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Production of hides, skins, wool and hair

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Production of hides, skins, wool and hair

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As these proceedings were being finalized, we were informed of the untimely passing away of our colleague and good friend Professor YALÇIN. We want to dedicate this issue to his memory, in recognition of his loyal and unselfish action in favour of the Mediterranean Small Ruminant Sector.

Jean Boyazoglu and Jean-Claude Flamant
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* text in French

Preface

Dear Colleagues,

It is a great pleasure for me having you here for the "International Symposium on Production of Hides, Skins, Wool and Hair: Evaluation and Future Role in The Mediterranean Basin and The Middle East" which is jointly organised by European Association for Animal Production (EAAP), International Center for Advanced Mediterranean Agronomic Studies (CIHEAM), the European Community (EC), Çukurova University and The Ministry of Agriculture and Rural Affairs in Çukurova University campus on November 2–6, 1991.

Our young University with a past history of only 17 years is situated on 2 000 hectares of land overlooking the Seyhan River Lake, in the fourth largest city of Turkey, Adana, the center of textile industry and major producer of cotton and citrus fruits. During the symposium, you will be having scientific and technical discussions with your colleagues on many subjects and will exchanges ideas and information as well. Besides, you will also have the chance to see our historical and natural beauties. The church of St. Peters in Antakya and the early Christian settlement of Cappadoccia and their natural beauty and historical sites will attract your attention.

Your short stay in Istanbul on your arrival or on your departure, will give you a chance to observe the mingling of the cultures, histories and arts of the East and the West. Repeating my earnest desire of having you at the Symposium and visiting our University, I would like to express my regards to you all.

Prof. Dr. M. Özsan
Rector University of Çukurova

Introduction

The Mediterranean basin and the neighbouring regions have a long-standing history of sheep and goat raising. There are various production systems; however, extensive systems predominate. Recent changes had a considerable effect on the evolution of the traditional chains of small ruminant production, and also on the processing and marketing of products, in particular under the economic influence of intensive production models of the North European countries which provide the market with mass produced milk and meat products.

This symposium is one among a series of Mediterranean symposia organized every year by EAAP and the CIHEAM in cooperation with FAO and the EC. A common feature is the search for alternatives to intensive production models, based on improving individual performances of animals, which are usually proposed by livestock science for meat and milk production. The subject of this symposium shows such a concern: what are the prospects for the production of hides, skins, wool and hair in the Mediterranean region and surroundings?

Actually beside meat and milk, animal husbandry produces also by-products, textiles, leather and hides, intended not only for marketing as raw material at international level, but also for local processing into specialized products. Farmers' attention should be drawn to the importance of the secondary products particularly whenever the economic relevance of the main products diminishes. It could be a possible specialized orientation for the animal husbandry in the Mediterranean basin. This was the issue of this international symposium.

It is true that recent technical and economic evolutions as well as modern marketing patterns tended to ignore the relevant importance of these products. This symposium highlighted the fact that this was and still is more a matter of choosing the easy and sometimes convenient way of voluntary marginalizing their importance, rather than developing the more intricate theme of the potential high commercial value in their specificity and their traditional importance in the context of local domestic industries linked to regional production and processing patterns, as it should be.

In a nutshell, the valorization of these so-called "by-products" will allow the reduction of the global production costs of the sheep and goat industries in our region and can help its development.

At this point it is important to remember that what can be called the hides and skins subsector concerns here, over and above the small ruminants, also the cattle and even camel and buffalo productions. From a general standpoint, all these products of the animal sector represent a noteworthy potential of the livestock income.

It seems normal that the national and regional agricultural policies (including those of the EC.) should give more attention to these products, particularly since a competition, not always fair, has developed in recent years from far-off, low cost producing areas of the world. The relevant processing industries in Europe and in the Mediterranean region are an important link within the rural chain and it is thus indispensable to evaluate the future possible pathways of development through research and technological information. This symposium can help in this direction.

At production level, the fundamental problem could be the improvement of production technics of these secondary products, particularly in the more difficult and marginal extensive production areas with special reference to the local animal genetic resources. It seems to us that we must aim at linking the obvious aspects of specificity and quality of these products with the concept of a certain degree of modernization of production technics and with some form of dynamic collection and marketing.

Textiles, leather and hides require a great deal of processing and marketing efforts before they become a finished product that can be purchased by the consumer. Procedure analysis shows that, if farmers want to make good profits from these products, they must integrate part of the added value, particularly by personalizing the product range. However, in this case, it is a matter of "small series" that cannot pretend to reach a run of customers.

In the field of transformation, it is probably the updating and modernization of the processing structures and machinery that we must look at. They are mostly too dispersed and scattered over large areas and their technological level is primitive. This means high production and transformation costs, squandering valuable available resources, and even insufficient quality of the marketed products. Setting up large centralized processing facilities is not necessarily the answer to this problem; instead, we should rather think in terms of developing medium-sized units ensuring adequate technics and better economic prospects. Obviously an up-to-date grading process and minimum standards of the products are absolutely necessary. In any case, long-term views can only lead to some active awareness regarding environmental protection.

From the marketing point of view, it seems that the golden road lies somewhere between specialized productions offering high added value and a planned diversification and novelty of the products. In all cases, a long term strategy can only be that they are complementary to one another; therefore, also from the investment point of view, there must be a planned cooperation between production and transformation zones, and private and public sector involvement is necessary.

We would like to thank our Turkish colleagues here for making this most important meeting possible, the Ministry of Agriculture, the local authorities and the leather, hair and carpet industries. We would like to mention in particular, not only those friends from Adana but also from Ankara, Istanbul, Bursa and Izmir, but this list would be too long. Though, in the name of all of us we want to thank the Rector, Prof. Özsan, and through him the Dean of the Agricultural Faculty, Prof. Tekinel, and the Director of the Department of Animal Science, Prof. Pekel, who, in true Turkish tradition, received us here in the most modern campus which they built themselves with hard team work and tenacity, in a relatively short time. When we started planning this meeting more than five years ago, and our good friends, Professors Elicin, Dogan, Yalcin, Tuncel, etc. said: "let us go to the south", we had difficulty in understanding why in the beginning. We all know now that there was a need after the first successful EAAP symposium we had in Ankara in 1983 to confirm that success in Adana eight years later.

Last but not least a hearty word of thanks, personally and cordially, to our friend Okan Guney and all his colleagues for the hard work they put in the preparation of the meeting; without their devotion this would not have been possible.

In the name of the organizers and of both CIHEAM and EAAP we want to express our appreciation to the European Community and FAO's European Office without the help of which the participation of many foreign scientists to this meeting and the publication of these proceedings would not have been possible.

J. Boyazoglu,
J.C. Flamant

Introductive session

Chairman: O. Tekinel
Co-chairman: J.L. Tisserand

A world review of hides, skins, wool and hair production and marketing

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Summary

World supply, demand and particularly prices of hides, skins, wool and derived products have been subject to considerable fluctuations over the past quarter century. By 1991 prices of both hides and wool fell to rather low levels as demand decreased, whereas supplies increased, with wool stocks reaching an all-time high. In February 1991 Australia and other major wool exporters discontinued their price stabilization schemes, allowing the wool market to operate freely for the first time in 17 years. Following the abolition of price stabilization schemes in major exporting countries, and with the progressive liberalization of wool markets in East Europe, most of the world's wool is now being produced under free market conditions. Trade in hides and skins remains subject to export restrictions by developing countries.

The reduction in demand for consumer goods made from these raw materials has been particularly pronounced in East Europe and the USSR. While the developing countries account for the larger part of global population of ruminant animals, productivity in terms of such products as meat, milk, hides, skins and wool is generally much lower than in the developed countries. However, there has been a shift in the processing of hides, skins and wool to the developing countries, notably in East Asia and parts of Latin America and the Mediterranean region. Although being increasingly dependent on shipments of hides, skins and wool from the OECD area, a considerable number of developing countries have become large exporters of leather and leather goods, as well as wool-based textiles, in spite of heavy import protection in several industrialized countries.

The short-term outlook is for little change in demand and supply in general, although demand for wool should experience some recovery due to the current low relative price of this commodity. In the longer term, successful conclusion of the GATT's multilateral negotiations (Uruguay Round) would not only enable developing countries to capitalize on their comparative advantage in the processing of hides, skins and wool, but there could also be some shift towards developing countries in milk and meat production, both for export and domestic consumption. The resultant increase in employment and income would probably also stimulate domestic demand for leather goods and textiles in the developing countries, which by the year 2000 will account for about four-fifths of global population. At present, average per caput consumption of leather shoes, for example, in the developing regions as a whole is only about one pair in three years, as against 2–3 pairs a year in West Europe and North America. In contrast, if the Uruguay Round failed, growth in the world livestock and derived products economy would presumably be sluggish, and the difference in income and consumption levels between OECD countries and developing countries, especially those in Africa and Latin America, might widen further, accompanied by a decline in East Europe and the Soviet Union.

Present situation and recent developments

Production

Although the number of ruminant animals which provide the hides and skins, wool and hair discussed in this paper (cattle, buffaloes, sheep, goats and a few other species) has increased over the past quarter century or so, growth has lagged behind that in human population. This reflects to some extent rising productivity per animal, notably in terms of milk and meat, but also in terms of hides, skins, wool and hair. Moreover, the rise in demand for milk, bovine and sheep and goat meat has slowed or come to a halt altogether in several parts of the world, with pig and poultry meat accounting for an increasing proportion of global meat consumption. Finally, competition from raw materials of vegetable origin, such as cotton and synthetics has grown.

The developing countries keep the larger part of global population of ruminant animals. However, as can be seen from Table 1, the developed countries produce not only more meat and milk but also more wool, while output of hides and skins from bovine animals and sheep, in quantitative terms, is about the same in the two categories. Only the output of goat skins is concentrated in the developing countries. Milk, meat and wool yields in the group of developed countries are generally higher, which is also reflected in larger output of hides and skins per animal. But unlike in the majority of developed countries, cattle and buffaloes in the developing regions are still used, to a considerable extent, for work, which while of great importance to the overall economy of the countries tends to depress average yields of meat, milk and hides as well as the quality of the latter.

According to FAO (FAO, 2), since hides and skins account for only a relatively small proportion of the total value of the animals from which they are obtained, the production of hides and skins rarely forms the principal object of livestock breeding. Cattle and goats are kept chiefly for their meat and milk, and sheep mainly for their meat and wool. It follows that their supply varies independently of changes in the demand for leather and leather products. The collection and marketing of hides and skins in remote areas may intensify when prices rise sufficiently to cover costs of collection, handling and transport, and slacken when falling prices render collection and marketing unprofitable.

Table 1. Ruminant animal numbers and their output (late 1980s).

	World Total	Developing Countries	Developed Countries
Cattle and buffaloes (billion head)	1.42	1.02	0.40
Sheep (billion head)	1.18	0.62	0.56
Goats (billion head)	0.53	0.50	0.03
Beaf and veal (million tons)	50.90	16.80	34.10
Sheep and goat meat (million tons)	8.80	5.10	3.70
Milk (all species) (million tons)	528	144	384
Hides and skins (fresh) (million tons)	8.64	4.62	4.02
of which cattle and buffalo	6.90	3.55	3.35
sheep	1.29	0.64	0.65
goats	0.45	0.43	0.02
Wool (clean) (million tons)	1.94	0.54	1.40

Source: FAO Production Yearbooks (FAO,1).

More recently, cattle numbers and consequently slaughtering and hides and skins output have decreased in almost all developed countries. In North America, the world's principal beef producing region, the shift in demand from red meat to white meat has curbed cattle farming. Current beef and dairy cattle numbers are well below the levels registered in the 1970s, and the historical cattle cycle has virtually disappeared. In West Europe, where cattle farming is predominantly oriented towards milk, governments have taken measures to reduce cattle populations in view of large milk and beef surpluses. There has, however, been some change in the composition of West European cattle herds, with specialized beef breeds and their crosses becoming more important. In addition, the proportion of calves to total cattle slaughterings has fallen and, in the veal sector, calves have been fattened to heavier weights. The USSR and East Europe, where cattle farming is also mostly milk-oriented, have experienced a contraction in cattle numbers since the late 1980s which has accelerated in 1990/91. The decline was particularly sharp in the former German Democratic Republic when its agriculture and livestock sector had to adjust to a completely new economic situation and the common agricultural policy of the European Community. At 116 million in early 1991, the USSR still had the largest cattle population among developed countries, although this was 5 percent less than at the 1986 peak.

In terms of beef and hides, however, the US continues to be the number one producer in the developed regions, in spite of the fall in cattle numbers from a record level of 132 million in 1975 to slightly less than 100 million by the end of the 1980s, with only a small recovery in most recent years. Japan has been one of the few developed countries experiencing some increase in cattle numbers, although the country remains a relatively small producer of milk, beef and hides. In fact, with demand for beef and dairy products outpacing domestic production, Japan has gradually opened its market and raised imports. This in turn has encouraged beef output in North America and Oceania for export to Japan. In the past, developments of the beef cattle population of Australia and New Zealand had largely paralleled those in the US, the main outlet for Oceanian beef. Cattle farming in Australia, as in the US, is basically beef-oriented, while New Zealand is an important producer and exporter of beef and milk products.

In the developing regions, China and other countries in East Asia have expanded cattle numbers with a view to satisfying higher demand for beef and milk. India continues to be the country with the largest number of bovine animals in the world but, because of religious creed, slaughterings are limited and the bulk of hides output is obtained from fallen animals. In the eastern Mediterranean region Turkey is by far the biggest producer of beef and hides. While Africa accounts for a relatively small proportion of global cattle population, Latin America has traditionally been a major consumer and exporter of beef. However, the almost chronic depression of prices in international beef trade since the mid-1970s, accompanied by decreasing demand for beef at home, has curbed cattle farming in many countries of this region, most notably in Argentina. By the late 1980s, cattle numbers in Argentina had fallen below 50 million from over 60 million at their peak in 1977, although there has been a slight increase at the beginning of this decade. On average, in the developing countries the offtake rate in cattle farming is about 13 percent and beef carcass weight 161 kg, compared with 36 percent and 242 kg respectively, in the developed countries. The resultant lower yields in terms of hides and skins are often accompanied by lower quality of these by-products. Hence, over the past one and a half decades or so, cattle and buffalo numbers have tended to rise in those parts of the world where hides productivity and quality are relatively low. In contrast, cattle numbers have been reduced sharply in such regions as North America, the largest producer and exporter of cattle hides, and Scandinavia, the hides and skins of which are appreciated for their high quality. However, the short term effect of measures to curb excess milk production in West Europe and the contraction of livestock industries in East Europe has been a temporary increase in cattle slaughterings and hide supplies in 1990/91.

Goat farming has staged some recovery in the developed regions, mainly for milk and hair production, but, as can be seen from Table 1, most goats continue to be kept in developing countries, with Asia and Africa as the most important regions. India, China, Pakistan, Iran and Turkey have the largest goat populations. In a number of developing countries, notably in Africa and Latin America where incomes and standards of living have been falling, there has been some shift from large to small ruminants, such as goats and sheep, as well as in consumer demand from beef to goat and sheep meat. According to FAO (FAO, 2), goat skins tend to account for a higher proportion of the gross carcass value than skins and hides from sheep or cattle. However, in quantitative terms, global output of goat skins is much lower.

In the case of sheep numbers and sheep skin output, developing and developed countries share about equally in the world total. In the former category, Asia and Africa are the most important regions, although the proportion of Latin America is larger than in the case of goats. China, Turkey, India, Iran and Pakistan are the biggest producers of sheep skins in Asia. In Africa, Nigeria and Ethiopia are the main producers, and in Latin America, Argentina and Uruguay. The latter two countries keep sheep primarily for wool production. China expanded sheep farming during the 1980s with a view to raising output of both wool and meat, although the expansion seems to have come to a halt most recently. Sheep milk is appreciated in several countries of Asia and Africa, and some sheep breeds also provide hair.

Among the developed countries, sheep milk is of some importance in Southern Europe. However, lamb production is the main objective of sheep farming in Western Europe, with mutton, wool and skins arising as by-products. Support granted to sheep meat producers under the common agricultural policy resulted in a substantial expansion in EC sheep flocks in the 1980s, although measures have recently been taken to curtail this increase. In East Europe and the USSR a high degree of self-sufficiency in wool was one of the objectives of livestock policies until the late 1980s. Nonetheless, sheep farming in the USSR has experienced a decrease since the second half of the 1980s, the contraction accelerating at the beginning of the new decade. In the former German Democratic Republic the wool-oriented sheep sector was virtually wiped out in 1990/91 during the rapid integration of East Germany into the European Community which provides no specific support to wool growers. Removal of support coupled with liberalization of wool imports has also curbed sheep farming in several neighbouring East European countries, although greater emphasis is now given to lamb production. The US remains one of the few developed countries where government grants support to wool growers, but sheep farming has for a long time been an insignificant item in the US livestock economy.

While New Zealand is an important producer and exporter of lamb and wool, sheep farming in Australia and South Africa is wool-oriented. Sheep numbers rose rapidly in Australia during the second half of the 1980s, and the country has again become the world's biggest sheep producer although the upward trend has been reversed at the beginning of the 1990s. In 1990 Australia kept some 173 million sheep, 40 million more than ten years ago, prior to the start of the expansionary phase in the current wool cycle. But flocks have been significantly reduced by 1991. The South African sheep population decreased by nearly a fifth during the 1970s and the first half of the 1980s although it has recovered somewhat more recently. Sheep farming in New Zealand has contracted since the early 1980s, with some shift towards merino wool production. While there has been a rapid increase in the number of other small ruminants, such as goats and deer, total population of deer and goats at about 2 million accounted for just 2 percent of New Zealand livestock population (in terms of livestock units) in 1990. Inventories of farmed deer and other game ruminant animals have also increased in Australia and West Europe, reflecting growing demand for venison and policies to discourage dairy farming. Overall, world production of hides and skins is estimated to have increased by about a tenth during the past decade, with output of bovine hides and skins rising at a slower pace than that of sheep and goat skins.

In global *wool* production, the developed countries' share is much larger than in that of sheep skins, as shown in Table 1. As a matter of fact, five developed countries, Australia, New

Zealand, the USSR, the United Kingdom and South Africa, account for nearly two-thirds of world wool output. The first two, Australia and New Zealand, which are by far the largest suppliers in the international wool market, alone produce over 40 percent of the world's wool. In the UK and elsewhere in the EC, support to sheep meat producers has also resulted in an increase in wool output. In New Zealand the contraction of sheep farming and wool output since the early 1980s reflected, to a large extent, the discontinuation of government subsidies on sheep meat and wool, although the wool industry maintained its own price stabilization scheme (introduced in 1952) until early 1991. In early 1991, wool boards in New Zealand and other producers and exporters in the southern hemisphere ceased setting floor prices, following the suspension of the Australian Wool Corporation's reserve price scheme in February 1991. The permanent abolition of that scheme was announced by the Australian Government in May 1991.

In the developing regions, China expanded wool output rapidly during the 1980s, becoming the leading producer in this category, although the rise has levelled out most recently. Argentina and Uruguay are the next most important producers, being also the largest exporters among developing countries. Other major producers are Pakistan, Turkey, Morocco, India and Iran.

Over the past decade world wool output grew by almost a fifth. The expansion accelerated during the second half of the 1980s, chiefly reflecting the developments in Australia, China and to a lesser extent the European Community. According to the Commonwealth Secretariat (1991), in 1990/91 merino wool (of which Australia is the biggest producer) accounted for 46 percent of world raw wool output, crossbred wool (which is mainly used for carpets and of which New Zealand is the biggest producer) for 25 percent and other wool (of which the USSR and China are the biggest producers) for the remainder.

Hair, produced by such ruminant animals as goats, some sheep breeds, alpaca or vicuña, albeit important for some countries, amounts to only a very small fraction of total supplies of natural textile fibres and an even smaller portion of the combined supplies of natural and man-made textile fibres, as can be seen from Table 2.

International trade and prices

The proportion of world output of hides, skins and wool that enters international trade is considerably higher than is the case of other products derived from ruminant animals, such as meat and dairy products. As with meat and dairy products the developing countries as a group have been net importers of hides, skins and wool in the recent past. However, since much of the final products made from these raw materials is sold to developed countries, the developing countries are net exporters in overall trade in hides, skins, wool and their derived products.

According to FAO (FAO 2 and 5), the expansion of trade in bovine hides and skins during the past two decades reflected exclusively larger shipments from developed countries, whereas

Table 2. World output of textile fibres (late 1980s).

		1 000 tons	Percent share
Total		38 000	100
Man-made		17 600	46
Natural		20 400	54
of which:	cotton	17 500	46
	wool (clean)	1 950	5
	mohair	25	-

Source: Commonwealth Secretariat and FAO (FAO, 4).

exports of developing countries have decreased significantly, as can be seen from Table 3. The US continues to be the leading supplier in the international market of bovine hides, accounting for over a third of total exports. The sharp rise in competitively-priced hide exports from the USSR had propelled this country into the second position among world exporters during the second half of the 1980s, although this growth has levelled off in most recent years. In contrast shipments from Australia, the third largest supplier, have recovered, in line with an upswing in beef output.

Exportable supplies from developing countries have remained scarce, given the widespread export restrictions on raw hides imposed to ensure supply to the expanding tanning and leather industries. Such important producers of hides and skins as India, Pakistan and Argentina are among those countries that have banned exports of raw hides altogether. Exports of sheep and goat skins have increased less, although, as shown in Table 3, there has been a similar change in the shares of developed and developing countries as in the bovine sector.

Import patterns continue to reflect the steady shift in tanning activities from developed to developing countries. In recent years, the Republic of Korea has overtaken Italy as the largest buyer of cattle hides. Import requirements have also grown in Thailand and Indonesia, in order to satisfy the needs of their expanding tanning sectors, as capacities are being transferred from higher-cost countries of East Asia, notably the Republic of Korea, and Taiwan. In fact, import requirements of Taiwan have declined in the wake of the transfer of tanning capacity to the People's Republic of China and other countries of the Far East. In the Near East, Turkey whose economy is experiencing one of the highest growth rates in the world, has raised imports of hides and skins. Whereas in Latin America, Argentina's leather industry depends on domestic raw materials, Mexico's export-oriented leather industry has substantially increased purchases from abroad in recent years, but Brazil has bought less due to a weak domestic economy. Among the developed countries Italy and Japan remain the largest importers although imports have levelled off or decreased more recently as have imports of East European countries,

Table 3. Exports of raw hides and skins[1].

	Bovine hides					Sheep and goat skins				
	Production (10^3 tons)		Share in world trade (%)			Production (10^3 tons)		Share in world trade (%)		
	60's	80's	Growth	60's	80's	60's	80's	Growth	60's	80's
World	1180.4	1830.4	55.1	100.0	100.0	209.6	220.3	5.1	100.0	100.0
Developed countries	884.7	1683.5	90.3	74.9	92.0	119.2	152.3	27.8	56.9	69.1
Developing countries:[2]	295.7	147.0	–50.3	25.1	8.0	90.4	67.9	–24.9	43.1	30.8
Latin America	199.8	17.2	–91.4	16.9	0.9	15.2	2.9	–80.9	7.2	1.3
Near East[3]	4.8	18.7	289.6	0.4	1.0	40.7	40.4	–0.7	19.4	18.3
Asia & Pacific region	24.5	63.6	159.6	2.1	3.5	12.9	7.8	–39.5	6.2	3.5
Africa	66.2	47.0	–29.0	5.6	2.6	21.5	16.8	–21.9	10.3	7.6

1 Late 60's and late 80's.

2 Figure shown may be slightly different from the sum-total due to existence of some 'other developing countries' not shown separately.

3 Excluding Egypt, Libya and Sudan which were included in Africa.

among which Czechoslovakia had become the largest buyer in the 1980s. Weaker import demand of the leather industries in several OECD countries has been due to a combination of factors, such as rising labour costs, more stringent effluent control legislation and a mild economic recession. However, in East Europe the demand has decreased more sharply, as incomes have fallen, subsidies on basic consumer goods been removed and exports of leather shoes to the USSR, the main outlet for East European exporters, decreased. In this situation, world market prices of hides have fallen considerably since the middle of 1990, as illustrated in Figure 1. This chart also shows the high degree of volatility of prices in international hides trade over the past three decades.

The bulk of wool that enters international trade also comes from developed countries, in particular Australia and New Zealand, followed by South Africa. In the developing regions, Argentina and Uruguay have traditionally been the main exporters, but as a group the developing countries have a large net import. As in the case of hides and skins, processing capacities in the developing countries have grown faster than in the developed regions, partly for shipment of finished goods to developed countries. China, Taiwan, the Republic of Korea, India and Turkey have become major importers of raw wool, although in China the rapid expansion of textile production seen during most of the 1980s has been reversed most recently. Overall, however, the shift in wool processing from developed to developing countries has been less pronounced than in the hides and skins sector, partly reflecting a relatively higher degree of protectionism. In fact, the developed countries still account for the largest part of world wool imports, with the EC being the biggest purchaser, followed by Japan, the USSR and the US (Table 4).

In the international wool market, prices have been under downward pressure for about three years, as illustrated by Figure 2. This followed a sharp increase during the period 1984 to 1988 when the Australian Wool Corporation raised its support price (in local currency) by 85 percent, accompanied by similar steps in other exporting countries. (It may be worth mentioning that, unlike the government-financed agricultural intervention schemes in West Europe and North America, these stabilization schemes are largely financed by the wool industries of the countries concerned.) High support prices stimulated output, notably in Australia, but discouraged demand and eventually led to the accumulation of large stocks, reaching a record level of 0.5 million tons, i.e. one-fourth of world production at the beginning of the 1990/91 marketing year. Stocks rose further by 1991, with Australia alone holding more than 0.5 million tons early this year. In this situation the floor price in Australia was reduced by 20 percent in June 1990 and, as mentioned in the previous section, support purchasing was discontinued altogether in early 1991.

According to USDA, the recent decline in wool demand partly reflected a switch by the textile industry to cotton and man-made fibres at a time when technical innovations in the manufacture of man-made fibre and in the processing of cotton knitwear provided a wide range of texture choices, enhancing substitution. Moreover, economic growth has slowed in several OECD countries, the principal wool consumers, which, together with the reaction to record wool prices, caused a significant reduction in consumption. However, the decrease in demand was much more pronounced in East Europe and the USSR, for similar reasons to those mentioned with regard to hides and skins, as well as in China, as countries suffered not only from an, at least temporary, contraction of demand, but also an acute shortage of foreign exchange to buy raw materials in the international market. East Europe, the USSR and China accounted for nearly 40 percent of world consumption of virgin wool (at the spinning stage) by the wool textile industry during the second half of the 1980s.

The collapse of wool prices in international markets has been accompanied by a sharp reduction in prices of hair. According to Laniera (1991), prices of South African mohair, in terms of Italian Lire, decreased by about a third in the course of calendar year 1990. Current prices of Peruvian Alpaca hair are only one-third of the levels of three years ago and not much higher than wool prices, according to a recent report in the Financial Times, (Financial Times,

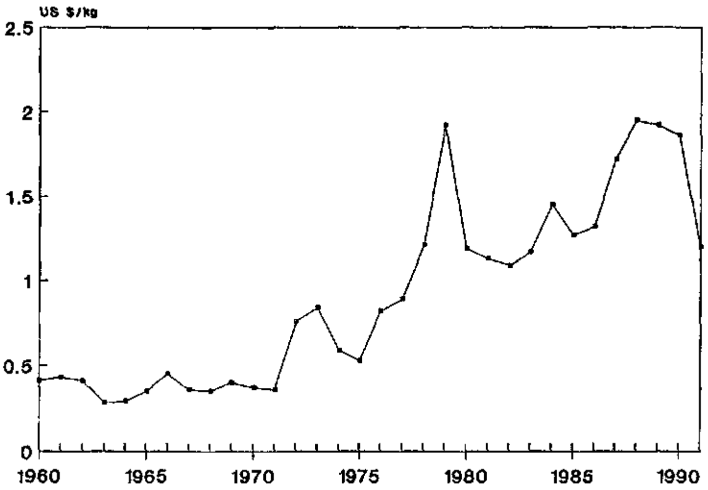

Figure 1. Cattle hide prices (US $ per kg; Light native cowe hides, Chicago)

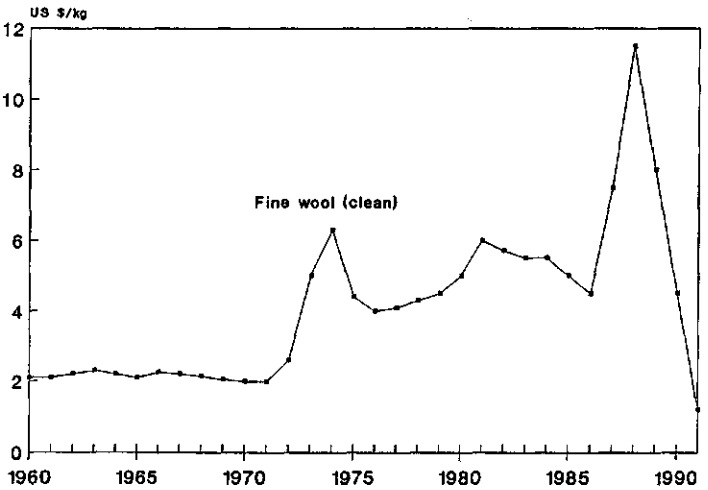

Figure 2. Wool prices (US $ per kg, c.i.f. London).

