They are not troubled by either high or low temperatures. They are resistant to internal parasites and external ones are non-existent (Schmiedlehner, 1979).

References

Bond, R.M., 1975. Small livestock for meat production in the Virgin Islands. In "Virgin Islands Agriculture and Food Fair. Feb. 15, 16, 17, 1975" (2pp).

Devendra, C., 1977. Sheep of the West Indies. World Review of Animal Production, 13: 31-38.

Faulkner, D.E., 1962. Report on livestock development in the British Virgin Islands. Interim Commission of the West Indies, Port of Spain, Trinidad.

Foote, W.C., 1979. Personal communication to J. Rohl.

Parker, C.F., 1978. Personal communication.

Schmiedlehner, H., 1979. Personal communication.

Smith, David, 1979. Personal communication.

2.3 BAHAMA NATIVE by A.S. Demirüren

According to the FAO Production Yearbook the sheep population of the Bahamas has gradually risen to 31,000 in 1977. However there are reasons to believe that in fact it may have been falling.

The hair sheep of the Bahamas is a thin-tailed medium-sized mutton breed with a well proportioned skeletal structure. The ewes are polled and the rams have horns. The body cover is a mixture of hair and kemp and the fibre colour is usually white with some brown and black spots. The thin tail is about 25 centimetres long and extends down to the hocks. The legs are white with brown and black spots over the hoofs. The size of the head of the ewes when measured from the top of the crown to the tip of the nose is 23 cm and in rams 30 cm. The face is white with black or brown spots. Ears are of medium size and about 11 cm long. Rams have Roman nose and powerful horns. The average body weight of the mature ewes is 37 kg and mature rams weigh about 65 kg. It was possible to take some skeletal measurements as follows:

Ewes	70 cm	-	68 cm	-	34 cm	-	22 cm
Rams	83 cm	-	75 cm	-	41 cm	-	31 cm

These figures represent (1) trunk length from front of the scapula to pin bone, (2) from the highest point of the wither vertically to the ground, (3) vertical distance from wither to the ventral surface of the sternum immediately behind the front legs, (4) chest width at scapula. Visual evidence of imported breed influence (e.g. Barbados Blackbelly, Wiltshire Horn , Cadzow Improver) is strong in some individuals.

During the visit to the sheep farms on Long Island, farmers said that ewes can breed and lamb twice a year. The experiments conducted at the BARTAD Station in North Andros Island and observations made on 298 lambings and 278 weanings indicate that ewes will give birth to 1.4 lambs per lambing and wean 1.2. The average birth weight of the lambs was 3.3 kg and they reached 25 kg in 90 days. Interval between lambings averaged 227 days (1.6 lamb crops per year) when the rams are continuously with the ewes. Using these figures it was estimated that the average ewe at the BARTAD Station bore 2.25 and weaned 1.9 lambs per year.

The conclusions from the results are as follows:

1. Performance of Native ewes and rams is equal to or better than introduced Barbados Blackbelly, Florida Native and Suffolk sheep. Therefore, future breeding programmes should stress the use of Native stock, particularly by identifying and selecting the higher producing ewes and concentrating the most desirable seedstock in elite herds.

2. Selection programmes should aim at improvement of ewe prolificacy and lamb rate of growth from birth to weaning, without sacrificing the ewe lambing interval. This can be accomplished by using fast-growing twin-born ram lambs from ewes with lambing intervals of 250 days or less. Ewe phenotypic characteristics should not receive a great deal of emphasis.

A sheep husbandry station is now being set up on Long Island by the Government of the Bahamas, one function of which will be to establish a flock of hair sheep from the best genetic material available and improve the breed through selection based on economic traits.

Reference

Katsigianis, T.S., Wilson, L.L., Cathopoulis, T.E., Dorsett, A.A. and Fisher, D. 1977. The productivity of indigenous and exotic strains of sheep on North Andros Island, Bahamas. Bahamas Agricultural Research, Training and Development Project, Final Report No. 32.

2.4 PELIBÜEY SHEEP OF CUBA

These sheep apparently came from Africa first to Cuba but precisely when and from where is not known. However there is a tradition that the slaves from Cuba came chiefly from Angola. Although differing in colour, being chiefly tan, white or tan-and-white the sheep are clearly similar to the Barbados Blackbelly (see Plate 10).

According to the FAO Production Yearbook 1977 there are 346,000 sheep in Cuba. This is more than all the other Caribbean islands together. About 75 percent of these are of the hair breed called originally "Carnero de Pelo de Buey" (i.e. ox-haired sheep) and now shortened to "Pelibüey". These sheep are also called "Criollo" but they differ from the Criollo of the mainland of Latin America which are wooled sheep descended from the Churrro of Spain. About 75 percent of the hair sheep are on private farms, not state farms.

Pelibüey sheep are of all colours including tan (or red), white, tan-and-white, black belly and black. The first three colours are the most frequent. The black may in fact be a very dark mahogany red. The Pelibüey sheep on State farms are either red or white. The red animals are preferred since they are believed to be stronger. Also the red colour is dominant to the white of the Pelibüey (but not to the white of European breeds).

In one State farm lamb mortality has recently been reduced from 20 percent to 13.4 percent by keeping the lambs in a "day-care centre" while the ewes are at pasture. The lambs are thus spared the long walk to pasture and back. They suckle early in the morning and when the ewes return at 13.00 hours. During the morning they have access to bagasse and molasses.

In Cuba, the policy on the State farms is to form a new breed by crossing the Pelibüey with improved mutton-wool breeds. The Suffolk, Cheviot, Corriedale and Dorset have been used in experimental crossing. The Suffolk is favoured and trials are in progress to determine the optimum proportion of Suffolk blood. Suffolk x Pelibüey F_1 ewes are being put to a Suffolk ram so that the halfbred can be compared with the threequarterbred.

This policy may be satisfactory for State Farms but there seems little doubt that under ordinary levels of feeding and management it is the pure hair breed which will perform best. In view of the large number of these sheep, a selection programme should be initiated.

Reference

Mason, I.L. 1978. Report on a visit during 4 January-14 February 1978, to Barbados, St Croix, Dominican Republic, Haiti, Jamaica, Cuba, Mexico, U.S.A. FAO/UNEP Project "Conservation of Animal Genetic Resources - Prolific Tropical Sheep". FAO, Rome, (Mimeo).

2.5 TABASCO SHEEP OF MEXICO

Origin and history. Pelibüey sheep were introduced from Cuba to the Yucatán peninsula of Mexico probably in the 1930s but possibly earlier. Because of their ability to live in the hot, humid tropical environment they gradually moved westward into Tabasco and Vera Cruz, but even in the census of 1960 the number of sheep in Campeche and Tabasco was given as zero with only 149 in Quintano Roo (Berruecos et al., 1975). Their name became corrupted to Peligüey. Now they have been renamed Tabasco (see Plate 11). The first appearance of this name is in Ruz (1963). Official policy is to expand numbers as rapidly as possible and to this end export of females is forbidden. It is estimated that they now number about 100,000. (The rest of the 4.5 million sheep in Mexico are wooled - either Criollo or its crosses with Rambouillet. There are also a few pure and crossbred Suffolk, Hampshire, Dorset, and Corriedale). Most of the flocks are small but there are large experimental flocks on several experiment stations of the Instituto Nacional de Investigaciones Pecuarios (INIP). As a result, most of the hard facts about the Pelibüey are derived from the Tabasco sheep of Mexico.

In many ways the Tabasco is similar to the Barbados Blackbelly and a study of blood polymorphisms by Guzman et al. (1975, 1976) showed that while there are significant differences in two or three cases the two breeds could derive from the same ancestral stock. The Barbados Blackbelly appear higher on the leg than the Pelibüey of the same colour at Mocochá Experiment Station, Mexico, but are probably no different in weight (Mason, 1978).

Colour. It is the white and tan varieties which were imported to Mexico. Tan and white are the commonest colours but tan-and-white, tan and black and white ("payaso" = harlequin), tan with black belly, and tan with black face stripes, can be seen (Mason, 1978). The various shades of tan are called "café", "café tabasco" and "rojo" by Berruecos et al. (1975). Black is rare. The same authors describe the black belly pattern as "golondrino". They also mention black body with pale belly (i.e. reversed badger face).

Tan ("café") animals have a higher percentage of wool fibres and are more variable in this respect than the white animals which have a higher average fibre diameter. Tan is dominant to the other colours and patterns of the Tabasco (there is more doubt about pied) but the white of the Merino is dominant to Tabasco tan (Berruecos et al., 1975).

Description. Berruecos et al. (1975) give the following description which they modified from Ruz (1966): "Mesocephalic, broad rounded forehead without horns, with two depressions behind the orbits, orbits protuberant, face of medium length and breadth with large sebaceous glands below the internal angle of the eye, profile straight, semiconvex or convex. Hair on the face short and fine, skin fine and close-fitting. Ears short and lanceolate, covered with fine, short and smooth hair, carried horizontally. Eyes large, not prominent, coffee to green in colour. Mouth small and lips strong, the upper one cleft in the centre. Ocular, nasal and buccal mucosae can be pink or pigmented.

"The neck is short, strong and rounded. The male usually has long hair extending from the occiput to the withers and ventrally from the pharyngeal region to the beginning of the chest. This hair is not present in the female in which the neck is finer, longer and thinner. Sometimes wattles are present in the pharyngeal region.

"The trunk is cylindrical with prominent withers, dorsal line straight or saddled, rump straight or slightly sloping, tail thin with a low insertion and about 30 cm long, generally with a white tip. Ribs well sprung and with a good thoracic capacity, abdomen spacious and hips strong and rounded. The skin is fairly closely adherent; it is covered with hair and a short undercoat of wool which is sometimes visible.

The legs are of medium size, straight, slender and fine, covered with close fitting skin and short hair. The typical ovine interdigital sebaceous gland is voluminous. Hooves are light or pigmented."

From his observations Mason (1978) reported that the development of the shoulder hair in the male is very variable. Some animals have the mane without the throat ruff. At the Mocochá station in Yucatán about 1 - 2 percent of animals carry wattles and 3 - 4 percent of rams develop small horns; these latter are culled.

Adult males weigh 44 - 50 kg (Ruz, 1963, 1966) and females 35 - 40 kg (Ruz, 1963, 1966; Castillo et al., 1972; Berruecos et al., 1975). Height at withers is 64 - 66 cm for males and 59 - 66 cm for females (Ruz, 1963, 1966; Castillo et al., 1972). However, Berruecos et al. (1975) give the higher figures of 78 and 67 cm for 6 males and 138 females at Tizimín experiment station, Yucatán. Ruz (1966) gives complete body measurements for 6 males and 20 females (see Table 13) and Talavera et al. (1974a) measured 450 animals of mixed sex and age.

Management. Tabasco sheep first became popular among small farmers who until their introduction had owned no livestock. They are kept with minimum attention to supply the family needs of meat. They are also important for grazing under fruit trees (e.g. mangos and citrus) in Cuba and in Vera Cruz, Mexico. In Yucatán they are being tried out to graze in the henequen (sisal) plantations.

On large farms and experiment stations in Mexico they are grazed on improved pastures. Experiments have shown that they can be kept at a stocking rate of 12 - 22 head per hectare on pastures of Cynodon plectostachyus, Cynodon dactylon, Panicum maximum, Pennisetum clandestinum, Brachiaria ruziziensis and Digitaria decumbens among others (Torres, 1974; Arroyo, 1974; Trevino, 1974; Torres et al., 1975). Daily gains varied from 44 to 79 g according to pasture and stocking rate.

Table 13 Body measurements of Tabasco sheep (cm)

	Males	Females
Number	6	20
Withers height	65	66
Length of forelegs to elbow	40	36
Length of back (withers to pins)	64	56
Chest width	30	21
Chest girth	95	87
Cannon-bone girth	9.5	7.5
Cranial length (occiput to nose)	33	31
Face length (eye to nose)	18	16
Face width (between eyes)	13	10
Craniomaxillary perimeter (in front of ears)	51	42
Ear length	9	9
Ear width	6	5
Tail length	33	26

Source: Ruz (1966)

On the INIP experimental stations the sheep are grazed for 3 - 4 hours early in the morning and again in the late afternoon. They spend the midday hours and the night in corrals where they have access to water, mineral licks, and supplementary feed prior to mating and to lambing (Valencia et al., 1975; Peña, 1976). In the dry season in Yucatán they are fed roughage such as maize silage and henequen pulp.

Lambs are weaned at 4 months on government farms. A trial on small numbers of partly housed animals showed that lambs weaned at 75, 90, 105 or 200 days did not differ in weight at one year but the ewes conceived a month earlier following the early weaning (Castillo, Román and Berruecos, 1974). However subsequent experience on pasture showed that weaning at 75 days gave the lambs a big set-back with high susceptibility to parasites and diseases, often leading to death (Valencia et al., 1975). The age at weaning has therefore been raised to 4 months and may be raised further (Mason, 1978).

Diseases. The chief trouble arises from gastro-intestinal parasites and in times of stress, e.g. ewes in lactation or lambs after weaning, mortality from this cause may be as high as 60 percent (Valencia et al., 1975). In the INIP stations in Mexico sheep are regularly dewormed e.g. at the beginning of the rainy season and two or three times later at intervals of 17 days. The commonest genus of nematode is Haemonchus, followed by Oesophagostomum, Chabertia, Cooperia, Trichostrongylus, Ostertagia, Nematodirus, Strongyloides and Bunostomum (Barrios et al., 1973). Methods of treatment have been studied by Herrera et al. (1973 a and b); Barrios et al. (1974); Ortega et al. (1974). Monieziasis may give trouble in the first few months of life (Quiroz et al., 1972).

The second most important disease is foot rot and regular treatment with copper sulphate in a footbath is essential (Valencia et al., 1975). The incidence of haemorrhagic septicaemia and of blackleg is low. There are no ticks or lice. Scab is cured by a single dipping (Mason, 1978).

In experimental tests 2.5 percent of animals exhibited antibodies against Brucella ovis (Suares et al., 1974) and 21 percent reacted to the Cooms anti-globulin test for B. melitensis (Martinez et al., 1974).

Reproduction. The Tabasco breed shows oestrus at all times of the year (Valencia et al., 1975) but the proportion of ewes on heat is low (60 - 70 percent) during February-May (Pena, 1976). The conception rate is high - normally over 90 percent. Litter size is 1.2 - 1.4 depending on the nutrional level. These and other indices of female reproduction are listed in Table 14. The first four columns represent single experiments (or observations); the next two are results quoted in review articles, which therefore may be repetitive, and the last is a personal communication.

Salinas et al. (1975) and Peña (1976) reported the results of feeding concentrate supplements to ewes during lactation or pregnancy or both. Supplementation raised the twinning rate from 3 percent to 24 - 27 percent and reduced the interval between parturition and oestrus from 43 to 33 - 34 days (or from 92 to 69 - 84 days in a second experiment). However, conception to first service was reduced from 94 to 67 percent so that interval from parturition to conception was not significantly changed (from 44 days for the untreated to 39 - 42 days in the supplemented groups).

Table 14 Aspects of female reproduction of Tabasco sheep on INIP stations in Mexico

Station	Hueytamalco	Paso del Toro	Tizimín	Paso del Toro		Tizimín	Mocochá
No. of ewes	39	49	288	29–62			300
Year	1970 and 1971	1971	1972 and 1973	1970–73			1978
Feed	Pasture	Pasture & sorghum	Pasture	Pasture + feed			Pasture
Age 1st oestrus (days)				300 ± 61		300	328
Weight 1st oestrus (kg)				22.8±2.7			21.8
Oestrus length (hrs)			36.3	28.4±7.7	24–48	24–48	
Cycle length (days)			17.4		17.5±1.5	16–20	
Age 1st lamb (days)				481			
Parturition to oestrus (days)	57±49	54±35			25–60	21–90	
Conception rate (%)	70	97	89.4	93.5	90+	89.4	90
Gestation length (days)	149±4	150±2	149		150±3	149±3	
Lambing interval (days)	271±78	229±38				248±61	240
Litter size	1.19±0.4	1.29[a]±0.4	1.18		1.19–1.40	1.18–1.40	1.20
Source	Castillo et al., 1972 Valencia et al., 1975		Valencia et al., 1974c	Castillo et al., 1974a, 1977	Valencia et al., 1975	Peña, 1976	Mason[b], 1978

a. Recalculated

b. Personal communication from Valencia

Characteristics of semen of twelve Tabasco rams collected by electro-ejaculation are shown in Table 15.

Table 15 Semen characters of 12 Tabasco rams (mean ± standard deviation)

Age (days)	231	231	422
Weight (kg)	29.4	29.4	44
Ejaculate	First	Second	First
Volume (ml)	0.6 ± 0.5	0.3 ± 0.3	0.8 ± 0.9
Motility (%)	70 ± 0.3	66 ± 0.5	71 ± 7.5
Density (per ml)	$(2.55\pm.01)\times10^9$	$(1.29\pm.03)\times10^9$	$(2.85\pm.23)\times10^9$
Abnormal sperm (%)	6.9 ± 9.4	3.6 ± 1.3	4.6 ± 3.8

Source: Castillo et al., 1976.

Better samples were obtained with the artificial vagina than by electro-ejaculation (see Table 16).

Table 16 Semen characters of 16 Tabasco rams (16 ejaculates from each ram)

Method of collection	Artificial vagina	Electro-ejaculation
Volume (ml)	0.88 ± 0.3	0.68 ± 0.3
Density (per ml)	$(6.75\pm2.87)\times10^9$	$(2.93\pm2.78)\times10^9$
Motility (%)	83 ± 10	74 ± 20
Abnormal sperm (%)	7.3 ± 3.6	6.2 ± 4.3
Live sperm (%)	88 ± 6	84 ± 20
Motile sperm (per ml)	$(5.08\pm3.20)\times10^9$	$(1.80\pm2.33)\times10^9$

Source: Hernandez et al., 1976.

Mortality. At Mocochá, before treatment for worms was started, mortality up to 6 months was as high as 25 - 30 percent. Now young animals ($2\frac{1}{2}$ - 6 months of age) are drenched every two weeks and mortality has been reduced to 4 percent. The small farmer does not suffer in this way because his animals graze over a wide area (Mason, 1978).

At Paso del Toro, lamb mortality up to 6 months during 1970–73 was 9.4 percent for single and twin lambs and 35.7 percent for triplets and quadruplets. In 1972 weight of ewes and conception rate were very low while lamb mortality rose to 16.4 percent. This was attributed to parasitosis (Castillo et al., 1974b).

Body weight and growth rate. Table 17 shows some birth and weaning weights taken on various experimental stations in Mexico.

Table 17 Birth and weaning weights of Tabasco sheep (no. of animals in brackets)

Station	Birth wt (kg)		Weaning wt (kg) (3 months)		Daily gain to weaning (g)	Reference
	Singles	Twins	Singles	Twins		
Hueytamalco, 1970–71	2.6±0.5(69)	2.1±0.5(32)				Castillo et al., 1972
Paso del Toro, 1971	2.8±0.6(48)	2.2±0.5(24)				
Tizimín	2.78±0.51(130)		11.03±2.5(130)		120±30(130)	Valencia et al., 1972
Hueytamalco	2.44±0.6(144)		11.18±2.79(144)		97±26(144)	Talavera et al., 1974b
Paso del Toro, 1970–73	2.7	2.2	15	12.7		Castillo et al., 1974b
Tizimín	2.79±0.48	2.21±0.45(55)	16.1±2.6(106)	11.4±2.6(55)		Valencia et al., 1974b
CAMPA, Tampico	2.5(121)					Gonzalez et al., 197?

Males weighed about 0.2 kg more than females at birth and about 2 kg more at weaning. Figures for weights after weaning are given by Valencia et al. (1974b) as follows:

Weight at 120 days:	singles:	18.1±2.9 kg (92);	twins 12.9±2.8 (46)
Weight at 1 year:	singles:	29.2±6.8 kg (92);	twins 23.7±6.1 (45)

Gonzalez et al. (197?) gives an 8-month weight of 30.2 kg for male singles, 29.5 for male twins, 25.7 for female singles and 22.8 for female twins.

Valencia et al. (1974a) slaughtered 40 males at 11 months of age with an average liveweight of 29.9 kg and carcass weight of 14.3 kg giving a dressingout percentage of 47.9.

Improvement and research. The policy of INIP is to obtain as much information about the breed as possible before any crossbreeding is attempted. To that end several of the experiment stations ("Centro Experimental Pecuario") have established flocks of Tabasco sheep. The principal flocks are at Tizimín, and Mocochá, Yucatán; "La Posta", Paso del Toro, Vera Cruz and "Las Margaritas", Hueytamalco, Teziutlan, Puebla. Several small stations on the tropical Pacific coast are also starting up with sheep. The results of research and observation made at the main stations have been quoted above. The research programme at Tizimín is described by Peña (1976).

At Mocochá there are three main research programmes - reproduction, genetics and nutrition. In the reproduction programme an attempt is being made to reduce the lambing interval from the present figure of 8 months i.e. to raise the number of lambings per year from 1.5 to 1.7 in one line and to 2.0 in a second. Induced parturition and synchronized oestrus may be necessary to achieve the 6-month interval. In the genetics programme, three lines are in operation. One is selected for prolificacy - rams must be born as twins and ewes must produce twins on two occasions. The second is selected for growth rate up to one year. The third is a control line in which there is no selection. In the nutrition programme the feeding of henequen pulp together with protein supplements (coconut, cotton seed, fish meal, safflower) has been studied. Other research is on legumes, effect of time of supplementation (before or after lambing) and of "flushing" (supplementation before mating) (Mason, 1978).

At Hueytamalco a special line of research has studied the blood picture and blood chemistry of the Tabasco sheep (Larios et al., 1976; Cantó et al., 1976).

Small experimental flocks are also maintained by the University of Mexico at its Centro Nacional de Ensenanza, Investigación y Extensión de la Zootecnia, Cuatro Milpas, Tepotzotlan, and by the Centro de Adestramiento y Mejoramiento de la Producción Animal (CAMPA) at "El Apuro", Aldama, near Tampico, Tamaulipas.

Crossbreeding. At an early stage in the study of Tabasco sheep a male was used on Merino ewes (Ruz, 1966). The crosses had low quality wool on the body while the head and legs were bare of wool; they were poorly adapted to the tropical environment.

At Cuatro Milpas grade Dorsets have been crossed with Tabasco rams. The F_1 is called "Tarset". It is a white wooled animal with bare belly and is superior to both parents in growth rate and fertility. Its twinning rate (on small numbers) is 50 percent compared with 20 - 30 percent for the pure Tabasco. The Tarsets are being put to a Suffolk ram (Mason, 1978). The onset of puberty was studied in nine Tabasco x Dorset F_1 males using as criterion the presence of live spermatoza in the ejaculate. Seven reached puberty at 132 $\pm$ 9 days with an average weight of 29.7 $\pm$ 2 kg. The remaining two did not reach puberty until 41 days later with an average weight of 23 kg (Valencia et al., 1977).

Conclusions. Mexico is to be commended for its systematic exploration of this new genetic resource. While the litter size may not equal that of the Caribbean island breeds the Tabasco shares with them the early sexual maturity, high fertility and short lambing interval which makes it a highly fecund breed. The information which has been gained on methods of management and productivity will be useful to all breeders of American hair sheep whether prolific or not.

Experience elsewhere indicates the wisdom of the policy of not cross-breeding females. Selection within the pure breed should be able to improve performance without losing adaptation. On the other hand the successful use of Tabasco males on the wooled Criollo breeds indicates another way of exploiting the hair sheep, which will not lead to dilution of their blood.

References

Arroyo R., D., 1974. Evaluación de la capacidad de carga en pasto guinea con borrego Tabasco o Peliguey en Playa Vicente, Veracrúz, clima Am. 11a Reunión Anual del INIP, México, p. 18. (Abstract).

Barrios, Z., Quiroz, H., Lagunes, J. and Robles, C., 1973. Identificación de generos de larvas infectantes de nematodos gastroentéricos de ovinos Tabasco o Peliguey en clima A(f) C. 10a Reunión Anual del INIP, México, p. 57. (Abstract).

Barrios, Z., Quiroz R., H., Castillo, H. and Ortega, I.V., 1974. Control de nematodos gastroentéricos en borrego Tabasco o Peliguey en clima tropical Aw. 11a Reunión Anual del INIP, México, p. 19. (Abstract).

Berruecos V., J.M., Valencia Z., M. and Castillo R., H., 1975. Genética del borrego Tabasco o Peligüey. Técnica Pecuario en México, 29: 59-65.

Cantó, G.J., Monroy A., V., Rodríguez del Rosal, E., Larios G., F., 1976. Química sanguínea en ovinos de la raza Tabasco o Pelibuey en clima sub-tropical. Técnica Pecuaria en México, 30: 110. (Abstract).

Castillo R., H., Valencia Z., M. and Berruecos V., J.M., 1972. Comportamiento reproductivo del borrego Tabasco mantenido en clima tropical y sub-tropical. I. Indices de fertilidad. Técnica Pecuaria en México, 20: 52-56.

Castillo R., H., Berruecos, J.M., Hernández, L.J., Pérez S., J.M., Lopez, A.J. and Quezada, R., 1974a. Comportamiento reproductivo del borrego Tabasco o Peliguey mantenido en clima tropical. IIa Reunión Anual del INIP, México, p. 16. (Abstract).

Castillo R., H., Berruecos, J.M., Quezada, B.R., Pérez S., J.M., Hernández, L.J. and López, A.J., 1974b. Cambios en la eficiencia reproductiva (70-73) en el hato de borrego Tabasco o Peliguey mantenido en semiestabulación en trópico mexicano. 11a Reunión Anual del INIP, México, p. 17. (Abstract).

Castillo R., H., Román P., H. and Berruecos V., J.M., 1974c. Característica de crecimiento del borrego Tabasco. Efecto de la edad y peso al destete y su influencia sobre la fertilidad de la madre. Técnica Pecuaria en México, 27: 28-32.

Castillo R., H., Berruecos V., J.M., Pérez S., J.M., Hernandez L., J.J. and Quezada B., R., 1976. Comportamiento reproductivo del borrego Tabasco mantenido en clima tropical. II. Características seminales. Técnica Pecuaria en México, 31: 63-67.

Castillo R., H., Hernández L., J.J., Berruecos V., J.M. and Lopez A., J.J., 1977. Comportamiento reproductivo del borrego Tabasco mantenido en clima tropical. III. Pubertad y duración del estro. Técnica Pecuaria en México, 32: 32-35.

FAO, 1978. Production Yearbook 1977. No. 31, FAO, Rome.

González R., A., De Alba M., J. and Foote, W.C., 197?. Crecimiento de corderos Peliguey en pastoreo.

Guzmán G., R., Garza R., J. and Berruecos V., J.M., 1975. Determinación de los grupos sanguineos solubles del borrego Tabasco o Peliguey. 12a Reunión Anual del INIP, México, p. 10. (Abstract).

Guzmán G., R., Garza R., J., Martinez R., L. and Salinas T., E., 1976. Determinación de los grupos sanguineos solubles del borrego "Black Belly". Técnica Pecuaria en México, 30: 95. (Abstract).

Hernández L., J.J.P., Rodriguez R., O. and González P., E., 1976. Evaluación de cuatro metodos para colección de semen en borrego Tabasco o Pelibuey. Técnica Pecuaria en México, 30: 45-51.

Herrera, D., Quiroz, H., Lagunes, J., Dávalos, E., Dominguez, P., García, R., Trejo, J.F. and Trigo, J.F., 1973a. Importancia de la cronología en la terapia antihelmíntica en ovinos Tabasco o Peliguey en clima tropical A(f)C. 10a Reunión Anual del INIP, México, p. 58. (Abstract).

Herrera, D., Quiroz, H., Lagunes, J. and Robles, C., 1973b. Comportamiento de dos antihelmínticos contra nematodos gastroentéricos de ovinos Tabasco en clima A(f)C. 10a Reunión Anual del INIP, México, p. 57-58. (Abstract).

Larios G., F., Lora M., P.P., Trigo T., F. and Rodríguez del Rosal, E., 1976. Fisiologia del ovino Tabasco o Pelibuey en clima subtropical A(f)C: I. Hematologia y niveles sericos de calcio, fósforo y magnesio. Técnica Pecuaria en México, 30: 84-90.

Martínez V., E., Ciprian C., A. and Flores C., R., 1974. Estudios serológicos sobre Brucella melitensis en borrego Tabasco o Peliguey. 11a Reunión Anual del INIP, México, p. 20. (Abstract).

Martínez R., L., Merino Z., H. and Ortiz O., G., 1975. Alimentación del borrego Tabasco o Peliguey en crecimiento y finalización. Técnica Pecuaria en México, 29: 110. (Abstract).

Mason, I.L., 1978. Report on a visit during 4 January-14 February 1978 to Barbados, St. Croix, Dominican Republic, Haiti, Jamaica, Cuba, Mexico, U.S.A. FAO/UNEP Project "Conservation of Animal Genetic Resources - Prolific Tropical Sheep". FAO, Rome (mimeo).

Ortega, I.V., Nájera F., R., Talavera, J.C. and Robles B., C., 1974. Efecto de la aspersión de tiabendozole en el pasto sobre la productividad de borrego Tabasco o Peliguey. 11a Reunión Anual INIP, México, p. 19-20. (Abstract).

Ortiz, G., Zorrilla R., J.M. and Merino Z., H., 1974. Estudio preliminar de requerimiento proteícos y energéticos de borregas Tabasco o Peliguey en gestación. 11a Reunión Anual del INIP, México, p. 17. (Abstract).

Peña T., F.J., 1976. Cria y explotación del borrego Tabasco. In "1er Día del Ganadero, Centro Experimental Pecuario Tizimín, Octubre 1976", pp. 43-47. INIP, Mexico.

Quiroz, H., Serran, E., Ortega, I.V., Robles, C., Lagunes, J. and Nájera, R., 1972. Importancia económica de la monieziosis en ovinos Tabasco o Peliguey en clima A(f)C. Técnica Pecuaria en México, 21: 59. (Abstract).

Ruz, J.G., 1963. Modificaciones de la piel y capa lanosa en los borregos de Tabasco. 1a Reunión Anual del Centro Nacional de Investigaciones Pecuarias, México (quoted by Berruecos et al., 1975).

Ruz, J.G., 1966. Estudio del ovino tropical "Peliguey" del sureste de México y sus cruzas con ovino Merino. Tesis (M.V.Z.), National University of Mexico, Mexico City (quoted by Berruecos et al., 1975).

Salinas T., E., Martínez R., L., Peña T., F. and González P., E., 1975. Efecto de suplementación en gestación y lactancia en borregas Tabasco o Peliguey sobre la aparición del primer celo y el peso al destete de los corderos. Técnica Pecuaria en México, 29: 121. (Abstract).

Sánchez, A., Quiroz, H. and Lagunes, J., 1973. Frecuencia y abundancia de las especies del género Eimeria en ovinos en clima tropical, A(f)C. 10a Reunión Anual del INIP, Mexico, p. 58-59. (Abstract).

Suáres G., F., Martínez V., E. and Flores C., R., 1974. Presencia de anticuerpos contra Brucella ovis en borrego Tabasco o Peliguey. 11a Reunión Anual del INIP, México, p. 20. (Abstract).

Talavera U., J.C., González P., J.M. and Berruecos V., J.M., 1974a. Análisis de algunas características fenotípicas del borrego Tabasco o Peliguey. 11a Reunión Anual del INIP, México, p. 15. (Abstract).

Talavera U., J.C., González P., J.M., Berruecos V., J.M., 1974b. Factores genéticos y ambientales en el crecimiento al destete del borrego Tabasco o Peliguey. 11a Reunión Anual del INIP, México, p. 15. (Abstract).

Torres H., M., 1974. Producción de carne de borrego Tabasco o Peliguey en pastoreo de zacate ferrer y guinea en Tizimín, Yuc. clima Aw. 11a Reunión Anual del INIP, México, p. 17-18. (Abstract).

Torres H., M., Garza T., R. and Molina S., I., 1975. Estudio sobre capacidades de carga de borrego Tabasco o Peliguey en zacate estrella de Africa en Tizimín, Yucatán. Técnica Pecuaria en México, 24: 99. (Abstract).

Treviño S., M., 1974. Pruebas de aceptación de plantas forrajeras y aumento de peso con borrego Tabasco o Peliguey en Hueytamalco, Puebla, Clima A(f)C. 11a Reunión Anual del INIP, México, p. 19. (Abstract).

Valencia, J., Barrón, C. and Fernández Baca, S., 1977. Pubertad en corderos Tabasco x Dorset. Veterinaria Mexicana, 8: 127-130.

Valencia Z., M., Villarreal, M. and Berruecos V., J.M., 1972. Crecimiento en el borrego Tabasco o Peliguey. II. Curva de crecimiento durante la lactancia. Técnica Pecuaria en México, 21: 30. (Abstract).

Valencia Z., M., Berruecos V., J.M., Salinas T., E., 1974a. Características de la canal del borrego Tabasco o Peliguey. 11a Reunión Anual del INIP, México, p. 15. (Abstract).

Valencia Z., M., Salinas T., E. and Berruecos V., J.M., 1974b. Crecimiento y productividad del borrego Tabasco o Peliguey al año de edad. 11a Reunión Anual del INIP, p.2.

Valencia Z., M., Salinas T., E. and Berruecos V., J.M., 1974c. Evaluación de la fertilidad del borrego Tabasco o Peliguey en Yucatán. 11a Reunión Anual del INIP, México, p. 16. (Abstract).

Valencia Z., M., Castillo R., H. and Berruecos V., J.M.. 1975. Reproducción y manejo del borrego Tabasco o Peliguey. Técnica Pecuaria en México, 29: 66-72.

2.6 HAIR SHEEP IN THE DOMINICAN REPUBLIC

In the Dominican Republic there are only 52,000 sheep (FAO, 1978). About 90 percent of these are said to be hair sheep. In or about 1932 Battista presented Trujillo with some of the red Pelibüey sheep of Cuba. They thrived and spread and are now found in small flocks over a wide area, especially around Santiago. However there must have been hair sheep on the island earlier since the common sheep are hairy but smaller and less uniform than the Pelibüey. They are lighter, shorter in the body and longer in the leg. Their colour varies from white, through pale tan to dark red-brown. Their coat is less sleek than the Pelibüey and they carry some wool on their backs. In fact there are also wooled Criollo in the Dominican Republic and the common sheep may be derived from crossing between these and hair sheep (Mason, 1978).

2.7 AFRICAN SHEEP IN COLOMBIA by Riberto Bautista Otero and Juan José Salazar Cruz

Name and history. African sheep originate from the west of the African continent (Bautista, 1977). Large numbers of these sheep came to America, and particularly to Colombia, with the slaves from that region and the present population derives from the surviving remnants of those embarked to feed the slaves. Later this type of sheep was also introduced into Colombia by merchants of the Magdalena department who traded with Aruba and Curaçao, and also by smugglers who travelled between the Caribbean Islands and Guajira. The most recent arrivals are the sheep imported by Don Manuel Majia in 1940 and taken to the districts of Armero, Honda and Venadillo, where they still exist.

This type of sheep is very mixed and only in a few flocks can pure specimens be found. However, it is possible to distinguish two types: one yellow with reddish-brown shades (called Sudan) and the other red - cherry red and dark red verging on black (called Etiope). (These names have no relation to countries of origin).

In Colombia African sheep are known by various names: "Rojo Africano", "Pelona", "Camura", "Criollo" (Montoya, 1957).

Numbers. The national sheep population consists of Criollo (wooled), African and crossbred types, with a few flocks of improved breeds, as shown in the following table:

National sheep population - 1975

Group	Number	Percent
Improved breeds	31,785	1.5
Crossbreds	221,900	10
Criollo	1,483,300	70
African	392,015	18

FIGURE 1. GEOGRAPHICAL DISTRIBUTION OF AFRICAN SHEEP IN COLOMBIA.

As regards the population of African sheep, it can be estimated that some 35 percent are purebreds and 65 percent crossbreds.

According to the livestock programme of the Ministry of Agriculture (1975), 37 percent of the total population consists of animals aged less than 1 year old and 63 percent of animals more than one year old. Of the total sheep population, 36 percent are males and 64 percent females.

Distribution. African sheep are reared in various regions of Colombia in which, owing to the climatic conditions, wool sheep cannot flourish and produce; they are extremely hardy, thriving in inhospitable areas, with periods of excessive drought and with scanty pastures.

They are found in the departments of Córdoba, Sucre, Bolívar, Atlántico, Magdalena, Guajira, Cesar, Santander, Cundinamarca, Tolima, Cauca, Huila and Meta (see Fig. 1).

From Guajira these sheep have penetrated into the neighbouring Zulia province of Venezuela where they are known as Roja Africana (González Jiménez, 1979) (see Plates 12 and 13).

Description. The African sheep of Colombia are very similar to the Pelibüey of Mexico already described in Section 2.5. The yellow or Sudan type varies in colour from yellow to reddish brown, some almost white specimens being found. The red or Etiope (Ethiopian) type is red, sometimes so dark as to appear black. It is slightly longer in the leg than the yellow type.

The African sheep are agile, resourceful, hardy and adapt to all management systems, even becoming very tame; they respond with affection and faithfulness to the treatment and care given them by their owner. It should be noted, however, that they are susceptible to foot rot when the annual rainfall exceeds 1,000 mm.

The following measurements (cm) have been obtained from a population of 300 adult red African sheep on the Granja de Venadillo, Tolima.

Withers height	Rump height	Depth of chest	Width of chest	Chest girth	Width of rump	Length of body
59	60	28	20	79	22	63

The weight of this breed at different ages is 2.5 kg at birth; 15-18 kg at weaning (4 months) and 35-40 kg at one year. By fattening up to twelve months, weights of 49 kg are obtained for males and 45 kg for females. A four-year-old male in good condition may weigh 80 kg.

Management. There is almost no commercial sheep production in the country, with the exception of government enterprises in which purebred animals are kept on improved pastures, are given mineralized salt and receive adequate management. 95 percent of the sheep rearing is carried out on a family basis by primitive methods using empirical techniques and subsistence farming criteria.

The largest farms are between 20 and 100 hectares. 40 percent of the flocks have 50 or less sheep; 34 percent between 51 and 100; and 24 percent between 101 and 500. There is only one flock with more than 1,000 animals. (Flores and Vargaz, 1970; Otero de la Espriella, 1973).

Reproduction. It is the custom among our peasants for the breeding ram to live with the flock, no control being exerted over mating. This system requires at least 4 rams for every 100 ewes. In commercial farms controlled mating is used; chalk-covered harness is placed on the breeding ram, the colour being changed after three cycles (17 days per cycle), i.e. every 51 days.

The animals start to serve at 15 months and the ewes are put to the rams from 10 and 14 months onward; the average age at first lambing is between 15 and 19 months. Three lambings are obtained every two years.

According to studies by Montoya (1957) in the Granja de Venadillo, Tolima, fertility rates of 98 percent were obtained, with 32 percent of the births giving twins and 1 percent triplets. This is a prolificacy of 134 percent. This is almost the same as the prolificacy of 138 percent given by González Stagnaro (1976) for the flock of Red African sheep at Zulia University, Venezuela. The average gestation period is 152 days. The African breed has the lowest mortality among Colombia sheep breeds, with 10 to 12 percent for young animals and 2 to 3 percent for adults (accidents).

Selection so far has concentrated on the phenotypic characteristics of each type of African sheep, namely adaptability, prolificacy and body development. Selected rams are sold both by government farms and by some private producers.

Marketing. In most regions of the country marketing takes the form of sale of the live animals to the butcher, usually at the weekly fair. The price paid is agreed between buyer and seller, the buyer making a rough assessment of the animal's value. Although there are no statistics which make possible a detailed analysis, it can be stated that there is industrial under-utilization of sheep meat, since apart from the Zenú producers of Medellín and a few meat-product shops and canning factories in the capital, the sheep meat produced is intended for direct and internal consumption. Much of the slaughtering in the countryside is clandestine. There is also clandestine trade of live animals to neighbouring countries.

Conclusions. The African sheep in Colombia represents an important resource for the small farmer. Its adaptation is indicated by the large population which has

developed without any encouragement or support from breed society or government organizations.

Its conservation and improvement need official recognition. A survey should be made of the distribution and numbers of these sheep together with information on management and performance. For the purpose of improvement and further diffusion more sheep breeding centres should be set up, particularly on the Atlantic coast. At the same time sheep farmers need increased technical assistance.

References

Bautista, R., 1977. Oveja Africana. Manual de Ovinos. Temas de Orientación Agropecuaria, Bogotá, No. 125. 64pp.

Florez, V. and Vargas, S., 1970. Problemas de Producción y Mercadeo de la Industria Ovina en Colombia. Departamento de Economía Agrícola, Instituto Colombiano Agropecuario, Boletín No. 7.

González Jiménez, E., 1979. Las razas ovínas adaptadas a las condiciones climaticas de Venezuela. TS .

González Stagnaro, C., 1976. Ovinos tropicales: la oveja Roja Africana. Mimeo.19 pp. Universidad del Zulia, Facultad de Agronomia, Maracaibo.

Montoya, R., 1957. Estudio sobre la oveja Africana. Tesis de grado, Universidad Nacional de Colombia, Bogotá.

Otero de la Espriella. 1973. Oveja para el trópico. Revista ESSO, Agrícola, Bogotá, 4: 11.

2.8 MORADA NOVA OF BRAZIL by E.A.P. Figueiredo

Name and history. The name was given to the red variety by Prof. Octavio Domingues, during his visit to Northeast Brazil in June 1927, because they were first seen by him in the Municipality of Morada Nova, State of Ceará (see Plate 14). Other names which have been used are Deslanado do Nordeste (= Northeastern woolless), Deslanado vermelho (= red woolless) and Deslanado branco (= white woolless). At a meeting held by the Ministry of Agriculture in Fortaleza, Ceará, in October 1977, it was decided to use the name Morada Nova for both varieties, red and white. The white Pele de Boi of Bahia was included with the Santa Inês breed (white variety). This breed may be red, pied, black or white. The Santa Inês breed results from crossbreeding between the Morada Nova (red or white) and the Bergamasca breed of Italy. It inherits the roman nose, lop ears and traces of wool from the Bergamasca and its hair coat from the Morada Nova (see Plate 15).

According to Domingues (1954) the red, white and spotted hair sheep are descended from the Bordaleiro of Portugal which came to Brazil at the time when these virgin areas were being populated. These Bordaleiro sheep are distinguished by their coat, which is a mixture of hair and wool. In the course of time, natural selection favoured the survival of woolless individuals with short, goat-like hair in the midst of others with longer, coarse hair and even with varying degrees of woolliness. However the Morada Nova is very similar to the red African breed of Venezuela. [While there may be Bordaleiro blood in the Morada Nova it seems likely that African blood is predominant. Ed.]

Distribution and number. The woolless sheep inhabit an extensive area which includes practically all the Sertão (drylands) of the northeast. Domingues (1954) recorded the occurrence of woolless sheep in all the northeastern States, from Alagoas to Piauí. It is typical of the Sertão but a few isolated individuals are found away from this area or in the mountains.

In the flocks of the Sertão, woolless individuals are mixed with others having varying degrees of woolliness, from a fine fleece to a covering of coarse wool leaving bare the head, legs and belly (see Plate 15).

Of all the States of Brazil, Ceará seems to be the one in which there is the greatest concentration of woolless sheep, particularly in the Jaguaribe valley and that of its tributary, the Salgado. The Sertão of the lower and middle Jaguaribe had 185,480 head (the largest population of sheep in the State), and the Sertão of the Salgado and Jaguaribe, 144,210 head (Domingues, 1954). These two zones included one third of Ceará's sheep population which numbered 942,180 head in 1954. At present it is 1,134,000, the third largest number of the States of Brazil (Anuário Estatistico do Brasil, 1976).

We are not able to give the total number of purebred animals but the number of purebreds registered in the Provisional Herd Book for the Morada Nova breed up to May 1978 was 8 males and 60 females (Ovinocultura, 1978).

Environment (EMBRAPA, 1974). The basic environmental factor in the semi-arid zone is the scarcity and poor distribution of rainfall which is concentrated in a single period (3 to 5 months). Rainfall is so irregular as to make annual

averages meaningless; they vary between 150 and 1,300 mm. Rainfall is also irregular during the rainy period and from one place to another, coming in the form of heavy cloudbursts.

In the semi-arid zone average annual temperatures are high, between 23 and 27°C, varying very little from one region to another and with daily and monthly fluctuations of 10°C and 5-10°C, respectively.

Compared with the semi-arid zone, the Agreste zone is characterized by a better distribution of rainfall. It is the intermediate area between the humid zones (mid-north and Littoral-Mata) and the semi-arid zone. The average annual rainfall in the various localities in the Agreste zone varies between 650 and 1,000 mm. The largest sheep populations are located in areas with yearly rainfall between 600 and 1,000 mm. In a general way the soils of this area have the drawbacks of being shallow and low in fertility and water retaining capacity, thus requiring either irrigation or special dry-land farming techniques.

There are three types of vegetable formation in the semi-arid zone:

(a) caatinga campestre (caatinga = thorn forest),

(b) thick bushy-arboreous caatinga,

(c) scattering of other vegetable formations within the caatinga area.

The natural caatinga campestre covers small areas and is overlaid by a vegetable cover of wild grasses - usually discontinuous - intermingled with small bushes and sometimes replaced by large tufts or small areas of herbs usually belonging to the Gramineae, Compositae, Leguminosae and Malvaceae. The herbaceous covering may be replaced by some trailing Cactaceae and small land Bromeliaceae. Round the edges of the clearing there may be thickets of bushes and small trees, usually covering small areas. The landscape is known by the name of dry, scattered caatinga or 'Seridó' and is found here and there in the States of Ceará, Rio Grande do Norte and Paraíba.

The stratified bushy-arboreous caatinga is now rather sparse due to devastation caused by felling. It is usually found covering small areas, in rather inaccessible localities, on relatively fertile soils.

In most cases, the bushy-arboreous caatinga has been replaced by caatinga 'capoeiras'. This is a secondary forest arising from enclosed areas that were formerly cultivated.

There are other scattered vegetable formations inside the caatinga zone. These consist of evergreen bushes situated in more favourable ecological surroundings.

Breed description (Associação Brasileira de Criadores de Ovinos, 1977)

The weight and body measurements of this breed are shown in Table 18.

Table 18 Some weights and heights of Morada Nova sheep

Age	No.	FEMALES				No.	MALES			
		Body weight (kg)		Wither height (cm)			Body weight (kg)		Wither height (cm)	
		Mean	S.D.	Mean	S.D.		Mean	S.D.	Mean	S.D.
Suckling	36	11.5	2.9	49.0	4.0	26	12.7	3.1	50.7	3.7
Milk teeth	43	23.9	3.4	60.0	6.3	15	24.4	3.7	61.1	2.8
2-tooth	19	26.7	4.2	60.1	3.3	9	25.9	3.4	61.2	3.8
4-tooth	20	26.8	3.3	61.4	3.4	4	29.2	2.2	64.7	2.1
6-tooth	37	29.7	3.6	62.0	3.5	5	37.4	3.6	69.2	3.1
Full mouth	74	31.4	4.2	62.0	3.7	17	38.8	5.0	66.8	4.0

These figures were established on the basis of measurements on approximately 360 individuals by technicians of the EMBRAPA National Goat Research Centre (CNPC), and are part of the biometric work being carried out by the Centre. Sheep are slaughtered at an age of 18-24 months and a weight of 27-35 kg. Cull ewes and rams weigh about 30 kg.

Conformation: deep thorax, flat ribs, not very developed belly, well-muscled thighs and thin rump. The wither is evident in the male and sunken in the female. Head broad and long, sub-convex profile, short muzzle, thin neck, short slightly inclined rump, long thin tail, thin vertical legs, small strong hooves.

Coat: various shades of red, lighter in the region of the perinaeum, scrotum, udder and head; white tail tip; dark skin covered with short hair, dark mucosae. There is also a variety with a white coat. The proportion of different colours has not been determined.

Hair is short, thin and coarse. Ears are shell-shaped, about 9 cm long, ending in a point. Females are hornless but males may show vestigial horns (scurs).

The udder tends to a spherical shape with a circumference of about 35 cm when full and 28 cm when empty. Teats are arranged laterally, about 2 cm long. These observations on the mammary apparatus are derived from work being carried out at CNPC.

The skin of the Morada Nova has good market acceptance. It is tanned before export.

They are docile animals, quickly adapting to handling practices, homing in the evening. According to Arruda (1978) the Morada Nova breed has a heat

tolerance index of about 95%. This is confirmed by the Ittner-Kelly test used by this author in the course of work being carried out by CNPC.

As to direct solar radiation, these animals have a red coat, tending to purplish, whose harmful effects are reduced to a minimum since the coat texture is soft and shiny. In addition to the advantage presented by the coat colour, when exposed to the sun they adopt a posture reducing the incidence of its rays: they always stand, never lying down, when there is little shade.

Management. The breeding of Morada Nova sheep is in no case a priority activity for the farmer for whom it is always a secondary or tertiary activity, usually coming after cattle raising and crop growing.

The natural feed available is the vegetation native to the Northeast, characterized by the presence of trees, bushes and grass, of which the main components are: 'sabiá' (Mimosa caesalpinifolia), Rôla bean (Phaseolus lathyroides), 'juazeiro' (Zizyphus joazeiro), chicken foot grass (Echinochloa crusgalii), Damascus grass (Aristida setifolia), Ceará mimosa (Anthephora hermaphrodita rose grass (Panicum parvifolium) (Braga, 1976). Artificial conservation of fodder is rarely practised in the Northeast. Pastures for use in the dry season (capineiros) are widely utilized but they are small and do not produce enough to feed the entire flock during periods of shortage. The grazing system is semi-extensive with the sheep returning to the farmstead in the evening. In times of shortage they receive some supplementary feeding in the form of cut grass, millet and bran of grain or cotton. Stall feeding is practically non-existent; it is practised only sporadically, just before livestock shows and only with breeding animals.

Shelter is uncommon and, where it exists, it is only for the animals to spend the night. Shelters are fenced and roofed with 'sapé' leaves (any of several gramineous plants used for fodder, paper-making, etc.).

Water is provided by sluice dams, deep wells or 'cacimbas' (pools holding run-off water from swamps) on the farms.

Castration is seldom practised by breeders; males are marketed entire. When it is practised it is done at weaning by the manual method of cutting the sperm ducts or by the mechanical pincer method.

Young lambs are raised together with their mothers until weaning and are handled in the same way as adults. Weaning occurs naturally around the age of 3-4 months. Lambs receive supplementary feeding on a few farms but only at critical periods. Animals are neither shorn nor milked.

Diseases (Torres, 1945). Verminous gastro-enteritis of goats and sheep (known in Brazil as 'seca'): According to Torres (1945), this is a mixed chronic helminthiasis caused by worms of the Trichostrongylidae and Strongylidae families, of the genera Haemonchus, Trichostrongylus, Oesophagostomum, Cooperia, etc. According to the author there is no disease that surpasses 'seca' in the damage caused to goats and sheep in the Northeast.

Coccidiosis: Not unusual among goats but less prevalent among sheep, especially in the Sertão, are cases of haemorrhagic enteritis showing a large number of

coccidia in the faeces. According to Torres (1945), in the flocks decimated by verminous gastro-enteritis there are many cases in which coccidiosis is the only agent accountable for animal deaths. The same author adds that sheep in Pernambuco are more affected by Eimeria minae (80%) than by Eimeria arloingi (68%). Treatment is the same as that used for verminous gastro-enteritis.

Pediculosis (lice): Serious infestations of Bovicola caprae and even more so of B. ovis occur among sheep, even those with short hair (woolless). The skin becomes squamous and scabs may form, resembling mange. The largest number of lice are found along the dorsal ridge and the rump in the places with most wool or hair. A massive infestation can lead to restlessness, loss of appetite, weight loss, exhaustion and finally death. Treatment is by dusting with anti-mange powder.

Infectious pododermitis (foot rot): A rather frequent affliction among sheep long known to Northeast breeders. Its greatest incidence is during the winter months with heavy rain. It is treated with ointment applied to the feet together with antibiotics.

Caseous lymphadenitis (commonly called 'caroço' or fruit stone): caused by Corynebacterium ovis.

Tetanus occurs frequently in sheep after castration and tail cutting; it is caused by Clostridium tetani. Treatment consists of prophylactic asepsis and proper protection of wounds caused by castration and docking.

Contagious pustular dermatitis (commonly known as 'boqueira', or cracks at corners of mouth), causes a certain amount of mortality among lambs. In its initial phase, tumefaction of the muzzle is observed making it difficult or impossible for the lambs to suck, so that they eventually die. It is caused by a filterable virus or by Actinomyces necrophorus. It is treated with repellent and scar-forming medicines.

Foot-and-mouth disease is not infrequent in the forest area (Mata) and in the littoral. In the Sertão it contributes in winter to the occurrence of foot rot with almost certain fatal results. Control is preventive with systematic inocculation of animals over four years at regular four-month intervals.

Reproduction and breeding. Males are put to service for the first time at the age of 12 to 14 months. Ewes lamb for the first time at the age of 14 to 16 months. Often the age of parturition is too early, due to lack of control of reproduction.

Studies under way by CNPC at one breeding station gave the following results on 21 ewes following a restricted breeding season between 16 February and 17 April 1978: 91.3% births, 4.3% abortions and 4.3% embryonic deaths or non-fertilization, gestation period of 149.0 $\pm$ 1.3 days; 28.6% single, 66.7% double and 4.8% triple births giving a birth rate of 176.1%. On the commercial farm run by MAISA (Mossoró Agro-Industria S.A.), where sheep are extremely well fed, a high twinning rate (60 percent) is also obtained. However on the average farm the figure is probably nearer the 20 percent twinning reported from Peri Peri farm, Petrolina, the 35 percent on Iracema farm, Quixadá, and the 25 percent from the Pentecostes farm of the University of Ceará.

Rams are obtained from neighbouring farms, breeders association, agricultural fairs or are bred by the owner. The criteria for selection are phenotypic such as coat, girth, length, weight and age. The selection of ewes is less critical.

Crossing is indiscriminate due to lack of organization of farm holdings, whereby animals can be in touch with neighbouring farms due to lack of fences. Crossing takes place with all the other breeds of the Northeast, such as Bergamasca, Santa Inês and Brazilian Somali (Blackhead Persian).

Happily the policy of CNPC and other research organizations is to pick out the constituent breeds - namely Red Morada Nova, White Morada Nova, Santa Inês and Brazilian Somali, and explore their characteristics and performance. Several purebred selection flocks have now been established for the Morada Nova in the northeast of Brazil. This is a commendable conservation effort to prevent loss of breeds by mongrelization.

References

Anuário Estatística do Brasil, 1976. Rio de Janeiro, IBGE, No. 37, 816 p. 1976.

Arruda, F.A.V., 1978. Aplicação do Teste de Dowling em caprinos e ovinos deslanados. CNPCaprinos, EMBRAPA, Sobral-Ce. Mimeo 12 p.