Table 4. Trade in wool (late 1980s, thousand tons, clean).

	Exports	Imports
World	420	400
Developing countries	70	150
Developed countries	350	250

Source: FAO (FAO , 1)

15 August 1991). Peru's Alpaca industry has progressively moved into manufacturing, exporting cloth and knits rather than raw fibre or tops which are more susceptible to international price fluctuations. Peru and Bolivia keep most of the world's Alpaca, although there has recently been some export of live animals, at attractive prices, to developed countries, notably New Zealand and the US. Chile has been expanding its population of vicuñas for the production of a type of hair which is said to be softer than cashmere. For cashmere China has recently reduced its export price from US$ 95 to US$ 79 per kg.

Processing

From the end of the 18th century, i.e., the beginning of the industrial revolution, until well into the 20th century, the rapidly expanding processing industries in Europe, and somewhat later North America and Japan, conquered world markets, as a result of which, especially in the textile sector, much of the existing local industries in what is now called the developing regions, was virtually eliminated. From a small net importer Europe turned into a large net exporter. However, during the second half of the 20th century leather and textile industries in the developing countries grew much faster than in the developed regions.

According to FAO (FAO, 5), there has been a drastic shift in tanning and leather products manufacturing capacities away from the industrialized countries, particularly those belonging to the OECD, to the developing countries. Over the past quarter century or so, the developing countries have changed from a net exporter to a net importer position in hides and skins trade. While world production of light cattle leather has risen by about three quarters since the early 1960s, that of developing countries has grown by over 150 percent. Similarly, while global leather footwear manufacturing rose by 60 percent, that of the developing countries grew by 180 percent, to account for 40 percent of all shoes produced in the second half of the 1980s, against 20 percent 25 years earlier. By the same token, the pace of growth in exports of leather and leather footwear from developing countries has been much faster than for developed countries. The former group accounted for 40 percent of leather shoes entering international trade in the late 1980s, compared with merely 8 percent in the early 1960s. However, growth has been uneven among developing countries. Exports of the Asia and Pacific region and, to a lesser extent Latin America and the Mediterranean region, grew fast but Africa's share in world tanning and manufacturing output and trade remained small. Although being major producers of hides and skins, countries in sub-Saharan Africa have often failed in their efforts to establish local manufacturing industries.

In the 1980s, the USSR was by far the world's largest producer of shoes. Among OECD countries, Italy, the US, Spain and France remained major producers, but output stagnated or declined in the OECD area as well as the USSR and East Europe during the 1980s. In contrast, shoe industries in countries such as China, India, Republic of Korea, Turkey and Brazil have experienced very rapid growth.

High processing costs and increasingly stringent effluent control legislation have been among the factors causing the shift in tanning and leather industries from OECD to developing countries. More recently, there has also been a transfer from several East Asian countries where costs have reached relatively high levels, such as Taiwan and the Republic of Korea, to the People's Republic of China and South East and South Asia. With the main exception of Japan, markets of shoes and other leather goods of the OECD countries are relatively open. The US, for instance, has raised its net imports of shoes and leather products almost tenfold to over US$ 10 billion between the mid-1970s and 1990 (US Leather Industries Statistics). Other large markets are Germany, France, the UK and, despite its huge domestic output, the USSR.

Although the developed countries remain the largest importers of raw wool and manufacturers of wool textiles, there has also been a pronounced shift of fibre-processing capacities to developing countries. According to FAO (FAO 4), in the mid-1980s almost 50 percent of all textile fibres were spun in the developing countries, as against 37 percent in 1975. The expansion in mill activity was accompanied by a sharp increase in exports of textile manufactures by developing countries, although the expansion was most pronounced in cotton and man-made fibre manufactures. Unlike in the leather sector, Japan's market for textiles is relatively open, with capacities being progressively shifted towards Asian developing countries where costs are lower. Imports into West Europe and North America have been subject to substantial restrictions under the Multi-Fibre Arrangement. In the developed regions, the USSR, Italy, Japan, Germany and the UK are the largest processors of wool, while China is the biggest manufacturer of wool textiles among developing countries and the world's second largest.

Consumption

Although the developed countries export a sizeable portion of their production of hides and skins and wool to the developing regions, much of this comes back in the form of semi-finished or finished consumer goods. Thus, per caput consumption of leather and wool in the developed regions is well above that in the developing countries, as can be seen from Tables 5 and 6.

The wide differences may be partly due to climate, but the principal factor is income. In fact, largely reflecting incomes, per caput consumption levels in the developing regions differ not only substantially from country to country but, within countries, also between income groups. On the whole in the developing countries, not much improvement has occurred over the past quarter century or so. In this group of countries the proportion of leather going into shoes has been gradually increasing, whereas it has been decreasing in the developed countries. On the world level, probably somewhat less than half of total leather output is used in footwear manufacture.

In Western Europe and North America per caput consumption of shoes seems to be near saturation point level, although demand for other leather goods is still rising. In quantitative terms, per caput consumption of leather shoes and wool in East Europe and the USSR in the 1980s was about the same as in the OECD area, in spite of generally lower incomes. This reflected government policies to keep retail prices of basic consumer goods low, using massive subsidies to bridge the difference between the costs of production and the final consumer price. However, with countries moving to a market economy, consumption has fallen sharply by the beginning of the 1990s. In the former German Democratic Republic much of the local leather and textile industry was laid idle, when following the abrupt integration into the European Community in 1990, incomes decreased, subsidies were removed and consumers switched to

Table 5. Apparent consumption of leather shoes (pairs per caput per year).

	Early 1960s	Mid 1980s
World	0.8	0.8
Developing countries	0.2	0.3
Latin America	0.8	0.8
Africa	0.1	0.1
Near East	0.5	0.8
Asia and Pacific	0.2	0.3
Asian centrally planned	0.1	0.1
Developed countries	1.9	2.2
North America	2.8	2.7
West Europe	1.8	2.1
East Europe and USSR	2.0	2.8

Source: FAO (FAO, 5)

Table 6. Apparent annual consumption of wool and total apparel fibres (mid 1980s, kg per caput).

	Wool	Total fibres
World	0.4	7.1
Developing countries	0.1	3.8
Latin America	0.2	5.2
Africa	0.1	1.3
Near East	0.6	7.0
Asia and Pacific	0.0	2.6
Asian centrally planned	0.2	4.9
Developed countries	1.2	18.0
North America	0.8	26.0
West Europe	1.3	16.2
East Europe and USSR	1.3	15.4

Source: FAO (FAO , 4)

Table 7. EC Imports from third countries of wool carpets in 1989 (10^3 ECU).

		Total EC	W. Germany
Carpets comprising < 350 knots per metre of warp knotted			
Total imports		264	182
of which from	Nepal	68	54
	China	54	24
	Morocco	46	43
	India	44	33
	Iran	15	7
	Turkey	6	3
Carpets comprising 300–500 knots			
Total imports		397	283
of which from	Iran	214	156
	India	63	56
	Turkey	45	29
	Afghanistan	19	16
	China	17	8
	Pakistan	14	4
	USSR	11	8
Carpets comprising > 500 knots			
Total imports		206	132
of which from	Pakistan	71	33
	India	56	44
	Iran	40	30
	China	19	16
	Turkey	9	7
	USSR	5	5

Source: Eurostat.

western goods. Similarly, in the neighbouring countries of East Europe, rising unemployment and inflation, removal of subsidies and gradual liberalization of trade have curbed demand for and output of leather goods and textiles. This decline has been reinforced by a reduction of exports to the USSR while access to OECD markets has remained restricted. In the USSR, following a 5 percent decline in 1990, the output of textiles and footwear decreased by 11 percent each in the first half of 1991, while imports of textiles and footwear and distribution through the state and cooperative retail network fell even more sharply (Ekomomika i Zhizn No. 30, July 1991). In the same period, production of leather footwear declined by 24 percent in Poland and 12 percent in Czechoslovakia. Output of woollen fabrics was down 23 percent in both countries. Hungary's textile and leather industries both contracted by 24 percent in the first half of 1991.

Next to textiles and clothing, carpets and other floor-coverings are probably the most important item in world wool usage, especially insofar as coarse wool is concerned. Fluctuations in prices of coarse wool have been smaller than in those of fine wool. Also, international trade in carpets is subject to less restrictions than that in textiles and clothing, with customs tariffs being lower. West Europe is by far the chief outlet for carpets made in the developing countries, notably in Asia and North Africa. Annual registered purchases of knotted carpets by EC and other West European countries have exceeded US$ 1 billion in recent years.

Table 7 shows imports of three categories of carpets of wool into the European Community and West Germany, the largest buyer (International Trade Centre, 1980 and 1981). During the second half of the 1980s, the officially recorded value of West German imports of the above types of carpets rose at an annual rate of 3 percent to reach DM 1.1 billion in 1990. The larger market of united Germany is likely to experience further growth in the 1990s.

Outlook

Short-term

Global supplies of hides and skins are unlikely to change much during the next year or two. In East Europe and the USSR cattle and sheep numbers are still decreasing. The mid-1991 census in the USSR showed a reduction in cattle and sheep (including goats) inventories on state and collective farms by 4 and 9 percent, respectively, compared with July 1990. In West Europe the expansion in sheep numbers is slowing. The cattle population, although still milk-oriented, is gradually changing towards increased beef output. Slaughterings of cattle in the EC are expected to rise somewhat in the early 1990s, partly due to efforts to curb excess milk output, but they should decline towards the mid-1990s. There will also be some increase in slaughterings in North America, Oceania and Japan, with the proportion of intensively fed animals rising further. In the developing regions China intends to expand its population of ruminant animals to make better use of its vast areas of grassland, but considerable efforts will be necessary to improve pasture productivity. Although overall output of hides and skins in developing countries will probably grow only slowly, technological developments such as more widespread splitting of hides could add to leather supplies in this group of countries.

World wool output is forecast to fall by 4 percent in 1991/92, following a 1 percent decline in 1990/91, according to the International Wool Textile Organization. Oceania, East Europe and the USSR are likely to account for most of the reduction, with a possible small increase in West Europe and China. Australian production in 1991/92 is forecast to decrease by 10 percent, with sheep numbers in early 1992 expected to be 155 million, about 20 million less than in 1990. However, total supplies from current production and stocks will probably exceed the previous year's level by some 6 percent, and thus remain well above the requirements of the world wool textile manufacturing industry.

Following a 13 percent contraction in 1990, consumption of wool has started to recover in recent months, a recovery which should continue into 1992, reflecting the present very low relative price of wool, replenishment of traders' and manufacturers' stocks and somewhat improved economic conditions in several OECD and developing countries, although the recession may not yet have bottomed out in the USSR and East Europe. With global supplies exceeding demand, wool prices will remain relatively low in the short-term. In fact, the Australian Bureau of Agricultural and Resource Economics expects a 30 percent decrease in average wool prices in Australia in 1991/92, although prices could increase slowly over the following few years.

Prospects of demand for leather are similar. However, FAO expects (FAO, 2) that demand for the different end uses will not expand at the same rates. Demand for leather furniture, using large quantities per unit produced, could continue to be the pace-setter for leather usage, although this would be largely confined to higher quality cattle leather. Other fast growth areas are leather bags and fashion accessories, whereas more moderate expansion might be expected for leather shoes and leather garments as some clothing market segments seem to have approached saturation.

A certain increase in prices could occur in the longer run, notably regarding higher qualities. Generally, demand for natural looking leather with full grain is expected to grow, whereas that for low-grade, corrected leathers is likely to decrease. However, price developments in the short term may vary considerably for hides and skins from different animals, for different qualities from the same animal species and for the different types of leather derived from them. Hence, the volatility in international market conditions and prices experienced in recent years is not likely to disappear (FAO, 2).

Longer-term

Looking ahead beyond the early 1990s, the number of potential consumers will continue to rise, whereas prospects for effective demand are mixed. World population is projected to reach some 6.1 billion by the year 2000 (as against 5.2 in 1990). Most of the increase will occur in the developing countries (from 4.0 billion in 1990 to 4.8 billion in 2000). In East Europe and the USSR population is projected to be about 0.4 billion in 2000, but average incomes may continue to decrease for some time to come. At the end of the decade per caput consumption of animal products such as meat, milk, wool and leather may still be lower than in the late 1980s.

The rich countries of OECD are projected to have a population of 0.9 billion in 2000 (as against 0.8 billion in 1990), not assuming massive migration from the East and the South. In this group of countries, demand for the products and by-products from ruminant animals seems to have reached, and in some cases passed, saturation point level. While the trend towards higher quality products is likely to be maintained, there is a small, but rising proportion of consumers who reject products from slaughtered animals, such as meat and leather, a trend which has already had adverse effects on the fur industry. This could stimulate substitution by synthetics or other raw materials. In contrast, as regards wool, as M.J. Godfrey (Commonwealth Secretariat, 1991) has pointed out, re-substitution away from man-made fibres as a result of lower wool prices "could be reinforced by the 'green' trend in a more environmentally conscious society, for wool is ecologically sound, being not only natural but also renewable and biodegradable". Thus, once stocks of exporting countries have been worked down and prices have recovered, world wool output may witness a new cyclical upswing later in the current decade.

Regarding economic prospects in the developing regions, there is general agreement that incomes will increase further in Asia, although perhaps not at the same rapid pace as in the 1980s. In the year 2000, Asia will account for over half of global population. For Africa and Latin America, the World Bank and the International Monetary Fund forecast a recovery of incomes, following the contraction during the 1980s, whereas the United Nations is rather sceptical, particularly insofar as Africa is concerned.

Economic, employment and income prospects would improve in the developing countries as a result of successful conclusion of the GATT's multilateral negotiations (Uruguay Round). Better access to OECD markets for food, textiles and leather goods, coupled with the removal of trade distorting subsidies on West European and North American agricultural commodities would probably also lead to more rapid economic recovery in the former centrally planned developed countries. Liberalization would not only enable these two groups of countries to capitalize on their comparative advantage in the processing of hides, skins and wool but there could also be some shift away from West Europe and North America in milk and meat production for both domestic consumption and export, adding to local supplies, notably of hides. The resultant increase in employment and incomes would probably also stimulate domestic demand for leather goods and textiles in the developing countries. At the same time, liberalization of trade in food, leather goods and textiles and removal of support to agricultural production in West Europe, North America and Japan would mean lower prices to consumers and a reduced burden to taxpayers in these OECD countries of the northern hemisphere.

However, complete liberalization of trade appears to be a very distant goal. In any event, especially in the beef and dairy sectors, following decades of depressed prices in export markets, it would probably take some time until producers and processors in low-cost countries regain confidence and start investing again. If the Uruguay Round fails, growth in the world livestock and derived products economy would presumably be sluggish and the difference in income and consumption levels between OECD countries and developing countries, especially those in Africa and Latin America, might widen further. Excessive cost of support policies may eventually result in some reduction of animal output in West Europe and North America, but supply would continue to exceed effective demand, and world markets would remain distorted. To cope with the environmental problems, livestock industries may consider high-tech (and probably high-cost) solutions for processing and disposing of manure rather than lowering output of animal products. Manure would be processed into dry pellets and possibly marketed overseas (Doornbos, 1991). Such plans, understandable as they may be from a micro-economic viewpoint, would just add to what Professor H. Priebe has called "Die subventionierte Unvernunft" — subsidized irrationality (Priebe, 1985). In order to utilize its excessive production and processing capacities, the West European livestock economy currently imports sizeable amounts of feed and disposes of, in external markets or as livestock feed, sizeable amounts of meat, dairy products and eggs, at huge cost to taxpayers. Dried manure could then become another costly export item of the West European livestock industry, possibly being shipped to the same countries from which the feed comes. From a macro-economic viewpoint, and in the context of optimum resource allocation at the global level, it would of course be much more sensible to enable conversion of feed into animal products directly in the exporting countries where this would add to employment, income and foreign exchange earnings.

A compromise regarding agricultural trade, would be the discontinuation of export subsidies. Referring to the European Community's agricultural policy, the former West German chancellor, Helmut Schmidt, at a time of rising world petroleum prices, asked the question, why Iranians, Arabs or Venezuelans should get cheap European cheese, meat and milk powder when Europe had to pay high prices for their oil. This was a rhetoric question. Mr. Schmidt knew, of course, that a chief opponent to any rationalization of the Common Agricultural Policy was the Minister of Food, Agriculture and Forestry in his own cabinet. In fact, ever since Bismarck introduced his corn duties more than a century ago, German ministers of agriculture have been among the toughest, and — from their point of view — most successful fighters for protection in agricultural trade. Nevertheless, this scenario has more recently been discussed at some length in several quarters of the European Community and elsewhere, and might be accepted by traditional exporting countries as a second best solution if full liberalization proves unattainable. For instance, Professor Weinschenck of Hohenheim University, in a recent article in Agrarwirtschaft (Weinschenck, 1991) has suggested a compromise between ecologists, who call for a reduction of animal output to save the environment (Isermann, 1990) and proponents of free trade. While export subsidies would be phased out, the EC would maintain a relatively restrictive import policy so as to enable a sustainable, more ecologically oriented crop and animal agriculture. At the Berlin International Green Week Fair last January, I also heard from German agricultural politicians and farmers' representatives that better use of the money could be made than spending it on subsidisation of exports and depressing world market prices. It remains to be seen whether other member countries of the European Community which depend more on agricultural exports than Germany can go along with this.

In West Europe, discontinuation of subsidies on agricultural products might be accompanied by certain concessions on imports of textiles and foods, which would benefit mainly neighbouring countries in East Europe and the Mediterranean region, although several of these countries may eventually join the European Community anyhow. Similarly, under this scenario, North America, South Africa and Japan might grant greater import concessions to and enhance economic cooperation with developing countries in Latin America, sub-Saharan Africa and Asia, respectively. However, this second best solution of a compartmentalized world economy would fall far short of the expectations raised when the Uruguay Round was launched at Punta del Este in 1986.

Tentative assessment of the impact of protectionist measures on international trade

Present trade policies

With the discontinuation of price support schemes in major exporting countries in early 1991 and the progressive liberalization of markets in the former centrally planned developed countries, the bulk of the world's wool is now being produced and traded under free market conditions. The US is one of the few developed countries that continues to provide direct support to wool growers. Indirectly, however, the industry benefits from support to sheep meat production, notably in West Europe. Similarly, in West Europe, North America and Japan hides and skins arise as by-products from animals kept by meat and dairy producers who enjoy substantial protection.

Although several major developing countries restrict exports of raw hides and skins, international trade in raw hides and skins and wool is relatively free overall. In contrast, trade in leather and leather goods and wool textiles remains subject to widespread protectionism, notably by importing developed countries. Even so, the degree of protectionism and distortion of international trade appears to be less than for such products as meat and milk, derived from the same animal species, where severe restriction of imports is accompanied by massive subsidization of exports of several OECD countries in the northern hemisphere. Also, whereas quantitative restrictions negotiated under the Multi-Fibre Arrangement, for instance, generally provide for a growth factor, this is rarely the case with meat and dairy products import quotas.

According to FAO (FAO, 3), the US charges a tariff of up to 20 percent on imports of shoes, while tariffs on leather are between 5 and 10 percent and nil on raw hides. Nevertheless, as mentioned earlier, US net imports of leather and leather products have experienced a rapid rise over the past one and a half decades. As in the US, tariffs on leather and leather goods tend to increase with the level of processing (tariff escalation) in other developed countries, sometimes accompanied by a rise in non-tariff barriers along the processing chain. In the European Community the tariff on raw hides is nil, it is 7 percent on leather and 8 percent on shoes. Although under the Generalized System of Preferences (GSP) imports of leather and shoes into the EC are free of tariffs, such important shoe exporters as Brazil and the Republic of Korea do not enjoy this preference. Japan does not charge a tariff on imports of raw hides, whereas the bulk of leather imports (over and above a tariff quota on which a 20 percent duty is levied) is taxed at up to 60 percent (which is to be reduced to 40 percent over the next five years). In the developing countries customs tariffs and tariff-like charges on imports are generally higher than those of developed countries. A number of developing countries, notably Brazil, grant subsidies on exports of shoes. Other developing countries tax exports of hides, leather and leather products and some important hide producers, including India, Pakistan and Argentina, have banned exports of raw hides altogether.

There is a similar tariff escalation in trade in wool and wool textiles, besides a host of non-tariff barriers, notably quantitative restrictions, on imports and 'voluntary' restraints imposed by importing countries on exporting developing countries. According to the GATT's latest annual report (GATT, 1991), the product group with the highest number of discriminatory export restraints in 1990 was agricultural products, with textiles and clothing close behind. The fact that the latter group had the second largest number of restraints acquired added significance when it was recalled that the figures did not include restraints specifically negotiated under the Multi-Fibre Arrangement (MFA).

Among the three big economic powers, Japan, US and EC, Japan does not restrict imports of textiles and clothing under the MFA but, as pointed out by GATT (1991), it has recently asked certain developing countries to restrain their textiles and clothing exports to the Japanese market, while maintaining relatively high tariffs for these products. In the US, according to the Overseas Development Council (ODC Policy Focus, 1991, No. 4) the textile and apparel industries are among the most protected manufacturing sectors. Tariffs on woollen clothing range from 17 to 21 percent. In addition, there is a complex system of quota arrangements with specific countries under the MFA as well as regional arrangements for off-shore manufacture of US apparel in Caribbean countries and Mexico. According to ABARE (ABARE Quarterly, March 1991), more than 80 percent of US imports of textiles and apparel is restricted by quota arrangements under the MFA. Nevertheless, as stated in the above ODC report, US imports of textiles and apparel rose threefold during the 1980s.

In the European Community tariffs are lower than in the US and Japan, but as in the US there is a large number of quantitative restrictions on imports from developing and East European countries.

As the latest GATT report mentions, members of the MFA account for most of the world's exports and imports of textiles and clothing. Textile exports from the members of the MFA to all destinations amounted to an estimated US$ 125 billion in 1989, accounting for just over 80 percent of world textile exports (excluding EC intra-trade). The restrictions negotiated under the MFA apply to a large part of the exports of developing and state-trading participants to developed countries. The MFA has been regulating international trade in textiles and clothing since 1974. It was extended for the third time in July 1986 for a period of five years. The current arrangement (MFA IV) has now been extended until the end of 1992. According to ABARE, while the MFA was intended to be a temporary measure to allow older textile industries in developed countries time to adjust to competition from low cost foreign suppliers, subsequent negotiations have resulted in an increase in its restrictiveness and an increase in the coverage of fibre types. Although established under GATT, the MFA is inconsistent with the basic rules of GATT, especially the general prohibition on quantitative restrictions, in that it permits restriction of imports from developing and East European countries on a selective, bilateral basis. Hence, the Uruguay Round negotiating goal for textiles and apparel is the re-integration of the sector into the GATT, as distinct from the MFA. It was hoped that all textile and apparel import quotas would be phased out during a transition period.

Cost of protectionism and possible benefits resulting from liberalization

A number of studies have been carried out by FAO, or for FAO, to discuss the effects of protectionist measures on trade in hides, skins and leather (FAO, 3); meat, with particular reference to beef (Tangermann and Krostitz, 1982); and dairy products (Krostitz, 1986). The first study concluded that, after full liberalization, trade in hides and skins and their derived products would expand significantly, with some increase in world market prices and export earnings accruing to the developing countries as a group. In the beef and dairy sectors where the degree of protection is higher, the recovery of world market prices due to liberalization and removal of support to production, notably in West Europe, North America and Japan, would be more pronounced. At the same time, there would be a certain shift in beef and milk production to low cost producing countries in Oceania and the developing regions. In these regions, export earnings and incomes from increased employment in farming and processing would grow while the burden on consumers and taxpayers in West Europe, North America and Japan would decrease.

The effects of protectionist measures on trade in textiles have been studied for instance by the World Bank, the Overseas Development Council and ABARE. The latter two studies are mainly concerned with protection of the US textile and apparel industries. Removing the quotas and tariffs that protect textile industries in OECD countries would produce substantial welfare gains for the countries while considerably raising export earnings of developing countries. The World Bank (World Development Report, 1990) estimates that, if trade in textiles and clothing were fully liberalized, developing countries whose export earnings from these products amount to about US$ 30 billion, would realize an extra benefit of US$ 11 billion. At the same time, employment by textiles and clothing industries in developing countries might rise by 20 to 45 percent.

Restrictions by OECD countries on imports from developing countries and East Europe have, to some extent, also furthered trade in textiles among OECD countries. In fact, among the five leading exporters there are only two developing countries. In the late 1980s the world's largest exporters of textiles were West Germany (which was also the largest importer) and Italy, followed by China, Hong Kong and Japan. To offset their high labour costs (in 1990, the total cost per operator hour was between US$ 15 and 20 in Japan, North America and West Europe, more than five times the level in Hong Kong, Taiwan and South Korea and ten to fifteen times as much as in South and South East Asia), OECD countries have been rapidly rationalizing local textile industries, turning spinning and weaving into highly capital-intensive activities ("World Textile", Financial Times, 3 October 1991).

A comprehensive look at the impact of protectionist measures in the livestock sector and such derived products as leather and wool textiles suggests that liberalization would not only enable developing countries to capitalize on their comparative advantage in the processing of hides, skins and wool, but there could also be some shift towards developing countries in milk and meat production, adding to local supplies of hides in particular. The resultant increase in employment and incomes would probably also stimulate domestic demand for animal products, be they for food or footwear and clothing, from their currently very low levels. At the same time, consumers and taxpayers in developed countries would realize substantial benefits.

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Sheep production in Turkey

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Summary

Turkey is among the major sheep raising countries of the world with a sheep population of 45 million heads in 1988. Of the sheep population, 97% belong to native breeds and the remaining 3% are Merino and Merino crosses. Among the sheep breeds, White Karaman is the most numerous breed (43.2%) followed by Red Karaman (22.4%), Dagliç (12.3%), Kivicik (7.7%) and Awassi (2.3%). Karakul, Chios and Imroz have small populations.

The sheep population of Turkey have been decreased by 12% in the last 5 years. One of the major reason of the decrement is the changes which are recently occured in economical and social structures of the farmers who are involved in sheep industry as well as the changes in the whole Turkish economical structure. In fact it was more desirable that the decrement in the sheep population would appear as a result of shift in the sheep raising systems from extensive to the intensive system.

Mutton is the primary product of sheep in Turkey. Although it forms some 44% of total red-meat production of the country, carcass weight per capita is still very low as 8 kg/head for lamb and 16 kg/head for adults. Milk is still considered as a secondary product of sheep in Turkey and it consists of 22.4% of the total milk production. Regarding the wool production of Turkey, native sheep breeds have low genetic potential in terms of wool quality and quantity. Although wool production follows the other two, sheep breeding strategy in early fifties was intensified on improving the wool production of sheep. On the other hand, sheep industry is one of the most numerous sector providing raw material for the leather industry in Turkey.

Since the improvement strategies have to be based on natural conditions of the country, it is strongly suggested that to import and adapt new technologies into Turkish sheep industry is still necessary.

Introduction

There is a wide spectrum of regions in terms of topography and climate in Turkey. In some regions, where subtropic climate is dominant, intensive horticulture is generally practised and in other parts where arid and semi-arid climate is dominant there is only vast native grazing lands and steppes. Total annual precipitation varies from 300 mm in steppe areas to 2 000 mm in very productive regions.

In this natural topographic and climatic conditions, sheep breeding has been playing an important role in Turkish agricultural system for centuries and Turkey is always one of the leading country in sheep production in the world. Because of the current demand for sheep products and relatively high prices paid for these commodities, sheep population showed an increasing trend in number with regard to other livestock. The vast permanent grazing lands and dry steppe areas and poor nutritive value provided by these lands are the other affecting factors of the increment in number of sheep. This increasing trend has been continued until recent years although improved irrigation systems and mechanization are applied in intensified agriculture.

Table 1. Composition of sheep population in relation to breeds.

Breed	Number (10^6)	Proportion (%)
Fat-tailed		
White Karaman	23.2	47.6
Red Karaman	9.0	18.5
Dagliç	7.4	15.2
Awassi	1.1	2.2
Thin-tailed		
Kivircik	3.8	7.8
Turkish Merinos	1.4	2.9
Karayaka	1.2	2.4
Imroz	0.07	0.14
Others		
Chios	0.01	0.05
Local crossbreds	1.6	3.2

Table 2. Mean values of production data for Turkish native sheep breeds.

Breed	Liveweight (kg)	Milk yield (kg)	Greasy fleece weight (kg)
White Karaman	40–45	50–55	1.5–2.0
Red Karaman	40–45	55–60	1.2–1.5
Dagliç	35–40	40–50	1.8–2.0
Kivircik	40–42	70–90	1.3–1.7
Karayaka	38–40	40–45	2.0–2.5
Merino types	50–55	55–60	3.0–3.7
Awassi	40–50	100–155	1.8–2.2
Chios	40–45	120–180	1.6–2.0
Imroz	35–40	70–100	1.6–2.0

As it is seen in some countries in the world, mutton and especially lamb meat is preferred by the consumer and receives a high price in Turkey. Besides there is a big demand for sheep milk products such as cheese and yoghurt in the country. On the other hand, wool is an important raw material for Turkish carpet and kilim industries. It is also partly used in woolen material manufacturing. Therefore it can be said that sheep husbandry will maintain its importance in the foreseen future where scanty rainfall, poor rangelands and insufficient winter feeding occurs.