Associação Brasileira de Criadores de Ovinos, 1977. Regulamento do registro genealógico provisório de ovinos no Brasil. Flock-book brasileiro (F.B.B.), Bagé, R.S., 30 p.

Braga, R., 1976. Plantas do Nordeste, especialmente do Ceará. 3rd ed. Fortaleza: Escola Superior de Agricultura de Mossoró. 540 p. (Coleção Mossoroense, 42)

Domingues, O., 1954. Sobre a origem do caprino deslanado do Nordeste. Publicação No. 3 da Seção de Fomento Agrícola do Ceará, Fortaleza-Ce, Brasil. 28 p.

Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), 1975. Sistemas de Produção para Caprinos e Ovinos. Circular No. 70, Quixadá-Ce, Brasil. 30 p.

EMBRAPA, 1974. Anteprojeto para implantação do Centro Nacional de Pesquisa de Caprinos e Ovinos. Brasília, Brasil. 61 p.

Ovinocultura, 1978. Associação Brasileira de Criadores de Ovinos, Bagé-Rs. Ovinocultura, 10, (22), 1978.

Torres, S., 1945. Doenças dos caprinos ovinos no Nordeste Brasileiro. Rio de Janeiro: S.I.A. 154. 34 p.

2.9 THE ORIGIN OF THE AMERICAN HAIR SHEEP

It is now generally accepted that the hair sheep of tropical America came originally from the west coast of Africa and that they were brought along with the slaves. The African origin was recorded for Barbados as early as 1657 (see section 2.1) and is explicit in the name West African used in Venezuela and Africana in Colombia (section 2.7). It is more difficult to determine exactly when they came (except for the date 1624-57 to Barbados) or exactly where they came from.

Lydekker (1912, p. 221) wrote about the Guinea long-legged sheep: "Early in the seventeenth century these sheep were carried by the Portuguese to the northern districts of Brazil, while about the same time, or perhaps still earlier, they were introduced by the Spaniards into the West Indies and Guiana.....

"The West Indian breed, from which the Brazilian is probably inseparable, is stated by Fitzinger to differ from the Guinea type by the constant lack of horns in the rams; but a mounted specimen in the Natural History branch of the British Museum is further distinguished by its small upright ears, as well as by its uniformly foxy coat and the absence of a throat ruff".

To pinpoint more precisely the exact time and place or places of origin of the American hair sheep it would be necessary to study the original documents concerning the history of the slave trade. A simpler approach is suggested by the differences noted by Fitzinger, and quoted by Lydekker, between the Guinea sheep of West Africa and the West Indian sheep.

The sheep of West Africa are commonly divided into two types (Mason, 1951; Epstein, 1971): a larger long-legged lop-eared type in the north and a smaller type with horizontal ears in the southern zone. They both have a hair coat and a thin tail to the hocks. The males are commonly horned and sometimes also the ewes. The male of the southern type has a mane of coarse hair. The northern type lacks this mane and its height is typically over 70 cm. The southern (or Fouta Djallon) type is shorter than this; in the Guinean forest zone along the coast it is a true dwarf with a withers height of 40-60 cm and a weight of 20-30 kg; in the Savannah zone it is larger - 60-70 cm in height and 30-40 kg in weight.

The American hair sheep described in sections 2.1 to 2.8 correspond in appearance with the Fouta Djallon sheep of West Africa except that they lack horns. In size they fit the Savannah rather than the Forest type. Either they were brought from inland rather than from the coast or else they have undergone an increase in size since importation.

The absence of horns can be easily explained - presumably only polled specimens were chosen for the long voyage in a confined space. Subsequent selection then favoured the hornless type.

In colour the American hair sheep are predominantly white, tan or some combination of tan such as tan-and-white and tan with black belly. Black and black-and-white are very rare and the occasional black animal may in fact be a very dark tan (mahogany). The sheep of the Guinean zone of West Africa,

on the other hand, are predominantly white, white with black markings, or black, in that order of priority. This is clear from the descriptions in the report on "Trypanotolerant livestock in West and Central Africa" (FAO/ILCA/UNEP,1980). In all the countries from Senegal to Nigeria combinations of white and black predominate although occasionally tan or tan-and-white specimens occur.

In the west of Central Africa, on the other hand, tan, and its combinations are common. In Cameroon the frequency of tan is noted below. In Gabon "up to 30 or 40 percent of sheep have a tan back and black belly, particularly in the coastal areas". "In Congo most of the sheep are black-and-white but sheep with tan backs and black bellies are also common, especially in the coastal areas" (FAO/ILCA/UNEP,1980). In Angola, Lima Pereira (1969) describes two types of thin-tailed hair sheep. The smaller variety has a long tail and short rudimentary or no horns; the male has a throat mane. Coat is pied or self colour. This corresponds to the Fouta Djallon. The larger variety has a shorter tail, with short horns in the male and none in the female. Coat is self colour or pied (black or brown). There is no throat mane. The sheep of Angola corresponding to the Fouta Djallon of West Africa are described by Epstein (1971) as "black, white, or white with large patches of rufous". The tan with black belly pattern has also been observed in the vicinity of Bonny and Brass on the Niger delta in Nigeria (Gale, 1977).

The evidence from appearance would thus suggest that the hair sheep of America came from one or more of the countries between Nigeria and Angola. They probably came from the savannah zone and were selected from populations with high frequency of the tan colour and its combinations.

In confirmation of this conclusion in respect to Brazil it appears that most of the slaves arriving in north-east Brazil between 1516 (or possibly 1536) and 1850, when the trade was abolished, came from the Congo area in which is included northern Angola and all the countries up to and including Cameroon. A few came from the Guinea coast (De Azevedo, 1970). Lima Pereira (1969) states categorically that the larger variety of sheep in Angola is the ancestor of the Morada Nova; they both lack the mane of the Fouta Djallon.

In the case of the Barbados Blackbelly an origin has to be found both for the special colour pattern and for the high prolificacy. Epstein (1971, p. 52-3) described three varieties of "dwarf" sheep in Cameroon: a black and black-and-white variety and two tan with black belly varieties, one smaller and one larger. Vallerand and Branckaert (1975) speak of only one Fouta Djallon sheep in Cameroon. "The most commonly encountered colours are black, black-pied and, more rarely, white, red and red-pied. In certain regions (East province in particular) tan animals with black belly and feet are seen. This sub-breed is genetically stable and the animals appear larger. This impression is confirmed by their average weight which is over 28 kg in adult females". The average weight for adult Fouta Djallon females in Cameroon is 25 kg and their height is 59 cm.

This range of colour was confirmed by Mason (1977) who observed 397 sheep in the Centre-South Province; 150 were black, 131 black-and-white, 18 white, 56 tan with black belly (with or without white patches), 6 tan and black and white (harlequin), 2 tan, 32 tan-and-white, 2 tan-and-black (pied) (see Plate 16).

Although the proportion of different colours varied from place to place there was no suggestion of different sub-breeds or varieties as suggested by Epstein (1971) and Vallerand and Branckaert (1975).

In Bakossiland there is an even greater range of colours and patterns. Among 82 sheep observed by Ejedepang-Koge (1978) 34 were black, 15 black-and-white, 10 tan with black belly, 7 white with black belly, 6 tan (with white tailtip and feet), 2 tan with white belly, 8 black with tan belly.

As for fertility, Vallerand and Branckaert (1975) give a twinning rate of 17 percent i.e. a litter size of 1.17 rising from 1.0 at the first lambing to 1.2 for third and later lambings. Vallerand (1977) emphasizes that out of 1,200 recorded lambings, plus numerous enquiries in the field he has never come across the birth of triplets. It appears that in Cameroon, colour and fertility are not correlated and there is no evidence that the high prolificacy of the Barbados Blackbelly came from Cameroon.

Nevertheless it should be pointed out that, in Iceland, Adalsteinsson (1975) has shown that sheep carrying the allele A^{wt} (white or tan) at the Agouti locus have a smaller litter size than those with other alleles at this locus - which includes the gene for blackbelly.

It is interesting to note that blackbelly sheep from Cameroon were imported into Germany (probably during the period of German administration i.e. 1884-1914). Their height is given as 60 cm which accords well with the present height of sheep in southern Cameroon. From Berlin they were distributed to several other zoos. The flock at Munich zoo retains the characteristics of the Cameroon sheep of the tan with blackbelly pattern. Adult females average 26.5 kg in weight and their twinning rate is 20 percent. Males carry horns (as well as some females) and a throat mane (Wünschmann, 1977). About 13 percent of lambs are black which indicates that a high proportion of the blackbelly sheep are heterozygotes.

In general the moderate twinning rate of the Cameroon sheep is repeated in other Fouta Djallon village populations in West Africa. Ginisty (1976) reported a twinning rate of 10 percent among village sheep in Ivory Coast. SEDES (1975) gives the same figure for Togo. Matthewman (1977) gives a litter size of 1.15 for 34 dwarf ewes in one village in Oyo State, southwest Nigeria. At Koldu Research Station in Senegal Gueye (1972) reported a twinning rate of 15.5 percent for Djallonké sheep. In Ivory Coast, Rombaut and Van Vlaenderen (1976) recorded a twinning rate of 27 percent for the dwarf variety of Fouta Djallon.

On the other hand, some cases of higher prolificacy have been reported. However they come from research stations or from rather doubtful verbal reports on small numbers. For dwarf sheep in the University of Ibadan flock (Nigeria), Orji and Steinbach (1977) give an average litter size of 1.46, rising from 1.2 at first lambing to 2.0 at the seventh and later. Triplets never exceeded 10 percent. At the Kumasi College flock in Ghana twinning rate was 39 percent, litter size rising from 1.2 at the ewes' first lambing in the College (age unknown) to 1.7 at their third (Jollans, 1960). At Musaia Research Station, Sierra Leone, multiple births averaged 41 percent over the years 1964-67 (Payne, 1971). Among 40 births in Bakossiland, Cameroon,

Ejedepang-Koge (1978) claims an average litter size of 1.47.

It would appear that the potential for multiple births exists in the Fouta Djallon sheep of West Africa but that is not restricted to particular colour types or to special local populations. It seems likely that selection was made for this characteristic independently in Barbados, the Virgin Islands and the Bahamas among sheep selected at the same time for special colours. It is also possible that crossing with European breeds introduced further genes for prolificacy (see section 2.1).

The other components of high reproductive rate - noted in American hair sheep, namely early age at first lambing and short interval between lambings - are also present in the Fouta Djallon sheep of West Africa (see Table 19).

Table 19 Age at first lambing and lambing interval in Fouta Djallon sheep

Country	Cameroon	Ghana	Ivory Coast	Nigeria
Source	Station	Station	Village	Station
Age at first lambing				
Mean (months)	16.3		11.5	14
Range (months)	12-24		9.5-14	10-22
Lambing interval				
Mean (months)	7.9	7.6	c. 7[b]	7.7
Range (months)	5-13[a]	6.3-9	5-9+	5-16
Reference	Vallerand and Branckaert, 1975	Jullans, 1960	Rombaut and Van Vlaenderen, 1976	Orji and Steinbach, 1977

a) Intervals above 13 months (3.8%) defined as 'temporary sterility' and not included,

b) 75% less than 7 months.

References

Adalsteinsson, S., 1975. Depressed fertility in Icelandic sheep caused by a single colour gene. Annales de Génétique et de Sélection animale, 7: 445-447.

De Azevedo, A., 1970. (Ed). Brasil a Terra e o Homen. Vol. II. A Vida Humana. Companhia Editora Nacional, Editôra da Universidade de São Paulo.

Epstein, H., 1971. The Origin of the Domestic Animals of Africa. Vol. 2. New York: Africana Publishing Corporation.

Ejedepang-Koge, S.N., 1978. Bakossi Livestock. Report for FAO/UNEP project "Conservation of Animal Genetic Resources". 31 pp. TS.

FAO/ILCA/UNEP, 1980. Trypanotolerant livestock in West and Central Africa. Rome: FAO. Addis Ababa:ILCA.

Gale, V.E., 1977. Personal communication.

Ginisty, L., 1976. Sélection et amélioration des ovins et caprins de Côte d'Ivoire. Centre de Recherches Zootechniques de Minankro-Bouaké Rapport annual, 1975. (Quoted by FAO/ILCA/UNEP, 1980).

Gueye, E.H., 1972. Ovins et caprins au Sénégal. Elevage. Perspectives d'Avenir. D.Vet.Sci. thesis, Ecole Nationale Vétérinaire d'Alfort. 70 pp. (Quoted by FAO/ILCA/UNEP, 1980).

Jollans, J.L., 1960. A study of the West African dwarf sheep in the closed forest zone of Ashanti. West African Journal of Biological Chemistry, 3 (4): 74-80.

Lima Pereira, J., 1969. A ovinicultura de lã em regiões tropicais. (Bases para o fomento zootécnico da criação de ovinos de lã em Angola). Estudos, Ensaios e Documentos No. 123, Junta de Investigações do Ultramar, Lisboa.

Lydekker, R., 1912. The Sheep and its Cousins. London: George Allen.

Mason, I.L., 1951. The Classification of West African Livestock. Farnham Royal, England: Commonwealth Agricultural Bureaux.

Mason, I.L., 1977. Tropical sheep in Southern Cameroon. Observations from a visit during 26 October - 3 November 1977. 5 pp. mimeo.

Matthewman, R.W., 1977. A survey of small livestock production at the village level in the derived savanna and lowland forest zones of southwest Nigeria. University of Reading, England. 153+[20]7 pp. mimeo.

Orji, B.I. and Steinbach, J., 1977. Das fortpflanzungsbiologische Potential des westafrikanischen Zwergschafes. Giessener Beiträge zur Entwicklungsforschung, 3 (1): 79-86.

Payne, W.J.A., 1971. Sierra Leone: The Livestock Industry. Integrated Development of the Agricultural Sector. ESE: SF/SIL 3. Technical Report 6. Rome: FAO/UNDP.

Rombaut, D. and Van Vlaenderen, G., 1976. Le mouton Djallonké de Côte-d'Ivoire en milieu villageois. Comportement et alimentation. Revue d'Elevage et de Médecine Vétérinaire de Pays Tropicaux, 29 (2): 157-172.

SEDES, 1975. Projet de développemnt des productions ovines et caprines dans les régions Plateaux, Centrale, La Kara. Rapport général et rapports complémentaires. Paris, 336 pp. (Quoted by FAO/ILCA/UNEP, 1980).

Vallerand, F., 1977. Personal communication.

Vallerand, F. and Branckaert, R., 1975. La race ovine Djallonké au Cameroun. Potentialités zootechniques, conditions d'elévage, avenir. Revue d'Elevage et de Médecine Vétérinaire de Pays Tropicaux, 28 (4): 523-545.

Wünschmann, A., 1977. Personal communication.

3. SOUTHEAST ASIA

According to the FAO Production Yearbook for 1977, 96 percent of the sheep of Southeast Asia are located in Indonesia. None are recorded in Brunei, Laos, Sabah, Sarawak or Singapore. Cambodia has 1,000 Vietnam 13,000, the Philippines 31,000, peninsular Malaysia 46,000 and Thailand 52,000, making a total of 143,000. Indonesia on the other hand has 3,286,000. Numbers declined slowly in the years preceding 1972-74 since when they have stabilized.

Within Indonesia the distribution is equally irregular as shown in Table 20:

Table 20 Sheep distribution in Indonesia, 1973

West Java (including Jakarta)	1,450,000
Central Java (including Yogyakarta)	928,000
East Java (including Madura)	475,000
Sumatra	207,000
Other islands	147,000
	3,207,000

Source: Buku Saku Peternakan, 1975

Ninety percent of Indonesian sheep are on the island of Java; within Java their density is three times as great in the west (the wetter end) as in the east. Goats are more numerous than sheep in all provinces except West Java where sheep outnumber goats in the ratio three to two.

3.1 PROLIFIC SHEEP IN JAVA

This concentration of sheep in one of the most densely populated islands in the world, and in a climate defined as humid tropical, is clearly worth study, the results of which should be of interest also to other countries in the region. It should also be noted that these sheep have a reputation for high fertility: Groenewold (1971) gives a total lamb production of 200-220 lambs per 100 mature ewes per year. The Javanese sheep clearly merited inclusion in the FAO/UNEP study of prolific tropical sheep.

Management. Sheep are the next most important source of meat for the rural population after poultry and goats (except in West Java). They are also

valued as a source of manure and as a form of saving. (This last point makes numbers more important than size). Wool production is relatively unimportant and ewes are never milked.

Sheep ownership averages about 3-5 animals per farmer. The animals graze waste land during the day and are kept at night in simple covered bamboo pens or sheds; these have slatted or woven bamboo floors raised 30-40 cm off the ground. There they are fed on cut forage and agricultural wastes; sometimes they are given rice bran and salt.

Disease does not appear to be a problem. No trouble from foot rot was reported. In West Java, fluke, tapeworm and Haemonchus are the most serious afflictions. In Central Java scab, not Haemonchus, is the chief problem. In East Java, helminths are the major parasites and Haemonchus may be a cause of mortality. Modern drugs are too expensive for the ordinary farmer to use in the control or treatment of parasites and diseases but traditional methods may be used, e.g. against fluke. No doubt the slatted floors are an advantage and may account for the absence of foot rot. Rotational grazing would be desirable but is difficult to implement because of the restricted grazing area available.

Breeds. There appear to be three native sheep breeds in Java: the local Javanese thin-tailed; the Priangan of West Java; the fat-tailed sheep of East Java.

Javanese Thin-tailed (domba pribumi or domba asli = native sheep) (see Plates 17 and 18). This is the common sheep of West and Central Java. It is said to occur also in East Java but in fact the author saw only fat-tailed sheep there. In West Java it is estimated that 80-85 percent of the sheep belong to the local breed, the rest being Priangan. It is a small sheep with an average slaughter weight of only 19 kg according to the official figure of the Ministry of Agriculture (Buku Saku Peternakan, 1975) but a wither height of 57 cm. Adi Sudono (1965) gives weights of 20-35 kg for adult females and 35-60 kg for adult males.

It is usually white and commonly has black patches around the eyes and nose and occasionally elsewhere. The tail shows no sign of fat and does not reach the hocks. The ram carries closely curled horns and the ewe is normally polled. The ears are of medium size and are carried in a semi-pendulous position. Its fleece is of coarse wool.

This breed is not mentioned by Fischer (1955) nor by Robinson (1977) although it is the dominant breed of Indonesia. The local sheep at P4 (Pusat Penelitian dan Pengembangan Peternakan - The Australian Indonesian Centre for Animal Research and Development), Bogor, which are called "Priangan" might be more appropriately termed "Javanese Thin-tailed".

Priangan (see Plates 19 and 20). - In the Priangan residency of West Java which embraces the five districts of Bandung, Garut, Sumedang, Ciamis and Tasikmalaya, there is a breed of sheep which has been developed primarily

for ram fighting. It differs from the common thin-tailed sheep in its larger size, convex facial profile, high frequency of the earless gene, variety of colour and by the presence of a throat ruff or mane and a distinct deposit of fat at the base of the tail.

Merkens and Soemirat (1926) record all that is known of the history of the Priangan breed (which they call Preanger). It is said to be descended from Merino and Cape sheep crossed on to the local breed about the year 1864. Certainly during the 1860s there were several imports of Merinos from Australia. Cape sheep from South Africa were also present and these two breeds were crossed with each other and with the local sheep, both by Mr. Holle of Garut, by the Regent of Limbangan and by other sheep breeders around Garut. There is no description of these Cape sheep but it seems likely that they were of the fat-tailed Africander breed. They were present already in the 18th century; it is recorded in 1802 that sheep of the Cape breed were thriving in the vicinity of Batavia (Jakarta) (De Haan, 1912, p. 500). The aim was to incorporate the greater height of the Cape sheep and the wool production of the Merino. Certainly the Priangan is larger than the local sheep and the hairy throat ruff and the slight fat at the base of the tail could well have come from the Africander. There is, however, little trace of Merino characters and the wool is no finer than that of the local breed.

The colour is extremely varied. The 66 rams which the author saw at the ram fighting competition in Bandung on 14 August 1977 were roughly categorized as follows:

Black	12
Black with little white (on tail, feet, poll)	6
Black-and-white pied	26
White with little black (on face, feet, rump)	10
White	1
Grey or grey-and-white	7
Tan or tan-and-white	4

The horns of the male (females are polled) are heavy with pronounced cross ridges and sharp angles. They are usually closely coiled (as in the local sheep or the Merino) but occasionally they form a loose lateral spiral (as in the Africander). Sometimes the ram has four horns (Atmadilaga and Asikin, 1962) but the author did not see any such animals; sometimes the ewe has scurs. The tail rarely extends more than halfway to the hocks. The throat ruff is rendered more conspicuous in the fighting rams by shearing the fleece from all the body except the neck and shoulders. The facial profile is convex.

Some authorities (including Robinson, 1977) distinguish between the Priangan and the Garut, restricting the latter name for the strain used solely

for fighting. It is said to have a higher incidence of short or absent ears. This distinction appears to be artificial and unnecessary and most people used the names Priangan and Garut as synonyms.

Pure Priangans number about 250,000 but the rams are used for grading up the local sheep so it is difficult to make an absolute distinction between Priangan and Javanese Thin-tailed.

Opinions differ about the weight of the Priangan. Merkens and Soemirat (1926) gave a weight of 30-40 kg for the females and 60-80 kg for the males. For 1954 BPPP (Balai Pusat Penjelidikan Peternakan) gave an average of 38 kg for females and 58 kg for males. On the other hand Dr. Atmadilaga thinks that the average weight today is only 20-30 kg for females. Since he (Atmadilaga, 1958) described one-third of the sheep of Indonesia as Priangan (i.e. 1 million rather than 1/4 million) he perhaps uses the name to embrace the local sheep which have been partially graded to Priangan sensu stricto.

The West Java Livestock Husbandry Inspectorate has recently started a flock of 200 two-year-old Priangan ewes at Maragawati near Garut. They will be fully recorded and selected for meat characters. The aim is to produce improved stock for distribution.

Ram fighting. The Priangan sheep are bred primarily for ram fighting (Ketangkasan Seni Domba). The competitions are held regularly in Bandung and at smaller local centres. Competing rams are divided into three classes based on age and size and rams fight in pairs only within their own class. They start fighting at 2 years of age and continue for 4-5 years. Fighting rams are given a special diet which, in addition to grass and concentrates, may contain eggs, honey, liver or iron tonic, and black beer. They are given intensive training which includes exercise, practice fighting, swimming and massage. The resulting animal is large, muscular, well grown without being fat, and remarkably docile except during the actual combat.

The fight takes place on a grass surface within a circle of spectators. A band plays and the rams are encouraged by the dancing and singing of their attendants. The competitors are placed facing each other and a few metres apart in the centre of the ring. They back away from each other up to a distance of 5-10 metres and then charge each other with their heads down to collide head on. The base of the horn takes the major impact. They then back away and charge again. This may be repeated up to 50 times in the case of the largest class but up to only 25 times for the smallest class. After 10-12 encounters there is a pause during which the animals are petted and groomed. If one ram is a clear winner by knocking the other down or forcing him backwards or if one is a clear loser by walking away or losing interest, the fight is stopped. Usually the two adversaries are very closely matched and the winner is decided by a group of six judges who award points on the basis of agressiveness, style, dexterity, alertness and stamina. If there is any gambling on the result, it is not conducted openly. It appeared to the author that the smaller animals were more agressive than the larger ones. Animals are rarely hurt and no sign of blood was seen during the encounters watched by the author.

The rams are selected for size, horn size and for fighting ability. The champion rams are highly priced and may fetch up to 300,000 rupiah (US$ 1 = 415 rupiah). However, they are not used for breeding during their fighting career as it is feared that mating would deprive them of their taste for fighting.

Selection for fighting ability should also improve mutton production by producing a large muscular healthy animal. It may, however, emphasize development of the forequarters rather than of the hindquarters. Ram fighting is also described by Merkens and Soemirat (1926) and by Fischer and Atmakusuma (1959).

East Java Fat-tailed (domba ebor gomuk) (see Plates 21 and 22) - The sheep of Madura and East Java differ from those of West Java in having a fat tail and are said to be adapted to the drier climate. They are also, typically, white and hornless. They are coarse-woolled.

These sheep are said to have been brought originally from southwest Asia by Arab traders. As early as 1731 the Government decided to import Kirmani males from Persia. (Kirmani is an alternative name for the fat-tailed coarse-wooled Baluchi breed of Iran). This decision was repeated in 1754 and in 1779 importers were offered monetary inducements but there is no evidence that any action was taken (De Haan, 1912, p. 500). It may be significant that "dumba" is the Persian for "tail" and has been used to refer to the fat-tailed sheep of Iran, Afghanistan and Pakistan. The native Indonesian word for sheep is "biribiri".

In the island of Madura all sheep belong to this breed. They have spread into East Java where now most of the sheep are fat-tailed. The author saw fat-tailed sheep between Surabaya and Situbondo and in the neighbouring village of Semiring but the tails were smaller than on Madura. On Madura the tail of the first quality sheep was usually strap-shaped or carrot-shaped and hung to the hocks. A stick may be put through the tail of the ram lamb to bend it up and make it get fatter. In Semiring the tail was much smaller, not reaching to the hocks, and triangular in shape.

Even in Central Java the fat-tailed sheep is preferred because of the better taste of its meat, its superior leather and, above all, its larger size. The tail itself is a culinary delicacy. More than 50 percent of sheep in Central Java are said to be fat-tailed but around Yogyakarta the author saw only the local thin-tailed sheep except in the Kaliurang Experiment Station.

The sheep of the eastern islands - Lombok, Sumbawa, Kisar, Sawa - are also fat-tailed. In southern Sulawesi there is a breed called Donggala which Dr. Atmadilaga describes as fat-rumped. Fat-tailed sheep from Lombok have recently been imported into Irian Jaya.

The typical fat-tailed sheep is completely white and is hornless in both sexes. Occasionally rams carry scurs or small horns. As in the other breeds ears are normally of medium size and semi-lop but the earless gene is present (Fischer and Atmadilaga,1955). Fat-tailed sheep are larger than the

thin-tailed. Buku Saku Peternakan (1975) gives an average liveweight at slaughter of 24 kg compared with 19 kg for the local sheep. In fact "superquality" rams can weigh 45–50 kg and ewes 30 kg. BPPP (1954) gives weights of 43 kg for males and 40 kg for females.

There is no crossbreeding in East Java and Madura but the Government runs an improvement programme based on selection within the pure breed. Rams selected on size and conformation (the "superquality" rams mentioned above) are bought by the Government and distributed to villages. Here they are kept by one man but are run with the whole village flock of ewes. After 2–3 years the ram becomes the property of the farmer who has looked after it. Ewes are also distributed and are passed on to a different farmer after they have had 1–2 lambs.

Wool production. All Javanese sheep carry a light fleece of extremely irregular, coarse hairy wool. Previous descriptions of a hair breed appear to have arisen because of the thinness of the fleece, the frequency of shearing and the shedding of unshorn fleeces. Fleece weight averages only 200–300 g per year from ewes and about twice as much from rams (BPPP, 1955). Smith (1976) studied 20 specimens from native sheep in Central Java and 5 from Priangan in West Java. Mean values were as follows: staple length 6.8 and 4.4 cm, fibre diameter 39.6 and 35.0 μ, medullation 42.6 and 32.5 percent. The differences are not significant.

At first sight the sheep on Madura appear woolless but this is due to the fact that they are shorn every three months. They are also washed regularly (in the sea) and there may be more frequent partial shears to remove any dirty wool. Clean woolless sheep are believed to thrive better than dirty unshorn ones. The wool is thrown away. In East Java the fleece may be allowed to shed naturally. Even in West Java wool is used commercially (for carpets) only to a very small extent; it may be used as manure. Some wool is exported from East Java to Singapore.

Reproduction. Age at first mating of ewes varies from 6 to 12 months. Zulbardi (1977) quotes four experiments in which the averages were 7.2, 8.0, 8.0 and 7.9 months respectively. Lambing may occur at any time of the year. With careful management ewes can lamb every 6 months but a lambing interval of 8–9 months is more usual. Natasasmita (1978) demonstrated a service period of 56 days which represents a lambing interval of 206 days. In Madura rams may be removed from the flock after the birth of the lambs, so only one lamb crop per year is obtained. Observations on gestation length record 147.5 and 149.9 days for Priangan, 150.3 for Fat-tailed and 149.0 for their cross (Ambar Rusyad, 1977).

Fat-tailed ewes are kept for at least three years. At 4 years they may be sold for slaughter on account of barrenness – the old females are difficult to mate because of the fat tail. Hand mating with human help may be necessary.

Rams are active from 6 months to 5 years of age but they are usually slaughtered earlier on account of aggressiveness. For ethical reasons, castration is not practised.

Prolificacy. For all three breeds it is reported that the ewes normally have one or two lambs at a birth and occasionally three.

Table 21 tabulates the observations quoted in the reviews by Zulbardi (1977) and Ambar Rusyad (1977) of LPP (Lembaga Penelitian Peternakan - The Animal Husbandry Research Institute, Bogor) together with some figures obtained at IPB (Institut Pertanian Bogor - Bogor Agricultural University). It is a clear that the Priangan is well within the prolific class and the fat-tailed breed is on the border line but the local thin-tailed cannot qualify. Feeding level naturally influences litter size and there is a tendency for flocks in experimental stations to perform better than those outside. Age is also an important factor.

Table 21 Prolificacy of Javanese breeds

Breed and reference	No.	Percentage of births:				
		Single	Twin	Triplet	Quadruplet	Mean litter size
Local thin-tailed						
Ma'sum	309[a]	50.8	41.1	7.4	0.6	1.58
Koesnan (1972)	68	48.5	42.6	8.8	-	1.60
Usri (1971)	200	84.5	15.0	0.5	-	1.16
Nurmanaf (1974)	495[a]	81.5	18.5	-	-	1.19
Harahap (1973)	369[b]	95.9	4.1	-	-	1.04
Pasaribu (1973)	118[b]	61.9	37.3	0.8	-	1.39
TOTAL/Mean	1559	76.3	21.6	2.0	0.1	1.26
Priangan						
Kurnadi (1976)	22	65.0	25.0	10.0	-	1.45
Sugihen (1974)	68	16.2	75.0	8.8	-	1.93
BPPP (1955)[c]	58	31.0	37.9	24.1	6.9	2.07
Supan (1977)	51	52.9	43.1	3.9	-	1.51
IPB (1977)[c]	23	47.8	34.8	4.3	13.0	1.83
TOTAL/Mean	222	36.5	49.1	11.3	3.2	1.81
Priangan x fat-tailed						
BPPP (1955)[c]	55	47.3	40.0	10.9	1.8[d]	1.69
Fat-tailed						
Wardojo and Adinata (1956)[c]	132	50.8	43.2	5.3	0.8	1.56

Notes: a: estimated from number of farms; b: North Sumatra, all others in West Java; c: experimental flocks; all others are farmers' flocks; d: quintuplets

Table 22 shows that litter size increases up to the third parturition but little thereafter.

Table 22 Litter size according to age

Local			Parturition No.	Priangan		Fat-tailed	
Age (years)	No.	Litter size		No.	Litter size	No.	Litter size
1	1	1.00	1	17	1.88	49	1.40
2	81	1.07	2	7	1.86	46	1.65
3	63	1.20	3	10	2.40	26	1.61
4	34	1.24	4	10	2.30	8	1.75
5+	21	1.29	5	2	2.50	3	1.67
Source: Usri (1971)				BPPP (1955)		Wardojo and Adinata (1956)	

The prolificacy may not look spectacular compared with the Finnish Landrace or the Chios breed but with a lambing interval of 8 months, the lambing rate per annum should average 2.72 for the Priangan and 2.34 for the fat-tailed, which amply bears out the estimate of 200-220 lambs per 100 ewes per year given by Groenewold (1971).

Imported breeds and crossbreeding. During the Dutch administration there were many attempts to import Merinos into Java and Sumatra starting with the importation of 1864. Merkens and Soemirat (1926) mention imports of Australian Merinos in 1897, 1903 and 1906 and of Romney Marsh in 1912 and 1914. These imported animals could only be maintained by taking them to the mountains and even then the death rate was high. But there must have been earlier imports of wool sheep; in 1778 a prize was offered "to anyone who could explain why sheep in Java degenerated so quickly, why their fleeces became hairy and how this could be prevented". As already mentioned there is now no trace of Merino influence in the Javanese sheep presumably because of the high death rate and the natural selection for a hairy fleece which is more adapted to the hot wet climate.

Later the Texel breed was imported by the Dutch and was found satisfactory for crossing both in Bogor and in Bandung. Birth weights and weights at 4 and 6 months were increased by crossing on to Priangan at IPB. There is no information about the effects on fertility, resistance to parasites or mortality.

The present policy in West and Central Java is to try out the Suffolk, Dormer (Dorset x Merino) and Suffmer (Suffolk x Merino) imported from Australia. Rams of these breeds are being used on Priangan and fat-tailed ewes at several experimental and private farms. It was difficult to obtain exact figures, and the numbers involved are still comparatively small, but the author's impressions are as follows. The imported breeds appear to thrive and reproduce

satisfactorily if maintained at an altitude of at least 800 m, and if well fed, clipped frequently and dosed regularly against helminths. However, even at Kaliurang (800 m) the respiration rate of Dormers was 100–150 per minute compared with 40–50 for the local sheep.

Under less favourable conditions there is a high mortality among lambs. Local ewes tend to suffer from dystocia when mated to a Suffolk ram. The F_1 animals appear to perform satisfactorily if carefully managed.

A comprehensive crossing trial is being undertaken by Gajah Mada University at Yogyakarta. The crossbreeding will take place at three locations. Brebes on the north coast (hot), Kaliurang at 800 m (cool and misty), and Baturadea (cool and clear, good nutrition). There will be three groups: Dormer x fat-tailed, F_1 x fat-tailed, fat-tailed x fat-tailed. There will be 20 ewes per group in each of the three locations. The sheep will be kept in sheds (with slatted floors) with some grazing time (chiefly for exercise) each day. Mating will be year-round. This trial was due to start in September 1977.

Conclusions. The sheep of Java form an invaluable genetic resource; they should be treasured for their adaptation to an environment traditionally considered difficult for sheep and for their high rate of reproduction. They are an extremely important source of meat in a primarily agricultural area and make no demands in the way of imported feedstuffs or the production of forage crops. Any improvement which is attempted should bear in mind these special advantages.

The Priangan and the East Java Fat-tailed are larger and more prolific than the local thin-tailed. Improvement programme should therefore concentrate on these two breeds which should then continue to be used, as at present, to grade the smaller and commoner breed. Two of the Government activities for genetic improvement of these two breeds are particularly relevant. The selection within the Government flock of Priangan sheep at Garut and the selection programme among the farmers' stock of the fat-tailed sheep in East Java are both excellent initiatives which hopefully will be expanded and intensified. They should produce more productive sheep which still maintain their adaptation and their fertility and therefore can be used on ordinary farms where conditions do not permit a high level of feeding, expensive disease control programmes or other aspects of sophisticated management.

Crossbreeding with temperate breeds may be useful for some farms in favourable situations but this should be restricted to those who can afford the improved management necessary to maintain a more sensitive breed. Before such crossbreeding is generally expanded controlled experiments should be undertaken to compare the purebred locals and the crosses under different environmental conditions to find out what level of foreign blood is desirable in a given environment. The crossbreeding experiment at Gajah Mada University is an excellent example of the type of investigation which is needed.

Such crossbreeding will improve size and growth rate but if it does so at the expense of fertility and lamb viability the overall improvement in production in terms of weight of lamb per ewe per year may be negligible.

This must be carefully watched in all comparisons of purebreds and crossbreds.

The crossbreeding with medium or fine-wool breeds will not improve the wool for the one local outlet - carpet making. For this purpose crossbreeding with a carpet wool breed might be considered - and preferably a carpet wool breed from a hot area such as the Awassi from the Near East or the White Karaman from Turkey. This suggestion is made with some misgiving. Past experience makes it clear that heavily wooled breeds do not thrive in Indonesia. Furthermore, their fat tail may be undesirable except in East Java but their wool does not seem to be desired. Therefore, if any import is made, a hairy tropical breed would be more appropriate. An interesting idea would be to use the Barbados Blackbelly which combines tropical adaptation, absence of wool and high prolificacy.

If carpet wool production was increased by crossbreeding, a better marketing system would have to be devised which gave the farmer incentives in the form of a higher price for his wool and a more efficient system for collecting it. The carpet factories might consider the manufacture of woven carpets (kilims) in addition to the more expensive tufted types, and the development of an export market.

References

Adi Sudono, 1965. Ilmu Ternak Umum [General Animal Science]. Diktat Fakultas Peternakan IPB (not published) (cited by Zulbardi, 1977, and Ambar Rusyad, 1977).

Ambar Rusyad, 1977. Sheep breeds of Indonesia. Report for FAO/UNEP Project "Conservation of Animal Genetic Resources". 10 pp. TS.

Atmadilaga, D., 1958. Study on the milk yield of Indonesian sheep with special reference to the Priangan breed. Hemera Zoa, 65: 3-14.

Atmadilaga, D. and Asikin, 1962. Some observations on the polyceraty in the Priangan sheep. Com. Vet., 6 (2): 63-68.

BPPP, 1954, 1955. Laporan tahunan, Balai Pusat Penjelidikan Peternakan [Annual Report, Centre for Animal Husbandry Research]. Bogor (cited by Ambar Rusyad, 1977).

Buku Saku Peternakan, 1975. Direktorat Penyuluhan Peternakan, Jakarta.

De Haan, F., 1912. Priangan. De Preanger-Regentschappen onder het Nederlandsch Bestuur tot 1911. Vol IV. 1,040 pp. Bataviaasch Genootschap van Kunsten en Wetenschapen, Batavia.

Fischer, H., 1955. Schaflhaltung und Wollverwertung auf der Insel Java. Tierzüchter, 7: 311-313.

Fischer, H. and Atmadilaga, D., 1955. Untersuchungen über die Ohrform bei Fettschwanzschafen in Indonesien. Berliner und Münschener tierärztliche Wochenschrift, 68: 115-117.

Fischer, H. and Atmakusuma, A., 1959. Schafbockkampf, ein Volkssport in West-Java. Tierärztliche Umschau, 14: 40-42.

Groenewold, H., 1971. Review of livestock development possibilities, Indonesia. (Unpublished report, FAO, Rome).

Harahap, M.H., 1973. Keadaan peternakan domba di Kecamatan Padang Bolak Tapanuli Selatan. [Sheep husbandry situation in Padang Bolak district of South Tapanuli]. Special report, Animal Husbandry Faculty, IPB, Bogor. (Cited by Ambar Rusyad, 1977 and Zulbardi, 1977).

Kurnadi, T., 1976. Manajemen ternak domba di P.T. Cita Mukti. [Sheep management in P.T. Cita Mukti]. Special report, Animal Husbandry Faculty IPB, Bogor. (Cited by Zulbardi, 1977).

Koesnan, H., 1972. Tinjauan terhadap beberapa faktor tatalaksana dan pertumbuhan anak domba pada peternakan rakyat. [Evaluation of several factors in the management and growth of backyard lambs]. Special report, Animal Husbandry Faculty, IPB, Bogor. (Cited by Ambar Rusyad, 1977, and Zulbardi, 1977).

Mason, I.L., 1978. Sheep in Java. World Animal Review No. 27: 17-22.

Ma'sum, K., 1973. Prestasi reproduksi ternak domba rakyat di Kecamatan Pacet, Ciomas dan Depok. [Study on the **reproduction** of backyard sheep in Pacet, Ciomas and Depok districts]. Special report, Animal Husbandry Faculty, IPB, Bogor. (Cited by Zulbardi, 1977, and Ambar Rusyad, 1977).

Merkens, J. and Soemirat, R., 1926. Bijdrage tot de kennis van de schapenfokkerij in Nederlandsch-Indië. Nederlandsch-Indische Bladen voor Diergeneeskunde, 38: 395-414.

Natasasmita, Asikin, 1968. Reproductive activity of Priangan ewes. Research Journal B-series, (1): 15-19.

Nurmanaf, A.R., 1974. Produksi anak (lamb crop) pada peternakan domba rakyat di Kecamatan Kalipati Kabupaten Subang, Jawa Barat. [Lamb crop of backyard sheep in Kalipati district, Subang, West Java]. Special report, Animal Husbandry Faculty, IBP, Bogor. (Cited by Zulbardi, 1977, and Ambar Rusyad, 1977).

Pasaribu, R., 1973. Keadaan peternakan kambing dan domba rakyat di Kecamatan Bosar Maligis, Simalungun dan kemungkinan pengembangannya. [Situation of sheep and goat husbandry at Bosar Maligis, Simalungun, and possibilities for development]. Special report, Animal Husbandry Faculty, IPB, Bogor. (Cited by Ambar Rusyad, 1977, and Zulbardi, 1977).

Robinson, D.W., 1977. Livestock in Indonesia. Peternakan di Indonesia. Centre for Animal Research and Development, Bogor, Indonesia, Research Report No. 1, P4, Ciawi, Bogor. Laporan Penelitian No. 1.

Smith, I.D., 1976. Sheep in south-east Asia. In "Sheep breeding. Proceedings of the 1976 International Congress, Muresk and Perth, Western Australia (ed. G.J. Tomes, D.E. Robertson and R.J. Lightfoot)" pp. 46-51. Perth: Western Australian **Institute of Technology.**

Sugihen, B.G., 1974. Efisiensi ekonomi faktor-faktor produksi pada usahaternak domba rakyat didesa Tenjonagara Kabupaten Garut. [Economic and efficiency factors in the production of backyard sheep in Tenjonagara district, Garut]. Thesis, Animal Husbandry Faculty, IPB, Bogor. (Cited by Zulbardi, 1977, and Ambar Rusyad, 1977).

Supan, 1977. Personal communication at IPB.

Usri, 1971. Korelasi antara induk dengan prolificacy pada domba lokal Kecamatan Cijulang, Kabupaten Ciamis. [Correlation between age and prolificacy of local sheep in Cijulang district, Ciamis]. Special report, Animal Husbandry Faculty, IPB, Bogor. (Cited by Zulbardi, 1977, and Ambar Rusyad, 1977).

Wardojo, M. and Adinata, M.M., 1956. Angka kelahiran dan lamanja masa perkandungan pada biri-biri ekor gemuk. [Birth rate and gestation period in fat-tailed sheep]. Hemera Zoa, 63: 441-445.

Zulbardi, M., 1977. Ternak domba di Indonesia. Sheep in Indonesia. Report for FAO/UNEP "Conservation of Animal Genetic Resources". TS 13 pp.

3.2 SHEEP IN PAPUA NEW GUINEA

Sheep from Java and Australia were imported into Papua New Guinea during the German administration but only those from Java thrived. In the 1930s Romney Marsh and other sheep were imported from Australia and crossed with the earlier imports. The present population of about 1,100 sheep descend from these crossbreds. Holmes and Leche (1977) examined three flocks; two were in the lowlands and one in the highlands.

"Four main types are described:

(i) 'White Wool': Largest, bare-headed, with poor quality wool, very open and with little crimp. They may include Romney Marsh or Border Leicester in their ancestry. Rams often have large, white horns.

(ii) 'Black Wool': Bare-headed sheep, black fleece, often a white blaze; little crimp. Ancestry is not obvious. Rams are polled or have small, black horns.

(iii) 'White Hair': Fleece contains 25-100% white hair; the rest is short wool with no crimp. Some of these animals are bare bellied at 1 year, then the brisket, neck, sides, rump, withers and back shed their fleece in that order, leaving short hair (1-2 cm) at about 3-4 years. Rams are goat-like, with large white horns, and a tuft of straight hair on the throat. Some sheep have large fat deposits at the tail base, although the tail is not fat.

(iv) 'Coloured Hair': Most goat-like, small, with long fine legs, long neck, light head and drooping ears. The coat is hair, often patches being shed to give a decrepit appearance. The colour is characteristic, black muzzle, ears, eyebrows, and lower legs, with the rest almost any colour from white to black, but usually light brown. Rams have large, black curved horns. Intermediate types are plentiful.

Of the 65 ewes in the lowland flocks, observed over 12 months, 19 did not lamb. In those that did lamb litter size was 1.4 lambs per ewe. Perinatal mortality was 5 percent for single lambs, 20 percent for twins and 61 percent for triplets. Later mortality was lower: 5 percent per annum in the lowlands and 4 percent in the highlands. (In contrast 32 Romney Marsh ewes with five rams on adjacent land in the lowlands did not produce a single lamb during two years.) A large flock of local sheep has been assembled at the Erap Research Centre of the Department of Primary Industries. So far age of first lambing has averaged 17 months and lambing interval about 8 months (Holmes and Leche, 1977).

Although these results refer only to small numbers they are quoted here because they show in general the importance of using an adapted breed in the humid tropics and, in particular, the utility of the Javanese breeds in this environment.

Reference

Holmes, J.H.G. and Leche, T.F., 1977. South East Asian sheep in Papua New Guinea. Proceedings of the Third International Congress of the Society for the Advancement of Breeding Researches in Asia and Oceania (SABRAO), Canberra, Australia, February 1977, 1 (c) 46-50.

3.3 SHEEP OF THE MALAY PENINSULA

Description. Smith and Clarke (1972) described the sheep of the Malay Peninsula south of the isthmus of Kra. Devendra (1975) described the sheep of West Malaysia. The sheep of southern Thailand (provinces of Narathiwat, Pattani and Yala) are similar to those of West Malaysia. In the latter country 45 percent of the sheep are in the province of Kelantan (and 25 percent in Negeri Sembilan) so that the breed is often called Kelantan.

These sheep are small. Adult rams weigh 25-30 kg and ewes 20-25 kg. Withers height of 39 rams averaged 47 cm (Devendra, 1975). Males have spiral horns about 11 cm long; ewes are usually polled but may carry scurs. Facial profile is straight. Ears are small and horizontal to semi-pendulous; 25 to 30 percent of animals have vestigial ears. The tail is short (average 8 cm) and thin. The fleece is of coarse carpet-wool type with a staple length of 5-10 cm. Head, underside of neck, brisket, belly and legs are bare. Fleece weight is 0.8-1.4 kg (Devendra, 1975). The majority of the sheep are white. Others are black, light brown or pied. Patterns include badger-face and reverse badger-face.

Reproduction. Ewes exhibit oestrus throughout the year. Smith and Clarke (1972) state that ewes produce their first lamb at 12-18 months of age and that twinning is common. However Fischer (1968) reported differently on a flock of sheep maintained by the Division of Veterinary Services in Mahang, Kelantan. Of 452 lambs born, 11 percent were twins. This represents a twinning rate of only 6 percent. Age at first lambing was 22-30 months and lambing interval 248 days. Devendra (1975) quotes two private flocks in Selangor where single lambs were the rule. In one the average lambing rate (including barrenness) was 106 percent.

Meat and wool production. In the flock studied by Fischer (1963) birth weight of single lambs averaged 1.8 kg and by 12 months they had reached 12 kg. This represents a daily liveweight gain of 28 g. Devendra (1975) quotes daily gains of 49-73 g. from other flocks.

Smith and Clarke (1972) studied skin samples from 53 adult sheep in West Malaysia. Mean secondary to primary follicle ratio was 1.07, follicle density 6.3 follicles/mm^2 medullation 42%, shed follicles (indicating kemp) 0.7%. Diameter of primary follicle fibres averaged 71.5 μm and of secondaries 27.5 μm. These values are close to those for the Bellary breed of Andhra Pradesh, India, and are suitable for a good carpet wool. Four wool samples studied by Smith (1976) had an average staple length of 4.5 cm, fibre diameter 47.3 μm and medullation 37.5 percent.

Management. In Malaysia sheep are kept for subsistence by peasant farmers in flocks of 3-10 animals. The two large private flocks in Selangor farm which Devendra (1975) quotes are almost unique. Sheep are grazed by the wayside and on fallow land. Kitchen waste may be fed but no concentrates. At night sheep are housed in simple sheds with slatted floors.

Attempts have been made to graze sheep in rubber plantations and these were apparently quite successful.

Improvement. In one of the large flocks in Selangor adult body weight has increased by 4-5 kg in 20 years. Carpet wool quality has also increased. This is attributed to selection (Devendra, 1975). Crossing with Dorset Horn increased lambing rate (to 151 percent) and birth weight (to 2.1-2.3 kg). However, because of the poor heat tolerance and poor adaptation of the Dorset, the project proved unsuccessful (Devendra, 1975).

Conclusion. It is not suggested that the sheep of Malaysia and Thailand can claim in any sense to be prolific. They are described here as a contrast to the Javanese sheep to emphasize that unselected sheep in a similar environment and a neighbouring area can be quite different in their reproductive ability. Furthermore, since it seems highly likely that sheep originally entered Java from the Malay Peninsula it would also appear likely that the high prolificacy of the sheep of Java was obtained by selection within that island.

References

Devendra, C., 1975. Indigenous sheep of Malaysia. Malaysian Agricultural Journal, 50 (1): 48-66.

Fischer, H., 1963. Sheep. In "Hints on Animal Husbandry" No. 19. Division of Veterinary Services, Malaysia. 3 pp, mimeo. (Cited by Devendra, 1975).

Smith, I.D., 1976. Sheep in south-east Asia. In "Sheep breeding. Proceedings of the 1976 International Congress, Muresk and Perth, Western Australia (ed. G.J. Tomes, D.E. Robertson and R.J. Lightfoot)" pp. 46-51. Perth: Western Australian Institute of Technology.

Smith, I.D. and Clarke, W.H., 1972. Observations on the short-tailed sheep of the Malay Peninsula with special reference to their wool follicle characteristics. Australian Journal of Experimental Agriculture and Animal Husbandry, 12: 479-484.

3.4 WERA BREED OF BANGLADESH

The sheep of Bangladesh have been described as follows:

"Sheep are relatively few in number and are kept mainly in the deeply flooded low lying areas of the south where their resistance to wet conditions gives them some advantage over goats.

"The indigenous sheep belong to the so-called Wera breed. They are hairwool sheep with an even subcutaneous fat distribution. They are reported to have similar fertility levels to the Black Bengal goats, but are smaller animals attaining a maximum weight of about 10 kg in ewes and 15 kg in rams. The yield of coarse wool is about 1 lb per animal per year but they are rarely shorn, wool being harvested only at slaughter." (FAO, 1971)

In the same report the fertility of the Black Bengal goat is described:

"The main kidding season is between November and January, when 90 percent of mature she-goats give birth to twins. The second kidding season is between May and July, when about 65 percent of the mature females give birth to one or two kids. The annual kidding rate is about 280 kids from 100 mature females."

However, according to the Head of the Department of Animal Breeding and Genetics, Bangladesh Agricultural University, Mymensingh (personal communication, 1979), there is no distinct breed of sheep in Bangladesh. The local animals vary in appearance, size, conformation and performance. The University has collected a flock of sheep from different parts of the country. The mean performance of 36 animals was as follows: age at first lambing: 433 days; lambing interval: 10 months; twins: 41%; adult weight: males: 18.5 kg; females: 16.8 kg; fleece weight: 160 g; staple length: 5.1 cm; fibre diameter: 48.4µm ; wool fibres: 19.4%; heterotype fibres: 10.8%; medullated fibres: 69.8%; body height: 48.3 cm.

The University is currently undertaking an experimental crossbreeding programme using the following breeds from New Zealand: Romney Marsh, Perendale, Dorset Down, Polled Dorset and Suffolk.

In view of the experience with temperate wooled sheep in other parts of the humid tropics (e.g. Indonesia, Sri Lanka) it might be expected that a wiser policy would be to explore more fully the potential of the local sheep and the possibility of their improvement by selection. There are over half a million sheep in the country. They must be adapted to be able to survive and with such a population there is plenty of room for variation.

Reference

FAO, 1971. Report of the East Pakistan livestock mission. Volume I. Sector review. FAO/IBRD Cooperative Programme. Report No. 10/71/PAK 4.

4. PROLIFIC BREEDS IN THE SUBTROPICS

Although this report is concerned primarily with the humid tropics the picture would not be complete without including some subtropical breeds. It could be argued, for instance, that prolific breeds from these areas will be more adapted to high temperature than breeds from northern Europe.

The climates in which these breeds live are as follows: D'man (Morocco) and Omani - subtropical steppe (BS of Köppen), Hu-yang of China and Svanka of Georgia - humid subtropical (Ca), Greece - Mediterranean or dry summer subtropical (Cs).

4.1 D'MAN BREED OF MOROCCO

Distribution and management. The D'man is a very special local breed confined to the subsaharan oases ("palmeraies") in the southeast of Morocco between the high Atlas and the Sahara. Its origin was in the Tafilalet (in the Ziz valley) and it has spread to the Dadés valley and to the Dra valley because of the traditional exchange of animals between the Draoui and the Filali tribes. Thus its present distribution area extends from Rissani to Zagora (see Figure 2). It is also found in oases in some parts of the Algerian Sahara, namely Touat, Tidikelt and Gourara which have close historic links with the Tafilalet. Indeed in Algeria the breed is called "race du Tafilalet" (Bouix and Kadiri, 1975). These areas are a long way from the Moroccan border. Yousef (1977) says that in Algeria the D'man breed is in fact commonest around Béchar (and especially the neighbouring town of Dibdaba) which is only about 170 km east of Rissani. The Algerian authorities have formed an experimental flock at Abadla 100 km south of Béchar.

There are about 400,000 D'man sheep in Morocco out of a total population of about 14 million (Marie et al., 1976).

The sheep are kept in small groups of 1-3 ewes per family and, since the whole of the oases is cultivated in gardens (averaging 1 ha in area), they remain permanently housed either in the farmer's house or in small sheds or pens in the vicinity. They are fed on lucerne, reject dates, date stones, kitchen waste, forage maize and straw. They are also grazed on cereal stubble, weed regrowth, and vegetation on sides of fields, paths and irrigation canals. Their dung is an important fertilizer for the date palms.

Export from Morocco is forbidden.

Description (Plates 23-25) - The animals are small, ewes weighing 30-40 kg and rams 50-60 kg (Bouix and Kadiri, 1975). However in the stations of Tabouassamt and Achouria corresponding weights are 40-50 kg and 65-85 kg indicating chronic underfeeding in farmers' flocks (Bouix et al., 1977).

The D'man breed is rangy and fine-boned. The head is narrow with a profile slightly convex in the female and markedly so in the male. Both sexes lack horns but males may carry scurs. Ears are long and pendant. The neck is long and narrow and often has tassels in the female, more rarely in the male. The

FIGURE 2. THE AREA OF THE D'MAN SHEEP IN MOROCCO.

chest is narrow and shallow and the withers are prominent. The abdomen is large. The tail is attached low; its length is variable, about to the hocks. Stance is often bad and hooves are small (Bouix and Kadiri, 1975).

The fleece is not extensive and weighs less than 1 kg; it does not cover belly and legs and sometimes it is absent or covers only the back. The staple is open and short and wool is hairy or very hairy. The male often has long hair on the neck and along the spine (Marie et al., 1976). Colour and pattern are of all imaginable varieties. Animals may be entirely black or brown or white or a mixture of two or of all three of these colours. Pigmented head may be combined with white fleece but not vice versa. Black animals have a white tail tip. In brown animals the head and extremities are brown and the fleece is tinged with brown (Bouix and Kadiri, 1975).