The sheep population in 1983 was 48.7 million. The number of animal of different breeds and their proportion in the population are given in Table 1 (Yalçin, 1985). The contribution of sheep meat and milk to total red meat and milk output of the country is 32 and 22%, respectively. Moreover an important amount of sheep exportation (live and carcass) to the neighbor countries was realized in the last decade which makes an important share in the total animal products exportation. Sheep is also the major raw material source of leather and carpet industry which are important export commodities. Sheep husbandry makes an important contribution into the Turkish economy by using the vegetation on noncultivated, unproductive lands, and the vegetation of in and/or near forest areas.

The agricultural production projections covering 1968–2000 years published in 1969. The sheep population in 1968 was 32.654 million head which was made up of 16.3 million ewes, 0.64 million rams, 15.714 million yearlings and lambs and the number of sheep estimated to be the same in the year 2000. According to this projection, milk yield, number of sheep for slaughter and fattening, mean carcass weight for ewes, rams, lambs and yearlings were estimated to be 733.000 tons, 11.99 and 7.0 million heads, 30, 40 and 20 kg respectively. It was also foreseen that the contribution of sheep meat to total red meat production would be 25% (Anonymous, 1969).

The sheep breeds in Turkey, their distribution and characteristics

According to 1983 statistics, Turkey is placed in the first 10 among the sheep raising countries of the world with a population of 48.7 million head of sheep. This high level of sheep population is a natural result of animal production system applied in Turkey. Because, animal production is mainly based on grazing on natural pasture which is more than 80% of these lands are typical sheep grazing lands covered with poor and short vegetation. Therefore sheep raising is free from the competition of either other livestock or of horticulture (Düzgünes, 1968).

However the conditions are changing in opposition to the sheep industry. In fact as a result of unplanned and overgrazing, a very big proportion of the sheep grazing lands become unproductive. So far as there is not legislative measurements taken in order to prevent and to use these lands in a more effective system. The foreseen number of sheep of 32 million head in the year 2000 is a striking indication of this statement. The production performance of indigenous breeds which are suitable for the extensive production would not be economical in the future, replacement of traditional system by intensive and semi-intensive system would be expected. These changes would not expected to be realizing at the same time with the same rate in different regions of Turkey. But distribution and rate of changes and targets that sheep production will be directed in are feasible (Düzgünes, 1968).

Fat-tailed native sheep breeds are dominant in the inland regions of the country which has arid climatic conditions. Of these breeds, White Karaman is distributed in Central and partly Eastern Anatolia, Red Karaman is distributed in Eastern Anatolia regions. Dagliç breed is mainly raised around the Central-West provinces of Turkey and Awassi is in the South-Eastern provinces. Of the thin-tailed breeds Kivircik is kept in Marmara and Ege regions, Karayaka is the dominant breed in the Black Sea region and Imroz is raised around Çanakkale province. As it is noticed, thin-tailed breeds are mainly distributed the coastal regions of the country. Pure and crossbred Merinos are localized in South Marmara and Central Anatolia and semi-fat-tailed Chios is kept in Ege and partly of coastal Marmara regions (Yalçin, 1978).

Mean values of data related to the production performance of some native sheep breeds are given in Table 2. As it is seen in the Table, live weight, lactation milk yield (exc. the milk sucked) and fleece weight of White Karaman, Red Karaman and Dagliç breeds which represent 80% of the sheep population, are 35–45, 60 and 1.5–2.0 kg, respectively. They produce coarse carpet type wool as with the other native breeds. In general, they are low producing breeds in terms of meat, milk and wool production. On the other hand, Kivircik, ÿmroz and especially Awassi and Chios have been noted with their high milk production. The average milk yield is 120–180 kg/year and it can be increased up to 210 kg under good management and feeding conditions.

To be some individual record animals in these breeds having milk yield of more than 300 kg/year can be considered as the evidence of possible improvement level of average milk yield in Chios and Awassi sheep by selection.

While the average litter size for native breeds is 85–90%, it can be as high as 230% for Chios breed. With its lambing performance, Chios has an outstanding position in the world. The milk yield for the thin tailed Kivircik and Imroz sheep are reported to be 70–100 kg/year. But Kivircik is noted with its potential for milk fed lamb production and carcass quality among the native breeds. The Merino crosses bred in Turkey are distinguished with their mature live weight, fleece weight and quality with regard to native breeds.

Improvement direction in sheep husbandry

Since the foundation of the Republic of Turkey, several research studies related to improvement of genotype of native breeds and the existing environmental conditions have been carried out and the results obtained have been extended to the farmers as much as possible. However the progress gained in sheep breeding up to day can not be considered satisfactory. The necessity of changes in the present extensive sheep husbandry system will be firstly in the areas where the conditions for economical dairy cattle production are available. It seems that the defined regions will be the Marmara and Ege where close to the high consumer potential and generally intensive and semi-intensive agricultural systems applied. Even these necessary changes can be expected in the East and North-East Anatolian regions where appropriate conditions are available for cattle production although they are far from mass consumer centers. But shifting the direction in sheep breeding would be expected to be slower and with a lower rate in dry and steppe regions of the country. This rate might gear up with the States policy applied related to sheep husbandry in these regions (Düzgünes, 1968).

Improving studies of native sheep breeds in Turkey

The very early and the most important improving work for Turkish sheep breeds is Merinolizing. Although some attempts were made aiming at Merinolizing the local breeds by means of crossbreeding before the Republic, the basic works were realized afterwards. With this objectives, the first Merino sheep were imported in 1934 according to a crossbreeding project to apply in Bursa, Balikesir and Çanakkale provinces which is prepared by W. Spöttel, who was then the Professor of Animal Husbandry at the Advanced Agriculture Institute in Ankara, Turkey. The objectives were to improve a sheep type which producing fleece with high quality and quantity, have better fattening performance and moderate milk yield and also is adaptable to the natural and production conditions of the region. Because of not to be able to achieve the objectives in the mentioned region, the project was removed to the Central Anatolia by the Ministry of Agriculture. The White Karaman ewes at the State Farms in Central Anatolia were inseminated with Merino semen by means of A.I. in 1952 and in consecutive years, crossbreeding is expanded to the village flocks level (Düzgünes et.al. 1960).

As a result of the big size of F1 generations and the higher income that farmer obtained from crossbreds wool which is subsidized by the State, farmers' interest to the Merinolizing works increased. Consequently the project is extended to the East Anatolian region as well in order to improve Red Karaman sheep by crossing with Merino. However the high level of Merino genotype coupled with unfavorable production conditions, a decrement in prolificacy and growth performance in crossbred animals were observed. In addition to this by lifting the subsidy of State on the Merino crossbred wool, the Merino population is kept rather small within this limited breeding area of three regions and the present population of 3% in total sheep population is made up.

Until recently the breeding studies of native sheep breeds by crossbreeding are realized between Kivircik and White Karaman with mutton-wool Merinos. Besides the different ecological conditions and characteristics of naive breeds, the changing trend in the market requirements must be taken into account. It is pointed out that there is a need in using some exotic breeds known with their growth performance, carcass quality, prolificacy and milk yield for improvement studies of native breeds. From this point of view, since 1968 Turkish Scientific and Technical Research Council have been supporting steering some number of research projects entitled "Improving the Turkish Sheep Breeds by Crossbreeding" covering Texel, East Friesian, Ile-de-France, Rambouillet and Mutton merino breeds (Yalçin, 1978).

One of these research projects is related to improving Dagliç sheep which is the dominant breed in Central and West Anatolian provinces. With this aim, Ile-de-France and Rambouillet sheep were used as the breeding stock. The other research project is on the improving possibilities of milk production and prolificacy in Kivircik sheep which is kept mainly in Western Anatolia and Thrace regions, by crossbreeding with East Friesian and Texel breeds.

It is reported that satisfactory results obtained from most of these research projects. Therefore improvement can be achieved in the productivity of Turkish sheep husbandry by transferring the results into practise. With the enlighten of these research works some English meat type breeds were imported in 1987 in a countrywise sheep project and distributed to the State Farms and willing farmers in different regions. But for the time being now, there is no records and any information about the performance and future of these breeding stocks at farmers level. It is believed that there is an urgent need to find out the required information and to analyze them in order to evaluate the project.

The research works on improvement of native sheep breeds by selection were mainly focused on Awassi sheep which is the dominant breed in the South Anatolian Region of Turkey. Milk is the primary product followed by meat production in Awassi sheep (Sønmez, 1973). Ceylanpinar Agriculture Enterprise has an important role on improvement of Awassi flocks around the region with the pure Awassi flock of 70 000 head and the male and female breeding stocks distributed from this center makes a big contribution to this improvement.

A group of Awassi rams were imported from Israel within a project conducted at the Ceylanpinar Agriculture Enterprise with FAO founds, in order to compare the performance of different characteristics of local and Israel origin rams under Ceylanpinar conditions. The objectives of this project are to find out the using possibilities of Israel origin rams for improvement studies of Awassi sheep in the region.

New approaches for sheep husbandry in Turkey

Marmara and Ege regions generally possess favorable management and nutrition facilities and climatic conditions for intensive and semi-intensive sheep raising especially high quality fat lamb production.

There is a need for researches on developing the sheep breeding on this target. In particular possibilities on improving prolific, high milk producing and unseasonal sheep genotypes which can be used as dam-line in fat lamb production practices must be studied. To achieve this, two-way and three-way crossbreeding must be applied between Kivircik ewes and Fin, Romanov and Chios breeds. Then comparative studies aiming to determine the reproductive performance, milk yield, length of breeding season and nursing ability of crossbred females obtained must be realized. With the same objectives, to use Ile-de-France, German and English mutton breeds can be considered. Thus by using the obtained sire and dam lines, an industrialized fat lamb production system which produce more lamb with high growth performance and carcass quality will be developed.

The expected situation in sheep production in Central and Eastern Anatolian regions does not seem favorable for intensive sheep meat production in the near future. In some part of these regions, where conditions are suitable improving the present performance of native breeds by using mutton-wool sheep breeds must be considered. But the level of exotic breed genotype must be kept at 50–75% in crossbred animals. This statement is also right for the Merino crossbred population raised in Central Anatolia at present.

It is proved that Rambouillet × Akkaraman crossbred genotypes can be successfully used as mutton-wool type breeding stock in this region. Moreover working on possibilities of making use of American Rambouillet, Targhee and Colombia breeds in grading up the Red and White Karaman sheep in Eastern Anatolia seems to be an important issue in the future.

While planning these development works for the future, raw material sources for Turkish woolen textile industry and for traditional carpet sector must not be ignored. Hence we must consider the necessity of required coarse wool production for these industries in some parts of the country.

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Session 1

Hides, skins and leather production

Chairman:	M. Valls Ortiz
Co-chairman:	E. Pekel

Anisotropy of physical characteristic functions of sheep leather

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Summary

The properties of leather are functions of the position coordinates and the orientation angle of samples. A sampling system was used in which either the orientation angle or the position coordinates, or both, were changed. The backbone line was chosen as the Y axis. The smallest sample size was selected. Results of the physical characteristics obtained from the tensile and elongation experiments are given for three Australian sheep leathers and three Finnish sheep leathers. Australian sheep leathers formed group 1 and Finnish sheep leathers group 2. All sheep leathers had been normally thinned in the dressing process. That may affect the sample thickness (THB) and the breaking load (BRL) for the sheep leathers studied. As regards the tensile strength, sheep leather is much stronger in the longitudinal direction than in the transverse direction. The skins were chrome-tanned. The properties of any given leather depend partly on the properties of the raw skin and partly on the processes of manufacture. Properties of raw skins are of great importance in a scientifically controlled tánning process and in all attempts to measure and evaluate quality in leather. Two-dimensional pictures of the physical characteristics show variations as a function of the transverse coordinate X and the longitudinal coordinate Y over the entire area of the leather. The differences in the elongation at break between belly, neck and rump are not statistically very significant, which suggests that there do not exist big differences in the collagen fibre structure of sheep leather at these sites. Typically, when the elongation at break gets higher values, the values for the tensile strength are then lower. The results for the tensile strength of sheep leather are different in nature from Wilson's classical results for the tensile strength of typical calfskins.
Keywords: sheep leather, physical characteristics, sample thickness, breaking load, elongation at break, tensile trength.

Introduction

There have been many investigations on the physical properties of sheep skins, also in the leather state. Any tugging applied to the wool, especially in the weaker zones, is sure to produce grain cracks as pointed out by Gratacos et al. (1991). According to this study it is clear that the flanks of sheep skins have a lower tensile strength than the central parts of the skin. Sheep skins are very sensitive to any strong extension in the head-tail direction if the stretching passes the abdominal regions. Changes in the collagen fibre tissue of the adjacent skin are caused by directional changes in the external muscle fibres of the animal's body and by changes in the hair follicles. Strength variations and directional variations in the skin's physical resistance are presented. It has been found, particularly, that the percentage of shrink may be considerably affected by the position of the sample and the orientation angle. Obviously direction must be taken into account in measuring such properties as the tensile strength, the breaking load, etc. (Conabere, 1944).

Measurements of the physical properties of leather of the same species, with reference to their position relative to the backbone line, produce different results, as noticed earlier with blue-fox and mink leathers. Sample size has a great effect on the physical characteristics in the tensile and the elongation experiments, which show a nonlinear behaviour as regards

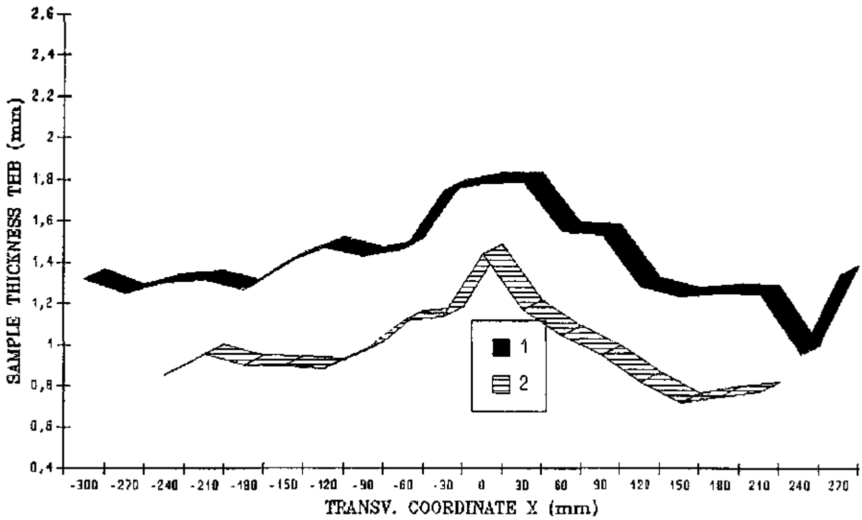

Figure 1. Sample thickness (THB) as function of transverse coordinate X for chrome-tanned Australian (1) and Finnish (2) sheep leather. ALPHA = 0° and Y = 400 mm.

sample size (Mäntysalo et al., 1989 and 1990). Also anatomical variations in the collagen fibres produce directional variations as well as variations in the physical characteristics of the skin.

All testing measurements were done using a fully computerized physical testing system developed in the Laboratory of Fur and Leather Technology (LFLT) at Tampere University of Technology (TUT). This sysytem enables all the data to be stored and processed automatically. Breaking and elongation tests were carried out in accordance with SLP.6 (or IUP/6). The pulling rate was 100 mm/min and the sample width 5 mm. All measurements made using digital equipment had an accuracy of 0.1 per cent, which is good considering the variability of the functions determined in this work. A blunt-pointed measuring head was used with a diameter of 1 mm, eliminating the need to remove the hair in measuring the thickness of the samples.

Results and discussion

The characteristics of fur leather used in this work were the breaking load (BRL), the percentage elongation at break (PEB), the sample thickness (THB) and the tensile strength (TEN).

The total number of samples was 2 700. The physical characteristics of different leathers were studied and compared using an analysis of variance. The median was used as a statistical measure. The median is more satisfactory than the mean when there is a rather small number of samples and no normality assumptions. Strength variations and directional variations in the skin's physical resistance are presented.

Sample thickness (THB)

In Figure 1 THB is presented as a function of the transverse coordinate X. The solid line corresponds to the chrome-tanned Australian and the shadowed line to the Finnish sheep leather. Overall the Australian sheep leather has higher sample thickness values than the Finnish sheep

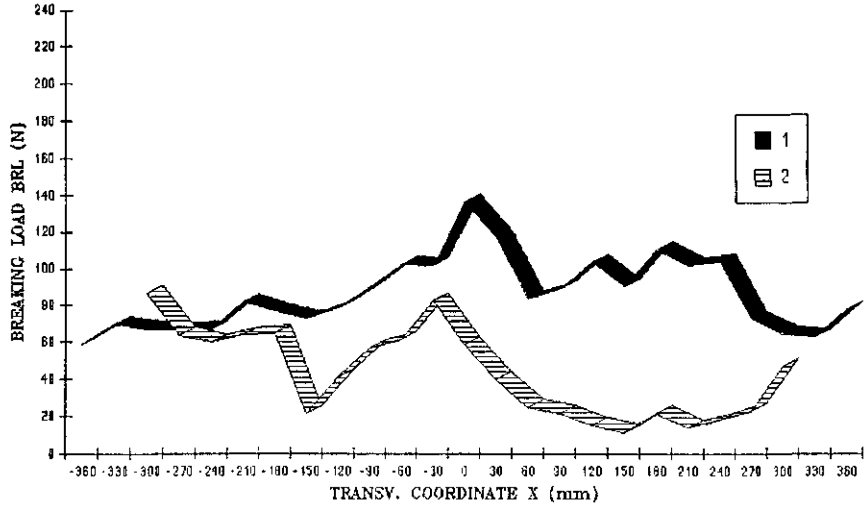

Figure 2. Breaking load (BRL) as function of transverse coordinate X for chrome-tanned Australian (1) and Finnish (2) sheep leather. ALPHA = 0° and Y = 400 mm.

leather. We should remember that sample thickness affects the breaking load as well as the fibre structure of collagen and the changes in the direction of the hair follicles.

Breaking load (BRL)

BRL is plotted as a function of the transverse coordinate X in Figure 2. With the orientation angle ALPHA = 0 the values of the BRL are significantly higher for the Australian sheep leather than for the Finnish sheep leather. In these tests the Australian sheep leathers seem to be stronger than the Finnish sheep leathers. BRL has its maximum values along the backbone line resulting from the fibre structure of collagen, as expected. Breaking load vary asymmetrically like other physical characteristics around the backbone line.

Elongation at break (PEB)

In Figure 3 PEB is shown as a function of the transverse coordinate X with the orientation angle ALPHA = 0. The values of PEB are higher for the Australian sheep leather than for the Finnish sheep leather. The values of PEB have their minimum on the backbone line, which correlates with the former studies done in the LFLT and was to be expected.

Tensile strength (TEN)

TEN is shown in Figure 4 as a function of the transverse coordinate X. TEN values are higher for the Australian sheep leather than for the Finnish sheep leather with the sample orientation angle ALPHA = 0 and the value of Y = 400 mm. The results correspond to the fundamental structure of the skin, which also was to be expected.

Tensile strength (TEN) as functions of longitudinal coordinate Y and transverse coordinate X for chrome-tanned Australian sheep leather is presented in Figure 5. Orientation angle ALPHA of the samples is now 30. The effect of position coordinates on the whole surface area

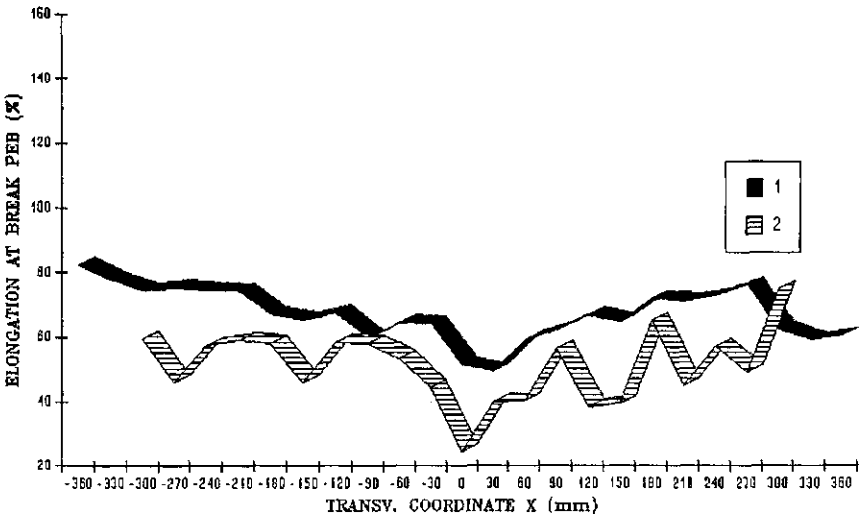

Figure 3. Elongation at break (PEB) as function of transverse coordinate X for chrome-tanned Australian (1) and Finnish (2) sheep leather. ALPHA = 0° and Y = 400 mm.

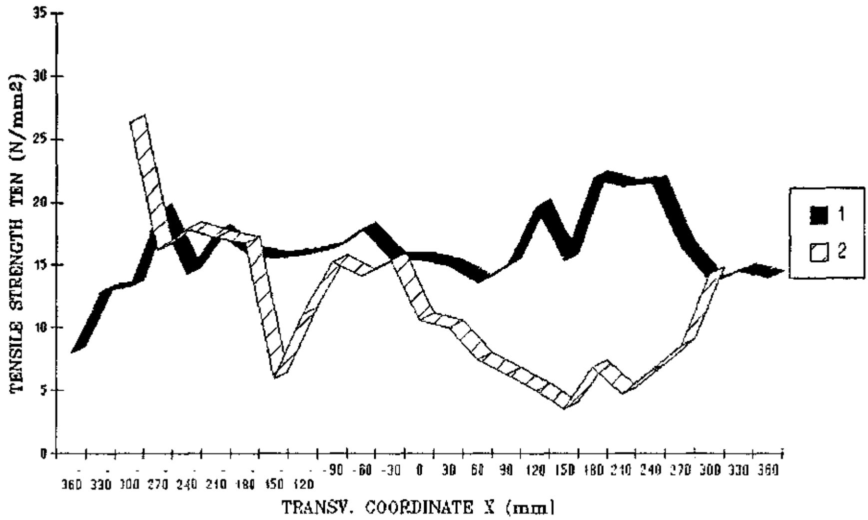

Figure 4. Tensile Strength (TEN) as function of transverse coordinate X for chrome-tanned Australian (1) and Finnish (2) sheep leather. ALPHA = 0° and Y = 400 mm.

can be seen. This figure differ from Wilson's classical results for calf leather and shows the asymmetry of the values of sheep leather.

There are no remarkable differences in the results with the Finnish sheep leathers and the Australian sheep leathers. Two additional reasons which might cause asymmetry are: firstly, the backbone line has been roughly estimated and, secondly, there is natural physiological

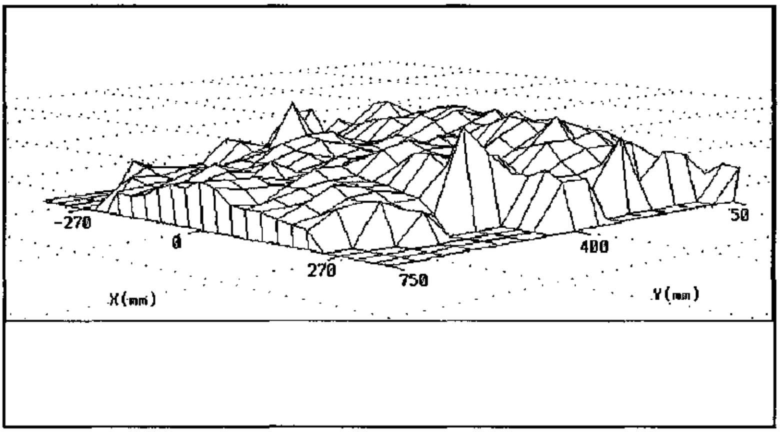

Figure 5. Tensile Strength (TEN) as functions of longitudinal coordinate Y and transverse coordinate X for chrome-tanned Australian sheep leather. ALPHA = 30°.

asymmetry. The change in characteristics is greatest near the backbone line. According to our measurements Y-coordinate does not affect the results very much. The results from this study are roughly similar to the results got for blue-fox leather earlier in our Laboratory. Variations of the values of the physical characteristics of sheep leather correlate to some extent with the thickness of the leather.

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Effets des maladies sur la production des cuirs, peaux et fibres animales

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Summary

The major disease of animals have a quantitative effect on the production of hides, skins and animal fibres, because the deaths caused by them usually result in complete loss of the carcass. However, more important are the effects of all pathological processes on the quality of these products.

All conditions which affect general health can leave visible defects of the skin and its appendages, although the skin diseases proper cause the most important damage. Some of these are of microbial origin: sheep pox, goat pox, contagious ecthyma, lumpy skin disease and dermatophilosis. Others are of parasitic origin, notably mange and mycoses in all species, and demodicosis in goats.

Myiasis is also responsible for depreciation of hides, skin and animal fibres. The most cosmopolitan of these is bovine hypodermosis (warble infestation). Other forms of myiasis are confined to certain regions, such as cutaneous dermatobiosis of cattle and *Tunga penetrans* infestation, occurring in intertropical America. Myiasis caused by the screw-worm *(Calliphora hominivorax)* is of major importance, being confined to the American continent until its appearance in Libya in 1988. The bites of ticks leave multiple small pits or fibrous scars chich devalue leather.

The diminution of losses depends on the implementation of measures aimed at preventing diseases of animals. However, there is little chance of such measures being applied unless the disease has an obvious effect on the health of animals or on the quality of products marketed directly by the producer.

Introduction

Les qualités et les défauts des produits finis, qu'il s'agisse de cuir tanné, de fourrure, de laine ou de toute autre fibre animale, traités pour leur assurer une présentation conforme à leur destination commerciale, reflètent, d'une part les caractéristiques génétiques et le passé biologique de l'animal et, d'autre part, les conditions et méthodes de préparation et de transformation des produits bruts. En ce qui concerne le passé biologique, l'influence de l'alimentation et celle de la pathologie sont considérables.

Toutes les affections qui ont une répercussion sur l'état général, peuvent laisser une trace visible sur la peau et les phanères de l'animal. Les maladies parasitaires internes exercent un effet notable sur les agneaux dont la diminution de pousse de la laine a pu être estimée de l'ordre de 60%. Par ailleurs, lorsque la maladie évolue vers la mort, le décubitus a pour conséquence un ralentissement de la circulation, une congestion du tégument et la stagnation du sang dans les vaisseaux superficiels. Il en résulte la formation de veinules apparentes après tannage, qui rendent la peau impropre à certaines finitions.

Ce sont, cependant, les pathologies spécifiques intéressant directement le tissu cutané, qui entraînent les pertes économiques les plus importantes et qui sont l'objet du présent exposé. Dans une première partie seront examinées les maladies infectieuses, et dans une deuxième partie, les parasitoses externes.

Maladies infectieuses

La *dermatophilose* est une maladie à évolution aigue ou chronique, que l'on observe chez tous les herbivores et qui provoque une dermatite exsudative avec formation d'éscarres et de croûtes. Fréquente en Afrique de l'Ouest en particulier, on la rencontre également dans les pays tempérés, là ou la pluviométrie est tres élevée. Elle est due à une bactérie tellurique, *Dermatophilus congolensis*, qui traverse l'épiderme, lorsque les conditions hygrométriques sont favorables. Les lésions s'installent, en premier lieu, au niveau de la face, des oreilles et de la région inguinale, les croûtes initiales faisant ensuite place à un véritable tissu corné. Les jeunes animaux sont plus sensibles que les adultes qui présentent généralement une forme subclinique, mais peuvent aussi présenter une forme aigüe, avec, comme chez les jeunes, extension des lésions à la région dorsale. La transmission peut se faire par contact direct et par l'intermédiaire des tiques et des mouches. Le contrôle de la maladie repose sur la balnéation régulière des animaux en utilisant des solutions acaricides et bactéricides.

La *clavelée* et la *variole caprine* sont des viroses du mouton et de la chèvre largement répandues en Afrique et en Asie. Le virus peut se transmettre par contact direct entre animaux malades et animaux sains, mais la contamination est le plus souvent indirecte. Les croûtes désséchées réduites en particules virulentes se déposent sur les eaux, les pâturages, les locaux, les véhicules, la laine etc., qui peut rester dangereuse très longtemps, en raison de la résistance du virus désséché. Les lésions sont le plus souvent observées sur les oreilles, le museau, le ventre, la face interne des cuisses, mais les parties couvertes de laine ou de poils peuvent également être envahies. On voit d'abord apparaître des papules, des tâches qui peuvent être hémorragiques et se transforment ensuite en pustules suivies de la formation des croûtes qui, en se détachant, laissent des cicatrices se traduisant par autant de défauts de la peau tannée. La lutte contre la clavelée et la variole caprine repose sur la vaccination.