Reproduction. Owners claim that ewes first lamb at the age of one year and the interval between lambings is 6 months and 10 days. Lambing occurs throughout the year. Average litter size is two with a range of one to six (Bouix and Kadiri, 1975). Table 23 shows some figures obtained in stations. These tend to confirm the farmers' figures. In addition to the figures in Table 23 Harrouni (1976-77) made the following observations: Gestation period 149.5 days (range 139-162); days from parturition to first oestrus 49 (10-80); age at puberty 150 days (youngest 132); weight at puberty 19.3 kg (52% of adult weight); duration of oestrus 30 hours (adults), 24 hours (yearlings); length of oestrous cycle 4-58 days with peaks at 16-17 and 34-36 days.

Body weights and growth rate. Average birth weight was 2.3 kg in the data of Bouix and Kadiri (1975). Males were 15-20 percent heavier than females and lambs out of adult ewes 10 percent heavier than those from yearlings. Weight was reduced by 15-20 percent for each additional lamb in the litter. Thus twin males out of adult ewes weighed 2.8 kg but triplet females only 2.0 kg. Average weight at 10 days was 3.8 kg with the same variation, at 30 days it was 6.8 kg, at 90 days (weaning) 17.1 kg and at 6 months 33.5 kg. Average daily gain was 150 g between 10 and 30 days, 172 g between 30 and 90 days and 157 g between 90 days and 6 months. It should be noted that no artificial rearing of lambs was practised. Weight and growth rates are tabulated according to age of dam and sex and type of birth of lamb. The difference between male and female lambs increased with age but that between singles and multiples decreased.

Marie et al. (1976) report that milk yield is 90-140 litres per lactation, sufficient for 2-3 lambs.

Bouix et al. (1977) tabulate the ranges for weights and growth rates over several lamb crops (spring and autumn, two stations, several years).

Table 23 Reproductive performance of D'man sheep in three stations

	Tabouassamt 1974		Tabouassamt and Achouria (a)		Skoura 1973–76	
Age at first lambing						
No. of ewes	48		200		105	
Mean	420 days		12–14 months = 365–427 days		530 days	
Range	240–524 days				317–730 days(b)	
Lambing interval						
No. of intervals	41				162	
Mean (days)	192		185 – 195		202	
Range (days)	175 – 224				163 – 230	
Lambing rate	Adults	Yearlings				
No. of ewes	56	52			(482 lambings)	
% lambing	93	94	87 – 93			
			Adults	Yearlings	Adults	Yearlings
Litter size	2.67	1.90	1.98–2.67	1.67–2.00	1.83	1.59
% single births	10	39				
% twin births	38	39				
% triplet births	33	16				
% quadruplet births	15	6				
% quintuplet births	2	–				
% sextuplet births	2	–				
Lamb mortality (to weaning) %	20.1	10.8				
Litter size at weaning (90 days)	2.13	1.69	1.49–2.17	1.23–1.79		
Source	Bouix and Kadiri, 1975		Bouix et al., 1977		Harrouni, 1976/77	

a) The range is between the mean for different lambing crops – autumn and spring, two stations, different years.

b) Ewes not mated till 11–13 months of age or 30 kg in weight.

Improvement and research. Several stations have recently been established to conserve, study and improve the D'man breed. In December 1971 a flock was assembled on the Domaine Royale de Tabouassamt at Rissani by the Direction des Domaines Royales in cooperation with the Direction de la Recherche Agronomique. In April 1972 the Office Régional de Mise en Valeur Agricole de Ouarzazate created the Station d'Amélioration Ovine de Skoura and in April 1973 the Institut National de la Recherche Agronomique created the Station Expérimentale de Achouria at Jorf. Data from the flocks at these stations have already been quoted.

In addition various flocks have been assembled outside the habitat of the breed e.g. Casablanca, Marrakech and Meknés. The Institut Agronomique et Vétérinaire Hassan II, has an experimental flock at its station at Moghrane north of Rabat. In ongoing research on this flock Mr. Lahlou-Kassi and his colleagues in the Department of Reproduction of the Institute are studying aspects of female and male reproduction. They have already confirmed the early age at first oestrus, the short lactation anoestrus and the high ovulation rate (2.3 for yearlings and 2.8 for older animals). In the male they have demonstrated large testis size and high libido.

Bouix and Kadiri (1975) attribute the small size of the D'man to **inbreeding.** However, the high fertility rate does not suggest **inbreeding.** Furthermore they also attribute the variability in colour and fleece type to crossing with other Moroccan breeds. Again the consistenty high prolificacy does not accord with this hypothesis. It seems more likely that the small size is due to a low level of nutrition (the difference between the weight of ewes in local flocks and in experiment stations has already been remarked on) and the variation in colour and fleece to the absence of selection for these characters.

The range in colour is exactly that which the author observed in Cameroon (see Section 2.9). The hairy nature of the fleece is also reminiscent of West Africa. In fact the **D'man sheep** are very similar in appearance to the Fouta Djallon sheep. It is difficult to restrain the suggestion that perhaps the D'man sheep in southern Morocco and Algeria represent relicts of the sheep type existing before the arrival of the wool sheep typical of the rest of the two countries. They would thus be related to the hair sheep of West Africa which also represent the original type of domestic sheep migrating there before the evolution of wool sheep.

Conclusion. The D'man breed is of the greatest interest. It lives in small flocks in a difficult environment. Its isolation protects it from crossbreeding but it would be very sensitive to changes in economic and social conditions or to natural disasters. It is therefore very satisfactory to know that there are now several station flocks for its conservation and study. It is to be hoped that these flocks can be increased in number and size and that eventually export will be permitted so that other countries with similar conditions can benefit from this unique breed.

References

Bouix, J. and Kadiri, M., 1975. Un des éléments majeurs de la mise en valeur des palmeraies: la race ovine D'man. Options Méditerranéennes, No. 26: 87-94.

Bouix J., Kadiri, M., Chari, A., Ghanime, R. and Rami, A., 1977. Fiche signalétique de la race D'man. Homme, Terre et Eaux: Revue Morocaine des Sciences Agronomique et Vétérinaire, 6 (25) : 9-11.

Harrouni, M.M., 1976/77. Etude de quelques paramètres de reproduction chez la brebis de race D'man dans son berceau. Thèse pour le doctorat vétérinaire, Institut Agronomique et Vétérinaire Hassan II, Rabat, Morocco. 121 pp., mimeo.

Marie, M., Lahlou-Kassi, A. and Otte, P., 1976. Le mouton du sud-marocain - D'man. Film super 8 sonore durée 30 minutes. Département de Reproduction, Obstétrique, Insémination Artificielle, Institut Agronomique et Vétérinaire Hassan II, Rabat, Morocco.

Yousef, Ali, 1979. Personal communication.

4.2 OMANI SHEEP

In 1976 Dr. C.W. Fox and Mr. Khamfer (then Director of Animal Production) told the author that the sheep of Oman were thin-tailed - which marks them off from all the other sheep of the Arabian peninsula - and that triplets were common. Dr. Abdul Hamid Osman (then with ACSAD, Damascus) also reported in 1977 that the sheep of Oman were thin-tailed and prolific. It was therefore decided to visit this country (north only) and include its sheep in the project report.

Livestoc numbers. The lack of information on livestock in the country is demonstrated by the disparate estimates of numbers made by various authorities as follows:

	FAO Production Yearbook 1977	Oman Statistical Yearbook 1976	Bakkar (1978)[1/]
Goats	197,000	164,600	430,000
Sheep	77,000	57,000	50,000
Cattle	77,000	133,800	220,000
Camels	6,000	13,500	25,000

There is certainly a preponderance of goats over sheep in northern Oman; the author estimates it to be nearer the 8 to 1 of Bakkar's estimate than the 2 or 3 to 1 of the first two estimates. Few camels were seen and no cattle outside research and development centres.

Sheep type (Plate 26) - The same type of sheep was seen in all places visited. They vary in colour, being black, white, brown, pied, white with black face or black with white spot on tail and head. In some areas the black predominates but in most flocks no one colour or pattern was dominant. Tails are thin and hang to the hocks. There is usually a basal portion which is bare on the inner side and which may have some accumulation of fat in well fed animals. This and the long fleece gives the tail a bushy appearance. Sometimes the tail is shorter and consists only of the fleshy basal portion. The fleece is long and very coarse; it is variable in amount of hair and in extent. Animals have bare face and lower legs; the lighter fleeced ones also have bare bellies.

Ears are medium-sized and semi-lop. Sometimes they are rudimentary. Ewes are always hornless and males may or may not have short coiled horns. The animals are small and have a straight facial profile.

Sheep performance. It was extremely difficult to obtain figures about the performance of this breed. They are medium to small in size. Bakkar (1978)[1/] gives a body weight of 25-35 kg in Batinah and Oman Dakhel. He mentioned a larger type of 40-50 kg in Ibri of Dhahireh region. Graham Bell at the Khabura

---

1/ Bakkar, N. 1978. Final report of animal production expert FAO Project OMA 77/001.

project told the author that ewes weighed 20-25 kg under farm conditions; the maximum was 35 kg under good conditions but stunted animals of 17-18 kg were common. His lambs averaged 2.4 kg at birth, 8.8 kg at 30 days and 13.4 kg at 60 days. They put on fat easily enough but are poorly muscled.

Sheep are not milked and the wool does not seem to be exploited.

As for reproduction there is a tradition that the Omani sheep are highly prolific but since no records are available from the two government flocks in Rumais and in Wadi Quryat it is difficult to confirm this. Bakkar (1978)[1/] in his final report writes "Sheep in Oman are characterised by high prolificacy; most of the ewes are producing twins and triplets and very few are giving birth to one lamb at a time". Dr. Khamfer also believes in this high prolificacy. On the other hand Dr. Saad (Veterinary Officer, Nizwa) estimates that at Wadi Quryat only about 5 percent of ewes produce twins. At Rumais and in the Batinah generally Dr. Fikri (Veterinary Officer, Seeb) estimates only 2 percent. The only recorded figure available is from Graham Bell at Khabura. One ewe out of ten had produced twins.

Ewes are reported to become sexually mature at 9-12 months of age and they normally lamb once a year (during December - March). However they can lamb more frequently. At Khabura the interval between lambing and conception could be as low as 6-8 weeks.

Sheep diseases. The chief hazard of the sheep in the country is undernutrition. This is not a problem on the stations where the sheep are fed aritificially - they graze Rhodes grass at Khabura and are fed alfalfa at the government stations. However, copper deficiency appears to be present. The most serious disease is pneumonia and other diseases present include; myiasis, sheep pox, contagious pustular dermatitis, foot-and-mouth disease, as well as worms and ticks. These diseases are only serious in combination with malnutrition.

Sheep improvement. There are about 50 breeding ewes at Rumais, 10 at Khabura and 70 at Wadi Quryat. The plans for the first two centres are to cross the local sheep with Syrian Awassis. The rams are already available at Rumais.

There is no doubt that the F_1 will be larger and will produce more meat, wool and milk. The effect on fitness, i.e. fertility, viability and hardiness, must be investigated very carefully. It is these qualities that are the most important in the Omani sheep and they should not be lightly discarded by crossbreeding. Therefore the crossbreeding should be well controlled on an experimental scale before it is extended into the field. At the same time the performance of the purebred should be explored. This could be done at Wadi Quryat (as well as with half the flock at Rumais used as a control for the crossbreeding). If the flock could be increased to 100 or more ewes then it would be large enough to start a small selection programme. Selection should be for prolificacy. This is suggested because apparently numbers are more important to the local sheep keepers

---

1/ Bakkar, N. 1978. Final report of animal production expert FAO Project OMA 77/001.

than in size or quality. Certainly yield of wool and milk do not seem to count. If there is to be crossbreeding, consideration should be given to the idea of crossing with another subtropical prolific breed. For this the D'man breed of Morocco would be ideal since it comes from a similar climate.

Conclusions. The sheep of Oman, and to a smaller extent of the United Arab Emirates, are certainly unique in Arabia. The only other thin-tailed wooled breeds in the Near and Middle East must be sought in isolated pockets in widely separated areas e.g. the Arrit breed of Eritrea, the Dongola of north Sudan, the Kurassi of southern Egypt, the Karayaka of north Turkey and the Zel of north Iran. It is tempting to think that these represent relict populations, in areas isolated by mountains or deserts, of the wooled sheep which displaced the earlier hair sheep but were not displaced themselves by the subsequent wave of fat-tailed sheep.

This uniqueness is sufficient to justify steps for the conservation of the Omani sheep. If they also prove to be prolific the case is made even stronger but at the moment this claim is doubtful and at the best "not proven". It is to be hoped that recording will be speedily introduced at Rumais and at Wadi Quryat in order to establish their reproductive performance.

In the meantime crossbreeding should proceed with caution and more attention should be paid to selection within the environment to which these animals are so remarkably adapted.

4.3 HU-YANG BREED OF CHINA

This breed is described by Epstein (1971) and, since no further information has been obtained, his account is reprinted here.

Jeĺowicki (1962) estimated that about 1.1 percent of China's 109 million sheep belong to the Hu-yang breed.

> "The Hu-yang or Wusih, also called Lake sheep, is bred in the plain of Tai Hu, south of the lower Yangtze Kiang, in the southern part of Kiangsu province and in the adjacent northern part of Chekiang province. This region, which has a warm climate and plentiful supply of water, is intensively used for irrigated crops, mainly rice. There is no pasture land available, and the sheep are penned throughout the year in small sheds at the homesteads of the peasants of the agricultural communes. In spring and summer they are fed on vegetable offal and grass cut at the borders of the fields; in autumn and winter their feed consists of water plants, sweet potatoes, dried mulberry leaves and a little rice bran.
>
> "A small flock of these sheep was exhibited at the London Zoological Gardens in 1855 and the following years. Since they were presented by the British Vice-Consul at Shanghai and also shipped from that port, they were referred to as Shanghai sheep .....
>
> "The Hu-yang is a fat-tailed breed, believed to be descended from Mongolian sheep which became differentiated in the new environment in the course of a thousand years or more. Erkes (1954) contended, however, that sheep breeding south of the Yangtze Kiang is relatively recent.
>
> "Adult rams weigh 35-60 kg, and ewes 30-45 kg. Balezin (1959) recorded the following average measurements of adult Hu-yang rams and ewes with mean live weights of 39.8 kg and 37.7 kg respectively at Wutsin (Changchow): height at withers: rams 66.6 cm; ewes 64.4 cm .....
>
> "The Hu-yang has a long, slender head, with a convex profile and narrow semi-pendulous ears; some animals are practically devoid of external ears..... Both rams and ewes are polled. The neck, body and legs are long and rather poorly muscled. The tail is short, with a small triangular fat deposit in the upper part, which does not extend to the buttocks, and a thin terminal portion that is usually twisted; in a few animals the tail hangs straight down, but never as low as the hocks. The inner surface of the fat tail is naked, but the extent of the hairlessness varies considerably. The Hu-yang is practically always white without any pigmentation. The wool is carpet type, rather curly and mingled with hair, though of somewhat better quality than that of Mongolian sheep. The fleece is composed of 83.7% wool and 16.3% hair (Balezin, 1959). It is short in staple, because the animals are shorn twice a year. The clip is suitable as filling wools in carpet making (Burns et al., 1940). Fleece weight is approximately 1 kg per clip.

"The fecundity of the Hu-yang is exceptionally high, probably the highest of any sheep breed in the world, including the Romanov. Sexual maturity is reached early in life. The females lamb for the first time at 13-16 months of age. Oestrus is not limited to a season of the year; three lambings in two years are common and even two lambings per year occur. At the first lambing single lambs are the rule; at subsequent lambings twins are usual, triplets and quadruplets frequent, while some ewes have litters of five, or even six lambs. The lambing percentage thus exceeds 200, and the annual birth rate averages 300%. Bartlett (1857) reported: 'I find they breed twice a year, and produce four and sometimes five at a birth, the three ewes now in the Society's Gardens having this spring produced thirteen lambs'.

"At 2 or 3 days of age the lambs have valuable white pelts, light in weight and with lustrous wool curled in beautiful patterns, similar to Karakul pelts ....."

It only remains to add that the figures on prolificacy and age and frequency of lambing were confirmed to the author in 1976 when he visited Huashiu commune in Kiangyin county north of Wusih (see Plate 27).

There is another prolific breed in China, the Han-yang, found in hilly areas in Honan and parts of Shansi, Hopeh, Shantung and Kiangsu provinces. This is in the humid continental climatic zone (Da of Köppen) with warm summers and cold winters. Its litter size is only slightly less than that of the Hu-yang which it also resembles in being a fat-tailed wooled breed (Epstein, 1971).

References

Balezin, P.S., 1959. Zhivotnovodstvo Kitaya. Moscow: Sel'khozgiz. 159 pp.

Bartlett, A.D., 1857. Description of Chinese sheep sent to H.R.H. Prince Albert by Rutherford Alcock, Esq., H.M. Vice-Consul at Shanghai. Presented by H.R.H. to the Zoological Society in April 1855. Proceedings of the Zoological Society of London, 25: 104-107.

Burns, R.H., Bergen, W.von and Young, S.S., 1962. Cashmere and the undercoat of domestic and wild animals. Journal of the Textile Institute, Transactions, 53 (2) : T45-T68.

Epstein, H., 1971. Domestic Animals of China. Farnham Royal, Bucks, England: Commonwealth Agricultural Bureaux. 166 pp. + 203 plates.

Erkes, E., 1954. Das Schf in alten China. Asiatica, Leipzig, pp. 82-92.

Jeĺowicki, S., 1962. [Sheep breeding in the Chinese People's Republic] Postępy Nauk Rolniczyh, 9 (3) : 123-132. (In Polish). (Abstract in Animal Breeding Abstracts, 32: No. 2995).

4.4 SVANKA BREED OF GEORGIA, U.S.S.R.

The only available reference to this breed is in a short article by N.A. Kalinovskaya (1962) in Ovtsevodstvo, 8 (11) : 39.

A complete translation follows:

"Prolific mountain sheep - the Svanka. It is necessary to draw the attention of scientists to a breed of sheep on which one cannot find any information in the literature. I refer to the sheep of Svanetia, called Svanka. The characteristics of these animals are as follows: they are relatively small and have a flat, wide, fat tail, which narrows to an S-bend. Adults weigh 35-40 kg and one-year-old animals weigh up to 20 kg. These sheep are spread over the high and low parts of Svanetia in the Georgian SSR. The territory of Svanetia is circled with high mountains and there is only one connection through a dirt road, which connects Svanetia with Abkhasia. The paths through the Central Caucasian pass lead to the high mountain springs of the river Baksan. The local population of Baksan also has this type of sheep.

"The Svanka breed is very prolific. The ewe gives birth to 2-4 or more lambs at a time twice a year. According to our observations the weight of a newborn lamb is 1-3.5 kg, depending on the litter size. These lambs grow very quickly. I had three Svanka ewes which were mated with a Merino ram. As a rule the F_1 crossbred ewe gives birth to five lambs (sic!). The wool of the Svanka is short and coarse but the crossbred has wool of Merino type. The F_1 crossbred is heavier; it has a robust appearance and heavier fleece.

"The mass breeding of the Svanka is faced with some difficulties because ewes give birth at different times of the year and this leads to continuous production of lambs. But by controlled mating it is possible to restrict the births to six months of the year.

"The fleece of the Svanka is usually dark in colour, but there are some sheep with a pale colour. The average wool clip is 2-4.5 kg per year.

"We decided to draw the attention of sheep breeders to this interesting breed in order to stimulate a systematic study of them in Svanetia as well as in neighbouring regions."

According to Turner (1978, personal communication) the neighbouring Imeritinskaya (Imeritian or Imretty) breed also has a high litter size.

4.5 PROLIFIC BREEDS IN GREECE

The Chios breed of Greece is one of the most prolific in the world. It has an average litter size of 2.3 lambs Also it lives in a Mediterranean environment which is classified as subtropical. Therefore it merits inclusion in this report. However it has already been described in two other reports of this project namely "Declining breeds of Mediterranean sheep" by C.H. Brooke and M.L. Ryder and, under its Turkish name of Sakız, in "Sheep breeds of Afghanistan, Iran and Turkey" by B.C. Yalçın. Therefore no further description will be included here.

The same applies to some other island breeds in Greece which, while not reaching the figure for the Chios, do average 1.8 lambs per birth and therefore meet the criterion specified in the introduction. These are the Zakynthos (Plates 28 and 29), the Skopelos, and the Kymi of Euboea (Plates 30 and 31). They are all highly fertile and good milkers but numbers of each are low (a few hundred or a few thousand) and are declining. They have been described in the report by Brooke and Ryder (1978).

Recommendations for the conservation of these breeds are given in Section 5.3.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Prolific breeds in Europe

Most of the improvement work on sheep in Europe and other temperate regions of the world to which European sheep have been exported, has concentrated on meat conformation and growth or on fleece weight and wool quality. Recently it has been pointed out that this may no longer be the optimum method for increasing lifetime production. Selection of the largest individuals for breeding, without reference to type of birth, may mean selection of singles rather than twins and therefore may in the long run be counterproductive. Spedding et al. (1976) show that reproductive rate is one of the major factors influencing feed conversion efficiency in meat-producing animals. Reproductive rate can be increased in sheep by reducing the age at first lambing, reducing the proportion of barren ewes, increasing the number of lambs per birth, reducing lamb mortality and reducing the interval between successive parturitions. In regard to number of lambs per birth (litter size), Large (1966) investigated in England the relationship between the amount of food consumed by a ewe and her lambs over the entire year and the amount of carcass produced in the same period. Efficiency of food conversion was 35-50 percent higher for ewes with twins than for ewes with singles; ewes with triplets were 20 percent more efficient than those with twins. Turner (1978) has repeated this with Merinos in Australia and also found a 40 percent greater efficiency for ewes with twins.

Unfortunately the heritability of litter size, like that for other aspects of reproduction, is usually found to be low. This means that progress from selection is likely to be slow. Nevertheless if observations are restricted to adult and to fertile ewes heritabilities of litter size of up to 40 percent have been calculated and indeed considerable progress has been made in selection for this character (Turner and Young, 1969).

There is an alternative to selection, namely to cross with a known prolific breed. There are breeds in Europe which have a high prolificacy, presumably as a result of earlier selection. The "discovery" of the Finnish Landrace and its export, for the first time, to Edinburgh, Scotland, in 1962 was one of the first indications of the rising interest in high fertility (Maijala and Österberg, 1977). In the following year the similar Romanov brought from Yaroslavl, U.S.S.R., was used experimentally in France (Ricordeau et al., 1978).

On account of its high prolificacy Finnish sheep have been imported to over 30 countries all over the world, but chiefly Europe and North America, either for experimental purposes or to increase the fertility of local breeds by cross-breeding. First crosses are intermediate in litter size between Finnish and local breeds with little or no heterosis (Jakubec, 1977).

In several countries (Ireland, France, U.K., U.S.A.) new breeds are being formed or have been formed combining the prolificacy of the Finnish (or Romanov) with the desirable characters (usually meat or milk production) of the local breeds.

To a lesser extent the Finnish and Romanov breeds have been tried experimentally in some tropical and sub-tropical countries with the aim of improving litter size.

However, there are no reports of favourable results from these experiments. There is reason to believe that the lack of adaption of these north European breeds to the high temperatures, irregular feed supplies, local diseases and less satisfactory management conditions in the receiving countries, has prevented the prolific breeds from exhibiting their potential. Certainly there is plenty of evidence that rams of thin-tailed breeds are incapable of mating with fat-tailed ewes, that the libido and fertility of rams from temperate countries are adversely affected by heat and that European breeds are more sensitive to trypanosomiasis and helminthiasis than tropical breeds.

Therefore, if genetic improvement in prolificacy is desirable - and this is a point to which we must return later - it would appear more sensible either to achieve it by selection, or to import a prolific breed from an environment as similar as possible to that of the breed to be improved. The present review has shown that there are such breeds in the tropics and subtropics but, like the Finnish and the Romanov, they have been unknown or unappreciated outside their own country, and sometimes within it.

5.2 Characteristics of prolific sheep

The reproductive characteristics of the prolific tropical and subtropical breeds reviewed herein, together with those of the temperate breeds, are summarized in Table 24. It is clear that, in addition to their high litter size, these breeds are similar in having a low age at first lambing and a short interval between lambs. Even the temperate breeds can lamb every seven months although this is unusual. In addition, less complete figures show that these breeds have a high conception rate e.g. 98.5 percent for 3184 adult Finnish Landrace ewes (Maijala and Österberg, 1977). The males have a large testis size, high libido and early sexual maturity.

These similarities in reproductive performance do not reflect genetic similarity in other characteristics. The breeds listed in Table 24 are of every possible type as regards appearance and production. The two West Indian breeds are hair sheep; the others are coarse-wooled sheep. The East Javanese, Hu-yang, Svanka and Chios are fat-tailed and the rest are thin-tailed. Within these groups there are differences in the size of the fat tail and the length of the thin tail. There are also differences, both within and between breeds, in colour, size, type of fleece and presence or absence of horns.

Nor can the prolificacy be related to a similar physical environment. The breeds listed come from eight countries in three continents and the climates in which they are found range from cool temperate (Finland and Russia) through subtropical (Mediterranean and China) to humid tropical (West Indies and Java).

Furthermore each of these groups of breeds forms an island in the middle of populations either of different breeds, or breeds which are phenotypically similar but do not show the prolific characteristic. The prolific West Indian breeds are of the same general type as the hair sheep of Cuba, Mexico, Colombia and Brazil but none of these has a twinning rate of more than 30-40 percent at the most. The prolific Indonesian sheep have as neighbours the wooled sheep of Malaysia and, further away, the hair sheep of Sri Lanka and southern India.

Table 24 Reproductive performance of prolific breeds - ranges between different flocks, populations and years

Breed	Country	Age at first oestrus (months)	Age at first lambing (months)	Lambing interval (months)	Litter size	
					First lambing	Later lambings
Barbados Blackbelly	Barbados		14-22	6-9	2-2.3	
Barbados Blackbelly	Elsewhere	5-8		6.5-9	1.5-2.0	
White Virgin Island			13-14	6-8	1-2	
Priangan	Indonesia	6-12		6-9	1.4-2.1	
East Javanese Fat-tailed	Indonesia	6-12		6-9	1.6	
D'man	Morocco		12-18	6-7	1.6-2.0	1.8-2.7
Hu-yang	China		13-16	6-8	2	
Svanka	U.S.S.R.			6+	2-4	
Chios	Greece		13+	6-12		2.3
Finnish Landrace (1)	Finland	7-8		7-12	1.9	2.7
Finnish (1) Landrace	Elsewhere	5-10		7-10	1.5-2.2	2-3.2
Romanov (2)	U.S.S.R.	7-18			2.1-2.7	
Romanov (3)	France	6-8				2.6-3.3

Sources: (1) Maijala and Österberg, 1977

(2) CBABG (n.d.)

(3) Ricordeau et al., 1978

These breeds normally produce only single lambs. The D'man of Morocco is quite different in both appearance and fertility from all the other breeds of Morocco and Algeria. All the sheep of China (excluding Tibet) are coarse-wooled and fat-tailed but only the Han-yang and Hu-yang are prolific. The Svanka and Imeritian of Georgia resemble the other Caucasus breeds in fleece and tail type but differ in their high prolificacy. The Chios is quite special among the coarse-wooled fat-tailed breeds of Greece and Turkey. The other (thin-tailed) prolific Greek breeds show no similarity in fleece, tail, horns or conformation. The Finnish Landrace and Romanov belong to the North European Short-tailed group but the other breeds in this group (Iceland, Shetland, Old Norwegian, Swedish Landrace, Russian Northern Short-tailed) do not show exceptional prolificacy.

For a common thread linking the prolific breeds we must look to the way they are kept. All these breeds are kept in small flocks in agricultural areas; none is a range sheep. In Barbados flock size is 5-10 sheep; they are usually tethered. In Java each farmer owns 3-5 sheep; they graze by day and are brought back at night into pens near the houses where they are fed. In Morocco the D'man sheep are found in the pre-Saharan oases where they are kept in small groups of 1-3 ewes which are almost permanently housed; in the rest of the country sheep are herded in large flocks. The two Chinese breeds are in the agricultural areas of the east and well away from the range areas of the north and west. The Hu-yang are kept throughout the year in small sheds attached to the homesteads. In Greece the prolific breeds all originated on islands where they are kept on a family scale. Most of the Skopelos and Kymi sheep are kept in flocks of 2-6; they are grazed by day and brought home at night. Sakız sheep in Turkey are kept in groups of 2-4 animals. During most of the year they are fed in fruit and vegetable gardens; in winter they are kept and fed in simple stalls. In Finland the pasture season is only 4-5 months and for the rest of the year sheep are kept and fed indoors; 85 percent of flocks have only 1-4 adult sheep (Goot, 1973).

It would appear that keeping these sheep in close association with the household has made possible the careful observation which is needed to make selection effective, especially if it is done by eye and memory rather than on the basis of written records. The various aspects of fertility in sheep have a reputation for low heritability. However, Turner and Young (1969) have shown that if the selection is on number of lambs per ewe lambing (rather than overall lambing rate including barren ewes) and if first lambings are considered separately from later lambings, heritability can be considerably increased.

Furthermore high prolificacy seems to be one of a group of related reproductive characters which are shared by the prolific breeds, namely early sexual maturity, absence of lactation anoestrus, high libido in males, high conception rate. The common factor linking them would appear to be high level of gonadotropic hormone (or high sensitivity to the hormone). Thus selection may have been on any or all of these characters, not on litter size alone.

Using this technique the litter size of one Australian Merino flock has been increased from about 1.1 to 2.1 in about 25 years of selection (Turner, 1978).

It is therefore tentatively concluded that almost any breed of sheep could be selected for prolificacy and that the principal requirement is that the owners should conceive the idea. To carry it to a successful conclusion they must then have the will, the right management system, the time and the patience.

5.3 Conservation of prolific breeds

Owing to the small flock size and limited distribution the numbers of some of the prolific breeds described here are very low and in many cases they are declining. For the following breeds conservation programmes are urgently needed.

White Virgin Island - There are only a few thousand sheep on the U.S. Virgin Islands and not many more on the U.K. Virgin Islands. Many of these are of other breeds or are crossbreds. The breeders need government encouragement which should be conditional on the abandonment of crossbreeding and the initiation of a selection programme for prolificacy and meat production and against wool and horns which are indications of European blood. The scourge of stray dogs should be tackled systematically and above all a marketing system should be developed which will enable the local producers to compete with organized imports.

Bahama native - This interesting breed is receiving attention at the station of the Bahamas Agricultural Research, Training and Development Project on North Andros Island with gratifying results. It is to be hoped that the new project on Long Island will continue to explore its potential while at the same time implementing a programme for selection and development.

Greek breeds - There are about 10,000 sheep on the island of Zakynthos but many are crossed with East Friesian or Greek Zackels from the mainland. The total number of sheep on the island of Skopelos is 850 of which 250 are of the Skopelos breed or its crosses; possibly purebred Skopelos sheep on the island number only 100. However some large flocks have now been formed on the mainland. The Kymi breed numbers only 1,200 and is declining. It is confined to about a dozen village south of Kymi town on the island of Euboea. It is very similar to the Skopelos breed from which it may have been derived.

These Greek breeds form a unique genetic resource of thin-tailed prolific dairy sheep adapted to a Mediterranean environment. Their breeding should be subsidized, especially on the islands themselves, so that a source of purebred stock is available. At the same time for each breed a recording system should be established or supported - particularly for milk yield and prolificacy - so that there is a sound basis for continued selection. The Skopelos and Kymi breeds are so similar that they should be treated as the same breed, thus increasing the numbers available for recording and selection. They should be selected for milk yield, prolificacy and lamb survival, as well as for wool production. The Zakynthos breed should be selected for mutton production as well as for milk and lamb production. Crossbreeding on the islands should be discouraged - it may possibly increase milk yield but it will certainly reduce prolificacy and adaptability.

Experiments should be started or continued on the mainland to explore the use of these breeds in crossbreeding. All three should be useful in increasing milk yield and fertility in local mainland breeds. They might also be useful as a first cross in a stratified system of crossbreeding for meat production (like the Border Leicester in U.K.) and the Zakynthos might also be a useful terminal crossing breed.

For other prolific tropical breeds numbers remain reasonably high and comparatively stable. This refers to the Barbados Blackbelly, the Priangan and East Javanese Fat-tailed, and the D'man. For these breeds the important thing is to monitor their progress to make sure that they are not contaminated by ill-conceived crossbreeding policies introduced in the name of progress. Before any crossbreeding with temperate breeds is started in village herds it must be tested experimentally under ordinary feeding and management conditions and the results must be analysed on an economic basis so as to include reproductive rate and viability as well as growth rate.

5.4 The exploitation of prolific breeds and of other humid tropical breeds

There are four ways in which prolific breeds can be exploited:

1. They can be bred pure in the environment in which they are found.
2. The females can be used as foundation stock for crossing with males of improved meat breeds in a commercial crossing system.
3. The males can be used in crossbreeding to increase the prolificacy of breeds elsewhere.
4. They can be used to form a new breed by crossbreeding followed by selection.

5.4.1 Purebreeding

The tropical breeds reviewed herein form an important genetic resource because of their adaptation to an environment which is supposed to be unsuitable for sheep - namely the humid or subhumid tropics. This section thus has relevance not only to prolific breeds but to all the sheep in the climates designated Aw (tropical savanna), Am and Af (tropical rainforest) in Köppen's classification (Trewartha, 1957). This includes the hair sheep of tropical America, the hair sheep of West and west equatorial Africa, the hair sheep of south India and Sri Lanka, and the wool sheep of southeast Asia.

That sheep can thrive in these climates is shown by the 3 million sheep in Java. Their adaptation appears to be physiological rather tha morphological. A wooled fleece is present in southeast Asia but not elsewhere. Fat tails occur only in East Java. Although there has been little experimental work to prove it, circumstantial evidence would indicate that this adaptation involves heat tolerance, disease resistance, particularly to gastro-intestinal parasites, and tolerance of a low and irregular nutritional level. It is an adaptation which has been acquired by natural selection over a long period of time and may turn out to be the single most important economic characteristic of sheep in these environments kept under current management systems. Therefore it should not be lightly ignored. In particular it should not be jeopardized by crossing with so-called improved breeds which exhibit the more showy traits of large size, good mutton conformation or heavy fleece.

Therefore the primary breeding programme for the local breeds in these regions should be selection of the purebred for an accentuation of its characters of fitness (fertility and viability) combined with an improved meat production (chiefly growth rate). The need for such a policy has been appreciated in some countries - notably in Mexico where the Tabasco sheep are bred pure and there is not even any experimental crossing.

In other countries programmes for the study and improvement of the local breeds have barely started. They are particularly needed in Brazil, Cuba and Colombia. In each country a census is needed of the number, types and distribution of the sheep and their breeding structure. Their performance should be studied both in the field and in government stations under "reasonably acceptable" management levels, i.e. improved only to the extent that may be practicable on farms within the foreseeable future. At the same time a selection programme for fertility, viability and growth rate should be undertaken, preferably in the field, but if this is not possible, then in a series of government stations.

Lamb mortality is the major problem in all these regions. Research should be continued or initiated to discover its causes and explore simple husbandry methods to reduce it e.g. later weaning, later age at first lambing, longer lambing interval etc.

It must always be borne in mind that these tropical breeds are an important resource not only in their original habitat but also in countries with a similar climate which lack sheep or lack prolific sheep. Thus the Pelibüey from Cuba has spread most successfully in the tropical areas of Mexico. The Barbados Blackbelly has been imported into many Caribbean islands and mainland American countries. In the same way the Priangan and East Javanese Fat-tailed could be used with advantage in other countries of southeast Asia.

5.4.2 Commercial crossing

If it is desired to obtain the advantages of the improved breeds it is probably best to do so by a system of commercial crossing. In this system the local breed - again either prolific or not - is partly bred pure to supply replacements, and partly bred to rams of exotic mutton or mutton/wool breeds. Experimental work on these lines is being carried out in Barbados, and Rastogi (Section 2.1) describes a possible stratified breeding scheme using Dorset and Suffolk rams for crossbreeding.

The crossbred animals must be given special treatment and will all be slaughtered for meat. They will need a high level of feeding, good housing, and regular deworming, dipping and foot-bathing.

If conditions are favourable the F_1 ewes may be crossed again with a second mutton breed in order to produce three-quarter-bred European lambs for slaughter. It is important that the animals with the European blood should not be kept for further breeding since they lack the adaptation of the local breed.

In Jamaica (Mason, 1978) such a crossbreeding programme is being explored experimentally using several imported breeds: Suffolk, Polled Dorset, Rambouillet, Columbia, and various crossbreds involving Columbia and Finnish Landrace. The basic local breed is the St Elizabeth, a wooled Criollo type. The present scheme is to mate the St Elizabeth sheep to Rambouillet, Dorset or Columbia rams. The Rambouillet is used because of its subtropical origin, the Dorset because of its extended breeding season. These F_1 ewes will be distributed to farmers. They can use a Suffolk ram if a high standard of feeding and management is available; otherwise they are recommended to backcross to the St Elizabeth. Wool is an important product as well as meat - hence the crossing with improved wool-meat breeds is doubly important.

For such a commercial crossing system it is essential to use as the female line the local adapted breed. It is not essential that this be a prolific breed but the advantage of such a breed is that fewer ewes are needed to breed purebred replacements and more can be used for breeding the more profitable crossbreds.

5.4.3 Use of prolific males to improve breeds elsewhere

This is one of the ways in which the Finnish Landrace breed is used in temperate countries. For tropical and sub-tropical countries one of the breeds described in Sections 2.1, 2.2, 3.1 and 4 would be more appropriate. Indeed it is partly with the aim of using these breeds in just this way that the conservation and improvement programmes have been recommended for the White Virgin Island and the Greek breeds (see Section 5.3). The Barbados Blackbelly is already being used in this way in the Caribbean. The Priangan and East Javanese Fat-tailed could be so used in southeast Asia.

However, before such a programme is instituted, it must be established that an increase in prolificacy is in fact desirable. In steppe and semi-desert country a ewe cannot be expected to rear more than one lamb per year. Nor must it be assumed that it is necessarily the genetic potential which is the limiting factor - Dr. Allenby has shown in the FAO Sheep and Goat Project in Kenya that frequent drenching against worms can increase the lambing rate of the local Masai sheep by over 50 percent.

5.4.4 New breed formation and selection

This is also a system which can apply to both prolific and non-prolific adapted breeds. Its aim is to combine the adaptive characters fitness of the local breed with the improved meat characters of an imported exotic breed. Its justifications, as compared with commercial crossbreeding, are: 1. It does not involve the keeping of purebred exotic sheep to supply males for crossbreeding. 2. It is easier for small farmers to operate a one-breed system than to keep part of their flock for breeding purebred replacements and for producing commercial crosses. (But there could be division of labour within the industry with some flocks breeding purebred replacements and others producing crossbreds).

Genetically this breeding system implicitly assumes that additive gene action is more important than hybrid vigour.

This is the plan adopted by Cuba where a new breed is planned with Suffolk and Pelibüey blood (see Section 2.4). There is also some cross-breeding in Java but it is not clear whether the aim here is an infusion of exotic blood (Suffolk, Dorset and Merino) or a commercial crossing scheme. It will be interesting to see the results of the Dorset x Fat-tailed crossing experiment in Yogyakarta. The preliminary results from new breed formation in Sri Lanka (Buvanendran, 1978) are not encouraging and may lead to a review of the policy of introducing European breeds; certainly the present emphasis is on Indian breeds.

When the results of these crossbreeding experiments are available the pros and cons must still be carefully weighed. Can the ordinary subsistence farmer give the imported breeds and their crosses the extra attention they need? Can he afford the medicaments necessary for regular dipping against ticks and lice, drenching against worms, and treatment against foot-rot? Can he supply the extra food and better housing needed by a more exigent animal? Or would he be better to rely on the natural resistance of his local breed and the wide ranging grazing which minimizes the worm build-up?

5.5 The need for more information on prolific breeds

5.5.1 Russian and Chinese breeds

About three subtropical breeds mentioned above, namely the Svanka and Imeritian of U.S.S.R. and the Hu-yang of China, no new or first-hand information has been obtained. When an opportunity arises it should be grasped in order to make a thorough study of these breeds and assess whether they have a role to play in improving sheep production either within or outside their countries of origin. The Chinese study should also include the Han-yang. The Omani breed also needs further study.

5.5.2 Centre for the Study of Prolific Sheep Breeds

The information on most of the other breeds is sufficient to make clear their value in their present habitat. However, we know little about their comparative performance or their behaviour on being transferred to a new environment. These things must be known before advice based on firm facts can be given to those wanting to use these breeds for increasing the prolificacy of their own sheep.

It is therefore suggested that a project be established where several of these breeds can be bred under the same conditions and compared with each other and with the Finnish Landrace (or Romanov). The country chosen should be one with its own prolific breed. It would have to be intermediate in climate between equatorial and cool temperate and it would have to have liberal veterinary regulations about the importation of sheep from other countries. The institution at which this experiment was conducted would have to be suitably equipped with an experimental farm and laboratories. It should have well qualified staff who already have worked on the production, reproduction or genetics of prolific sheep.

Either Greece or Morocco would be a suitable country. In Morocco a suitable institution would be the Institut National Agronomique et Vétérinaire Hassan II at Rabat. They are currently working on the D'man sheep and would be prepared to establish a Centre for the Study of Prolific Sheep. The Institute has good laboratory facilities in Rabat (supported by an FAO project) and an active team working on the reproductive physiology of sheep. There is a large experimental farm some distance out of Rabat. Veterinary regulations should not cause any difficulties.

The experiment would by preference be undertaken in both Morocco and Greece in order to detect any genotype environment interaction. Such a development would involve a two-way exchange of breeding material on an international level and Morocco would have to relax its present export ban on D'man sheep in order to make this possible.

The first aim would be to import sheep of one or two other prolific breeds to compare them with the present flock of D'man. The breeds to start with would be the Finnish (or Romanov) and the Chios since they have been most studied and should be the easiest to obtain. Flocks of at least 50 ewes and 10 rams of each breed would be kept under the same conditions and their reproductive and productive performance and their reproductive physiology would be studied. Later their reaction to different treatments (nutritional level, regular deworming etc.) could be compared.

If the first two or three years of the experiment are a success steps should be taken to introduce other breeds, i.e. the Barbados Blackbelly, White Virgin Island, and Javanese. If the Chinese could be interested to send some of their Hu-yang and Han-yang sheep this would indeed be most desirable. The extension to further centres would be foreseen.

5.6 Summary of recommendations

1. The Barbados Blackbelly should be the subject of a thorough-going improvement programme based on recording throughout the island flock.

2. The White Virgin Island should be conserved and selected for prolificacy and meat production.

3. The Bahama native should be selected for prolificacy and growth rate.

4. The Zakynthos, Skopelos and Kymi breeds of Greece should be conserved and selected.

5. Adapted local breeds with large populations (e.g. the Colombian Africana, Morada Nova of Brazil, Pelibüey of Cuba) should be further studied and selected.

6. The Svanka and Imeritian breeds of the U.S.S.R. and the Han-yang and Hu-yang breeds of China should be studied.

7. A Centre (or Centres) for the Study of Prolific Sheep should be established in order to compare the characteristics of different prolific breeds - temperate, subtropical and tropical.

GENERAL REFERENCES

Brooke, C.A. and Ryder, M.L., 1978. Declining breeds of Mediterranean sheep. **FAO Animal Production and Health Paper No. 8, Rome**

Buvanendran, V., 1978. Sheep in Sri Lanka. World Animal Review, No. 27, pp. 13-22.

CBABG (n.d.). The performance of nine prolific breeds of sheep. Annotated bibliography No. 108, 108A. Prepared from Animal Breeding Abstracts 1934-68, 1965-72. Commonwealth Bureau of Animal Breeding and Genetics, Edinburgh, Scotland.

FAO/UNEP, 1975. Pilot study on conservation of animal genetic resources. FAO: Rome.

FAO, 1977. Mediterranean cattle and sheep in crossbreeding. FAO Animal Production and Health Paper No. 6. FAO: Rome.

FAO/ILCA/UNEP, 1980. Trypanotolerant livestock in West and Central Africa. Rome: FAO. Addis Ababa: ILCA.

Goot, H., 1973. Finnsheep in Finland. Agricultural Research Organization, The Volcani Center, Bet Dagan, Israel. Special Publication No. 28.

Jakubec, V., 1977. Productivity of crosses based on prolific breeds of sheep. Summary of reports presented at the E.A.A.P. Study Meeting in Zürich, 1976. Livestock Production Science, 4 (4): 379-392.

Large, R.V., 1966. The effect of litter size on the efficiency of meat production in sheep. 9th International Congress of Animal Production, Edinburgh, 1966, Scientific Programme and Abstracts, pp. 29-30.

Maijala, K. and Österberg, S., 1977. Productivity of pure Finnsheep in Finland and abroad. Livestock Production Science, 4 (4): 355-377.

Mason, I.L., 1978. Prolific tropical sheep. Report on a visit during 4th January - 14th February 1978 to Barbados, St Croix, Dominican Republic, Haiti, Jamaica, Cuba, Mexico, U.S.A. Mimeo, FAO, Rome.

Ricordeau, G., Tchamitchian, L., Thimonier, J., Flamant, J.C. and Theriez, M., 1978. First survey of results obtained in France on reproductive and maternal performance in sheep, with particular reference to the Romanov breed and crosses with it. Livestock Production Science, 5 (2): 181-201.

Spedding, C.R.W., Walsingham, J.M. and Large, R.V., 1976. The effect of reproductive rate on the feed conversion efficiency of meat-producing animals. World Review of Animal Production, 12 (4): 43-49.

Trewartha, G.T., 1957. Elements of Physical Geography. New York: McGraw Hill.

Turner, H.N., * 78. Selection for reproduction rate in Australian Merino sheep: direct responses. Australian Journal of Agricultural Research, 29 (2): 327-350.

Turner, H.N. and Young, S.S.Y., 1969. Quantitative Genetics in Sheep Breeding. Melbourne: Macmillan of Australia.

Yalçın, B.C., 1979. Sheep breeds of Afghanistan, Iran and Turkey. Rome: FAO.

ACKNOWLEDGEMENTS

The following is a partial list of people who have written reports or otherwise supplied information or photographs for this report. In general only one individual per institution is listed. To all, sincere thanks are expressed.

Australia

Helen Newton Turner, Honorary Research Fellow, CSIRO Division of Animal Production, P.O. Box 184, North Ryde NSW 2113.

Barbados

H.C. Patterson, Livestock Officer, Ministry of Agriculture, Food and Consumer Affairs, P.O. Box 505, Crompton Street, St Michael.

C.K. Laurie, Managing Director, Sugar Cane Consultants Ltd, P.O. Box 38, "Glenaire", Reservoir Road, Brittons Hill, St Michael.

Brazil

Elsio Antonio Pereira Figueiredo, Empresa Brasileira de Pesquisa Agropecuaria, Centro Nacional de Pesquisa de Caprinos, Sobral, Ceará.

Colombia

R. Bautista Otero, Departamento de Asistencia Técnica, Caja de Crédito Agrario, Industrial y Minero, Edificio Avianca, Of. 26-01, Bogotá.

J.J. Salazar Cruz, Empresa Colombiana de Productos Veterinarios S.A., Calle 26, No. 82-93, Bogotá.

Cuba

A. Aroche Rodriguez, Ministry of Agriculture, Havana.

Greece

N.P. Zervas, Department of Animal Husbandry, School of Agriculture and Forestry, Aristotelian University of Thessaloniki, Thessaloniki.

Grenada

E. Kent, Craigston, Carriacou.

Guyana

Noel Holder, Managing Director, Livestock Development Company, P.O. Box 773, Georgetown.

P.L. McKenzie, Project Director, Livestock Division, Ministry of Agriculture, P.O. Box 438, Georgetown.

G. Nurse, Livestock Officer, Ministry of Agriculture, Georgetown.

Indonesia

- Sumarmo, Directorate of Animal Production, Ministry of Agriculture, Jakarta.

Harimurto Martojo, Dean, Faculty of Animal Husbandry, Bogor Agricultural University (IPB), Bogor.

Rustandi Danumihardja, Director, Animal Husbandry Research Institute (LPP), Bogor.

M. Zulbardi and Ambar Rusyad. Same address.

- Yuntiwa, Inspector of Animal Husbandry for West Java, Bandung.

Didi Atmadilaga, Head of Department of Animal Breeding, University of Padjadjaran, Bandung.

Dukut Sularsasa, Faculty of Animal Husbandry, Gajah Mada University, Yogyakarta.

- Endung, Inspector of Animal Husbandry for Central Java, Yogyakarta.

Amin Darmani, Inspector of Animal Husbandry for East Java, Surabaya.

M.I. Soeherman, Livestock Officer, Pamekasan, Madura.

Jamaica

A.J. Muschette, Director of Small Livestock, Agricultural Development Corporation, 46 Trinidad Terrace, Kingston 5.

Mexico

J.M. Berruecos V., Facultad de Medicina Veterinaria y Zootecnia, Universidad Autónoma de Mexico, Ciudad Universitaria, Villa Obregón, Mexico 20 D.F.

M. Valencia Zarazúa, Director, Centro Experimental Pecuario Mocochá, Apartado Postal 100 Suc D, Mérida, Yucatán.

J. de Alba M., Director, CAMPA Training Centre, J. Cervantes 102-307, Tampico, Tamalaupas.

Morocco

A. Lahlou-Kassi, Département de Reproduction, Obstétrique et Insémination Artificielle, Institut Agronomique et Vétérinaire Hassan II, B.P. 706, Rabat.

Oman

Douglas Gray, Chief Veterinary Officer, Ministry of Agriculture, Ruwi, Greater Muscat.

Graham Bell and R.W. Dutton, Durham University Development Project, Khabura.

Sri Lanka

V. Buvanendran, Veterinary Research Institute, Peradeniya. Present address: National Animal Production Research Institute, P.M.B. 1096, Zaria, Nigeria.

Trinidad

R.K. Rastogi, Department of Livestock Science, The University of the West Indies, St Augustine.

U.S.A.

L.H. Boyd, Department of Animal Science, Mississippi State University, P.O. Drawer 5228, Mississippi State, Mississippi 39762.

W.C. Foote, Director, International Sheep and Goat Research Institute, Utah State University, Logan, Utah 84322.

Lemuel Goode, Department of Animal Science, North Carolina State University, Raleigh, N.C. 27607.

C.F. Parker, Department of Animal Science, Ohio Agricultural Research and Development Center, Wooster, Ohio 44691.

Maurice Shelton, Texas A & M University Agricultural Research and Extension Centre, Route 1, Box 950, San Angelo, Texas 76901.

Hubert Schmiedlehner, Piel Farm, Abbot Village, Maine 04406.

G.M. Spurlock, Extension Animal Scientist Emeritus, University of California, Davis, California 95616.

Venezuela

G. Mazzarri and A.E. Reverón, Sección Zootecnia del Centro Nacional de Investigaciones Agropecuarios, Maracáy.

E. González Jiménez, Instituto de Producción Animal, Universidad Central de Venezuela, Maracay.

C. González Stagnaro, Facultad de Agronomia, Universidad del Zulia, Maracaibo.

Virgin Islands, British

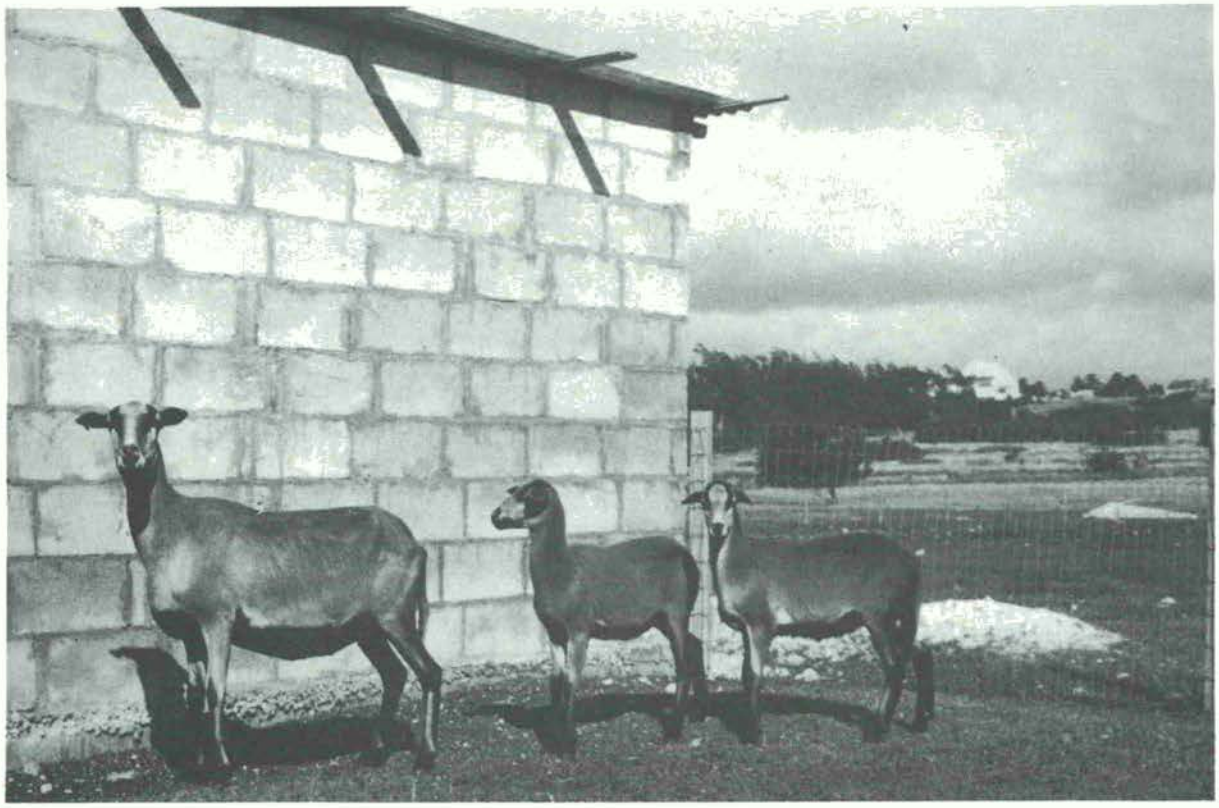
David Smith, Livestock Adviser, Department of Agriculture, Tortola.

Virgin Islands, U.S.