La *tremblante* est une maladie à évolution lente dont l'agent causal appartient à la catégorie nommée des 'virus lents' ou 'virus non conventionnels'. Les symptômes se manifestent chez le mouton adulte et moins fréquemment chez la chèvre. Elle est signalée en Amérique du Nord, au Japon, au Népal, à Chypre, en France, Irlande, Islande, au Royaume-Uni et en Turquie. Elle est caractérisée par des troubles nerveux qui se traduisent par des tremblements et des troubles locomoteurs ainsi que par du prurit amenant les animaux à se frotter contre tous les objets durs et à s'arracher la laine ou le poil. La transmission de la maladie peut être verticale de la mère à l'agneau ou horizontale par contact prolongé. Il n'existe ni vaccin, ni traitement.

On reparle beaucoup de la tremblante, depuis l'apparition en 1988, de l'encéphalopathie spongiforme bovine ou 'maladie des vaches folles' en Grande-Bretagne. Selon toute vraisemblance, la contamination des bovins a pour origine les aliments contenant des farines de viande d'ovins atteints de tremblante.

La *dermatose nodulaire contagieuse* se manifeste par l'apparition, dans l'épaisseur du derme, de nodules de nombre variable, mais pouvant atteindre plusieurs centaines. Due à un virus, elle est restée longtemps cantonnée à l'Afrique australe et à Madagascar, mais s'est étendue, au cours des dernières années à toute l'Afrique subsaharienne, ainsi qu'à certains pays du Moyen-Orient.

Parasitoses externes

Dans toutes les régions d'élevage, on rencontre une ou plusieurs espèces de parasites externes, qui provoquent des pertes économiques importantes, essentiellement imputables à la dépréciation des peaux et des fibres.

Les parasites externes en cause sont des insectes et des acariens qui peuvent être rangés en trois groupes, selon qu'il s'agit de parasites vivant sur l'hôte en permanence ou temporairement ou seulement pour se nourrir de son sang.

Parasites permanents

Les *poux*, très communs dans toutes les espèces, peuvent être piqueurs (Anoploures) ou broyeurs (Mallophages). Les femelles pondent leurs oeufs à la base des brins de laine ou des poils, près de la peau. Le cycle biologique au cours duquel l'oeuf se transforme en adulte dure 30 à 45 jours. La pullulation des poux proprement dits, comme des mallophages, est d'autant plus rapide que les animaux en grand nombre vivent en confinement.

Les espèces de poux broyeurs provoquent une irritation intense qui pousse l'animal à se frotter contre les objets durs ou même à se mordre. Chez le mouton, en particulier, la structure de la toison s'en trouve modifiée, ce qui a pour effet de détériorer les fibres et de rendre la tonte plus difficile.

Les poux piqueurs, de plus grande taille que les précédents, entraînent également des démangeaisons. Chez le mouton, on compte trois espèces différentes: *Linognathus ovillus*, *L. pedalis*, qui se localisent aux parties non couvertes de laine des races à laine améliorées des régions tempérées, et *L. africanus* pou du corps des moutons à poils et des chèvres observé en Afrique, Asie et Amérique. *L. stenopsis* se rencontre chez la chèvre.

Ces poux piqueurs provoquent moins de dégâts que les mallophages. Cependant, ils peuvent occasionner des dommages considérables aux toisons des chèvres Angora.

Melophagus ovinus, genre de mouche sans ailes, parasite du mouton, peut provoquer une infestation abondante de la toison. Son cycle biologique est de 5 à 6 semaines. On voit, en écartant la laine, des taches rouges correspondant aux insectes adultes gorgés de sang. Leur piqûre n'est pas très douloureuse, mais l'irritation qu'ils provoquent porte l'animal à se frotter et à se mordre. En conséquence, les peaux peuvent être défectueuses.

Les *acariens sarcoptidés* responsables des gales sont, parmi les parasites permanents, ceux qui causent le plus dégâts aux cuirs, peaux et fibres. Les gales les plus fréquentes chez les ruminants sont dues à deux sortes d'acariens: les sarcoptes et les psoroptes.

Les sarcoptes percent la peau pour en aspirer la lymphe. Les femelles creusent des galeries épidermiques dans lesquelles, elles pondent leurs oeufs. Le parasite dont le cycle biologique est d'environ 17 jours, provoque de très fortes démangeaisons, poussant l'animal à se frotter jusqu'à s'écorcher, aggravant ainsi les lésions primaires et entraînant la kératinisation et l'épaississement des parties lésées. Chez le mouton, seules sont touchées les régions dépourvues de laine.

Alors que généralement les sarcoptes épargnent le tronc de l'animal, les psoroptes s'étendent le plus souvent à tout le corps, d'où le nom donné à la gale psoroptique, de gale du corps. Ils vivent sous la peau se nourrissant de l'épiderme, provoquant la formation de boutons et un prurit intense. Chez le mouton, la laine se détache d'elle-même lorsque l'animal ne l'arrache pas en se mordant.

La gale chorioptique, moins fréquente, est plus facile à soigner, dans la mesure où elle est localisée aux pattes. La gale démodécique, qui peut atteindre les bovins et les chèvres, se manifeste par des pustules cutanées provoquées par le parasite logé dans les follicules pileux.

Il convient de signaler enfin un parasite qui est un sujet de préoccupation pour les éleveurs de Mérinos en Australie, *Psorergates ovis*. Cette gale est apparue avec l'abandon des bains arsenicaux pour les solutions d'insecticides organochlorés moins efficaces pour le contrôle de ce parasite.

La destruction des parasites responsables des gales est particulirèement difficile dans le cas des sarcoptes qui vivent dans les galeries creusées dans l'épaisseur de la peau. Les traitements par balnéation ou aspersion de solutions irsecticides doivent donc être renouvelés très fréquemment, en prenant la précaution d'interrompre ces traitements avant l'abattage ou la traite dans les délais prescrits pour éviter la présence de résidus toxiques dans la viande ou le lait.

Parasites temporaires

On appelle myiases les accidents plus ou moins graves produits par les larves issues des oeufs déposés sur le corps de l'animal par plusieurs sortes de mouches. Seules les myiases cutanées intéressent la production des cuirs, peaux et fibres. Les myiases cutanées les plus redoutables sont dues à:

- *Calliphora hominivorax* limitée jusqu'en 1988 à l'Amérique, du Mexique jusqu'à l'Amérique du Sud, mais introduite depuis lors en Libye, par des moutons vraisemblablement importés d'Amérique du Sud;
- *Chrysoma bezziana*, en Afrique tropicale, en Asie méridionale et dans les pays tropicaux de la zone Pacifique;
- *Wohlfahrtia magnifica* en Afrique du Nord et en Asie Centrale.

Ces myiases ne peuvent être contrôlées que par l'examen quotidien et individuel des animaux pour déceler les plaies sur le bord desquelles les mouches déposent leurs oeufs qui vont donner les larves se nourrissant de la chair des animaux pour, ensuite, tomber sur le sol et redonner des mouches.

Il existe également une *myiase cutanée du mouton* provoquée par les larves de mouches différentes selon les continents: *Lucilia cuprina*, en Australie et en Afrique méridionale, *Lucilia sericata* et *Calliphora stygia* en Nouvelle-Zélande, *Lucilia sericata* en Europe, *Phormia regina* et *Protophorma terrae novae* en Amérique du Nord.

L'infestation favorisée par l'humidité peut avoir pour point de départ une plaie ou les parties souillées par l'urine ou les fèces sur lesquelles les mouches pondent leurs oeufs, mais elle peut aussi, dans le cas de *L. cuprina* notamment, se développer directement dans les parties couvertes de laine lorsque la toison est mouillée jusqu'à la peau.

Le traitement repose sur l'application d'insecticides. Cependant, les phénomènes de résistance des parasites se développent rapidement. C'est ainsi que *L. cuprina* est maintenant résistante à la plupart des insecticides connus.

Les myiases provoquées par les larves de certaines mouches de la famille des oestridés sont également à l'origine de pertes non négligeables pour l'industrie des cuirs et peaux. La plus connue, qui est répandue dans les zones tempérées de l'hémisphère nord est l'hypodermose bovine, communément appelée varron. La mouche du genre *Hypoderma* dépose sur les poils d'un animal des oeufs qui éclosent pour donner des larves qui pénètrent sous la peau. Ces larves migrent à travers le corps et s'établissent dans les tissus sous-cutanés du dos de l'animal, où elles provoquent des boursouflures percées de petits trous permettant aux larves de respirer. Les cicatrices qui se forment lorsque les plaies guérissent laissent la place à des trous lors du tannage.

On rencontre également un varron chez la chèvre, dû à *Przhevalskiana* spp. en Afrique du Nord et en Afrique de l'Est, dans certains pays méditerranéens, en Asie centrale et dans le sous-continent indien.

Dans les pays d'Amérique tropicale, Dermatobia hominis, a des effets semblables chez l'homme, et chez tous les mammifères, mais surtout chez les bovins.

Ectoparasites hématophages

Dans ce groupe, les parasites à considérer sont les *tiques*. Présentes dans toutes les parties du monde, c'est cependant dans les pays chauds qu'elles sont les plus répandues et qu'elles occasionnent le plus de dégâts aux cuirs et peaux. Ces dégâts sont la conséquence des marques ressemblant à des piqûres d'épingles laissées par les morsures des tiques aux endroits où elles se sont fixées.

La lutte contre les tiques, dans les pays où elles posent un problème sérieux, repose sur l'application, par balnéation ou aspersion, de solutions insecticides.

Conclusions

Les pertes causées à l'industrie mondiale des cuirs, peaux et fibres par les maladies animales sont difficiles à évaluer, en l'absence d'informations suffisantes à cet égard. Elles sont particulièrement importantes dans les pays en développement qui, généralement, ne disposent pas des moyens nécessaires à la mise en oeuvre des mesures qui pourraient réduire l'impact de ces maladies. Cependant pour la quasi-totalité d'entre elles, les techniques permettant de les contrôler efficacement existent. Pour qu'elles soient utilisées, les éleveurs doivent y trouver un avantage.

S'agissant de la peau, elle est à l'exception de quelques productions comme l'astrakan, un sous-produit de l'élevage dont la qualité n'influence pas la valeur de l'animal. Il en va différemment de la laine qui constitue l'objet principal de l'élevage extensif du mouton.

A cet égard, l'exemple de la Nouvelle-Zélande, cité montre que la volonté des éleveurs, stimulée par leur intérêt est plus importante que tout autre facteur. Les éleveurs de moutons néo-zélandais, considérant les pertes que leur faisait subir la gale ont, à la fin du 19e siècle, décidé d'éliminer la maladie, par des dispositions pénalisant lourdement les propriétaires d'animaux galeux. Bien qu'on ne disposât pas alors des moyens techniques efficaces qui existent actuellement, la volonté collective des éleveurs s'appuyant sur la prophylaxie sanitaire, permit d'obtenir l'éradication de la gale une dizaine d'années avant l'établissement du Ministere de l'Agriculture, vingt ans avant l'arrivée du premier Vétérinaire dans le pays et trente ans avant la création d'une Station de recherches sur les maladies animales.

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Effets des traitements a l'abattoir sur la qualite des cuirs et peaux

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Summary

The commonest defects of hides and skins, and those most frequently seen are those which appear at the time of slaughter, after death of the animal. Blows aimed at the animals during brutal slaughter procedures produce contusions or excoriations which favour overheating and putrefaction of leather. Incompetence or negligence by abattoir workers during carcass skinning is a common cause of losses and defects through:

- loss of raw material due to faulty cutting;
- thinning of the skin in places, which becomes obvious during tanning, caused by the flaying knife: cuts, depressions, plaques and floral patterns, sometimes practically penetrating the skin;
- grain split following too forceful flaying;
- damage from excessive traction when pulling off the hide.

Hides and skins may also deteriorate after their removal through:

- either too much drying by exposure to sunlight, or too little;
- deterioration following salting;
- from faulty folding or packing;
- during storage or transport

Improvement in quality at the levels of the abattoir and the warehouse depends on education of the workers, grading of the hides, and payment according to quality.

Introduction

S'il est vrai que l'état de santé des animaux est un facteur important de la qualité des peaux, celle-ci est également conditionnée par les précautions prises lors du transport jusqu'à l'abattoir, de l'abattage, de la dépouille et du traitement des peaux après dépouille. Ce sont les défauts pouvant survenir au cours de chacune de ces phases qui seront examinés ci-après.

Transport des animaux jusqu'à l'abattoir, battage et saignée des animaux

Les glissades, les coups de corne échangés entre animaux, l'espace insuffisant dans les véhicules, les coups de bâton des convoyeurs sont autant de causes de blessures endommageant la peau des animaux avant leur abattage.

Le maniement brutal des animaux, l'absence de précautions pour leur éviter la vue de l'abattage de leurs congénères sont également responsables de blessures. L'abattage sans repos préalable des animaux, l'absence de dispositifs de levage sont responsables d'une saignée insuffisante, et par suite de la putréfaction de la peau.

Dépouille

La première opération est la 'parfente' qui consiste à pratiquer sur l'animal une longue fente, qui atteint la chair, et s'étend de l'encolure jusqu'à la queue, en suivant la ligne ventrale. Puis, de chaque côté de cette incision, l'ouvrier pratique une autre incision à la face interne des membres, en avant des membres antérieurs, et en arrière des membres postérieurs.

Vient ensuite la dépouille proprement dite, qui consiste à séparer la carcasse et la peau, sans léser viande et cuir, et peut être effectuée selon plusieurs méthodes:

- au sol, avec ou sans berce de dépouille;
- suspendue, dans les chaînes d'abattage, avec appareils de dépouille mécanique;
- suspendue, au poing ou au marteau pour les petits ruminants;
- par insufflation d'air, ou gonflage, dans le cas des moutons et chèvres.

Les dommages occasionnés à la peau peuvent provenir du manque d'habileté ou de la négligence de l'ouvrier (défauts de main d'oeuvre) ou encore être facilités par la méthode pratiquée.

Lors de mauvaise parfente, le cuir n'est plus symétrique, donc déprécié, car les tanneurs recherchent des peaux de forme régulière qui donnent le meilleur rendement en cuir.

La dépouille au sol, si celui-ci n'est pas lisse et si on ne dispose pas d'une quantité d'eau suffisante n'est pas à conseiller, en raison du risque d'abîmer le grain du cuir.

La dépouille par arrachage, si la traction de l'arracheuse est trop brutale compte tenu du rythme de la chaîne ou de la résistance plus ou moins grande de la peau selon l'origine de l'animal, peut être responsable de déchirures ou d'une déformation de la peau, au point de la rendre, parfois, inutilisable.

L'utilisation du marteau pour la dépouille des petits ruminants est pratiquement abandonnée, en raison des éclatements de 'fleur' (partie superficielle de la peau voisine de l'épiderme) qu'elle peut occasionner.

Les défauts de main d'oeuvre, les plus fréquents, sont dûs à l'utilisation de couteaux à lame pointue qui traversent partiellement ou totalement le derme.

Traitement des peaux après dépouille

Selon les cas, les peaux sont livrées par l'abattoir, après traitement pour assurer leur conservation ou apres avoir été simplement écharnées, rognées et lavées (peaux 'vertes'). Dans tous les cas, les peaux doivent, avant tout, être lavées, débarrassées du sang et des matières qui les souillent, pour éviter la putréfaction qui se manifesterait plus tard. Ce lavage, pratiqué à l'eau froide pour refroidir les peaux encore chaudes, doit être effectué soigneusement avec une brosse dure.

Les peaux de chèvres à longs poils et de moutons à laine ne doivent être lavées que du côté chair, pour éviter la rétention d'une grande quantité d'eau, qui conduirait à utiliser, par la suite, de trop grandes quantités de sel.

L'écharnage des peaux de moutons et de chèvres à longs poils, très minces et fragiles exige des précautions particulières pour éviter de les endommager.

La peau 'verte', qui contient environ 62% d'eau, constitue un milieu de culture idéal pour le développement des micro-organismes qui provoquent des dommages allant de la décoloration à l' 'échauffe', putréfaction débutante et localisée qui, au tannage, entraîne la fente du derme dans le sens de l'épaisseur. Ils peuvent même aller jusqu'à la putréfaction qui rend la peau inutilisable, du fait de la décomposition et de la liquéfaction des matières protéiques. Afin d'arrêter le développement des micro-organismes, il convient d'expédier très rapidement les peaux aux tanneries où elles seront traitées par des méthodes diminuant la teneur en eau. Ces méthodes qui peuvent également être mises en oeuvre à l'abattoir, pour assurer la préservation des peaux des qu'elles sont retirées de la carcasse, facteur essentiel de leur qualité, reposent sur le séchage à l'air ou le salage.

Le ***séchage à l'air*** se pratique, soit au sol, soit par suspension. Le séchage au sol donne des peaux de mauvaise qualité, car l'air ne peut circuler sur la face côté poils qui, touchant le sol, ne sèche pas à fond et garde l'humidité favorable au développement de l'échauffe. Exposées directement au soleil, les peaux peuvent présenter des défauts plus graves: désséchées à l'extérieur, elles peuvent receler à l'intérieur des poches gélatineuses qui provoqueront des trous au moment du chaulage, ou encore, surchauffées, leur graisse se décompose et, imprégnant les fibres, rend le tannage impossible. Les peaux de bovins séchées au sol deviennent dures et se craquellent lorsqu'on les plie.

Il convient, donc, de proscrire cette méthode et de lui préférer le séchage des peaux suspendues sur cadres suffisamment grands pour éviter le contact avec le cadre ou, pour les peaux de petits ruminants, sur fils de fer ou cordes tendus horizontalement. Une tension insuffisante sur le cadre ou le fil de séchage provoque la formation de plis, à l'intérieur desquels la peau reste humide ce qui entraîne la production de l' 'échauffe'. Une tension trop forte entraîne des tiraillements, lors de la rétraction de la peau, pouvant être suivis de rupture des fibres et de cassure de 'fleur'.

L'inconvénient du séchage est de donner aux insectes la possibilité d'attaquer les peaux séchées. L'insecte le plus nuisible est le dermeste, dont les larves provoquent le plus de dégâts. Ces larves dévorent, en effet, et détruisent le poil et le grain du cuir qu'elles peuvent même perforer entièrement.

Il convient donc de saupoudrer d'insecticide, les peaux placées dans un magasin. Si elles n'ont pas été suffisamment séchées, ou en milieu humide, les peaux peuvent être également envahies par des moisissures qui abîment le grain, mais qui peuvent être également combattues par des produits appropriés.

Le trempage dans une solution arsenicale, ou arsenicage, pour protéger les peaux séchées de l'attaque des insectes, est encore utilisé dans certaines régions. Les défauts d'arsenicage peuvent être dus à une concentration insuffisante de la solution, ou à un bain trop vieux, ou encore à un bain de durée insuffisante qui rendent encore possible l'attaque par les insectes.

Le *salage* peut se pratiquer par voie humide, ou à sec. Le salage par voie humide exige un personnel qualifié, de grandes quantités de sel et une température constante comprise entre 15 et 20° C. Déconseillé dans les régions tropicales, où il est difficile de le pratiquer de façon satisfaisante, il n'exclut pas la possibilité de développement de certains micro-organismes qui provoquent la 'décoloration' ou l' 'échauffe'.

Dans le salage à sec, après quelques jours de salage, les peaux sont séchées à l'air pour permettre l'évaporation de l'eau restante, en utilisant généralement des supports en bois. Les peaux salées à sec ne craignent pas les insectes, mais doivent être protégées de l'humidité.

Conclusions

L'abattoir constitue un observatoire remarquable de l'état de santé du cheptel qui se répercute non seulement sur la salubrité de la viande, mais aussi sur la qualité de la peau. Il est également, avec son annexe le séchoir, un maillon de la chaîne de production des cuirs et peaux sur lequel il est facile de porter les efforts nécessaires à l'amélioration de leur qualité. Celle-ci peut, en effet, être obtenue par l'application de techniques simples, donc faciles à enseigner. Les faire accepter par les opérateurs est, selon les pays, le rôle de l'Etat, ou des collectivités locales, ou encore du secteur privé.

Dans certains pays en développement, ont été créés des Services pour l'amélioration des peaux dépendant souvent des Services responsables de la production animale, dont les actions éducatives et de contrôle concernent l'ensemble de la filière, du stade de l'élevage jusqu'à l'exportation. Là où l'intérêt des opérateurs a été suscité par le paiement des peaux à la qualité, le succes a été assuré. Mais, lorsque les circuits commerciaux sont tels que les efforts des producteurs et bouchers ne sont pas récompensés, comme c'est le cas lors d'achat 'tout venant', aucun progrès ne peut être escompté.

Dans les pays industrialisés, l'Etat encourage parfois le secteur privé à éviter les pertes dues notamment aux maladies et améliorer la qualité des cuirs et peaux. La stratégie peut être établie à cet effet, au niveau national, par un Comité consultatif comprenant des représentants de l'élevage, des abattoirs et de l'industrie du cuir. C'est ainsi que, dans certains cas, ont pu être mises en oeuvre, avec succès, des mesures de lutte contre le varron et d'encouragement de bonnes pratiques pour la préparation, la conservation et l'entreposage des peaux.

Mais c'est surtout dans les pays en développement que les progrès les plus importants sont à faire. Ces progrès sont nécessaires pour la balance de leur commerce extérieur susceptible d'être améliorée par l'exportation des cuirs et peaux qui, de tous les produits de l'élevage, sont ceux auxquels les pays industrialisés opposent le moins de restrictions. Ils s'imposent d'autant plus que ces pays sont devenus, au cours des vingt dernières années, de gros utilisateurs de ces matières premières. La capacité de tannage s'y est accrue considérablement et, alors qu'ils étaient globalement exportateurs, ils sont devenus importateurs. Ce sont maintenant les pays industrialisés qui détiennent pratiquement le monopole des exportations de cuirs et peaux, avec près de 90% de la valeur totale des échanges internationaux. S'ils surmontent les difficultés, au niveau de la production de la matière première, les pays en développement pourront s'affranchir de la nécessité d'importer et, s'ils parviennent à satisfaire les exigences du marché international en matière de qualité, ils pourront créer des emplois en vendant des articles à plus forte valeur ajoutée.

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Utilisation des peaux au Maroc, caracterisation de la filière

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Abstract

The leather sector has played an important role within the national economy. It includes traditional and industrial tanneries. The purpose of this paper is first to characterize the sector and its evolution and to estimate the importance of hide production at the farm level.

Data used are from surveys organized at different levels of the sector and from the slaughter of animals raised at an experiment station.

Imports, exports and investments within the sector have increased during last years. Fourty tanneries are operating. Their capacity is 80 million feet squares of which 45% are for cattle. Major differences between artisanal and industrial tanneries are on the procedure and the lenght of treatment and the nature of final products.

Several kinds of leathers are produced from hides and skins. Quality is affected by different factors of which the conditions of storage of hides and skins is the most important for the industry. The ratio of value of hides/value of carcasse is the same for the production systems investigated. The pricing and the collection systems are not quality based. The paper presents some recommendations for the improvement of the sector.

Introduction

Le secteur du cuir qui regroupe les activités de la tannerie, la fabrication d'articles chaussants, la confection de vêtements, la maroquinerie,.. occupe une place sensible dans l'économie du pays. Elle est appreciée à travers la valorisation des matières premières, l'importance des investissements, la génération de l'emploi et la promotion des exportations. Comme dans la majorité des pays en développement, où l'industrialisation est progressive, le secteur est en pleine évolution. La phase actuelle se caractérise par la coexistance de secteurs traditionnels et de secteurs relativement modernisés. Plusieurs questions restent posées et sont relatives à l'efficience des systèmes de ramassage, de traitement et surtout à l'importance des productions de peaux pour les acteurs à l'amont: l'éleveur et le chevillard.

L'objet du présent rapport consiste à la caractérisation du secteur et son évolution, ainsi que l'appréciation de l'importance économique de la production des peaux pour l'éleveur et le chevillard. Les données relatives au premier aspect proviennent d'enquêtes initiées en 1990, auprès de differents acteurs de la filière. Afin d'apprécier l'importance économique des peaux à l'amont, nous présentons:

a. Les données d'abattages contrôlés de 188 mâles appartenant à 6 génotypes élevés en station expérimentale et abattus à des âges compris entre 18 et 22 mois. Les données ont été analysées à l'aide d'un modèle linéaire, dans lequel le poids à l'abattage est introduit comme co-variable.
b. Les résultats d'enquêtes conduites dans 4 régions du pays durant la campagne 1990–1991 pour la caractérisation de la structure et de la productivité des systèmes de production de viande bovine. L'importance économique des peaux est appreciée, pour chaque système par le rapport valeur de la production moyenne de peaux par unité zootechnique / valeur de la production moyenne de carcasse par unité zootechnique.

Caracterisation du secteur a l'echelle nationale

Sur la base des abattages controlés, les disponibilités nationales en matieres premieres s'elevent à environ 600 000 peaux bovines par an, 2 800 000 peaux ovines et 800 000 peaux caprines. Sept cent trois entreprises sont impliquées dans le secteur depuis la collecte des peaux jusqu'à la vente des produits finis. Le pays compte une quarantaine de tanneries megisseries d'une capacité totale de 80 millions de pieds carrés dont 40% pour les bovins. On distingue trois types de tanneries: artisanales, semi-industrielles et industrielles. Le volume de l'emploi dans les tanneries industrielles et les services auxiliaires s'élève à environ 15 000.

Comme l'indique le Tableau 1, le commerce exterieur au niveau du secteur est caractérisé par des importations et des exportations dont le volume a augmenté lors des dernières années respectivement de 5.68×10^6 DH à 847.08×10^6 et de 2.64×10^6 à 271.36×10^6. Le volume des investissements dans le secteur a lui aussi augmenté d'une manière très sensible lors des vingt dernières années.

Cinq phases caractérisent l'évolution historique du secteur. La période 1965–1972 a connu la multiplication des tanneries industrielles. Les exportations se sont accélérées depuis 1972–1974. Après 1974 et jusqu'à 1983, on a assisté à la promotion des investissements dont le volume a été multiplié par 4. La sécheresse, qu'a connue le pays au début des années 80, a eu des répércussions sur le secteur qui n'a connu le redressement qu'à partir de 1986.

Trois types de tanneries opèrent dans le secteur: les tanneries artisanales, semi-industrielles et industrielles. Les tanneries artisanales ont une histoire de plus de dix siècles au Maroc, notamment à Fès et à Marrakech où le tanneur était l'artisan du village ou du quartier. Il conservait jalousement ses procédés techniques qui constituaient un héritage familial. Les caractéristiques principales de la filière artisanale résident dans:

Tableau 1. Evolution des volumes des Importations, des Exportations et des Investissements dans le secteur de cuir au Maroc en 10^6 dirhams.

Année	Import	Export	Investissement
1972	5.68	2.64	
1982	393.58	74.07	40.53
1987	847.08	271.36	110.17

Source: Ministère du Commerce et de l'Industrie, 1989.

Tableau 2. Classifications des raies selon le poids et le rendement moyen.

Catgorie		Poids (kg)	Rendement (pieds/kg)
Veau léger		<3	2.5
moyen		3–5	2.25
lourd		5–8	2.00
Taurillon et vachette	légèrs	8–12	1.80
	moyens	12–18	1.60
	lourds	18–24	1.45
	extralourds	>24	1.35

a. Le 'clientelisme' développé au niveau du ramassage,
b. la précarité des procédés de traitement, ex: utilisation de la fiente de volaille pour 'assouplir' les peaux, séchage à l'air libre, égrainage manuel,..
c. la non utilisation de la croûte qui est tout simplement perdue, et
d. la lenteur des traitements: la durée entre la récéption des peaux brutes et la production du cuir artisanal peut atteindre 42 jours. Le coût économique du traitement s'élève à 46 dirhams, soit environ 50 dollars U.S. par pièce et pour une trame de 50 peaux.

Les tanneries industrielles se différencient des tanneries artisanales par
a. la mécanisation des principales opérations: le coroyage, le séchage à l'air conditionné,..
b. l'utilisation des produits chimiques pour le tannage
c. la rapidité relative des procédés depuis la récéption des peaux jusqu'à la fabrication du cuir,
d. l'utilisation des deux côtés de la peaux (la fleur et la croûte). Dans l'une des tanneries de Casablanca, le coût de traitement s'élève à environ 15 DH (quinze dirhams) par pied pour chacune des operations de rivière, de tannage, de retannage et de finissage.

Facteurs affectants la qualité du cuir

Les principales qualités du cuir marocain, fabriqué à partir des peaux bovines sont les suivantes:
a. le 'box calf' obtenu à partir du veau pleine, fleur ou légérement poncé
b. la 'vachette box' obtenue à partir des vachettes et des boeufs
c. a vachette fleur corrigée obtenue de la vachette fleur poncée
d. le Nubuck obtenu à partir des peaux de veaux et de vachette. La croûte est utilisée pour obtenir differents produits.

Comme le mentionne le Tableau 2, le poids des raies ainsi que le rendement varient en fonction des catégories d'animaux. Alors que le poids des raies augmente de moins de 3 kg pour les veaux legers jusqu'à plus de 24 kg pour les taurillons et vachettes extralourds, le rendement en pieds par kg évolue dans le sens inverse: de 2.5 pour les raies des veaux legers, il descend à 1.35 pour celles des taurillons et vachettes extralourds.

La qualité des peaux est affectée par différents facteurs à differents niveaux de la filière. Selon les utilisateurs marocains, surtout les tanneurs industriels et semi™industriels, les mauvaises conditions de conservation constituent le facteur qui affecte le plus la qualité des peaux. La putréfaction peut causer la perte totale de la peau. Les conditions de dépouille des animaux constitue le deuxième facteur qui en affecte la qualité. Les animaux sont toujours dépouillés manuellement, ce qui cause des déchirures au niveau de la croûte de la peau. Si le secteur artisanal n'utilise pas la croûte, le secteur industriel a beaucoup de manque à gagner à ce niveau. Les estimations quantitatives à ce niveau sont en cours de réalisation.