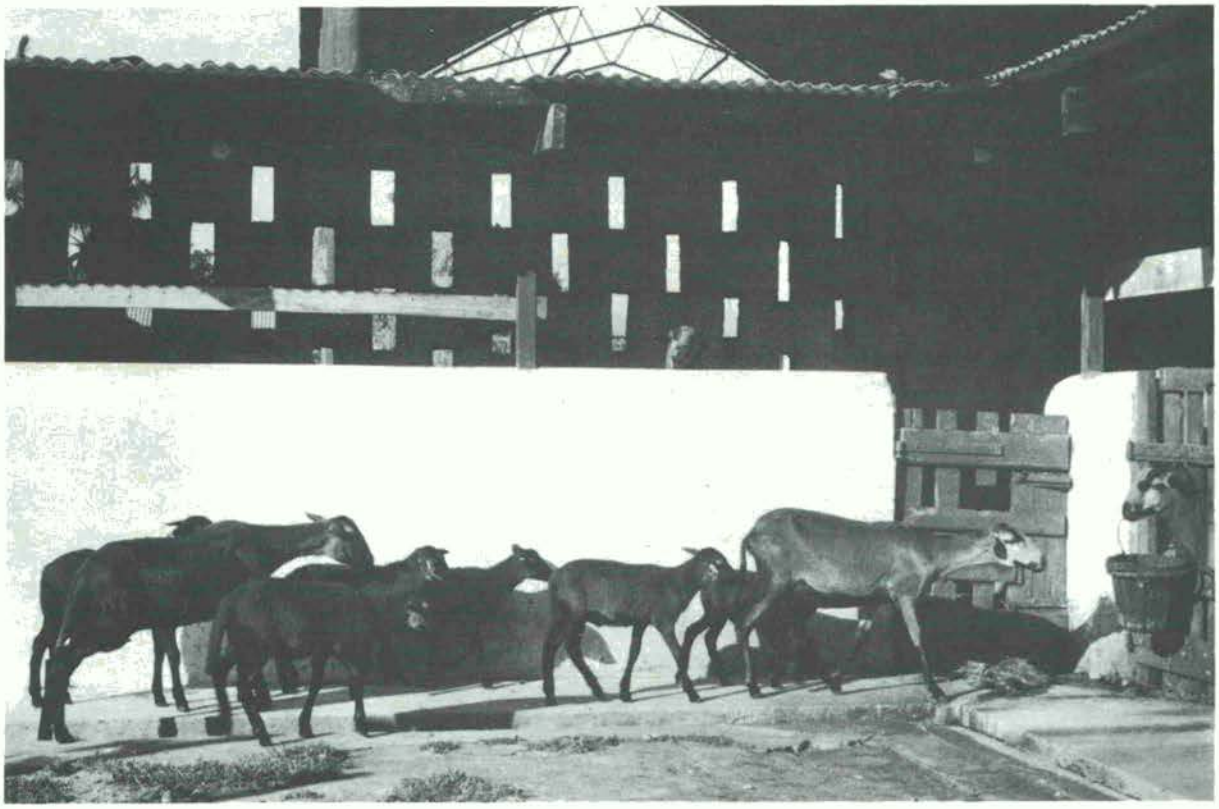
Duke Deller, Government Veterinary Surgeon, Department of Agriculture, P.O. Box U, Kingshill, St Croix, U.S. Virgin Islands 00850.

FAO

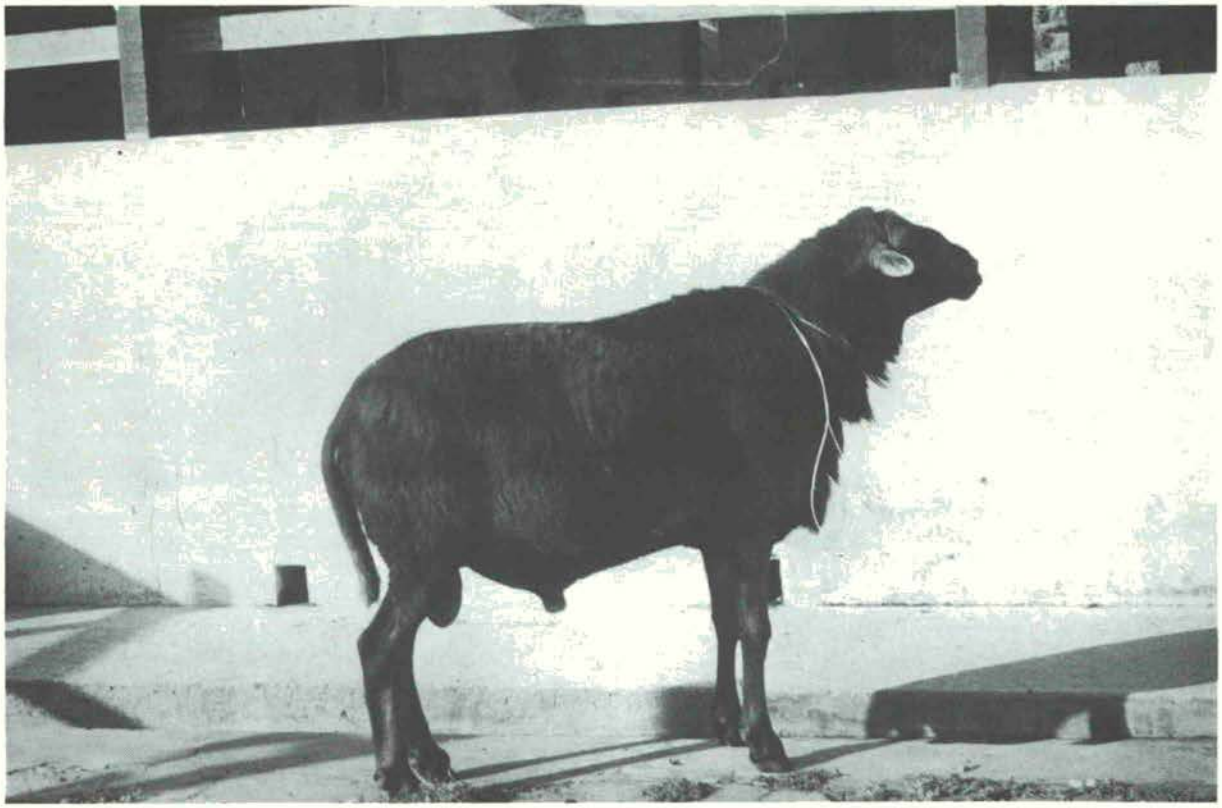
A.S. Demirüren, Animal Production Service, Animal Production and Health Division, Food and Agriculture Organization of the United Nations, Rome, Italy.



1. Barbados Blackbelly ewe with twins
(Photo - I.L. Mason)

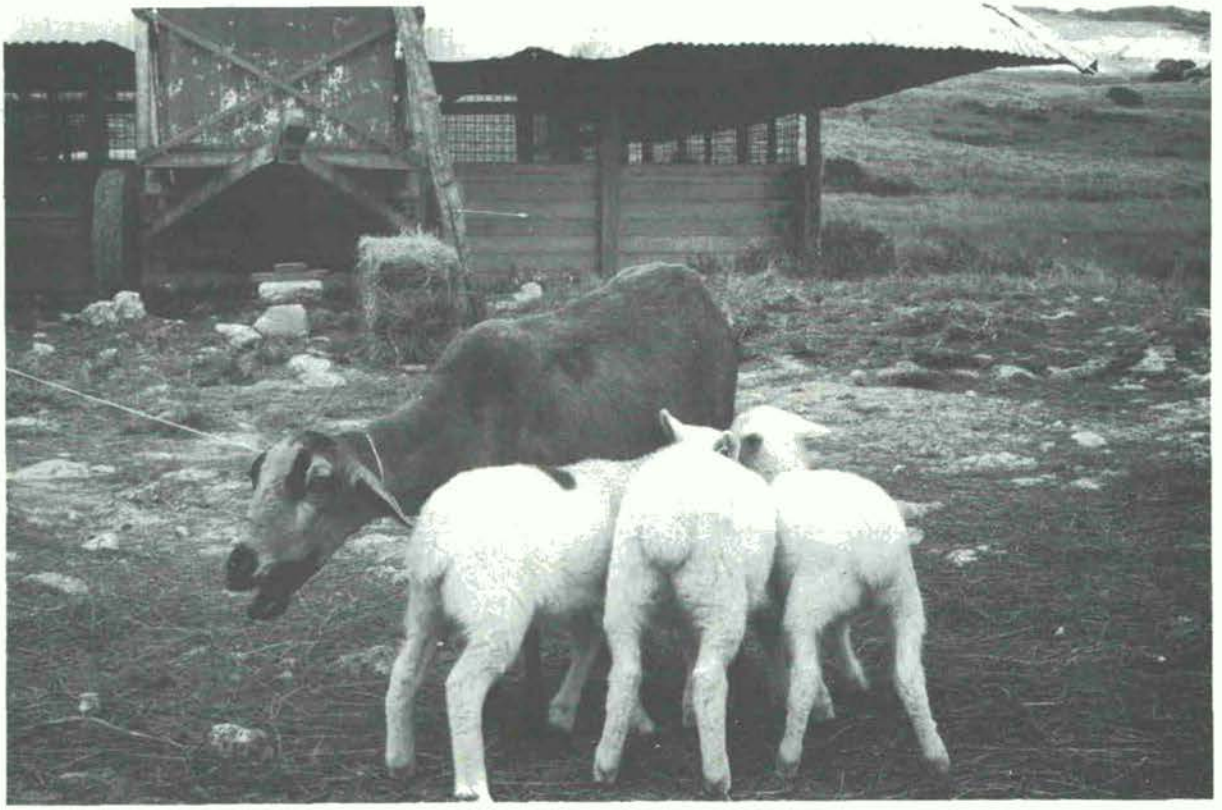


2. Two Barbados Blackbelly ewes each with trinlets
(Photo - I.L. Mason)

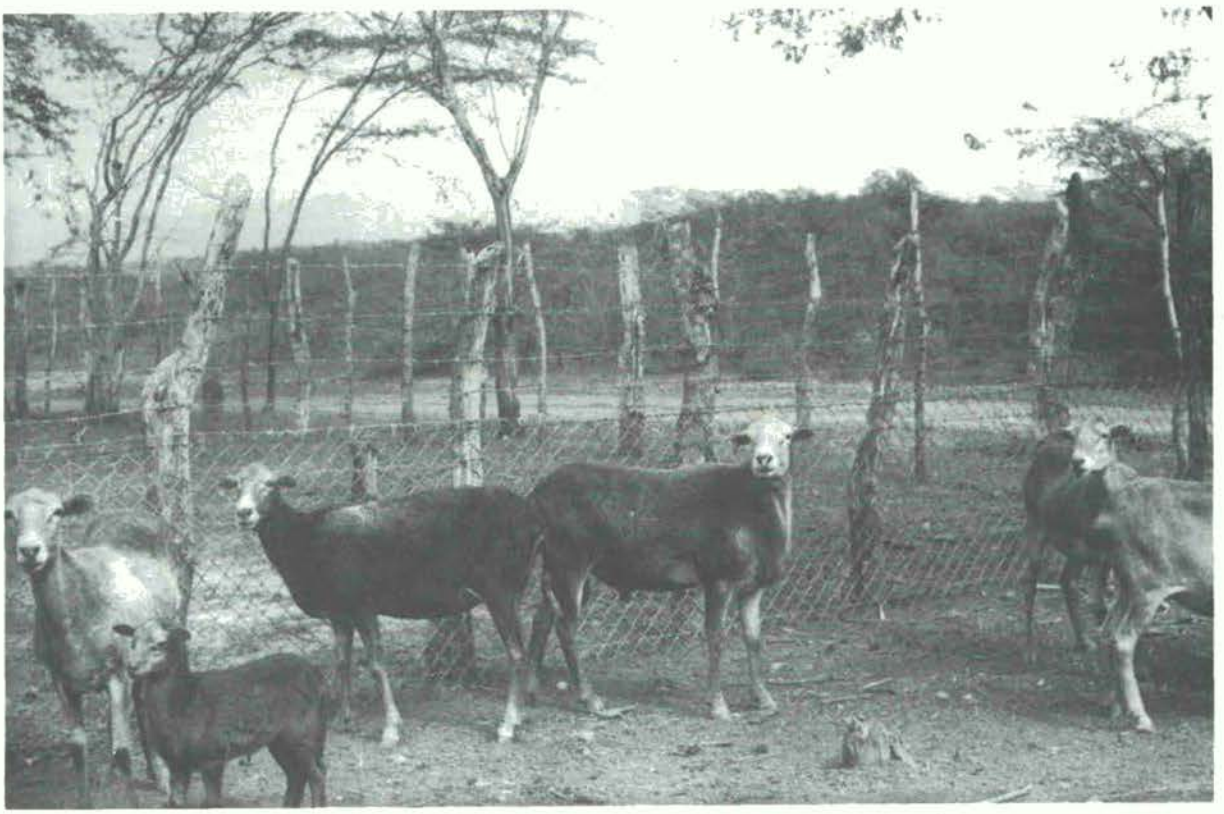


3. Barbados Blackbelly ram
(Photo - I.L. Mason)

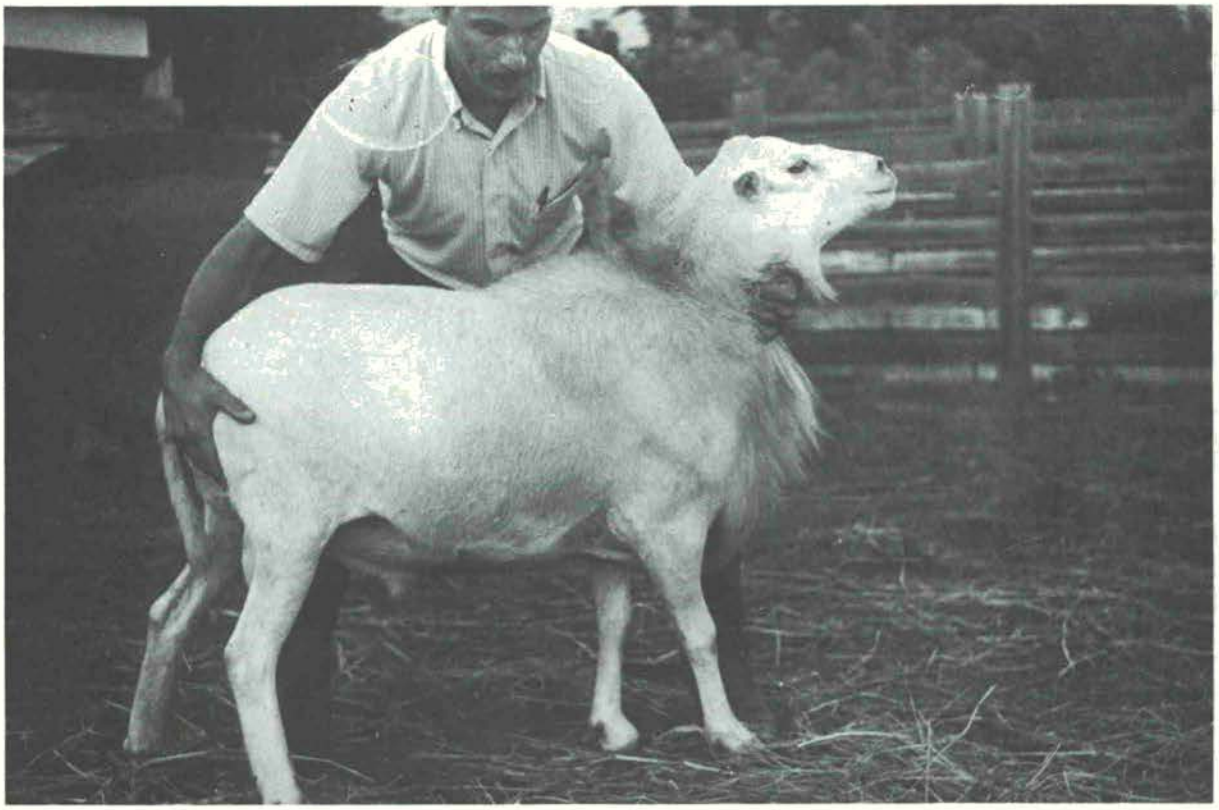
4. Barbado ram, California
(Photo - G.M. Spurlock)



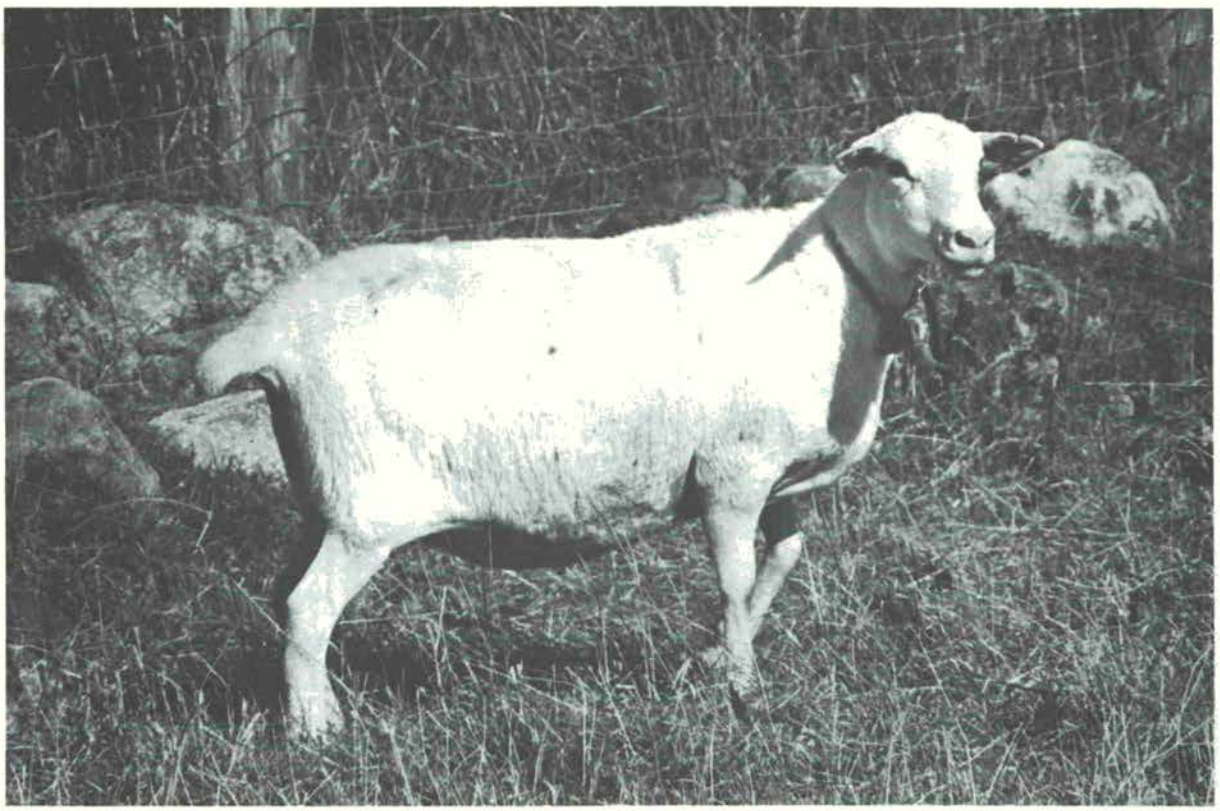
5. Barbados Blackbelly ewe with triplet lambs by Poll Dorset sire (Photo - I.L. Mason)



6. White Virgin Island sheep, St Croix (Photo - I.L. Mason)



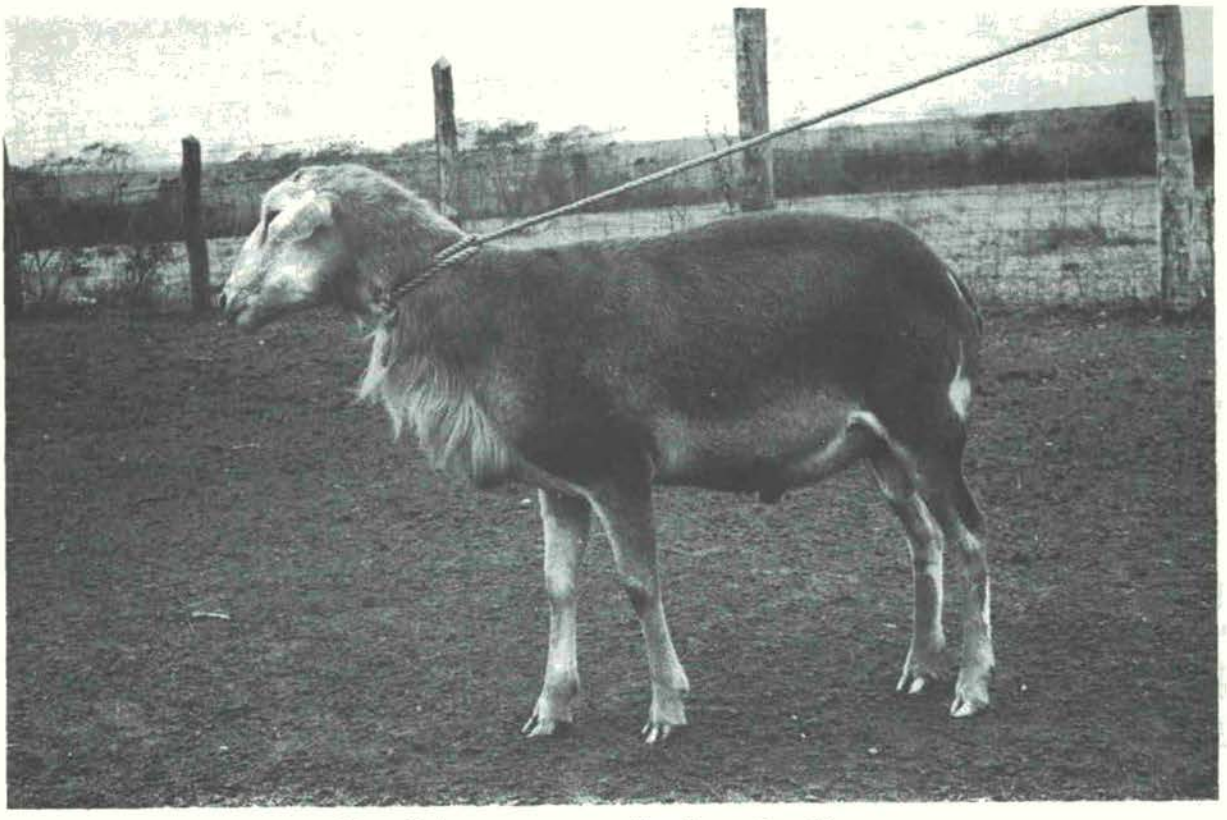
7. White Virgin Island ram, St Croix
(Photo - I.L. Mason)



8. Katahdin ewe
(Photo - H. Schmiedlehner)

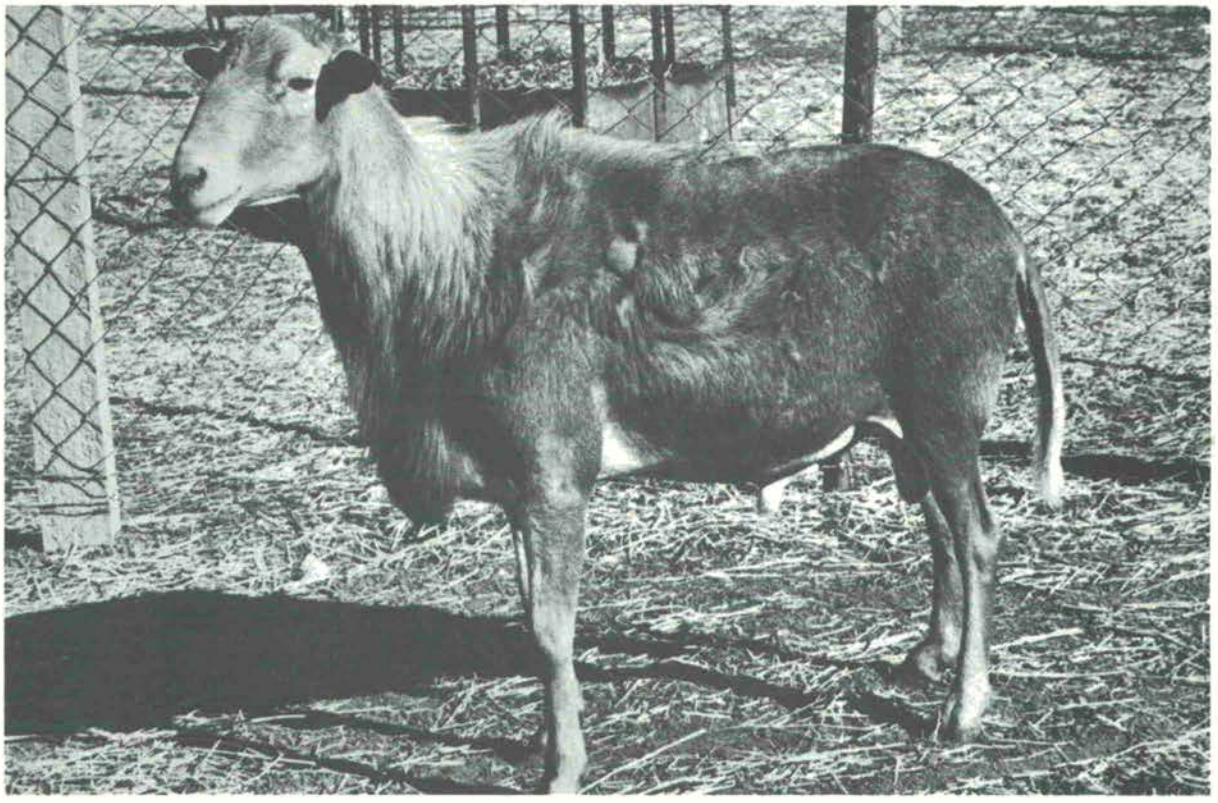
9. Katahdin ram
(Photo - H. Schmiedlehner)

10. Pelibuey ram, Cuba (red)
(Photo - I.L. Mason)

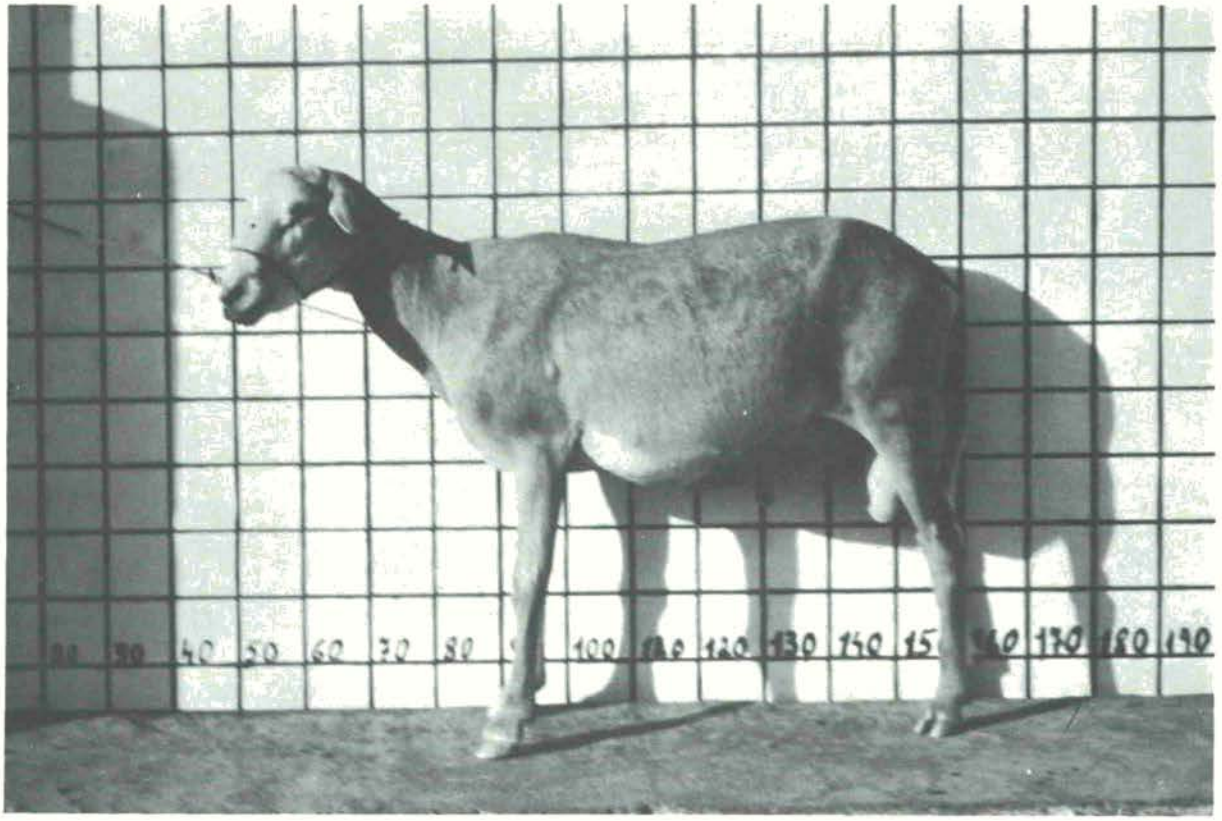


11. Tabasco ram, Mexico (red)
(Photo - I.L. Mason)

12. African ewe, Venezuela (red)
(Photo - E. González Jiménez)



13. African ram, Venezuela (red)
(Photo - E. González Jiménez)



14. Morada Nova ram (red)
(Photo - E.A.P. Figueiredo)

15. Local mixed sheep with Santa Ines ram, Ceará, Brazil (Photo - I.L. Mason)

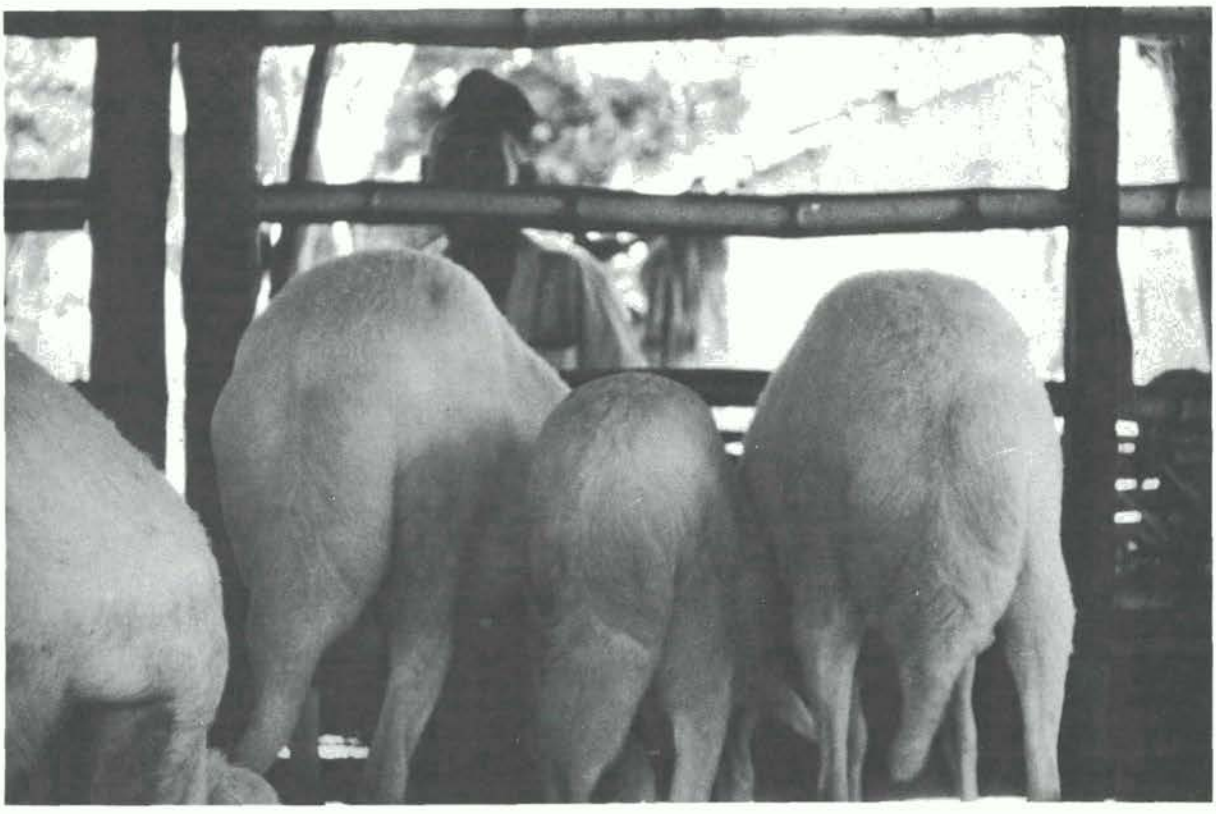
16. Pied Blackbelly ewe in Cameroon (Photo - I.L. Mason)

17. Javanese thin-tailed ewe with triplets
(Photo - I.L. Mason)

18. Javanese thin-tailed rams
(Photo - I.L. Mason)

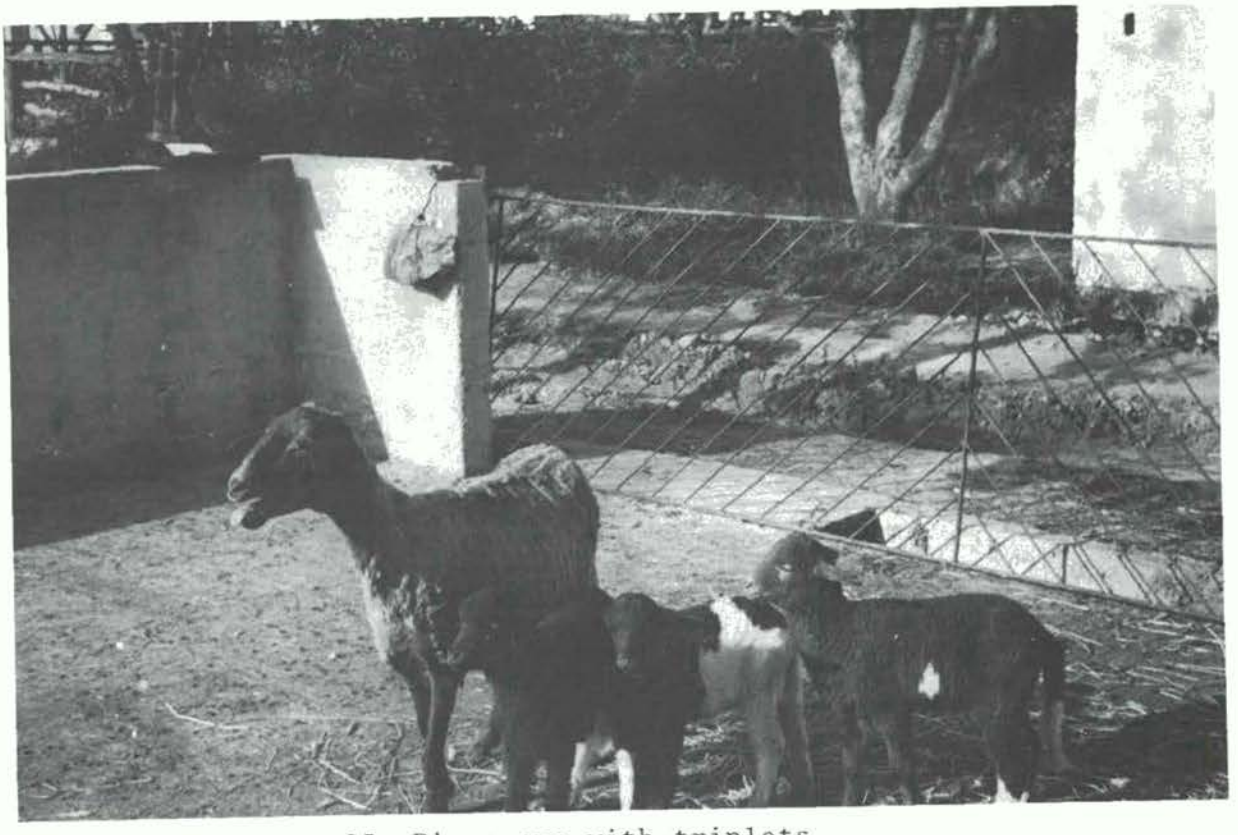
19. Priangan ewe with four lambs
(Photo - T.L. Mason)

20. Priangan rams
(Photo - D.W. Robinson)

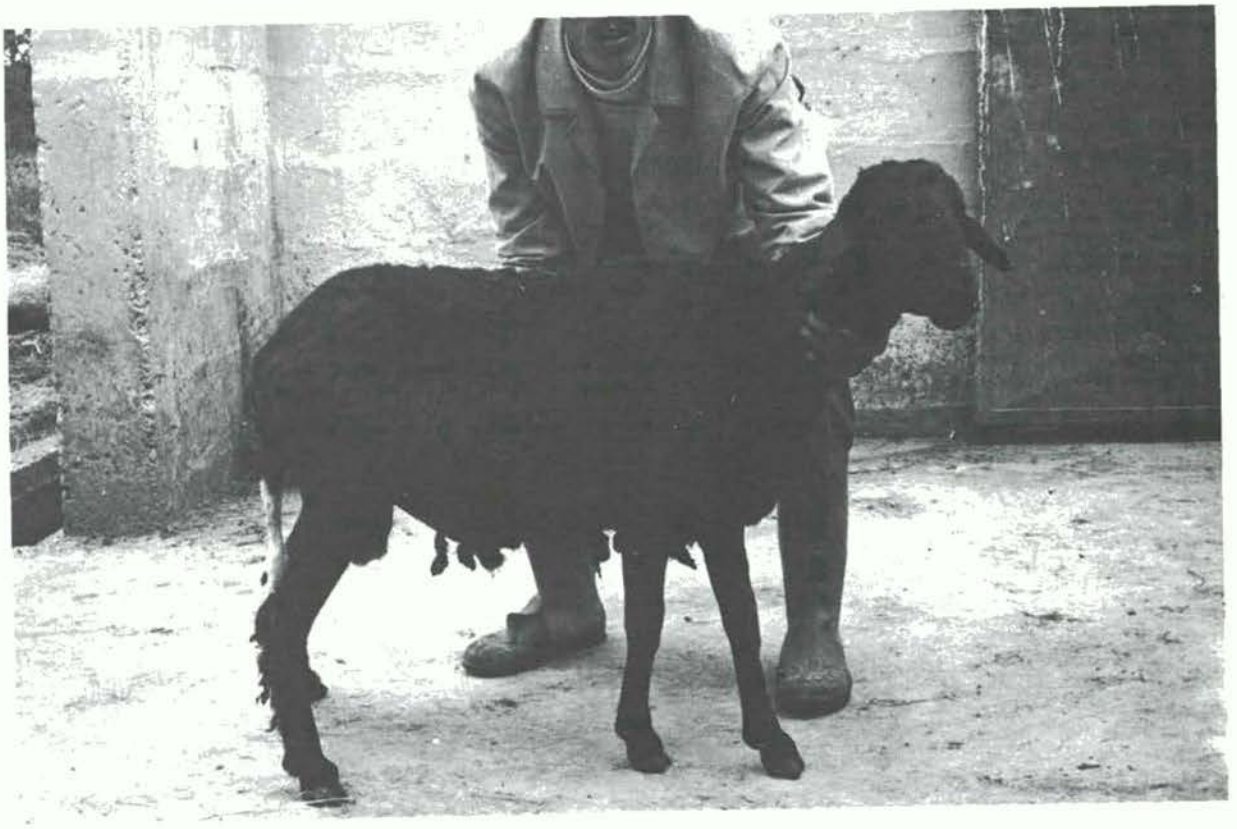


21. Javanese fat-tailed ewes
(Photo - I.L. Mason)

22. Javanese fat-tailed ram (polled)
(Photo - D.W. Robinson)



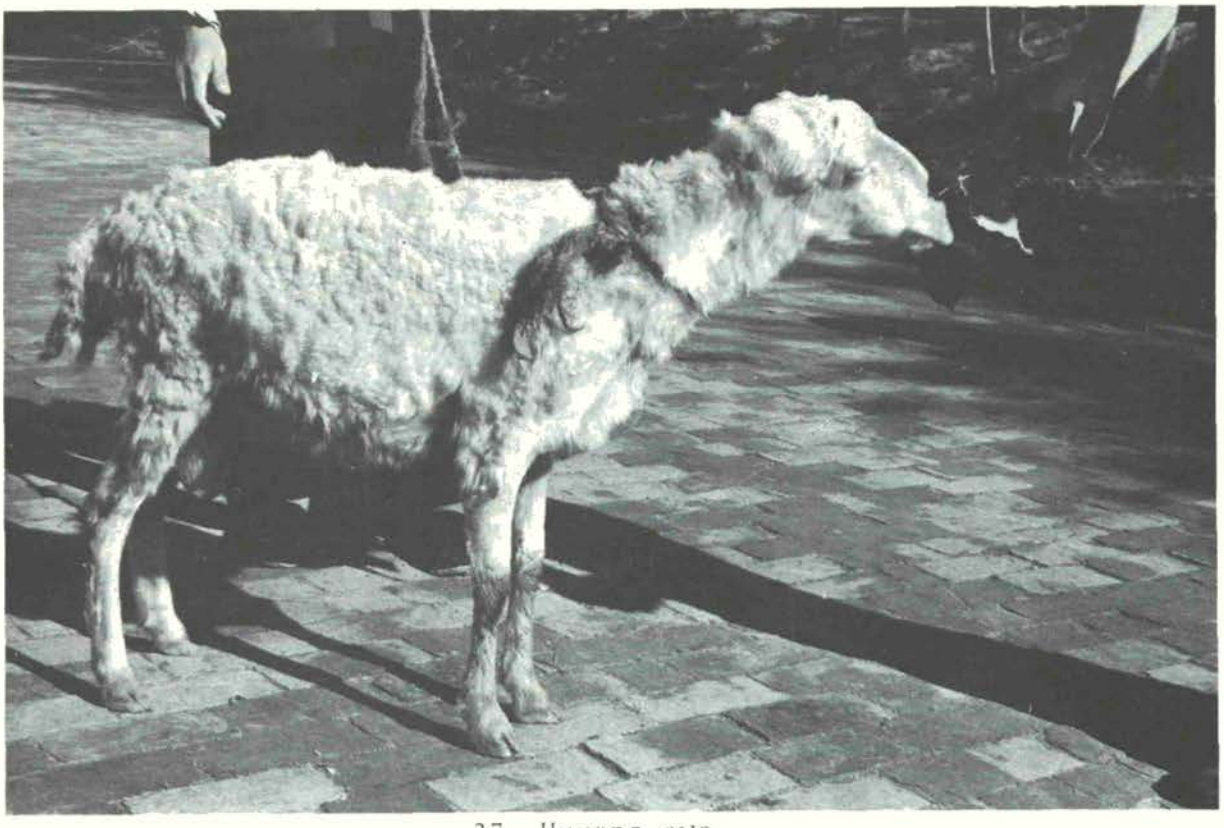
23. D'man ewe with triplets
(Photo - I.L. Mason)



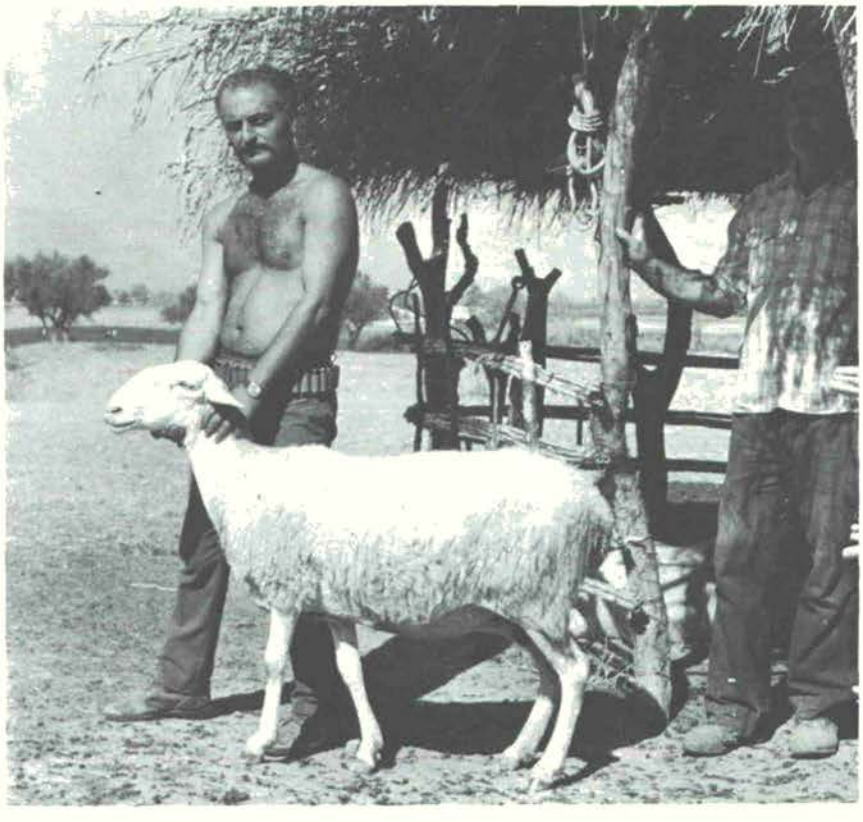
24. D'man ram
(Photo - I.L. Mason)

25. D'man ewes (shorn) and lambs (note variation in coat pattern) (Photo - I.L. Mason)

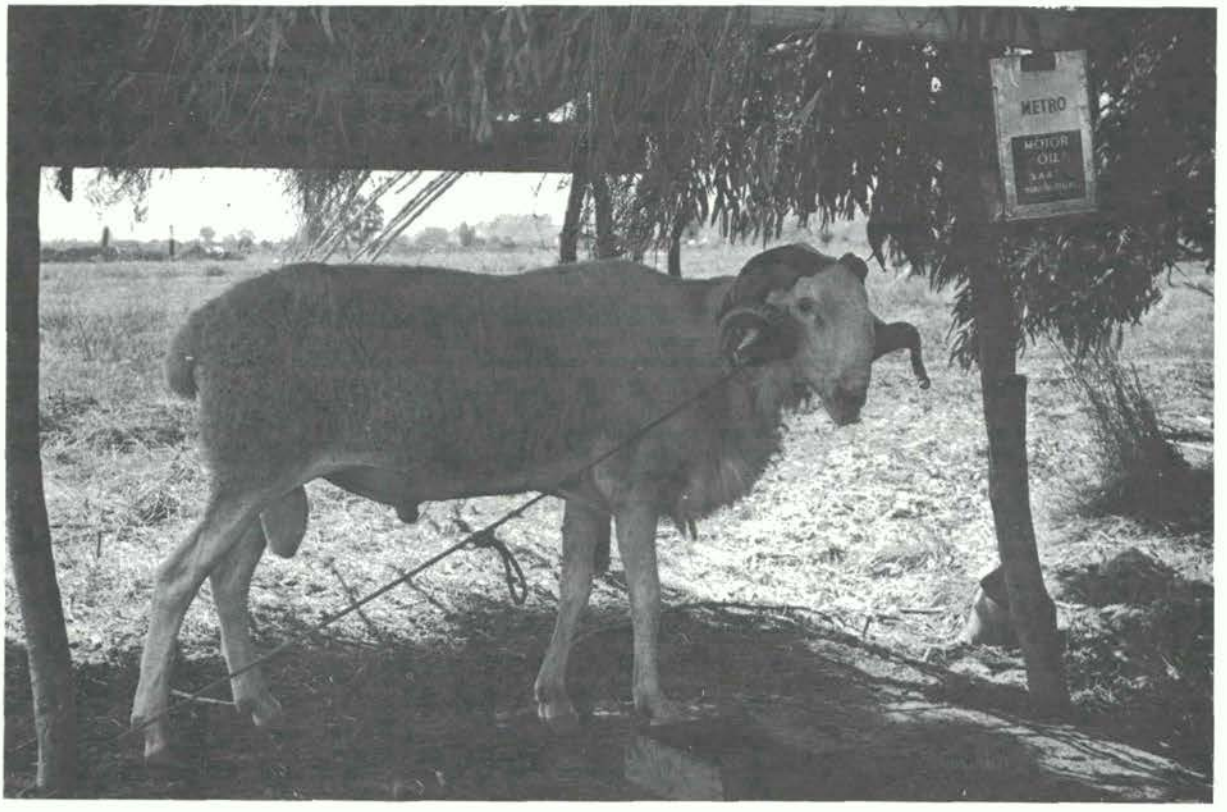
26. Omani ewe
(Photo - I.L. Mason)



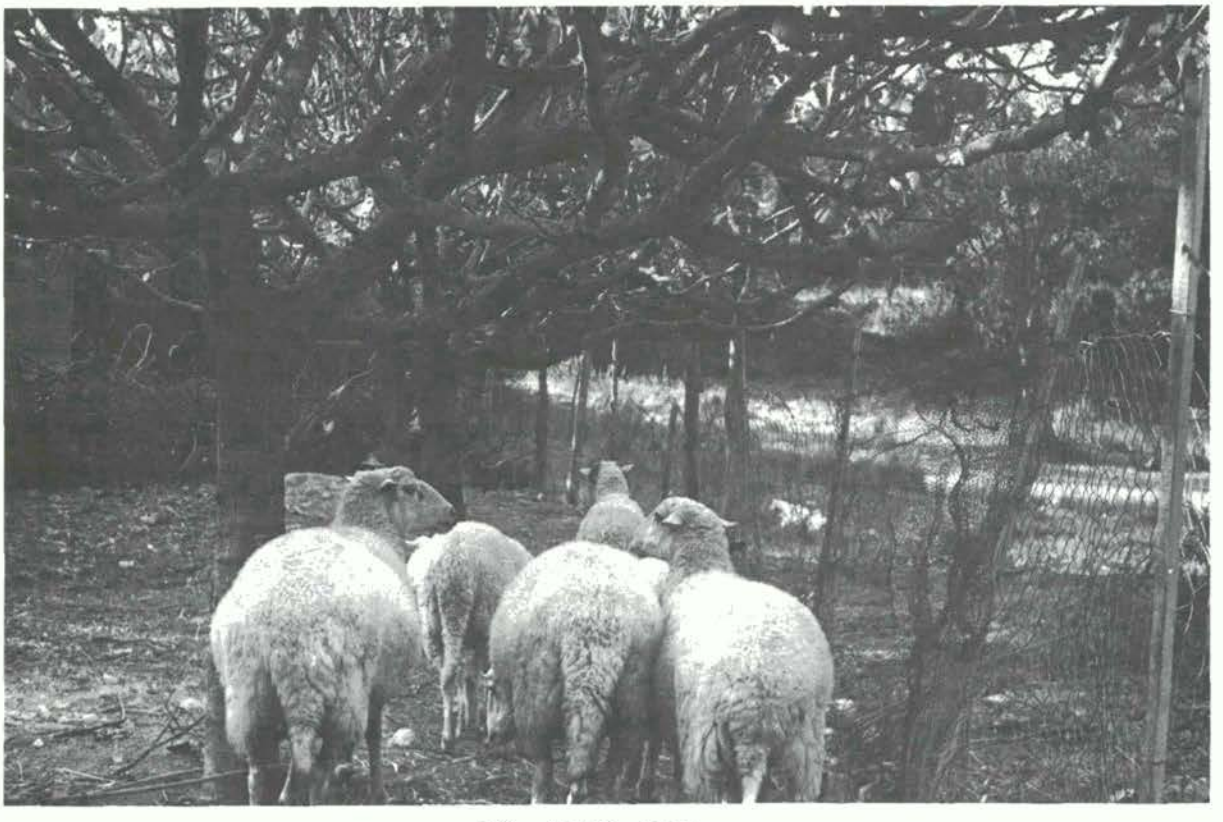
27. Huyang ewe
(Photo - I.L. Mason)



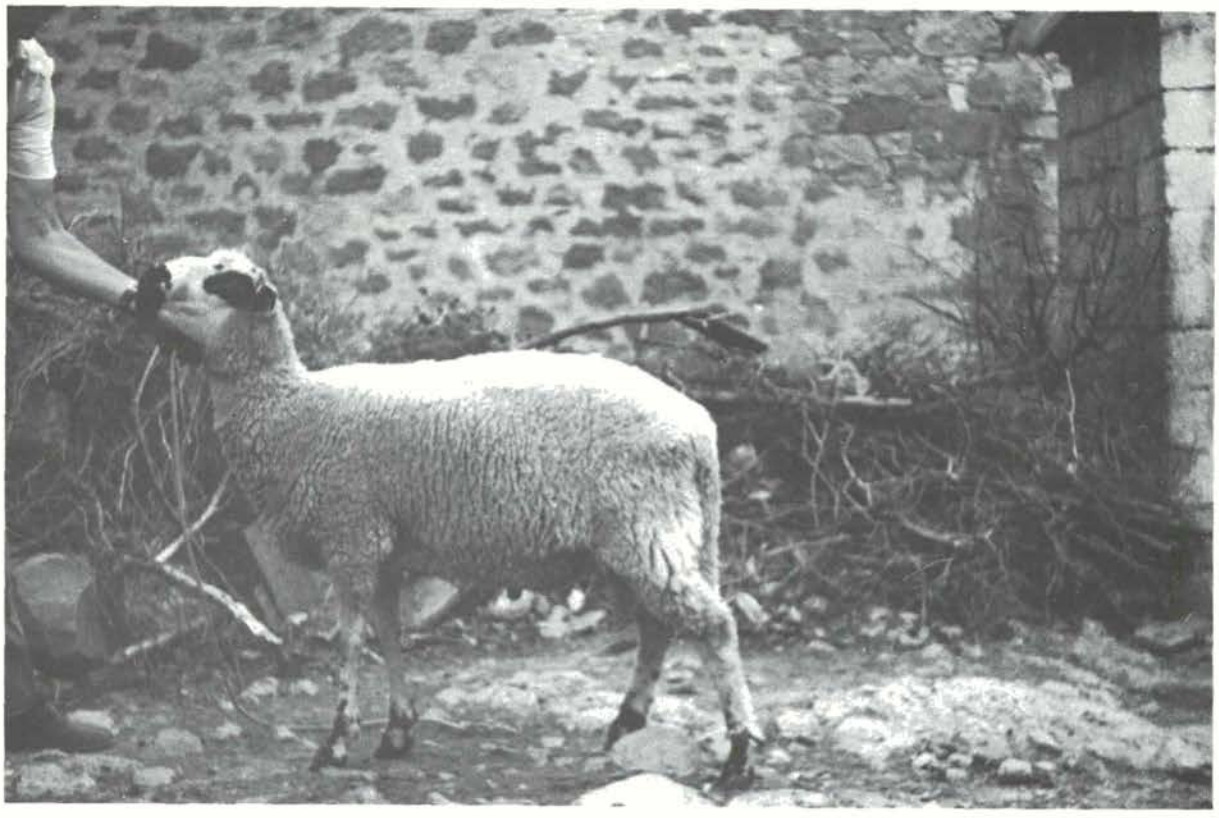
28. Zakynthos ewe
(Photo - I.L. Mason)



29. Zakynthos ram
(Photo - I.L. Mason)



30. Kymi ewes
(Photo - I.L. Mason)



31. Kymi ram
(Photo - I.L. Mason)

ISBN 92-5-100845-0