Au niveau des élevages les varrons constituent le facteur principal qui affecte la qualité des peaux bovines.

Système de paiement et importance économique des peaux pour l'éleveur

Pour caractériser l'importance de la production des peaux pour l'éleveur et le chevillard, il est nécessaire d'examiner le système de ramassage et de paiement des peaux. L'éleveur vend les animaux vivants au chevillard qui dispose de la licence d'abattage. Après abattage et dépouille manuelle des animaux (le paiement pour la dépouille se fait à l'unité), les peaux sont vendues par le chevillard au poids qui inclut celui des cornes et de la queue.

Le Tableau 3 montre l'absence de différences significatives au niveau des poids des peaux brutes des animaux males de différents génotypes abattus à des âges variants de 18 à 22 mois. Les moyennes ajustées des poids des peaux brutes se situent autour de 40 kg.

Tableau 3. Moyennes ajustées des poids des peaux des taurillons de 6 génotypes.

Génotype		Moyenne kg/peau
75% Holstein,	25% local	42.34
50% Holstein,	50% local	40.68
75% Frison,	25% local	40.12
50% Frison,	50% local	40.42
100%Frison		41.26
50% Frison,	50% local	40.67

local: Brune de l'Atlas.

Tableau 4. Importance de la production des peaux pour quelques systèmes de production de viande bovine.

Région	Système	Production de carcasse (kg/UZ/an)	Production de peaux (kg/UZ/an)	Importance économique des peaux[3]
D	Naisseurs[1]	111.6	17.2	4.28
L	Engraisseurs	88.2	13.6	4.28
T	Naisseurs[2]	83.6	12.9	4.28
C	Naisseurs[2]	61.5	9.5	4.28

1 Systèmes définis par Eddebbarh, Araba et Benzekri(non publié)

2 Système définis par Araba, Eddebbarh et Oulahboub (non publié)

3 Valeur appreciée par le rapport de la production des peaux en dirhams sur la production des carcasses en dirhams.

UZ Unité zootechnique

Le Tableau 4 résumant l'importance économique de la production des peaux pour l'éleveur montre que le rapport de la valeur de la peau sur la valeur de la carcasse par unité zootechnique est le même pour les 4 systèmes de production étudiés. Il est de 4.28, alors que les productions absolues de carcasses et de peaux varient sensiblement d'un système à l'autre. Le système de paiment des animaux, des peaux ainsi que le système de dépouille n'inclut aucune incitation sur la qualité des peaux

Conclusions

Ce rapport présente les résultats préliminaires d'un projet en cours de réalisation. Ils permettent de tirer les premières conclusions et de soulever les questions suivantes:

Tout d'abord à l'amont de la filière, l'éleveur et le chevillard n'ont pas beaucoup à gagner en améliorant la qualité des peaux dans le cadre des systèmes actuels de paiement et de dépouille des animaux. Le système d'utilisation des peaux, surtout au niveau de la filière industrielle, souffre beaucoup de la qualité des peaux. L'amélioration de la filière à ce niveau, doit passer par un système d'incitation de l'éleveur et surtout du chevillard. Le système de dépouille des animaux méritent d'etre mécanisé.

Les conditions de conservation entre l'abattoir et la tannerie affectent énormément la qualité des peaux. A ce niveau, si le système de ramassage parait difficile à réorganiser, dans les conditions actuelles, il est nécessaire et possible d'améliorer les conditions de conservation. La collaboration entre la recherche et les organisations professionnelles des industries du cuir devrait aboutir à la mise au point de méthodes simples de conservation appropriées au système marocain de collecte, et leur diffusion auprès des ramasseurs.

Le secteur d'utilisation des peaux, au Maroc est en pleine évolution. La coexistance des deux secteurs artisanal et industriel soulève la question du dilemme entre:

- Une tradition artisanale maintenue au vestitude de l'histoire depuis plusieurs siècles et qui constitue l'activité principale et la source de revenu de plusieurs familles, et,
- Un secteur industriel qui ne peut continuer d'évoluer que dans des conditions de rentabilité économique.

Dans ces conditions, assistons-nous à d'autres formes du dilemme entre l'équité sociale et l'éfficience économique? Jusqu'à quel point faut-il pousser la modernisation du secteur? L'un des premiers éléments de réponse pour éviter les conséquences sociales de l'industrialisation (chomage,...) réside dans la nécessité de l'intégration des artisans dans les processus d'organisation et de modérnisation du secteur.

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Les problèmes et previsions de l'industrie Turque du cuir

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Summary

The leather sector covers a wide range including marketing and sales operations besides doing all processing at hides and skins to the state in which they are offered for use as leather articles. The leather sector has proven that it has a structure to enable it to adapt itself in a short time to industrialization efforts in spite of its being a traditional branch of craft with old and traditional roots. Due to the fact that leather sector has competitive power and wide economical fields effected by it, it is included in the marked sectors of strategical importance.

Especially it is at the top second place among the manufacturing sector from the view point of earning net foreign exchange. Leather sector has the potential to rise its present yearly amount of export of US $ 800–900 million to one and half-two billion dollars with a given and reasonable support. Leather sector is, however, in a structural transformation stage in the direction of industrialization. It has certain problems and expectations in keeping up its successful development live. For example, hide which is the main input of the industry and procured from the sources within the country and abroad is insufficient in quantity wise as well as it has different problems in respect of quality. Establishment of free leather zone takes the first place among the measures required to be taken to solve the said problems.

Especially it has been forced to fight the financial problems due to the reasons such as resettlement And reconstruction, keeping pace with new process and technologies and reorganization works, aiming at wide scale investments, obligation to increase operating capital for more production.

Especially the industrialists based at organized industrial sites and exporters of leather and leather products are needing and expecting medium term cheap credit with a view to complete their expected development in the medium term and the sub-sector of shoe making industry to overcome their problems. Marketing and sale methods and systems need to be reorganized. There is necessary to get oriented towards original trade mark and fashion.

Organized training institutions and organizations are sufficient in quantity but insufficient in respect of quality. Preparation and application of packaged training programs based on analytical method should be widened.

Although environmental pollution constitutes a problem for the leather industry as well as for each branch of industry, the sector is wrongly know because of the effects of the information acquired during its operation with the old conditions. Today, the leather industry is the principal sector or branch showing most obvious respect to its Environment. The organized industrial site is the most concrete example for it. Problems and possibilities are reviewed under six headings: hides, production, finances, marketing, training, environment.

Introduction

Ainsi qu'il est souligné dans la première phrase de introduction de la brochure de présentation du symposium, dans les réunions à caractère scientifique en général, les articles 'cuir, poil et laine brute (Toison)' qualifiés de "sous produits animaux" ne sont pas suffisamment pris en considération.

Or à commencer par les années 70, l'Industrie du Cuir et des Articles en cuir qui suit régilièrement un rythme de progression ascendante possède une large part de contribution dans l'économie nationale. Le chiffre de production relatif à l'Industrie du Cuir et des Articles en Cuir représente un niveau supérieur à 3 % en moyenne dans l'ensemble de la production réelle de notre pays bien que selon les années ce chiffre accuse certaines variations. En 1988, en effet il a été 3.2%. Si l'on envisage la question sur le plan du secteur de fabrication, l'on constate que la production de cuir et de l'industrie d'articles en cuir représentent les 4.5 % de la production totale de ce secteur.

L'Industrie du Cuir et des Articles en cuir est un secteur qui nécessite une main d'oeuvre diversifiée et spécialisée et par conséquent elle est susceptible de créer un large secteur d'emploi.

D'après les sources de l'Organisation de Planification de l'Etat, la répartition de la main d'oeuvre nombre d'ouvriers dans le secteur se présente comme ci-dessous:

Traitement de la peau	26 374
Vêtements en cuir	22 232
Pelleterie	3 000
Bourrelerie-sellerie	2 212
Chaussures	22 309
Total	76 127

Source: Organisation de Planification de l'Etat, Vue d'ensemble sur l'Industrie du cuir et d'articles en cuir, Octobre 1988.

Toutefois, je suis d'avis que les chiffres produits dans le tableau ci-dessus sont excessivement bas par rapport à nos chiffres réels d'emploi. Le nombre de nos travailleurs occupés dans les secteurs de 'vêtements en cuir', de 'bourrelerie' et de 'chaussures' notamment est nettement supérieur aux chiffres indiqués.

Selon nos estimations ce chiffre n'est pas inférieur à 400 000. Si Si à ce chiffre nous ajoutons ceux qui d'une manière ou d'autre travaillent le ouir, il sera possible d'affirmer que 7 ou 8 cent mille personnes gagnent leur vie dans ce secteur.

Un côté important de ce secteur d'autre part est qu'il est orienté vers les exportations. Il constitue en effet le 'secteur locomotives' de nos exportations de cuir. Car il se classe immédiatement après le 'secteur textile' en ce qui concerne les recettes nettes en devises. Il représente un chiffre annuel d'exportation de un milliard de US $ environ.

D'autre part, le secteur de cuir qui s'est essentiellement renouvelé aux années 1970, se trouve, a partir du milieu des années 1980 dans la phase de réaliser d'importants projets qui lui donneront les dimensions réelles d'une industrie. Le transfert du 'Kazliçesme Deri Sanayii' qui représente le centre de l'industrie de traitement du cuir de notre pays et qui se glorifie d'un passé de 538 années, dans la 'zone organisée de l'industrie du cuir d'Istanbul' amenagée dans le secteur Aydnli-Orhanli de Pendik vient de commencer cette année. Les préparatifs des Industriels du Cuir de Yesildere à Izmir suivront immédiatement et les travaux de construction de la 'zone organisée d'Industrie du Cuir' comprenant 140 usines à Menemen sont en cours.

L'Industrie du Cuir de la Ville d'Usak qui a marqué un rapide développement au cours des dernieres années se trouve candidate à une 'zone industrielle organisée' dont les études sont en cours.

Messieurs les intivées et chers collaborateurs, j'ai essayé de faire un aperiu général sur l'ensemble de notre secteur. Je désire par la suite me pencher sur des sujets plus spécifiques qui seront présentés sous six titres différents: peau brute, production, finances, marketing, formation, environnement.

Peau brute

Les peaux brutes fournies à l'Industrie du cuir par les sources intérieures sont 'insuffisantes en quantité et non satisfaisantes en qualité'.

Bien que des données statistiques existent au sujet de l'existence dans notre pays du betail sur pieds, personne ne peut prétendre que ces chiffres correspondent exactement au nombre réel de bétail. On sait que dans notre pays l'élevage se fait en majorité dans le secteur rural. Ceci explique le fait qu'il n'est pas intensif et qu'il est continuellement en mouvement. Il est hors de doute que des variations importantes se constatent sur les nombres des bestiaux, selon les saisons d'été et dhiver. Les chiffres fournis par les statistiques officielles et exposés dans les tableaux doivent donc pour ces raisons, etre admis comme exacts, jusqu'à preuve du contraire. Les trois tableaux suivants indiquent le nombre et les projections du bétail.

On voit qu'il ne se produit pas un accroissement visible dans le nombre du bétail sur pieds. On ne sait pas d'ailleurs le nombre de bétail abattus par la consommation. Les abattages hors controle sont notamment difficiles à évaluer. Ces abattages hors controle et le nombre de bétail sacrifiés pendant les fetes de Kurban sont évalués par approximation.

Ce qui est certain, est que la quantité de peaux brutes obtenue à l'intérieur du pays ne peut plus répondre aux besoins du secteur la production de cuir et d'articles en cuir étant en augmentation progressive.

D'autre part, les problèmes d'avant l'abattage, au cours et après l'abattage proviennent en grande partie de l'erreur des hommes. Les mesures à prendre contre les maladies provenant de manque de nutrition ou de manque de soins de la peau ne sont pas appliquées pour cause de négligence ou d'ignorance.

Les données statistiques en rapport avec les importations de peaux brutes confirment en effet cette situation:

Dans les abattages de bétail sans controle opérés surtout dans les régions rurales, les peaux sont abimées à cause des erreurs de coupe ou de pelage. Après l'abattage, il arrive également d'importantes déteriorations et de bertes dûes également au manque de soin et de connaissance en matière de conservation.

En résumé, il est constaté que les actions négatives sur les peaux brutes, des problemes d'avant, au cours et après l'abattage atteignent des dimensions importantes. Ces défauts qui se révèlent lors du traitement de la peau sont les cuases de pertes matérielles considérables. Pour les peaux brutes provenant des régions où les abattages s'effectuent sans controle, ces pertes de valeur atteignent des pourcentages élevés tel que 50%.

J'estime qu'il est nécessaire de s'attarder sur l'importance de la valeur de la peau brute pour notre économie. Par ailleurs, les notions de base relatives à labattage et à la protection de la peau doivent etre inclus dans les programmes de l'enseignement primaire et secondaire dans les secteurs ruraux. La condition d'un 'Certificat d'abatteur de bétail' doit etre exigée, après un bref cours professionnal à l'exemple des chauffeurs de colorifere. Cette mesure qui serait imposée d'abord aux abattoirs sera d'une grande utilité économique.

A mon avis, la mesure la plus efficace et la plus utile à mettre en application contre l'insuffisance en nombre, de peaux brutes serait de créer une 'zone franche de peaux'. A coté de la zone organisée d'industrie de cuir d'Istanbul d'ailleurs une zone franche a commencé à naitre. Ceci facilitera sans doute l'acces aux sources extérieures. L'industriel pourra voir la peau qu'il achète d'une part, et d'autre part il sera libéré des longues durées de commandes et des difficultés de financement.

Tableau 1. Nombre de bovins et de buffles par années.

Années	Bovins	Buffles	Total
1987	13 951 527	729 954	14 681 481
1988	14 174 751	737 254	14 912 005
1989	14 401 547	737 254	15 138 801
1990	14 631 971	737 254	15 369 225
1991	14 866 082	737 254	15 603 336
1992	15 103 939	737 254	15 841 193
1993 (projection)	15 345 602	737 254	16 082 856
1994 (projection)	15 591 131	737 254	16 328 385

Source: DPT, VI, BYKP, rapport préliminaire de la commission spécialisée d'élevage.

Tableau 2. Nombre de moutons et de chèvres par années.

Années	Moutons	Chèvres mohair	Chèvres à poil	Total
1990	48 663 540	2 779 524	13 362 894	64 805 958
1991	49 190 175	2 821 217	13 463 115	65 434 507
1992	49 641 677	2 863 535	13 564 088	66 069 300
1993 (projection)	50 138 074	2 906 488	13 665 819	66 710 401
1994 (projection)	50 639 475	2 950 085	13 768 313	67 357 873

Source: DPT, VI, BYKP Rapport préliminaire de la commission spécialisée d'élevage.

Tableau 3. Production locale et importations de peaux brutes et de peaux picklées (10^3 têtes).

	Petit bétail		Gros bétail	
Années	Local	Importation	Local	Importation
1986[1]	26 675	11 782	4 392	295
1987[1]	26 046	17 741	4 533	642
1988[2]	25 803	12 223	4 535	324
1989[3]	25 940	20 240	4 127	451
1990[3]	27 257	23 937	4 230	718

Source: [1] DPT. Vue générale sur l'Industrie du cuir et d'articles en cuir (Octobre 1988)
[2] Calculé par tête sur base des données de l'Institut des Statistiques de l'Etat (DIE)
[3] Données de l'ordinateur du DIE

Production

L'industrie du Cuir en Turquie bénéfice en général d'une technologie et de méthodes developpées. Mais son développement général s'est effectué par l'extension des petites exploitations et par l'adaptation aux technologies et méthodes nouvelles. C'est pourquoi les techniques et les méthodes d'exploitation et de gestion rationnelles exigées par une production industrielle n'ont pu être appliquées.

Le fait que cette industrie soit installée dans des bëtiments de 3, 4 et même de 5, 6 étages constitue à ce sujet l'exemple le plus concret et le plus frappant. Cet aménagement empeche d'autre part toute solution du problème de l'environnement. Pour ces raisons, dans les locaux et les régions ou le tannage et la production du cuir se font à l'échelle industrielle la forme de l'installation 'physique' devient un problème qui gêne la production. Des 'zones organisées de l'industrie du cuir' en nombre suffisant apparaissent comme la solution de ce problème.

D'autre part, il est obligatoire de suivre les nouvelles méthodes et technologies et d'envisager les investissements exigés pour une production de cuir à l'échelle industrielle. Au cas contraire des difficultés apparaitront en matière de rentabilité et de qualité.

C'et pourquoi d'ailleurs l'ingustrie du cuir de Kazliçesme-Istanbul a commencé à partir de la seconde moitié de 1991 à transférer son installation dans la 'Zone Organisée de l'Industrie du Cuir d'Istanbul' créée dans le secteur Aydnli-Orhanli de Pendik.

Tandis que l'industrie du cuir de Yesildere à Izmir se prépare à s'installer dans quelques années dans la Zone Organisée d'Industrie du Cuir de Menemen. Pour l'industrie du cuir d'Usak également les même mesures et les mêmes dispositions se trouvent en cours d'études. Les chiffres de production de peaux traitées et articles en cuir sont ci-dessous:

	1982	1989	1990[1]
Production des peaux traites:			
Menu bétail (millons de dm)[2]	1 180.0	2 485.7	2 679.7
Gros bétail veau chromé (mil. dm)[2]	640.0	845.3	996.4
Cuir à ressemeler (mille tonnes)	5.6	6.6	7.5
Produits en cuir:			
Articles d'habillement (mille pièces)	2 476.4	5 960.2	6 342.4
Articles de sellerie (millions de TL)[3]	85 286.1	130 911.0	139 608.0
Chaussures (millions de paires)[4]	69.8	86.5	89.9
Souliers en cuir	26.0	33.2	34.9
Souliers en plastique	5.0	7.3	7.5
Souliers en matière textile	5.6	37.2	37.8
Pantoufles	33.2	37.2	37.8

[1] Estimation [2] Chiffres des commissions spécialisées d'élevage
[3] Prix de 1988 [4] Sauf caoutchouc et bois.

S'il faut résumer, l'industrie turque du cuir traverse une période importante de transformation durable. Si l'Etat accorde le soutien nécessaire aux problèmes financiers notamment de ce secteur, cette transformation peut se réaliser dans une période de cinq ans.

La production de peaux traitées et d'articles en cuir accuse une augmentation sensible au cours de dix ans. Toutefois avec l'entrée en circuit de la zone organisée d'industrie du cuir d'Istanbul seulement, la production du secteur sera doublé au cours des 3–5 années prochaines.

Financement

Le transfert des usines installées à Kazliçesme dans la 'Zone organisée de l'Industrie du Cuir d'Istanbul' a obligé l'industrie du cuir, qui se trouvait dans sa seconde phase de transformation, à entreprendre des investissements extraordinaires.

L'industriel s'est vu d'une part obligé à entreprendre d'importantes investissements pour la construction de nouveaux batimants d'usine et pour l'équipement de ces bëtiments et d'autres part, l'obligation d'augmenter sa production a rendu urgents ses besoins de capitaux d'exploitation. C'est dans ces conditions extraordinaires qu'il attend que des 'Crédits à moyen terme et à bon marché' lui soient consentis.

L'autre facteur important qui agit de facon négative sur le capital d'exploitation est le 'Taux d'inflation élevé'. Il devient impossible de porter sur les prix les rapides accroissements des prix de revient et d'y adapter le rythme du capital et ceci conduit à une diminution da la production causée par l'insuffisance du capital d'exploitation.

Ni dans le pays ni à l' étranger, il n'existe un problème de marché pour le cuir et les articles en cuir. Ce qui est important c'est la qualité et le prix. Sur les marchés extérieurs notamment, il n'est pas question de mesures restrictives telles que 'des quotas' pour le secteur du cuir.

Toutefois, il importe que le gouvernement mette en vigueur les mesures d'encouragement pour promouvoir les exportations de ce secteurs. Tandis que nos concurrents tels que l'Inde, le Pakistan et la Corée du Sud bénéficient d'encouragements officiels et officieux, nous sommes amputés chaque mois des modestes encouragements dont nous bénéficions et ceci n'augmente pas nos chances. A coté d'une politique de suppression des encouragements d'ailleurs insuffisants, la politiques de notre fouvernement relative aux 'cours de devises' paralyse l'exportateur. Le fait que les cours de devises soient tenus au dessous des chiffres d'inflation cote à l'exportateur une perte annuelles de 20–30%.

En outre les politiques et les méthodes mises en couvre pour le marketing et les Ventes en cuir et des article de cuir à l'intérieur comme à l'extérieur du pays se révélent nettement insuffisantes.

Une politique d'enseignement et de réorganisation simpose dans ce domaine. Le secteur doit d'une part intensifier ses travaux relatifs aux 'marques originales' et à la mode et le gouvernement de son coté doit porter ses encouragements à un niveau stasfaisant et mettre en application une politique réaliste de cours.

Enseignement

Les établissements qui fournissent un enseignement organisé en rapport avec le secteur du cuir sont en nombre suffisant. Il importe toutefois d'améliorer la qualité de cet enseignement. Le nombre et la compétence des enseignants doivent etre revus et remis à jour.

L'Institut professionnel de Pendik doit être doté d'un statut autonome et acquérir le caractère d'une établissement fournissant un enseignement de niveau international.

L'enseignement extensif doit être développé. Pour la main d'oeuvre dont l' industrie a besoin en grand nombre des programmes-paquet s'inspirant d'une méthode analytique doivent être mis au point et en application.

Environnement

L' opinion publique considère le secteur peaux et cuirs comme une 'branche d'industrie à caractère extrèmement polluant'. Or les technologies avancées des récentes années notamment ont réduit sensiblement les facteurs de pollution. D'autre part cette industrie a, à toute occasion, manifesté son respect de l' environnement et continue à le faire.

A Kazliçesme des efforts visibles ont été déployés dans ce sens dans la mesure que les conditions l'ont permis et devant l'impossibilité de multiplier dans ce secteur les mesures contre la pollution la décision du transfert dans la zone organisée de l'industrie du cuir a été mise en application ce qui constitue une preuve tangible de son comportement. La zone organisé de l'industrie du cuir d'Istanbul possède actuellement une installation d'épuration et de récupération unique au monde; 60 000 arbustes sont en ce moment plantés dans cette région.

Les industriels de cuir de la région d'Izmir également se sont orientés à mettre au point les meilleurs dispositions et dans l'intention de supprimer totalement la pollution ils sont en ce moment en cours de créer la zone organisée de l'industrie de Menemen.

The Turkish leather industry, its future and possibilities, the competition with the industry in the European Community

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Summary

In this invited paper, the place of Turkish Leather Industry within European Community, its future and its ccompetitive in relation to the industry in European Community are dealt with, in the light of the existing information in Türkiye.

When compared with EC countries, Türkiye occupies 3rd place in large ruminant numbers, 1st place in small ruminant numbers, 5th place in the production of raw hides from large ruminants and 1 st place in the production of raw skins from small ruminants.

With its share of 30–40 percent, European Community has an important place in the world market of skin and leather products. The figures show that the share of this sector in the Turkish trade with EC countries has reached important dimensions.

With its performance attained in exports in recent years and with the importance given to technological changes, Turkish Leather Industry has attracted a significant amount of attention. An important improvement in the production potential and quality will be obtained when the organised industry units using the most recent technologies are put to operation in the near future.

Turkish Leather industry has an outstanding performance which sets an example for competition in European Community.

Introduction

Türkiye applied for the membership of EC on April 14, 1987 after which new political, economic and social activities began. Since the application many establishments and firms studied the Turkish capacity to compete with EC Industry.

This note explains the position, future and competition capacity of the Turkish leather industry through studies carried out in Türkiye.

Hides and skins productions

The quantity of production is related to animal population. When looked at the animal numbers of EC countries and Türkiye altogether, (Table 1), it will be seen that Türkiye has 11 551 000 cows. This would make Türkiye the fifth country in Asia, and the fourth country in Europe (excluding USSR). The number of its sheep is 40 677 000, which makes it 4th in Asia, and the first in Europe (excluding USSR). The number of its goats is 11 329 000 which brings it to fifth position in Asia and first position in Europe. Another evaluation would show that Türkiye has 9.2% of the total number of cows, 26.9% of sheep and 98.1% of goats in Europe. Türkiye, by producing 77 480 mt hides is the fifth producer country in Europe (excluding USSR) and Asia; it is the third country in Asia and the first among European (excluding USSR) and EC countries by producing 76 160 mt skins (Table 1).

In Türkiye, the hide production in proportion to the livestock number is at a rather low level; because, the produce per unit is at a rather low level and, since the uncontrolled slaugh-

Table 1. Livestock numbers (10^3 head), hides and skins products (mt) in The World, Asia, Europe and Türkiye (TR).

	Cattle	Sheep	Goats	Hides	Skins
World	1 281 472	1 175 524	526 440	6 903 880	1 741 174
Asia	339 556	290 793	283 242	1 516 930	620 387
Europe (TR included)	137 120	191 941	26 464	1 247 631	291 673
EC	85 364	102 967	12 315	871 595	154 834
Bel.-Lux.	2 967	190	8	28 000	1 700
Denmark	2 226	86	-	20 625	225
France	21 780	12 001	1 103	160 100	17 460
Germany	20 369	4 098	71	259 900	6 017
Greece	731	10 376	5 970	7 652	19 160
Ireland	5 637	4 991	9	39 000	8 050
Italy	8 737	11 623	1 214	149 008	16 700
Netherlands	4 606	1 405	34	52 000	1 342
Portugal	1 359	5 354	745	12 780	6 300
Spain	5 050	23 797	3 100	45 930	41 280
UK	11 902	29 046	61	96 600	36 600
Türkiye	11 551	40 677	13 100	77 480	76 160

FAO, TOKB.

tering takes place at a high level, it causes great losses. Spread of culture races is an important factor causing an increase on the hide produce. Controlled slaughtering, which is being followed upon with great interest, is another important factor that prevents lost on the hide and skin production at large scales. By this way, the present capacity can be increased up to 50 per cent level (Artan, 1982).

Structural condition of the leather Sector in Türkiye

Leather sector is one of the oldest sectors of the Turkish industry. The establishments are mostly small ones. Since the attempts on utilizing the advanced technological improvement have not reached to a required level yet, the sector still maintains its labour printed character. The technological level being maintained at the leather processing and leather clothing branches is recorded to be at a medium degree while it exhibits a low degree at the shoemaking branch (Kartay, 1988).

The present establishments are specially settled at the western areas of the country. Istanbul and Izmir are some of these cities where those establishments are settled rather densely. Approximately 80% of the output of the sector is being produced at the work places at Kazliçesme, Istanbul. In order to create a capacity increase as well as a to apply a modernization at the leather sector in Türkiye, several investment encouraging funds are being executed (Table 2). Nowadays, there are four important projects that play an important role for the sector:

1. To transfer the present establishment settled at Kazliçesme, stanbul, which has a 300 ton/day total production capacity, to the Tuzla Organized Leather Industry Center where the daily capacity level is aimed to be increased to a level over 600 ton/day.
2. To activate the Minor Industrial Center at Ikitelli-Istanbul, which has been constructed in order to provide appropriate work places for the shoemaking, sadolery and ready-made

Table 2. Documents of incentive investment used in leather and sole industries.

Year	Doc. No.	Total investment (10^6 TL)	Operating revenues (10^6 TL)	Foreign exchange & Share (10^3 \$)	Employment (Labour)
1982	8	943	214	1 411	553
1983	10	1 726	432	2 193	775
1984	16	6 408	1 886	4 155	1 811
1985	30	9 634	1 413	6 320	1 135
1986	27	21 624	6 435	1 064	1 268
1987	40	33 765	20 368	11 991	2 738
Total	131	74 100	30 748	36 712	8 280

Table 3. The production of leather and leather products.

	1986	1987
Skin leather (10^6 dm^2)	1 931.7	2 407.2
Hide leather		
Upper leather (10^6 dm^2)	822.1	885.9
Sole leather (10^3 tons)	6.6	7.0
Leather garments (10^3 no.)	3 968.3	5 639.4
Shoes (10^6 pair)	81.9	86.6
Others (10^3 tons)	2.3	2.9

Table 4. World leather garments and accessories export market (10^6 US \$).

	1981	1982	1983	1984	1985
World	1 392 611	1 450 724	1 516 353	2 002 291	2 019 313
Europe	558 481	551 239	542 360	588 020	651 257
EC (10 countries)	458 145	473 433	492 013	536 655	598 993

1985. International Trade Statistics Yearbook United Nations, 1987.

leather workshops which are already making their manufacture under extremely primitive conditions.

3. To transfer the establishments situated at Yesildere-Izmir to the Organized Industrial Center of Leather situated at Menemen, and to increase the production level to 27 000 000 num./year.
4. To complete the modern center in Bornova-Izmir, which is being constructed by 750 shoemakers.

By the realization of these projects, the exportation volume of the sector is expected to reach up to a level of 3 billion US $ in 1995 (Özçörekçi, 1988).

In parallel with the improvement of the sector itself, compensating the need for qualified manpower is another aspect that is also being researched. At the moment, leather training courses based upon a two years or four years of education programs at the college level have been started at certain universities such as Ege University (four years of education, commencing from 1983 onwards), Istanbul University (two years, commencing from 1987); and these education programs are already be active. Moreover, at Pendik Leather Training and Research Institute (established in 1974), a leather technicianship training course based upon high school level is being given.

In the Plain Objectives and Annual Application Plans of the programs for 5 Years of Periods, DPT (State Planning Organization) has put forward certain measures regarding the improvement of leather and the leather products sector either in order to be brought into application at a continuous basis or within the program period (DPT, 1988).

Production of leather and leather products in Türkiye

Production of leather and leather products in Türkiye regarding the years of 1986 and 1987 has been shown at Table 3. Production increase speed in 1987 had been recorded as 26.9 percent. During the recent years, important increase levels have been recorded. However, these increases are still insufficient to respond the demands on the sector, and a great amount of leather is being imported. Within the year of 1987, 396 000 000 dm^2 of leather has been imported (Özçörekçi, 1988).

According to the sources of the International Trade Statistics Yearbook, the World's Leather Clothing and Accessories Export Market, and the world, Europe and EC Countries markets regarding the exportation of leather clothing and accessories have shown at Table 4. Among the world's leather and leather products market, EC Countries maintains an important place having a 30–40 % share of the market.

Türkiye's competition and the EC countries

Leather sector is one of the enterprising sectors an exportation in Türkiye according to the data gathered considering the years of 1980–1988. The ratio of the leather products on the production percentage of the whole exportation has been recorded as 19.2%, and the ratio of this amount to the total exportation is 2.7%. Growth at exportation is 125.8%, while growth on production exhibits a 11.7% of level. According to another evaluation realized considering the relations between the world's exportation and the Türkiye's exportation: the leather sector has been classified to be among the sectors having a competitive superiority (sectors recorded a relative success) (TUSIAD).

When the factors determining the competition superiority are considered according to an evaluation based upon 10 scale, the present situation at the leather sector is as follows: labour force cost, salaries 9; labour force productivity 9; capital cost 4; quality 9; specialities 9; Mismatches 7; Technology 5; Qualified labour force 4; Intrastructure 5; Availability of raw material 10; Domestic competition environment 7; Image of country 3; Foreign connections 4; Geographical situation 3 (Senatalar, 1991).

At this evaluation, this labour force productivity and the geographical situation can be accepted to be positive factors, while capital cost, application of new technologies and domestic competition environments are taken as negative factors. When compared to the developed or developing economics, Türkiye is at an advantageous situation from the respects of medium period labor force supply and salary level. The technologies being applied by certain sectors in Türkiye, generally, exhibit a variable situation at large scales and they can be classified as unproductive ones. However, the leather sector is among those which apply advanced technologies at sufficient degree. In Türkiye, raw material availability and low labour force cost are important factors which provide a competition superiority to the leather sector. The sector has an important effect on the employment volume, foreign exchange input power and the development of the non-developed regions.

Conclusion

In recent years, Turkish Leather Industry has gained an important success due to its recent performance on the exportation field as well as due to the importance of technological transformation it experiences. When the organized industrial centers of leather are activated by applying the most advanced technologies, the present production capacity and quality are expected to be increased to higher levels. Turkish Leather Sector, against the EC Countries, has a remarkable performance capability from the respect of its competitive power.

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Session 2

Environmental problems associated to the leather industry

Chairman: R. Fevrier
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Innovations scientifiques et techniques pour le controle de l'environnement et de la qualité des decharges dans l'industrie du cuir

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Abstract

The Italian leather industry started over 30 years ago to bring about an effective action in order to face ecologic problems connected with the industrial processing and it has always held a leading position at international level for the work performed and the studies relating to waste water treatment, depletion of emissions, sludge disposal and recovery of process by-products. 2 600 tanneries, producing 1 billion 700 million square feet of tanned leather and discharging around 30 million cubic meters of effluent per year give unquestionably rise to problems concerning depollution, also owing to the fact the Italian legislation is among the most restrictive in the world.

Keeping in mind that necessarily for processing hides into leathers chemical reagents have to be used, an evaluation will be made of all the technologies developed for reducing the pollution to a maximum extent from the stem point itself of waste treatment plants, while also pointing out the problems connected with emissions into the atmosphere as well as the present trends in the field of ecological finishing.

As to the over 300 000 tons of chromed and unchromed residues from Italian tanning processes, the current lines for approaching the question of the most effective utilization of these valuable nitrogenous raw materials will be pointed out. An overall view will then follow about the technologies which should be adopted for maintaining the present production standards in compliance with environmental requirements and in the context of the need for an overall higher productivity of the leather enterprises.

Introduction

A l'occasion d'un symposium international dont le sujet est axé essentiellement sur les peaux brutes, les races animales, les ressources zootechniques et sur l'utilisation de différents types de poils et laine, il est aussi nécessaire de parler de tannage, c'est-à-dire de l'industrie qui transforme les peaux en cuir, récupère la laine et les poils engendrant de véritables problèmes écologiques liés au travail des peaux.

Le tannage des peaux représente la transformation d'une substance organique putrescible en une substance imputrescible, ce qui est une véritable opération écologique; c'est ainsi qu'on récupère un bien précieux que l'homme utilise depuis la préhistoire et qui dérive du tannage des peaux réalisé au fil des siècles par des systèmes empiriques tels que la fumée, contenant des aldéhides, l'écorce des plantes, contenant des tannins, les substances grasses des peaux qui libèrent des aldéhides lors de leur rancissemnt; au début de ce siècle, les peaux étaient tannées avec des sels basiques de chrome.

La production de peaux dans le monde se monte à 1 milliard de peaux/an; plus les potentialités dans un pays sont élevées, plus les problèmes écologiques auxquels il faut faire face sont graves (Tableau no. 1). Dans plusieurs pays représentés à ce Symposium International, il existe un nombre important de tanneries:

Turquie	700	
Maroc	40	(140 millions pc/an)
France	182	
Angleterre	70	
Grece	160	
Egypte	230	(130 millions pc/an)
Finlande	45	
Italie	2 600	(1 600 millions pc/an)

Face à ces énormes quantités de peaux transformées, l'Italie a mis en oeuvre des stratégies exceptionnelles pour donner une réponse opérationnelle à la question environnementale dans son ensemble, par le biais d'études et de recherches multidisciplinaires pour aboutir à la construction de systèmes d'épuration dont les frais de gestion sont fort élevés. Malheureusement,l'épuration des eaux a pour conséquence la production de boues dont l'évacuation est très coûteuse. Une série de sous-produits dérivent des travaux de tannage; nos études ont démontré qu'ils peuvent être considérés comme des matières premières secondaires (MPS), utilisables pour la production de matière azotée pour l'alimentation du bétail, pour les emplois

Tableau 1. Production de peaux.

– Production de peaux dans le monde (peaux/an en millions)

Bovines	240	
Ovines	450	
Caprines	210	
Autres	100	
Total	1 000	(5.5 millions de tonnes/an)

– Tanneries dans le monde: 13 000 avec 500 000 empoyés
– Peaux tannées produites: 12.5 milliards de pieds carrés/an
– Valeur du cuir tanné: 50 000 milliards en lires italiennes

Trois pays produisent 25% du cuir tanné (pieds carrées millions)

Italie	1 600	(2 600 tanneries)
U.R.S.S.	1 000	(650 tanneries)
U.S.A.	700	(120 tanneries)

– L'Europe produit 43% du cuir tanné mondial
– L'Europe occidentale en produit 29%
– L'Italie produit 50% du cuir tanné de la CE, ce qui est égal à 14% du produit tanné mondial

– Eaux et résidues:	Eau usée (millions mc/an)	Boues (filtrées-pressées) (tonnes/an)	Résidues tannées et non-tannées (tonnes/an)
Monde	300		
Italie	28	280 000	270 000

– Incidence sur le prix du cuir tanné des coûts d'épuration, de l'écoulement des boues et des résidus, de l'abattage des émissions: environ 12 centimes américains/carré.

Tableau 2. Résidues du tannage.

100 kg de peau:	eau kg 65
	solide kg 35
	55% qui deviennent des peaux tannées = 18–19 kg
Les solides se divisent en:	45% de résidus tannés ou non-tannés + les boues
– Résidus *non-tannés*	
Résidus en poil.	
L'écharnage (après extraction des graisses) permet d'obtenir de la farine azotée pour l'alimentation du bétail.	
Le découpage en tripe permet d'obtenir de la gélatine alimentaire et photographique, du collagène pour l'industrie cosmétique et pharmaceutique.	
Biométhanisation	énergie
Pyrolyse	énergie
Incinération	énergie
– Résidus tannés	
Dérayage au chrome + enzymes	chrome
	protéines
Dérayage + découpage + dépolissage	cuir torréflié
	matériaux composites
	carton-cuir

pharmaceutiques, pour les utilisations agricoles comprenant aussi les boues d'épuration (Tableau no. 2).

Récemment,une Commission de la Communauté Européenne a envoyé au Parlement Européen un document sur les stratégies communautaires à adopter en matière de gestion des déchets. Suivant les directives du Parlement, l'effort conjoint doit déboucher sur la 'prévention' de la formation des déchets avant leur valorisation qui est prévue et souhaitable. L'Italie suit cette directive depuis plus de vingt ans avec des coûts considérables; la répercussion sur le coût du cuir tanné s'élève à plus de 6%. Dans les autres Pays, aussi bien communautaires qu' extra-communautaires, ces problèmes ne sont pas abordés et les mesures adoptées en matière écologique n'en sont qu' à un stade embryonnaire.

Par conséquent, un aperçu sur les possibilités disponibles aujourd'hui, en amont et en aval du cycle de travail, pour réduire l'impact écologique peut donner des indications valables aux opérateurs du secteur, qui devraient saisir la nécessité de mettre en place des mesures écologiques, désormais inéluctables, pour la survie du commerce des peaux et des travaux de tannage.

Considérant que le temps à notre disposition pour exposer un sujet si vaste est réduit, je présenterai une synthèse portant sur les opérations possibles, phase après phase.

Peaux brutes

Les peaux sont stockées suivant la méthode de la chaîne du froid ou bien en ayant recours à l'emploi de conservants autres que le chlorure de sodium qui n'est pas biodégradable et qui constitue un problème dans les effluents. Le battage des peaux salées avant le verdissage ou l'emploi de foulons en réseau permet de récupérer, même si ce n'est que partiellement, ce polluant. Il existe aussi des systèmes de récupération des eaux de désalinisation qui séparent les protéines de la saumure; celle-ci est ensuite concentrée par évaporation et le sel réutilisé pour le salage.

Pentachlorophenol (PCP)

Les produits à base de PCP sont utilisés pour préserver surtout les peaux traitées en saumure des moisissures. Cet emploi crée plusieurs problèmes puisque les quantités de ces conservants sur les peaux finies sont supérieures à celles prévues par la Loi. La limite de 5 ppm imposée en Allemagne sera augmentée suivant une Directive Communautaire (76/769) qui prévoit une quantité jusqu'à 1 000 ppm de PCP. Entre temps, les conservants de cette classe peuvent engendrer, après incinération, des traces de dioxine; par conséquent, ils sont remplacés par d'autres produits à base d'ortophénilphénol, de parachlorométacréosol ou bien par des produits à base de TCMTB ayant le même effet anti-moisissure bien qu'ils soient plus coûteux et moins durables sur la peau.

Dépilage

Le dépilage traditionnel à base du complexe sulfure-chaux peut être remplacé par d'autres alternatives. La présence de quantités de sulfure, de DCO et DBO élevées après la destruction des poils provoquent des inconvénients pendant l'épuration; l'eau après chaulage a un COD de 40 000 à 50 000 contre une valeur de 12 000 à 13 000 si le poil est récupéré par des processus d'immunisation et l'emploi de basses quantités de sulfures. Dans le cas des peaux lainées, le dépilage enzymatique ou l'emploi de petites quantités de sulfure combiné aux enzymes ayant une activité spécifique en milieu alcalin, auront un très grand intérêt à l'avenir. Les enzymes susmentionnés sont déjà disponibles et à l'étude auprès des centres de recherche. Le principe de l'injection d'enzymes sous pression du côté cuir (Penetrator) est valable du point de vue écologique.

Déchaulage

L'une des substances chimiques les plus difficiles à éliminer des eaux résiduaires est l'ion ammonium qui dérive essentiellemnt des sels d'ammonium utilisés lors du déchaulage. L'utilisation du gaz carbonique testée même à l'échelon industriel résout en partie ces inconvénients. Le processus est très simple et les frais pour l'installation des foulons ne sont pas élevés.

Tannage

La plupart des peaux produites dans le monde sont tannées avec les sels de chrome. Considérant que les eaux résiduaires doivent contenir des quantités très basses de chrome, allant de 1 mg à 2 mg de Cr par litre et que la présence de chrome trivalent limite l'emploi des boues en agriculture, on a cherché à remplacer le chrome par d'autres produits minéraux, en particulier l'aluminium et le titanium. Mais malheureusement, ces sels tannants, y compris l'aluminium, ont des effets nocifs et les sels de chrome ne seront pas remplacés par d'autres systèmes de tannage. Par voie de conséquence, il faut évaluer toutes les possibilités existantes pour réduire les quantités de chrome à utiliser et surtout pour épuiser les bains de tannage et pour en récupérer le chrome résiduaire. Si l'on considère que les boues de tannage contiennent environ 50% de matière organique azotée, pour que ces matériaux conviennent pour la fertilisation, il faut faire tous les efforts possibles afin de réduire au maximum les quantités de chrome dans les effluents. Les systèmes permettant d'obtenir l'épuisement total des bains de tannage sont nombreux; le chrome, tout comme les autres produits chimiques, ne peut réagir que sur la substance dermique (SD) de la peau qui est égale à 20% du poids de la peau; si on apporte sur les peaux en tripe 2.5% de Cr_2O_3, nous fournissons à la partie réactive de la peau (SD) plus de 50% de son poids! Il est fort évident que ces quantités sont excessives, qu'une partie du chrome n'est pas fixée d'une manière stable et qu'on la retrouve non seulement dans les bains résiduels de tannage mais aussi dans les lavages, lors de la neutralisation et dans les bains de teinture. Outre la nécessité d'optimiser tous les facteurs qui influencent la réactivité du sel de chrome tels que le piclage, les temps, le pH et la basification, la température demeure l'un des paramètres fondamentaux. Suivant les expériences réalisées en Italie, nous avons démontré qu'à l'aide d'un chauffage programmé, qui peut accroître la température dans les foulons de manière progressive et linéaire jusqu'à atteindre 40 à 45° C dans les phases finales, on peut utiliser des quantités de chrome inférieures d'un tiers pour fixer à la substance dermique les mêmes quantités de sel tannant. En Italie, plusieurs tanneries ont appliqué ce système réduisant ainsi la quantité de chrome, obtenant des eaux de tannage presque épuisées et de faibles quantités de chrome dans les boues.

Il existe sur le marché des sels de chrome à haut degré d'épuisement qui permettent d'obtenir dans les bains épuisés moins de 1 gr/l par rapport à une quantité constante de 4 à 6 gr/l. En outre, beaucoup de produits peuvent favoriser la fixation du chrome ainsi qu'on l'a suggéré par exemple en utilisant des hydrolysats de chératine obtenus à partir du poil récupéré pendant la phase de dépilage avec recyclage. Quoi qu'il en soit, il faudrait mener des études ultérieures afin que le chrome fixé lors du tannage ne soit pas éliminé pendant les opérations successives.

Teinture

L'emploi de classes de colorants qui ont remplacé les produits benzidiniques ou ceux à base de toluidine afin de éliminer les effets cancérigènes de ces substances. La véritable innovation est l'emploi de colorants liquides qui évitent l'inhalation de poudres, qui peuvent être mieux dosés et qui ont une réactivité plus importante vis-à-vis des peaux chromées, grâce aux dimensions plus petites des particules du colorant.

Finissage

Il existe différents types de finissage qui comportent l'utilisation de machines et de produits chimiques. Les finissages peuvent être subdivisés en deux catégories: le finissage à base d'eau et le finissage à base de solvant. Les finissages à base d'eau impliquent l'utilisation de caséines et des traitements avec des produits réticulants (tels que le formaldéhyde ou des produits similaires). Les finissages à base de solvant prévoient, suivant les articles, l'emploi de solvants soit solubles, dans une certaine mesure, soit insolubles dans l'eau.

Les solutions sont apportées sur la peau par la pulvérisation (lignes de pistolets à vapeur), le saupoudrage ou l'enduisage.

Les produits qui peuvent provoquer des problèmes écologiques (pollution de l'atmosphère) sont les suivants: l'émission de particules, le formaldéhyde et les solvants insolubles dans l'eau. Par ailleurs, du point de vue des machines, les problèmes majeurs sont liés essentiellement aux lignes de pistolets à vapeur où la pulvérisation de mélanges, avec la création de l'aérosol et les débits élevés d'air (jusqu'à environ 15 000 m^3/h), demande l'emploi de grandes quantités de produits dont une partie seulement est apportée sur la peau, alors que le reste est dégagé dans l'air.

Dès lors, il est nécessaire d'analyser chacun de ces éléments susceptibles de représenter une forme potentielle de pollution: *Particules:* les particules solides, composées essentiellement de résines, de caséines et de pigments, sont présentes seulement dans les lignes de pulvérisation. A l'heure actuelle, grâce à des critères et à des systèmes d'abattage à l'eau (tours à contre-courant), de très bons résultats, en conformité avec les normes en vigueur, peuvent être obtenus. *Formaldéhyde:* cette substance, employée traditionnellement dans le secteur du tannage, pour les finissages à l'"aniline", n'a pas été remplacée aujourd'hui encore par d'autres produits aussi valables. Les problèmes que le formaldéhyde pose sont corrélés à sa volatilité élevée et aux fortes contraintes établies par la législation actuelle. L'utilisation du formaldéhyde a comporté des investissements importants afin d'équiper les lignes de pulvérisation avec des installations d'abattage appropriées. Nul doute que les résultats obtenus sont satisfaisants et ceci a été possible en réduisant les quantités de formaldéhyde employées et en appliquant des technologies d'installation qui exploitent sa solubilité dans l'eau et sa réactivité particulière dans certaines conditions. *Solvants:* il faut faire une distinction entre les solvants solubles dans l'eau (par exemple, les glycols, l'acétone etc.) et les solvants insolubles. En ce qui concernent les premiers, il n'existe pas de problèmes d'abattage importants car en exploitant leur solubilité dans l'eau, on arrive à limiter leur teneur dans les émissions. En ce qui concerne les autres solvants, le problème est bien plus clair étant donné que les caractéristiques des émissions (concentrations, débits etc.) sont telles qu'elles empêchent d'avoir recours à des technologies expérimentées dans d'autres secteurs, par exemple les chambres de combustion catalytiques ou thermiques. Le coût de l'investissement et surtout de la gestion ne pourrait pas justifier cette opération. Que faire alors? La seule alternative serait de ne plus produire certains types d'articles, mais à vrai dire, celle-ci ne semble pas être la meilleure solution. Il faudrait plutôt une action concertée avec les producteurs de substances chimiques. Ceux-ci doivent être en mesure de proposer de nouvelles formulations qui permettent d'obtenir les mêmes produits avec des solvants différents de ceux utilisés actuellement et solubles dans l'eau: une hypothèse qui a déjà été préconisée par des études menées par la Stazione Sperimentale Pelli de Naples. C'est là, indiscutablement, la voie à suivre et à approfondir. Des raisons écologiques, techniques et économiques sont à la base de ces orientations d'autant plus que de cette façon, il sera possible d'envoyer les eaux d'abattage des solvants aux installations normales d'épuration des eaux dont chaque tannerie est pourvue.

En ce qui concerne les émissions, la législation italienne est récente, peu claire, incomplète et pénalisante et par voie de conséquence, elle doit faire face à tous les problèmes de la réalité productive.

On espère que, dans un futur proche, des normes seront formulées à l'échelon européen qui ne soient pas discriminantes pour les différents pays de l'Europe Unie.

Machines pour le tannage et cycles de travail

Ces dernières années, les activités de tannage en Europe ont subi un fléchissement léger de la production, dû essentiellement à la crise de l'industrie de la chaussure, aux difficultés d'approvisionnement en matières premières et aux problèmes écologiques du secteur qui contribuent à créer des sujets de réflexion. Le niveau de la qualité du cuir tanné, une condition fondamentale pour la compétitivité, ne semble plus être suffisant pour assurer l'expansion dans l'avenir. Une telle expansion est au contraire corrélée à une innovation technologique constante qui doit créer les différences nécessaires pour la compétitivité. Afin de réaliser ce processus d'innovation, il sera nécessaire de compter sur des systèmes d'automation très sophistiqués, avec une gestion entièrement informatisée de la tannerie. Dans une moindre mesure, il faudra réaliser une mécanisation intégrée poussée, en partie au moyen de systèmes informatisés et essentiellement en robotisant la plupart des opérations de manipulation des peaux.

La première solution peut être réalisée à long terme seulement par des tanneries ayant des productions très élevées. En revanche, la seconde solution offre, à moyen terme, une possibilité réelle d'applications différenciées selon l'importance de la production. Par conséquent, les initiatives industrielles auxquelles on devra accorder un intérêt prioritaire sont non seulement le contrôle des principales phases du processus, mais aussi l'emploi de nouveaux types de machines destinées à toutes les phases de la transformation, outre la robotisation de la manipulation des peaux. Ceci, dans le but de transformer le travail 'discontinu' de la plupart des machines utilisées actuellement en travail 'continu'.

Depuis plusieurs années, on a mis au point des machines qui sont largement employées: pour l'écharnage, le découpage, la ventilation la presse, la teinture et le dérayage. A notre avis, les perspectives futures de la transformation des peaux sont étroitement liées, pour des raisons économiques et écologiques, à une série de processus de rationalisation du cycle productif qui doivent être interprétés surtout comme une modification essentielle des processus de rivière, notamment du dépilage-chaulage, comme une simplification des opérations de charge et de décharge, comme des contrôles et si possible, le recyclage des bains et le dosage plus facile des produits chimiques.

Des innovations substantielles dans la rationalisation des opérations mécaniques sont aussi nécessaires, à travers le développement de l'automation, surtout pour le prélèvement, le positionnement et l'empilage des peaux à la sortie des foulons et des machines. En réduisant le nombre de travailleurs, les coûts seront eux aussi réduits. Toutefois, il est clair que ces innovations ne seront appliquées que si les coûts de l'innovation sont limités. En même temps, il sera possible d'obtenir une amélioration de la qualité des peaux, de plus grands rendements en terme de surface et aussi de réduire les problèmes écologiques. Des lignes de travail 'en continu' sont actuellement disponibles où, bien que l'homme remplisse encore une fonction fondamentale, des solutions valables sont adoptées pour l'automation et le contrôle du processus. De fait, la continuité et la vitesse de travail sont assurées par l'automation des transferts, ce qui permet une forte diminution des coûts de manipulation tout en garantissant la souplesse de travail nécessaire. A moyen terme, il est possible d'envisager une économie de la main d'oeuvre employée de 40 à 50% pour les raisons suivantes: 1) toutes les opérations de dépilage, de chaulage, de tannage et de teinture peuvent être réalisées dans un seul foulon, réduisant ainsi le mouvement des peaux; 2) toutes les opérations mécaniques peuvent être exécutées sur des machines en continu, dont plusieurs sont reliées en série, ce qui comporte une réduction considérable du nombre d'ouvriers.

En ce qui concerne les avantages écologiques des nouvelles lignes de travail préconisées — l'écharnage et le découpage associés au foulon à recyclage — elles permettent d'obtenir une diminution d'environ 50% des boues produites par la tannerie et une économie considérable d'eau. Il est également possible de récupérer les déchets de découpage, les croûtes et les oreillons qui sont indemnes de produits chimiques et qui peuvent donc être recyclés aussi pour l'alimentation animale ou pour la préparation de produits à haute valeur ajoutée. Dans l'atelier de finissage, si on adopte la pigmentation avec des machines à rouleaux pour remplacer le système traditionnel de pulvérisation, tout problème d'épuration s'en trouve éliminé et les solutions de couverture peuvent être entièrement utilisées. Enfin, le découpage automatique des peaux avec les déchets réduits au minimum, surtout pour les petites peaux de valeur, augmentera les rendements et limitera les problèmes d'élimination des déchets.

Grâce à un effort conjoint des tanneries, de l'industrie chimique, des producteurs de machines et d'installations et de la recherche du secteur, il est actuellement possible de réaliser une tannerie qui, sans gaspillage de ressources, puisse garantir l'avenir de l'industrie du tannage lié, sans aucun doute, à une productivité élevée, à une réduction générale des coûts, à un contrôle du processus et donc à une qualité constante, tout ceci en respectant en plein l'environnement.

Possibility of reduction and re-using the wastes of Turkish leather industry that cause environmental pollution

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Summary

From traditional handicrafts in twenty years the Turkish leather manufacturing has become a major industry, meanwhile rapid flow of population from rural areas to towns resulted in unorganized urbanization. Tanneries once located in provincial zones of towns now engulfed in rapid expansion and become part of city center areas where tanneries lack proper infrastructures. Consequently treatment plants weren't installed by the firms. And now suddenly environmental hazards of leather industry come to attention.

Institutions to supply this industry with skilled resources to increase the standards of knowledge were slow in forming. Insufficient establishments while moving upward for space in progress made it difficult, sometimes impossible, to treat and processes liquid and solid wastes. Thus, establishments who brought new technology weren't able to make complete use of them.

Considering the state of the Turkish tanneries today, to achieve desired decrease in solid and liquid wastes, various precautions can be effective. Education and training craftsmen must be the prime concern. Without skilled craftsmen no matter how new the technology is decreasing the waste to prevent pollution will not be possible. Also the chemical and water quantity in application for sorting, soaking, dehairing, liming etc. If it can be applied in specific amounts it will help to minimize the liquid and solid wastes.

Tanneries of Türkiye make no effort to recycle the waste. Waste water studies for agricultural use aren't made. Also no research is made for using the solid wastes.
Key words: tannery, wastes, reduction, sorting, recycling.

Introduction

Turkish leather industry, which has become a major manufacturing from traditional handicrafts, is one of the industry branches which must be pointed out with sensitivity and importance. The sector, which has showed a rapid development and changing in last twenty years, had neither its own infrastructure nor educated personnel. When the sectors's polluting side is noticed it was very late that the taken prevents couldn't be enough.

The areas that the leather industry is established and settled, in a short time, started to take place in city centers because of unorganized urbanization and rapid flow of population from rural areas to cities. So the establishments that normally have to show horizontal growth, parallel to unorganized urbanization, showed perpendicular development in limited areas. Environmental pollution has gradually intensed, treatment plants couldn't be established and the ones that have been established couldn't give the expected result because of technological incompetence.

In cities, problem of environmental pollution gradually increased and result of this, leather industry had the problem of changing place. As a result, studies about moving the leather establishments in Istanbul Kazliçesme to Tuzla Organized Leather Manufacturing Areas and the ones in Izmir Yesildere to Menemen Maltepe Organized Leather Manufacturing Areas are increased. Studies like that are also done in cities like Bursa, Usak. However financial problems hindered the organized leather manufacturing areas to gain workingness in a short time. On one side the prevents that the local administration took and on the other side the obligations that the environmental laws submitted especially caused the moving of the establishments in Kazliçesme to other cities. So, in country base besides not being able to take prevents to hinder the environmental pollution, postponing and decreasing occurred in the production of the establishments, the quality became lower and many firms couldn't implement their contracts.

General situation of Turkish leather industry

There isn't any certain knowledge about the number of leather establishments in Turkey, it is thought that there are about two thousand establishments. These establishments are insufficient both technically and technologically. Besides, they show difference from each other in working methods.

Most of the establishments in Turkey are intensed in cities and towns like Istanbul, Izmir, Usak, Bursa, Denizli, Çorlu, Gönen, Gerede, Kula. When these places are searched for their treatment plants the collected treatment plants are only in Izmir Yesildere and Gökdere. In other places, there aren't any treatment plants except 5–10 establishments. So, all liquid effluents are directly given to natural environment. These effluents, which aren't depended on any kind of treatment, causes environmental pollution. Shortly, today's Turkish Leather Industry doesn't have any possibilities to treat its own enfluents except 5–10 treatment plants. This problem can be solved only in the place where the treatment plant is and only if it works good.

Decreasing the environmental pollution

Some prevents can be taken by taking into account the situation of Turkish Leather Industry we mentioned above. This is possible only by educating firstly the leather manufacturer and then the ones working in the sector. Because it isn't possible to establish and to labour the technological possibilities to decrease the environmental pollution in these establishments. Here, because that many factors like discontinuity in the production, variety, and low capacity plays an important role, investments aren't become rational. So, it can't be possible to evaluate either liquid or solid effluents in an economic way.

It is possible to separate the effluents in leather manufacturing into two general groups as liquid and solid effluents. So, here it will be told about firstly how to decrease the liquid and solid effluents and then how to evaluate these effluents.

As known, raw materials are processed in different float amounts. Because of this, according to the kind of the raw material or semi-manufactured leather different amounts of water is used and chemical materials in various characters are added to the water. Also, the wasted-water structure shows a very mixed character with the protein, fat, hair, dust, solid, etc. during various processes. Because of this, to treat the effluents of leather manufacturing is more difficult in contrast with the other manufactures' effluents.

Below, approximate water amounts, which are used in labouring 1 000 kg of some raw materials and semi-manufactured leather in a classic formula, are given as an example to give an idea about the liquid effluent amounts.

For raw skin	70–90 m^3/t
For pickled leathers	30–40 m^3/t
For wet-blue leathers	24–30 m^3/t
For goat leathers	60–70 m^3/t
For pickled goat leathers	20–30 m^3/t
For wet-blue leathers	18–22 m^3/t
For calf upper leathers	60 m^3/t

Today, in most of the places of the world, water is used less than these values. Here, besides economical and ecological factors, the knowledge, technology and new auxiliary agents, which are improves gradually, started to be very effective.

The researches done in Ege University Agricultural Faculty Leather Technology Department showed that at least % 50 of water can be saved which is used for the production of clothing and upper leather in the sector today.

To decrease the effluent volume is possible by optimizing the processes. This needs firstly qualified personnel with enough technologic knowledge. By doing that, the variables effecting the procedure during the process can be adjusted well and the expected result can be provided. The first prevent to be taken to provide the decreasing of the effluent volume is to eliminate the superfluous washings and rinsing. The washings after liming decreasing, tanning, dyeing and washings before and after the neutralization needs very much attention. Also, the amount of the water that is used in the process must be adjusted very good and by using the technological knowledge, the chemicals that are given to the float must be taken as the maximum by the leather. Some process effluents can be used many times by recycling. However, the establishments are not suitable to establish an system like that because of settling and infrastructure. Also, it mustn't be forgotten that the regeneration needs a very good analytical control.

Besides liquid effluents, there is another kind of effluent causing environmental pollution which is called the solid wastes. These can be classified in three groups, such as:

a. hairy raw material wastes;
b. untanned leather wastes;
c. tanned leather wastes.

Their quantity rises up to 50–55 % of total raw material weight. The possibility of evaluating them, changes according to the type of the waste.

There is the possibility of evaluating the wastes. As most of the tanneries in Türkiye are in certain centers in Istanbul and Izmir, the problem of collecting the solid wastes is nearly finished. But, in Türkiye, there aren't institutions yet that can process these solid wastes. To establish these institutions the required studies must be done and the instutions must be established as soon as possible in the areas where the leather establishments are intensed. When this is succeeded, the nature will be effected in a positive way and the effluents will be evaluated by becoming the raw material of another industry:

Waste's type	Waste's usages
1. untanned wastes	Sausage case, surgical material, food matters, glue, manure
2. tanned wastes	Artificial leather, glue, food matter, manure
3. other wastes	Artificial leather, hair, soluble protein

Use of the biomasses and of the by-products of the leather industry in agriculture

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Abstract

Experimental data from trials with the use of leather tannery sludges in agricultural soils, typical of North Italy, on crops of rice, maize and wheat will be presented. The materials allow good yields, comparable with the yields of plots fertilized with mineral fertilizers only, and they permit a good saving of N fertilizers. As far as chromium is concerned, the data from experiments show that there are no risks connected with chromiumlevels in grains abd straw of crops because the element (present only in the form Cr III) remains in the soil as chromium oxide which is an inert material without any risk for the pollution of soil and groundwaters.
Keywords: Chromium, energy saving, fertilizing action, leather tannery sludge.

Introduction

Despite the diffuse opinion that belives that by-products coming from chemical, food and other industries have to be considered only as wastes, in these recent years scientists and international organizations (ECC Directive n 91/156/ECC 18 March 1991) have begun to consider the problem under a different point of view. In fact by-products are beginning to be regarded as energy and nutrient sources by virtue of organic matter, nitrogen contents, to be favourably employed as raw materials in primary activities, as in agriculture. In this new light the problem of finding suitable solutions for the disposal of wastes, changes in finding suitable fields where these materials could be profitably employed.That is the case of byproducts coming from leather industries which produce large amounts of different materials; in this paper sludges and their possible agricultural use will be only treated in detail, neglecting all other leather industry by-products. Aim of the paper is therefore to investigate about the possible use of leather tannery sludges in agricultural soils as organic manures which can restore fertility levels in soils submitted to intensive agricultural cropping.

Materials and methods

The experiments carried out can be subdivided in two parts: experiment 1 and experiment 2. The former will deal with the use of leather tannery sludges in soils where maize/wheat have been grown and the latter will deal with the use of the sludges on soils with rice crop. In the experiments, both two-year long, the same sludges and the same experimental design (randomized blocks) have been employed as it will be described in the following sections.

Experiment 1

The experiment 1 was carried out on a loam soil, typical of the Plain of Northern Italy, with medium fertility, subacid reaction and good e.c.c. (Table 1) with a cropping of maize (first year) followed by wheat (second year). The leather tannery sludges employed were of two types: one called Sludge 1, came from vegetable tanning and the other, called Sludge 2, from

Table 1. Main physical-chemical characteristics of the soils.

Parameters	Soil exper. 1	Soil exper. 2
pH (in water)	6.2	5.3
Total N%	0.12	0.19
Organic matter %	1.90	3.82
Avail. P_2O_5 ppm	40.5	56.5
Exchang. K_2O ppm	77.0	39.6
Chronium soluble in HCl 6 N ppm	73.5	18.9
Avail. chronium (Lakanen-Ervio) ppm	0.40	0.24
e.c.c. (meg/100 g) ppm	20.9	15.1
Physical analysis		
sand %	31.1	27.8
silt %	48.7	68.8
clay %	20.2	3.4

Table 2. Chemical analysis of the sludges employed in the trials.

Parameters	Sludge 1 chrome tanning	Sludge 2 vegetable tanning
pH (in H_2O; 1:2.5)	9.1	7.8
Dry residues at 105° C %	38.3	32.0
Mineral substances at 550° C (ashes) %	61.0	57.2
Organic substances %	39.0	42.8
Organic carbon (Springler-Klee) %	21.0	22.0
Total N (Kijeldhal) %	2.1	2.2
Total P_2O_5 %	0.42	0.40
Total K_2O %	0.010	0.023
Total $CaCO_3$ %	41.4	0.023
Exavalent chronium	absent	absent
Chronium extractable by HCl 6N (Cr %)	2.23	0.33
Available chronium (Lakanen-Ervio) %	0.440	0.036
C/N	10	10
Sludge treatment	filter-press	filter-press

chrome tanning. The main chemical analysis of the sludges are shown in Table 2. The experimental design was randomized blocks with 4 replications for each treatment; the treatments were 6 the first year and 8 the following one, so subdivided: the first year we had two organic, two organo-mineral, one only mineral and one no-fertilized treatment to be compared,on the basis of their N content. The following year, in order to have supplementary information about the residual effect of the sludges applied the year before, two organically fertilized plots were splitted. The experimental design and the nutrient supplies are shown in Table 3.

Table 3. Experimental design and nutrient supplies for maize and wheat.

Treatments	Crop of Maize				Crop of Wheat			
	t/ha of sludge suppl. (d.m.)	Nutrients supplied (kg/ha)			t/ha of sludge suppl. (d.m.)	Nutrients supplied (kg/ha)		
		N	P_2O_5	K_2O		N	P_2O_5	K_2O
Test unfertilized	0	0	0	0	0	0	0	0
NPK miner. fertil.	0	300	168	200	0	200	100	0
Sludge 1 org. fertil.	12.8	282	51	3	12.8	282	51	3
Sludge 2 org. fertil.	15.3	322	64	1.5	15.3	322	64	1.5
Sludge 1 + PK org. + miner. fertil.	12.8	282	219	203	12.8	382	101	3
Sludge 2 + PK org. + miner. fertil.	15.3	322	232	202	15.3	422	114	1.5

Table 4. Experimental design and nutrient supplies[1] for rice crop.

Treatments	t/ha of sludge suppl. (d.m.)	Nutrients supplied (kg/ha)		
		N	P_2O_5	K_2O
Test unfertilized	0	0	0	0
NPK miner. fertil.	0	140	100	180
Sludge 1 org. fertil.	6.40	141	25.6	1.5
Sludge 2 org. fertil.	7.66	161	32	0.75
Sludge 1 + PK org + min. fertil.	6.40	141	125.6	181.5
Sludge 2 + PK org + min. fertil.	7.66	161	132	180.8

[1] The doses applied the second year are equal to those applied the first year.

Experiment 2

The experiment 2 was carried out on a silty-loam soil sited in a Northern region of Italy, with high fertility, acid reaction (Table 1) with a cropping of rice for two years. For this experiment are valid the same experimental design made for the experiment 1. The experimental design and nutrient supplies are shown in Table 4.

Table 5. Grain yields for maize, wheat and rice crops (t/ha of dry matter).

Treatments	Maize	Wheat	Rice 1st year	Rice 2nd year
Test unfertilized	9.22	4.20[a] [1]	5.80[a]	5.67[a]
NPK miner. fertil.	10.38	6.48[d]	6.03[a]	6.80[b]
Sludge 1 org. fertil.	8.35	5.96[d]	6.78[b]	6.85[b]
Sludge 1 residual effect	0	5.05[b]	0	5.99[a]
Sludge 2 org. fertil.	8.36	5.93[cd]	7.00[b]	6.71[b]
Sludge 2 residual effect	0	5.28[bc]	0	5.99[a]
Sludge 1 + PK	9.30	6.36[d]	6.61[b]	6.84[b]
Sludge 2 + PK	8.39	6.01[d]	6.77[b]	6.83[b]

[1] 0.01 confidence level; diferences in small letters.

Table 6. Contents of chronium in grain and straw samples of rice, maize and wheat after harvesting (ppm).

Treatments	Rice 1st year		Rice 2nd year		Maize		Wheat	
	chaff	grain	chaff	grain	straw	grain	straw	grain
Test unfertilized	1.31	0.04	1.27	0.04	0.59	0.05	0.55	0.03
NPK miner. fertil.	0.91	0.05	1.33	0.05	0.50	0.06	0.48	0.03
Sludge 1 org. fertil.	1.03	0.05	1.11	0.04	0.62	0.06	0.54	0.06
Sludge 1 residual effect	0	0	1.13	0.05	0	0	0.48	0.07
Sludge 2 org. fertil.	1.21	0.03	1.11	0.06	0.64	0.05	0.61	0.09
Sludge 2 residual effect	0	0	1.21	0.06	0	0	0.50	0.06
Sludge 1 + PK	0.83	0.03	1.08	0.04	0.61	0.06	0.55	0.08
Sludge 2 + PK	0.76	0.03	1.34	0.05	0.51	0.04	0.54	0.06
	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

[1] ns: non significant differences between the means.

Results and discussion

Experiment 1

Table 5 shows the data relative to grain yields of maize and wheat; data relative to straw yields are less important and are not reported here. We can say that sludges needed a certain period of time to be incorporated and to reach steady-state conditions with soil organic matter; nevertheless even in the first year of application with maize crop, the yields of organically fertilized plots don't significantly differ from other plots, especially from those with mineral fertilizers only. In the second year,with wheat crop, the fertilizing action of sludges can be better observed in that the plots fertilized with leather tannery sludges show yields comparable with plots with mineral fertilizers only. Table 6 shows the value of contents of chromium in straw and grain of maize and wheat after harvest. There are no significant differences among the means and

Table 7. Statistical test on means of organic matter values in soils after final harvesting (Duncan test).

Treatments	Soil exp. 1[a] o.m. %[a]	Treatments	Soil exp. 2[a] o.m. %[a]
Sludge 2 + PK	1.95[c]	Sludge 2 + PK	3.88[c]
Sludge 2	1.92[c]	Sludge 2	3.87[c]
Sludge 1	1.91[c]	Sludge 1 + PK	3.86[c]
Sludge 1 + PK	1.90[c]	Sludge 1	3.85[c]
Sludge 1 residual effect	1.83[b]	Sludge 2 residual effect	3.80[b]
NPK	1.81[b]	Sludge 1 residual effect	3.78[b]
Sludge 2 residual effect	1.78[b]	NPK	3.76[b]
Test	1.64[a]	Test	3.60[a]

the values are very low, expecially for grains, which are of interest for human food. The data relative to organic matter (Table 7) and chromium contents in the loam soil after harvest show that leather tannery sludges restore initial organic matter levels in soils which have been reduced in their values in the other plots with slurry supplies. As far as chromium levels in soils are concerned,the plots fertilized with sludges show an increase in chromium lévels,but this element in the soil is present as Cr_2O_3 (trivalent form) and in this form it is transformed when it is added to soil by addition of sludges;therefore it has to be considered as an inert material (as suggested by EPA), without any risk for groundwater pollution.

Experiment 2

Table 5 shows the data relative to rice yields in the two-year experiment; we can say that the leather tannery sludges have been readily mineralized and their nutrients made available for rice roots, which uptake nitrogen directly as ammonium without any nitrification process. Therefore in rice field conditions leather tannery sludges have a fertilizing action already in the first application year. The data relative to yields obtained in the second year confirm those relative to ones of first year and point out that the organic or organic + mineral fertilized plots had yields similar to those relative to mineral fertilization only. For chromium contents in chaff and grain (Table 6) are valid the same observations made for maize and wheat of experiment 1 and the values of chromium, expecially for grain, are vary low for being a risk for human health. As far as O.M. (Table 7) and chromium contents are concerned, in silty-loam soil after final harvesting, data show that the sludges applied restore accettable levels of O.M. in soil more than a mineral fertilization only; for chromium the plots fertilized with sludges show chromium values significantly higher than those of the other plots but even in this case it was detected as Cr III (chromium-oxide) only, an inert and highly insoluble material, without risks for groundwaters.

Conclusions

After these field experiments the following remarks can be drawn:

1. The leather tannery sludges show a fertilizing action both in aerobic and anaerobic agrosystems with yields comparable with mineral dressings only;
2. These materials restore accettable levels of O.M. in agricultural soils submitted to intensive cropping and therefore they permit a nitrogen fertilizer saving.

3. The use of leather tannery sludges don't determine a cumulation of chromium in grain and straw of crops of food interest. The levels are always very low.
4. he materials determine an increase of chromium levels in soils,but chromium is only in the trivalent form,without risks for the pollution of soils and groundwaters.
5. During the experiments no pathologic or toxicologic effect for health has been observed.

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Session 3

Breeding and feeding in wool and hair production

Chairman: V. Timon
Co-chairman: A. Eliçin

Bases physiologiques et génétiques de la production de laine et de poils chez les petits ruminants et le lapin

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Summary

Two types of hair follicles are found in the coat according to the skin development:
1. epidermal hair follicles (primary + secondary) which produce coarse fibres and some fine ones, originate from the primitive epidermis;
2. derived hair follicles which produce the finest fibres, gather by budding on the preceeding epidermal hair follicle.

Such development provides a sufficient hair cover for the growing mammals. The number of these hair follicles in activity which determine wool and hair production differs between species. In sheep and goats, the number of derived hair follicles is low and constant. Growth of hair is either permanent in wolled sheep and angora goats or seasonal dependant in cashmere goats and wild sheep. This character is additive and due to several genes. Fleece is harvested by shearing once or twice a year. Usually, one type of non-medullated fibres, respectively wool and mohair, is found in the fleece of woolled sheep and angora goat, and two types of medullated and non-medullated are found in the coat of cashmere goats and wild sheep. In angora rabbit, the number of derived hair follicles is high and variable according to the season. Hair grows during 14 to 20 weeks. Fleece is harvested by plucking every 14 weeks. The angora character is due to a pair of autosomal recessive genes. Two types of medullated fibres are found in the fleece: bristles which are long (11 cm) and coarse, and down fibres which are shorter (6 cm) and finer. The factors influencing the quantity and the quality of fibre production are numerous and different in these 3 species.

Introduction

Le pelage des mammifères est un organe de protection contre les éléments du milieu: température, précipitations et prédateurs. Les propriétés mécaniques, physiques et chimiques des différents types de poils formant la toison jouent un rôle important pour cette protection. Par ailleurs, la structure et la composition du pelage subissent des modifications périodiques se traduisant par une adaptation du pelage aux conditions climatiques. Le système pileux se décompose d'une façon générale en 2 parties. Le pelage externe composé de poils longs et grossiers, les jarres ou poils de garde, qui assurent la protection mécanique, et le fragile pelage interne composé de duvets qui assure l'isolation thermique. Cette spécialisation des différents types de poils dans le pelage, leur nombre, leur répartition et leur morphologie s'établit au cours de la vie foetale. Les follicules pileux constituent des groupes biens définis où chacun occupe, suivant son ordre d'apparition, une place hiérarchique correspondant à la fonction du poil. Mais ce pelage de protection présente de nombreuses dérivations de composition et de structure, dues à des mutations que l'homme a conservé et sélectionné à son profit pour la production de poils textiles, comme l'illustre le Tableau 1. Le pelage du lapin angora est hétérotypique et composé exclusivement de fibres médullées. On y retrouve des poils de garde avec les jarres raides, longs et grossiers, et un sous poil, les duvets, plus courts, tres fins frisés et environ 50 fois plus nombreux que les jarres, ainsi que des poils intermédiaires, les barbes.

Tableau 1. Composition et structure du pelage chez le lapin angora et les petits ruminants.

	Lapin angora	Chèvre		Mouton	
		cachemire	angora	sauvage	merinos
Fibres médullées					
Primaires[1]	jarre 30–80 µ[2] 10 cm[3]	jarre 30–100 µ 6–20 cm	(jarre)	jarre	-
Secondaires[1]	duvet 15 µ 6 cm	-	-	-	-
Fibres non médullées					
Primaires[1]	-	-	mohair	-	wool
Secondaires[1]	-	cachemire 12–18 µ 4–8 cm	mohair 22–45 µ	(wool) 12–20 µ	wool 18–25 µ

[1] type de follicule pileux produisant les fibres désignées.
[2] diamètre des fibres en microns.
[3] longueur des fibres en centimètre.

Chez la chèvre on rencontre 2 types de pelages: d'une part une toison hétérotriche, chez les races produisant du cachemire, composée de jarres grossiers médullés, et de duvets fins dépourvus de moelle, et d'autre part une toison homotriche chez la chèvre angora où l'on rencontre normalement un seul type de poils, le mohair, une fibre kératinique pure dépourvue de moelle. Toutefois selon les souches et les individus, on trouve dans la toison de la chèvre angora, quelques vestiges du pelage externe, jarres et fibres hétérotypiques munis de moelle.

Le pelage du mouton est très diversifié selon les races. Cette diversité s'apprécie selon la présence des différents types de poils pouvant composer le pelage du mouton:

- toison homotriche composée exclusivement de laine, une fibre kératinique pure non médullée (Merinos), mais quelquefois pourvue d'une très fine moelle plus ou moins discontinue dans certaines races (Texel, Romney);
- toison hétérotriche où l'on rencontre à coté de la laine, des fibres grossières médullées, du crin à croissance permanente (Manech) et/ou des jarres à croissance saisonnière (Limousine, karakul).

Afin de mieux maitriser la production de fibres chez ces espèces, il est nécessaire de bien connaître la genèse et le fonctionnement des follicules pileux ainsi que les variations de structure et de composition du pelage.

Genèse du pelage

Le pelage est normalement constitué de 2 types de follicules pileux qui se différencient selon leur ordre d'apparition dans la peau. Tout d'abord des follicules pileux épidermiques qui se forment au cours de la vie foetale, par invagination de l'épiderme primitif avec formation d'un canal pileux. On distingue les follicules primaires qui apparaissent les premiers et sont normalement organisés en triades avec un follicule primaire central et 2 latéraux (Carter, 1943), et les follicules secondaires qui apparaissent ensuite à l'intérieur de la triade de follicules primaires pour former un groupe folliculaire.

Après la chute du périderme, lorsque les premiers signes de kératinisation apparaissent pour donner naissance à l'épiderme définitif, se forment les follicules dérivés par bourgeonnement des follicules épidermiques préexistants (Hardy et Lyne, 1956). Ce bourgeonnement donne naissance à un faisceau de follicules pileux qui ont en commun une même glande sébacée, le même canal pileux et forme un follicule pileux composé (Rougeot et al., 1984). Le bourgeonnement des follicules dérivés qui, selon les espèces, peut se prolonger lors des premières semaines de la vie de l'animal, permet d'assurer une bonne couverture pileuse au fur et à mesure de la croissance de l'animal.

Chez le lapin angora, les premiers follicules pileux apparaissent vers le 18 ème jour de la gestation (durée chez la lapine: 32 jours). Le groupe folliculaire est composé d'un follicule primaire central et de 4 latéraux. A la naissance on dénombre 8 à 12 follicules dérivés par groupe folliculaire et de 40 à 70 à l'age de 20 semaines (Mehner et Koetter, 1965; Thébault, 1977). Cette multiplication de follicules dérivés est indépendante de l'âge de l'animal et s'arrête lorsque l'animal a atteint un poids de 2±0.1 kg, soit entre 14 et 20 semaines d'âge (Thébault, 1977; Rougeot et al., 1984).

Chez la chêvre, les premiers follicules pileux apparaissent vers le 60 ême jour de gestation (durée chez la chèvre: 150 jours). On dénombre de 3 à 5 follicules primaires par groupe folliculaire. La multiplication des follicules dérivés se poursuit jusqu'à l'âge de 4 à 6 mois (Margolena, 1974), où l'on dénombre de 2 à 3 poils émergeant de la peau par le même canal épidermique (Dreyer et Marincowitz, 1967).

Chez le mouton, les premiers follicules pileux apparaissent vers le 60 ême jour de gestation (durée chez la brebis: 150 jours). Le groupe folliculaire est composé de 3 follicules primaires. L'apparition des follicules épidermiques secondaires et des follicules dérivés présente des intensités et des durées différentes selon les races. Ainsi on dénombre jusqu'à 8 follicules dérivés par follicule épidermique chez les races à toison dense (type mérinos d'Arles), 3 chez des races à toison hétérotriche ou jarreuse (Limousine, Karakul) et normalement aucun chez les races à pelage sauvage, mouflon, (Rougeot, 1974). Cependant, à la naissance, tous les follicules pileux sont formés.

A ces types divers et différents de follicules pileux correspondent des types particuliers de poils qui remplissent chacun une fonction bien déterminée dans le pelage. Chez le lapin angora, les follicules primaires centraux fournissent les jarres, les primaires latéraux, les barbes ou poils intermédiaires et les follicules secondaires produisent les duvets (Rougeot et Thébault, 1983). Chez le mouton et la chèvre, l'homme a profondément modifié la production des follicules pileux. Chez les races à toison de type primitif, mouton Soay, chèvre cachemire, on trouve des jarres, émanant des follicules primaires, enfouis dans la laine ou le cachemire que produisent les follicules secondaires. Chez les races à toison laineuse, mouton Merinos, chèvre angora, la totalité des follicules pileux, primaires et secondaires, produit de la laine chez le mouton ou du mohair chez la chèvre angora. Toutefois, à l'intérieur de la toison, les poils ont des longueurs et des diamètres très différents, dûs au type de follicules pileux. Ainsi, les follicules primaires fournissent les fibres les plus grossières et les plus longues, tandis que les secondaires produisent les fibres les plus fines et les plus courtes, l'amenuisement des dimensions s'accentue à mesure que la formation des follicules pileux a été plus tardive (Rougeot, 1974). Toutefois, chez la chèvre angora, les follicules primaires peuvent produire des jarres et/ou des fibres médullées.

La croissance et le renouvellement du pelage

Dans un pelage sauvage, les poils sont renouvelés périodiquement. Ainsi les follicules pileux présentent des phases d'activité ou anagene et des phases de repos ou télogène. La durée de l'anagène est héréditaire et caractéristique de chaque type de poil. La durée du télogène est variable et peut-être modifiée par des manipulations photopériodiques, traitements hormonaux, traumatismes ou épilation. Par un mécanisme de mues saisonnières, le pelage subit des modifications de structure et de composition en accord avec les variations du climat.

Cependant, dans un objectif de production de poils, l'homme a conservé et sélectionné des animaux dont le pelage présente des caractéristiques appropriées à la fabrication textile: poils longs, homogenes si possible et facile à teindre. Toutefois, des différences et des particularités subsistent selon les espèces.

Chez le lapin angora, la durée de croissance des poils est de l'ordre de 12 à 20 semaines. D'où cette longueur caractéristique du pelage angora du à un allongement de la durée d'anagène. Ce caractère angora est monogénique, récessif et autosomal (Rochambeau et Thébault, 1989). Toutefois chaque catégorie de poils possède sa propre vitesse de croissance. Après 14 semaines de pousse, les jarres mesurent 10 cm et le duvets 6 cm. Selon la saison, les dimensions des poils varient légèrement (Rougeot & Thébault, 1983). Par contre, les nombreux follicules dérivés des follicules composées jouent un rôle important dans les variations saisonnières de structure et de composition du pelage. En effet, une partie d'entre eux disparaît en été, puis se reconstitue en automne et en hiver, ce qui a un effet majeur sur la compacité du pelage (Rougeot & Thébault, 1983). Il en résulte des variation saisonnières de la production quantitative de l'ordre de 10 à 30% selon les auteurs (Rougeot et Thébault 1983; Magofke et al., 1982).

Chez les chèvres produisant du cachemire, la croissance du pelage est saisonnière, les jarres se renouvelent au printemps et les duvets poussent du solstice d'été au solstice d'hiver, d'où de fortes variations saisonnières de la population de follicules pileux avec l'absence de duvets dans la toison au printemps et en été (McDonald et al., 1987). Par contre, chez la chèvre angora, la durée de croissance du mohair est presque permanente, entre 8–9 mois minimum et 2 ans maximum (Schwarz et al., 1987). Ce caractère d'allongement du poil dû à une croissance quasi permanente est polygénique et additif. Toutefois la vitesse de croissance en longueur et en diamètre des fibres varie selon la saison avec un maximum en été et un minimum en hiver. De même, le taux de jarres et de fibres médullées varient légèrement avec la saison (Ryder, 1978). On peut également observer un renouvellement saisonnier partiel des poils (Margolena, 1974; Ryder, 1978).

Chez le mouton, la croissance des fibres est permanente, mais la vitesse de croissance fluctue selon la saison avec un maximum en été et un minimum en hiver. L'amplitude saisonnière est moins prononcée chez les races merinos. Chez les races à toison hétérotriche, les fibres grossières et médullées ont une croissance saisonnière et sont renouvelées chaque année.

La variation annuelle de la durée d'éclairement est l'un des principaux facteurs de l'environnement qui contrôle le fonctionnement des follicules pileux. Les variations saisonnières du pelage qui en résultent: dimensions des poils, nombre de fibres, sont sous la dépendance de l'axe hypothalamo-hypophysaire et de la glande pinéale par l'intermédiaire des secrétions de prolactine et de mélatonine (Rougeot et al., 1984; Allain et al., 1986; Lincoln, 1990). L'administration de mélatonine en été, qui permet de mimer l'action des jours courts, induit la croissance d'un pelage d'hiver chez le vison (Allain et Rougeot, 1980) et la chèvre cachemire (Lynch et Russel, 1989), et permet de supprimer la dépression estivale de la production de poils chez le lapin angora (Rougeot et al., 1986; Allain et Thébault, 1990). L'administration de mélatonine en hiver retarde l'apparition de la mue de printemps (Allain et al., 1981). Les mues saisonnières et la reprise d'activité des follicules pileux ont lieu au printemps lorsque les niveaux de prolactine augmentent (Allain et al., 1986; Lynch 1990; Lincoln, 1990) et inver- sement à l'automne lorsqu'ils diminuent (Martinet et al., 1984). En comparant la production de laine et les profils endocriniens chez différentes races de moutons, Lincoln (1990) en déduit que la croissance permanente de la laine est associée à des niveaux élevés de prolactine en hiver.

La production de poils

Chez le lapin angora la toison est récoltée par tonte ou par épilation. Cette dernière méthode qui est utilisée en France, provoque un synchronisme de repousse des poils où chaque catégone de poils conserve son propre rythme de croissance. D'où la production d'une toison bien structurée, contrairement à la tonte qui coupe les poils à différents stades de leur croissance. Rougeot & Thébault (1984) recommandent aux éleveurs d'épiler les animaux toutes les 14 semaines. Dans le cadre de la tonte, un rythme plus rapide de récolte, 10–11 semaines semble permettre une augmentation de la production annuelle, mais une diminution de la longueurs des fibres. Les différents facteurs de variations identifiés (Rochambeau & Thébault, 1990; Rochambeau et al., 1991) sont: le poids, le sexe et l'âge de l'animal ou son numéro de récolte, l'intervalle entre récoltes, la saison et le mode de récolte, ainsi que les conditions de naissance de l'animal: mois de naissance (Rochambeau et al., 1991) et taille de portée (Magoflce et al., 1982) dont les influences sont sensibles sur les premières récoltes. Ces facteurs influencent également la qualité de la toison dont les principaux paramètres sont la longueur et le diamètre des fibres, le taux de jarres, la morphologie des sections droites de jarres, la proportion de chaque catégorie de poils et la présence de poils feutrés ou sales.

Chez la chèvre, la toison est récoltée par tonte 1 fois par an chez la chèvre cachemire et 2 fois par an chez la chèvre angora. Les différents facteurs de variations de la production pondérale, identifiés chez la chèvre angora (Nicoll, 1985; Nicoll, Bigham et Alderton, 1989) sont: le poids, le sexe et l'âge de l'animal et ses conditions de naissance, âge de la mère, mois de naissance et taille de portée dont l'influence est sensible sur les 2 premières tontes, ainsi que la saison de récolte et l'intervalle entre tontes chez la chèvre angora. Les critères de qualité d'une toison sont le diamètre moyen des fibres et son coefficient de variation, le taux de jarres et de fibres médullées, le rendement au lavage et la présence de fibres sales ou colorées.

La toison du mouton est récoltée par tonte 1 fois par an. Les facteurs de variations de la production pondérale qui ont fait l'objet de nombreuses études sont l'âge, le sexe et le poids de l'animal ainsi que les conditions de son environnement de naissance, âge de la mère, période de naissance et taille de portée dont l'influence est sensible sur la première tonte. Les critères de qualité d'une toison sont nombreux: diamètre moyen des fibres et son coefficient de variation, le rendement au lavage, la longueur des mèches et sa variabilité, la résistance à rupture, la résistance à la compression, le degré de blanc et la présence de jarres et de fibres colorées.

Par ailleurs, chez ces différentes espèces, le niveau d'alimentation et l'état de reproduction ont une influence sensible sur la production de fibres.

En conclusion, chez les petits ruminants et le lapin, nous pouvons distinguer 2 types de production de fibres en fonction de la structure des toisons et de la croissance des fibres: d'une part les toisons hétérotriches, utilisées en l'état ou après séparation des duvets, que produisent respectivement le lapin angora et la chèvre cachemire, où les fibres ont une durée de croissance bien définie, des dimensions presque contantes, mais dont le nombre varie selon la saison, et d'autre part les toisons homotriches de la chèvre angora et du mouton à toison laineuse où les fibres ont une croissance permanente, leur nombre est presque constant, mais leurs dimensions varient avec la saison.

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Producing desired wool characteristics during fleece growth

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Abstract

How knowledge of wool growth is applied to wool improvement depends on the farming system and whether or not wool is a primary product. Emphasis should be placed on what the buyer pays for fine fibres in clothing wools, lack of kemp and pigment in carpet wools. But in all systems a heavy fleece comes first since price/fleece is more important than price/kg.

Most fleece characters are highly heritable and so weight and quality can be increased through selective breeding. Increasing weight by feeding is only economical through pasture improvement. An understanding of the relationships of characters can be gained from the formula: Fleece weight= the average fibre length (L) × the average fibre diameter (A) × the density in the skin (N) × the specific gravity of wool (D) × the skin area with wool (S).
Keywords: carpet, clothing, fleece, kemp, Merino, pigment, wool.

Introduction

Developing countries grow 30% of world wool production, but the fact that these countries also produce 40% of world sheep meat and 50% of the ewe milk, indicates that wool is usually a byproduct (Howe and Turner, 1984). In Britain, high meat prices and subsidies mean that wool accounts for less than 10% of the income from sheep flocks, despite much of the wool being of semi-fine 'Crossbred' type, having unique speciality uses. In the Mediterranean area milk is often the primary product of the ewe, and the wool is usually of less-valuable Carpet type, so that it is pushed into third place and accounts for no more than 5% of the income. Only in low-cost, extensive farming systems is it economical to produce wool as a primary product, and the wool grown is the most valuable fine-woolled, Merino type. The way in which the basic knowledge of wool growth is applied then depends on the farming system and whether or not wool is a primary product, no single recommendation can be made (Doney, 1983). In all systems, however, a heavy fleece weight is important since price per fleece is more important to the grower than the price of wool per kg. It is also more economical to make fleece improvements by breeding than through feeding.

Since wool is looked on solely as a crop, other aspects of the skin tend to be ignored. The fleece gives insulative as well as mechanical protection. A staple length of 5 cm will provide heat insulation equivalent to a temperature gradient of 40° C in hot as well as in cold conditions. A fleece therefore saves food that would otherwise be eaten to keep the sheep warm.

What does the wool buyer pay for?

The wide variety of wool and the diversity of its uses makes it difficult for textile manufacturers to specify wool's most desirable textile characteristics, which are also difficult to define in biological terms. The reaction of wool biologists has been to seek objectively the factors that determine wool price. In Australia during the 1950s it was found that the price of Merino wool was determined mainly by fibre fineness measured as quality number, and that the next most important characteristics were staple length and a white colour. This indicated that the greatest return would be gained from sheep growing a heavy fleece of white wool with a high quality number, and a long staple. The traditional quality number (e.g. 50s or 70s) is the buyer's estimate of fineness. It is defined as the number of hanks, each 560 yards (474 m) long, that might be spun from 1 lb (0.45 kg) of combed wool. Greater quality numbers therefore indicate finer wools. The number of crimps (waves) per unit length of fibre, which increases with decreasing fibre diameter, is used as a guide to fineness, and it was found that crimp number could be substituted for quality number as a factor determining price.

In a similar survey carried in USA during the 1960s, crimp number had no effect on price, but buyers paid more for wools with greater quality numbers and longer staple lengths. Fibre diameter is the single most important character in wool processing(contributing 80% of its spinnablity) and so in Australia, crimp number is no longer used in fleece appraisal. In fact, quality number itself has been replaced by the objective measurement of mean fibre diameter in microns.

A survey of the British Price Schedule showed that increased fleece weight gave a greater return than a better grade (Ryder, 1975). The British 'Grade' refers to overall degree of excellence, and incorporates penalties for faults as well as the quality number. Then, the 'Super' grade of semi-fine (Down-breed) wool with 56s quality fetched 59.1p per kg, while the 'Pick' grade with 58s quality fetched 61.9p per kg. With an average fleece weight of 2.25 kg, the price differential was 6.3p. But only 0.25 kg more of 'Super' grade wool would have added 14.8p.

Farmers usually make comparisons on price per kg, yet price per fleece is more important. Thus the relatively high (1991) price of 124.9p per kg for fine Shetland wool is transformed into a low return per sheep by the low fleece weight of 1 kg. Conversely a 5.5 kg fleece of Lincoln Lustre longwool converts the low price of 90.1p per kg into a gain of 495.6p per fleece. Most price differentials between grades of British wool (and even between different classes of Merino wool in Australia) are such that the more readily achieved object of 0.25 to 0.5 kg more wool is almost certain to bring a greater return than the more difficult change to a better grade. Only the Merino breed has a high wool price per kg and a heavy fleece weight, so that Merino fleeces on average are usually twice as valuable as non-Merino fleeces.

Anomalies exist in Britain where certain grades receive a high price because of increased demand, although the wool may be less fine. The coarsest Scottish Blackface wool has traditionally received the highest price for that type because of the demand for such wool to fill mattresses in southern Europe. In 1991 the mattress grade of Blackface wool fetched 92.4p per kg while the best carpet grade received only 89.9p. Changes in fashion can produce short-term variations in price. During the 1980s one grade of lustre longwool fetched twice the average British price — 224.4p per kg in 1989 — because it could be blended with mohair, yet by 1991 the price had fallen to 127.3p per kg.

Increasing fleece weight and improving wool quality

Having determined that fleece weight is the most important feature for the grower, how can it be increased without increasing fibre diameter, which is the most important characteristic for the wool user. Heredity contributes more to fleece type than does the environment, which includes such factors as day-length as well as nutrition. Genetic differences in fleeces can be exploited by selective breeding, which is a slow process, but it is advantageous that most fleece characteristics are highly heritable, the heritability of fleece weight being 0.3 to 0.6. In no breed other than the Merino, however, is it likely to be economical to apply selective breeding solely to wool characteristics. In most other breeds, meat or milk provide such a high proportion of the income that wool cannot be put first in breeding programmes and so the rate of genetic progress is reduced. But this does not mean that one cannot increase fleece weight and eliminate wool faults. There is no reason why a good meat ram should not also have a good fleece. Improved husbandry by reducing environmental variation leads to an immediate response in the fleece. Although it is not usually economical to provide extra food solely to get more wool, where sheep housing is common there is the possibility of reducing other seasonal variations brought about be changes in daylength.

A simple formula worked out by Helen Newton Turner for Merino sheep in Australia helps one to understand what the different components of fleece weight are, and how they are interrelated: fleece weight $W = L \times A \times N \times D \times S$. In this formula, L= the mean fibre length; A= the mean cross-sectional area of the fibres (measured as fibre diameter); N= the mean number of fibres per unit area of skin (fibre density); D= the density (specific gravity) of wool substance; and S= the total area of skin growing wool. To simplify, to get more wool you need larger sheep with longer and denser wool. The only component that cannot be changed is the specific gravity of keratin, which has the constant value of 1.31. Thicker fibres may be heavier, but they are undesirable since they reduce wool quality.

First, how are the components changed by *feeding* for more wool? Seasonal pasture variations mean that sheep rarely reach their genetic potential for wool production. Extra food in the form of long-term pasture improvement therefore stimulates wool growth and the greater fleece weight is brought about by increasing L and A. Fibre density (N) is unaffected by feed since all wool follicles are formed by about the time of birth. Good nutrition for the mother about the time of the birth of lambs is important in ensuring that the genetic maximum number of secondary follicles will develop and produce fibres. This is illustrated by the nutritional penalty of being a twin, in which the smaller number of follicles developed can reduce adult fleece weight by 3%. Better nutrition can also increase body size and therefore the skin area (S), but this has no effect on fleece weight since the result is merely a lower wool follicle density.

Breeding for increased fleece weight (W) could theoretically increase all the components except specific gravity. In some experiments with the Australian Merino the selective breeding caused an increase in fibre length (L) and diameter (A), while in others the increased fleece weight was brought about by an increased fibre density, which was actually associated with a *decrease* in mean fibre diameter of 1 micron. The best practical advice with Merino sheep is to select for finer wool at the same time as selecting for a greater fleece weight. In the Merino there is no genetic correlation between fleece weight and body weight. There is therefore no danger of obtaining heavier sheep that would eat more and so reduce efficiency. In other breeds fleece weight is correlated with body weight, but this is useful since any selection for increased body weight will incidently increase wool production.

Fleece characteristics

Since fibre diameter is the most important textile characteristic, fleece weight should not be increased by making the fibres thicker, and certainly not in the Merino breed. Because poor nutrition reduces fibre diameter, its expected heritability of 0.5 can be less than 0.2. Crimp number has a heritability of 0.4 to 0.5, but crimp number should not be used in selection for fibre diameter because it is poorly correlated with fibre diameter. Fleece weight can be raised by increasing staple length, provided that the increased length does not put the wool into an inferior class, which can happen in the Merino. Staple length is less affected by diet than is fibre diameter and has the higher heritability of 0.3 to 0.6.

Lack of uniformity in fibre length and diameter is a common complaint among wool users. In addition to the obvious genetic differences between breeds, there are genetic differences between flocks, between individual sheep, between different parts of the fleece and even within the wool staples. There is considerable scope in breeds other than the Merino for reducing this variability by selective breeding, e.g. the variation of individual fibre length within the staples and of staple length between sheep.

Wool faults

Given that there might be restraints on actual improvement, at least one can aim at reducing wool faults. Common hereditary faults are colour and kemp. Natural black fibres and kemp are rare in the Merino, but can be a serious fault in crossbred and carpet wools. Pigment and kemp are entirely genetic in origin and so can be tackled by choosing rams lacking such fibres, and at the same time culling badly affected ewes. Hairs (longer and less coarse than kemps), too, are basically genetic in origin, but they are subject to environmental influences in that the central medulla of hairs is only fully-formed during summer; hairs become narrow and to lose their medulla during winter, when they can appear like wool fibres-hence their name heterotypes. The heritability of hairiness ranges from 0.3 to 0.7.

Faults such as vegetable matter and external parasites can be tackled through management. Other faults due to the environment are less-fully understood and more difficult to control. Break, which occurs at only one point in the staple, results from seasonal narrowing worsened by poor nutrition, but stress from cold or disease is another cause of break and actual wool loss. Tenderness of the fibres can be caused by an attack from microorganisms and can occur in shorn fleeces if they are stored in damp conditions.

Wool Buyers penalize all yellow stains in fleeces since they cannot distinguish canary stain from those stains that will scour out during textile processing. Canary stain is common in hot countries and might be due to alkaline suint (sweat), but its seasonal occurrence allows shearing to be timed before the worst period. Weathering of the staple tip from too much sun or rain can cause a harsh handle and uneven dyeing.

Carpet wool

Since hairy fleeces are commonly used in carpets, the impression is gained that coarse fibres with a wide medulla are a desirable feature in carpet wools. In fact, hairy fleeces are used because they are cheaper, and many such fleeces have too many brittle kemps and coloured fibres for use in carpets. The main requirement for carpets is relatively coarse, non-medullated wool. This is shown by studies of old oriental carpets (Ryder, 1987). In modern factory carpet manufacture this is achieved by blending wools of several types (Ince and Ryder, 1984).

Here there is the possibility of either crossing with an improved type, or of selective breeding within existing breeds. Crossing with the Drysdale and Tukidale hairy strains of New Zealand Romney in Britain gave heavier fleece weights and lack of pigment, but the crossbred fleeces were kempy (Ryder, 1983). In a 20-year selection experiment with the Scottish Blackface, 8-week old lambs were selected on a medullation index and put into a Hairy or a Fine line. The Hairy line eventually acquired very coarse, heterotype hair fibres (not kemps) in each primary follicle, and the secondary (wool) fibres acquired a medulla, as well as becoming more numerous.

In the Fine line, the lateral primaries grew wool fibres in place of hairs, but the centrals retained kemps. The secondary fibres became finer and increased in number. Breeding together of the Hairy and Fine lines gave no evidence of a single-gene effect, but some evidence of heterosis in medullation such that crosses of hairy with fine sheep are likely to have more hairy fleeces than the intermediate value. In crosses with the long-woolled Wensleydale breed, offspring from the (kempy) Fine line lacked kemp, but offspring from the Hairy line showed much less reduction in medullation (Ryder, 1985).

Clothing wool

In the British stratification system draft hill ewes with carpet wool are crossed with long-woolled rams. The resulting crossbred ewes are crossed with a Down ram to produce fat lamb. This means that crossbred sheep provide most of the medium and semi-fine wool, which is therefore not of clearly-defined grade, and the semi-fine (Down cross) wool is obtained as skin wool. Merino influence could be injected at the hill stage and again at the longwool-cross stage (Boaz, Ryder and Tempest, 1977). The Merino breed is unique in combining a heavy fleece weight with a low fibre diameter, and Merino wool is always in steady demand because it has the widest range of uses. But it should not be used in a first cross with 'hair' sheep. A first cross with a longwool provides a fleece and eliminates kemp. The second cross with the Merino then makes the fleece finer.

Producing desired wool properties during fleece growth

Most IWS research funds go into the modification of the fibre e.g. applying more crimp and creating shrink resistance. The philosophy of the wool biologist is to do this during growth, either by diet (feltability and plasticity) or permanently through breeding (crimp) (Ryder, 1975). The current application of genetic engineering to wool makes this more of a possibility.

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Caracteristiques nutritionnelles des chèvres produisant du poils et strategies alimentaires a leur appliquer

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Summary

The level of Angora goat intake is limited. The digestibility of low quality roughage is close in Angora goats and other goats but it is lower in sheep. The nitrogen retention is higher in Angora goats than in Merinos sheep. Energy requirements of mohair production for a goat producing 6 kg per year increases maintenance requirement by 7–7.5%. Supplementary nitrogen requirements is about 2.5 g DCP per day.

Large underfeeding result frequently in abortions in Angora goats. An energy or nitrogen underfeeding, particularly if it limits the microbial protein synthesis in the rumen, can reduce hair production, but supplementary feeding supplies can improve this production. When the quantity of hair produced increases, generally the fiber diameter tends to increase. Heat treated oilmeals or protected methionine allow to improve hair production.

The feeding strategy of hair producing goats must be defined according hair price cotations and price differences between hair qualities. Nevertheless the production of kid hair must always be promoted. For that, gestating does must be carefully fed.

Introduction

Traditionnellement la chèvre productrice de poils (Angora, Cachemire) s'est développée dans des systèmes de production reposant sur l'utilisation des parcours et exigeant très peu d'intrants. Il a été très tôt remarqué que cette chèvre posait des problèmes nutritionnels importants en raison de sa susceptibilité au froid et de ses fréquents avortements (Shelton, 1984; Wentzel, 1987). Mais en réalité ces problèmes sont-ils dus aux aspects spécifiques des chèvres productrices de poil ou aux conduites alimentaires pratiquées? Malgré quelques articles généraux sur la nutrition des chèvres productrices de poil (Huston, 1981; Shelton, 1982; Wentzel, 1987), les travaux sur le métabolisme et la nutrition des chèvres Angora ou Cachemire sont encore limités par rapport aux connaissances acquises sur le mouton ou sur les autres caprins (Morand-Fehr, 1981). Ainsi en raison du développement actuel de la production de poil par les caprins de par le monde, il a semblé intéressant d'identifier les caractéristiques nutritionnelles des chèvres productrices de poil par comparaison aux autres caprins et aux ovins, et de proposer les diverses stratégies alimentaires à leur appliquer.

Caractéristiques nutritionnelles

Comportement alimentaire et niveau d'ingestion

La chèvre Angora est plus portée vers la flore arborée et arbustive que le mouton, et encore plus le bovin, (Huston, 1982; Knipe, 1982) bien qu'elle accepte, et parfois préfère la flore herbacée. Elle semble se comporter dans le choix des végétaux disponibles sur prairie ou sur parcours, dans sa rapidité à s'adapter aux modifications du disponible, et dans la sélection des

Tableau 1. Ingestion, digestibilité et rétention azotée des chèvres angora et des moutons merinos recevant 3 fourrages de differante qualité (Doyle et Egan).

	Espèce	Régime[1]		
		1	2	3
Niveau d'ingestion (g MO/kg $P^{0.75}$)	Chèvre	67.6	45.5	34.6
	Mouton	60.7	48.0	34.1
Digestibilité (%) Matière organique	Chèvre	72.1	64.9	49.5
	Mouton	71.3	57.3	45.6
Cellulose	Chèvre	68.8	67.4	54.0
	Mouton	67.4	58.9	51.1
Temps de rétention dans le rumen (h)	Chèvre	17.1	29.1	25.9
	Mouton	13.9	20.5	20.4
Rétention azotée (mgN/100 g MOD)	Chèvre	673	-87	-246
	Mouton	794	-200	-813

[1] régime 1: foin de trèfle souterrain (2.8% N, 38.2% NDF)
régime 2: foin de ray-grass (0.7% N, 73.6% NDF)
régime 3: foin de trèfle coupétardivement (1.1% N, 75.8% NDF).

Tableau 2. Influence des niveaux énergétique et azoté du régime sur la mortalité perinatale des chevreux angora (Westhuysen, 1980).

Niveau azoté (en % /Entretien)	100	100	50	50
Niveau énergétique (en %/Entretien)	100	50	100	50
Poids naissance (kg)	2.5	1.9	2.0	1.5
Mortalité	8	83	42	100

fractions de végétaux suivant la saison (Taylor and Kothmann, 1990; Somlo et al., 1987) comme les autres caprins (Malechek and Leinweber, 1972 ; Narjisse, 1991). La consommation d'herbe est dominante à la période de la pousse d'herbe (printemps et automne). Le choix se tourne vers la flore arbustive pendant les périodes sèches ou les arrêts de la végétation. Le choix des caprins est aussi influencée par la valeur nutritive des végétaux disponibles dans les différentes strates.

Domingue et al. (1991) observent que les caprins croisés Angora × Féral passent plus de temps à manger et moins à ruminer que les ovins croisés Border Leicester × Ronney; ce qui confirme les résultats obtenus sur caprins laitiers (Morand-Fehr et al., 1991).

Comme dans les pays forts producteurs de poil de chèvre, une partie importante de la ration est prélevée sur le parcours, nous ne disposons pas de données précises sur le niveau d'ingestion des chèvres Angora ou Cachemire et sur les facteurs qui le modifient. Même dans les documents du NRC (1981) ou de l'INRA (1989) donnant les recommandations alimentaires, aucune donnée n'est indiquée sur l'ingestion des caprins produisant du poil. Toutefois d'après les observations très fragmentaires d'ingestion sur les chèvres Angora dont nous disposons, les équations de prévision établies sur d'autres caprins auraient tendance à légèrement surestimer le niveau d'ingestion des chèvres Angora. Sahlu et al. (1989) pensent aussi que les Angora ont un moindre niveau d'ingestion que les Alpines autant sur des régimes de faible que de forte valeur nutritionnelle.

Digestion et efficacité de l'utilisation alimentaire

Huston (1976) indique que la chèvre Angora a un plus petit rumen et un plus court temps de rétention des aliments dans le rumen. De ce fait, la digestibilité des fourrages chez ces caprins pourrait être inférieure à celle du mouton et du bovin en raison d'un plus faible temps d'exposition aux fermentations du rumen (Huston, 1982). Toutefois dans la plupart des cas (tableau 1), la digestibilité de la matière organique et de la cellulose serait plus élevée chez les caprins Angora que chez les moutons (Doyle et Egan, 1980). En fait, d'autres facteurs pourraient intervenir tels que la plus grande secrétion de salive qui apporterait de l'urée dans le rumen comme l'ont mise en évidence Domingue et al. (1991), et tels qu'un recyclage de l'urée plus intense comme cela a été démontré chez d'autres caprins (Tisserand et al. 1991). Le temps de rétention des fourrages dans le rumen a pu même être trouvé supérieur à celui du mouton, et ceci d'autant plus prononcé que les fourrages ingérés sont de faible qualité (Doyle et Egan, 1980, tableau 1). Ces différentes observations conduisent à penser que la digestion des fourrages de médiocre qualité chez les caprins Angora serait tout à fait comparable à celle des autres caprins.

La rétention azotée est souvent plus élevée chez les caprins Angora que chez les moutons Mérinos (Tableau 1). Cela peut traduire le fait que l'Angora produit plus de fibres que le mouton rapportée au poids vif (Huston, 1982). Or l'efficacité de l'utilisation alimentaire pour la production de fibres est nettement supérieure chez la chèvre. Gallagher et Shelton (1972) ont montré que la production de fibre par unité d'énergie digestible ingérée est 2.7 fois plus élevée chez le bouc castré que chez le mouton castré, et 3.2 fois chez le chevreau que chez l'agneau. Mais l'efficacité de l'utilisation alimentaire pour le gain de poids est plus élevée chez l'agneau que chez le chevreau (+34%) et chez le bouc castré que chez le mouton castré (+17%). Ainsi la répartition des nutriments est différente chez l'Angora et le mouton adulte; leur orientation vers la production de poil serait donc supérieure chez les Angora (Gallagher et Shelton, 1972; Huston, 1982).

Capacité d'adaptation et sensibilité au stress

Malgré leur aptitude à bien digérer la cellulose et en conséquence à bien utiliser les fourrages de médiocre qualité, les caprins Angora ont fréquemment été décrits comme très sensibles à des sous-alimentations, et en particulier à celles qui provoquent des avortements au cours du quatrième mois de gestation (Shelton, 1979, 1984; Huston, 1982; Wentzel, 1987). Après l'émission de diverses hypothèses, Wentzel et al. (1975) et Wentzel et Botha (1976) ont bien confirmé la relation de cause à effet entre les sous-alimentations des chèvres en fin de gestation et la fréquence des avortements. Reeh et al. (1987) ont mis en évidence que c'est une sous-alimentation énergétique qui est la principale cause de ces avortements. En outre, Wentzel et al. (1975) ont précisé que les avortements au quatrième mois et la mortalité pérérinatale ont les mêmes causes nutritionnelles. D'après Westhuysen (1980) la sous-alimentation énergétique a un effet plus important que la sous-nutrition azotée sur la mortalité périnatale (Tableau 2).

Plusieurs travaux ont essayé de rechercher les causes physiologiques de ces avortements consécutifs à une sous-alimentation. Un excès d'activité physique (Reeh et al., 1987) ou une perturbation de la fonction thyroïdienne (Wentzel et Botha, 1976) ont été mis hors de cause. La faible glycémie de la chèvre Angora par rapport à la chèvre Alpine (Sahlu et al., 1989) ou son hématocrite plus faible que chez le mouton ou les autres caprins peuvent être évoqués comme facteurs favorisant l'avortement. En effet, la sous-alimentation abaisserait encore la glycémie; ce qui modifierait l'équilibre hormonal (Wentzel, 1982). Le taux plasmatique d'oestrogènes de la mère augmenterait alors fortement et provoquerait l'expulsion du foetus (Wentzel et al., 1975).

Est-ce que cette sensibilité aux avortements liés à des déficits nutritionnels est une spécificité des chèvres Angora? Il semble que non comme le reconnait Shelton (1979) puisque des avortements liés à de fortes sous-alimentations ont aussi été observés sur des races locales en zone tropicale (Shelton, 1979; Unanian et Feliciano Silva, 1987) et aussi sur les chèvres BOER en Afrique du sud (Coetzer et Niekerk, 1987). Mais le degré de sous-alimentation auquel étaient soumises les chèvres Angora: 40% des besoins énergétiques totaux en fin de gestation (Wentzel, 1982a, Westhuysen, 1980) est suffisamment important pour ne pas être étonné des accidents importants qu'il provoquait. Comme chez les chèvres Alpines ou Saanen, il apparait des hypoglycémies chez les chèvres Angora. Toutefois, chez les chèvres de type laitier, elles s'accompagnent de graves toxémies de gestation alors que les avortements seraient moins fréquents (Morand-Fehr et Sauvant, 1987) mais les sous-alimentations observées en fin de gestation chez les chèvres laitières ne sont jamais aussi sévères que chez les chèvres Angora.

Par ailleurs, Wentzel et al. (1979) ont montré aussi que les caprins Angora étaient sensibles au stress du froid, les jeunes plus que les adultes. Après la mise en jeu des mécanismes de lutte contre le froid (augmentation de la glycémie, du rythme cardiaque et de la production de chaleur), il peut apparaître un effondrement de la glycémie, de la température rectale et du rythme cardiaque avec augmentation de la sécrétion de la thyroxine et des corticostéroïdes. Des pertes de jeunes sont fréquentes, dues à cette sensibilité au froid, notamment après la tonte. Il apparait que la chute de la glycémie de 50 % de sa valeur normale serait l'élément déterminant. Wentzel (1982b) préconise pour lutter contre ces pertes, d'injecter du glucose ou de distribuer une ration riche en hydrates de carbone tout en évitant les acidoses.

Besoins

Les besoins spécifiques des caprins producteurs de poil sont souvent absents des revues proposant des apports recommandés. Le NRC (1981) et l'INRA (Morand-Fehr et al., 1987) se sont appuyés sur des données obtenues sur chèvres Angora, en particulier celles de Huston et al. (1971). Avec une efficacité de l'énergie métabolisable de 33 %, un kg de mohair brut demande 6 250 kcal EN; ce qui correspond à 0.01 UFL par jour et par kg de poil produit par an. Ainsi selon les systèmes énergétiques adoptés (NRC, 1981; INRA, 1988), l'augmentation de l'apport recommandé d'entretien d'une chèvre de 50 kg (sans tenir compte de ses dépenses liées à son activité sur la prairie) et ayant une production de Mohair de 6 kg est de 7–7.5%, soit une valeur relativement faible.

Les pertes azotées pour la production de poil varient entre 0.03 g et 0.10 g/kg $P^{0.75}$/j selon le niveau de production (Huston et al., 1971; Brun-Bellut et al., 1987). Dans le système MAD du NRC (1981), le besoin est fixé de 3 g par jour et par kg de mohair produit par an et dans le système PDI (INRA, 1988) compte-tenu du rendement moyen différent des PDI par rapport aux MAD, de 2.5 g par jour et par kg de mohair produit par an.

Il n'existe pas à notre connaissance de besoins ou de recommandations minérales calculées à partir de données enregistrées sur des caprins producteurs de poil.

Influence de l'alimentation sur la production et la qualité des fibres

Développement des follicules

Wentzel et Vosloo (1975) ont étudié le développement des follicules et des fibres sur des secteurs de peau de foetus et de chevreaux Angora. Il semble qu'à quelques différences mineures près, ils sont très voisins de ceux des follicules et des fibres de laine du mouton. La croissance des follicules atteignent un maximum au quatrième mois de gestation mais s'arrête au cinquième mois, probablement parce que le développement du foetus est alors prioritaire, pour reprendre après la naissance. Les fibres proprement dites ne se développent intensément qu'au cours des quatre mois qui suivent la naissance.

Bien qu'on manque cruellement d'information à propos de l'effet de l'alimentation des mères en gestation sur le développement des follicules et des fibres du jeune, il est probable que la fin de gestation, notamment le 4è mois de gestation, est une période cruciale. De plus, puisque chez les autres animaux et en particulier les moutons, une alimentation insuffisante ou défectueuse risque de réduire le poids à la naissance des chevreaux et que la surface de la peau dépend essentiellement du poids vif, cela peut avoir des répercussions importantes sur la production ultérieure de fibres.

Effet du niveau alimentaire, énergétique ou azoté du régime

Une restriction alimentaire limite la production de fibre et un apport alimentaire supplémentaire après une restriction tend à l'améliorer. Mac Gregor et Hodge (1989) ont montré que par rapport à un régime faisant perdre 5 kg de poids à des mâles castrés Angora pendant 84 jours, un régime maintenant leur poids vif permet d'améliorer la production de Mohair de 20%. De même le niveau d'énergie ingérée influence la pousse du poil Cachemire quand les animaux perdent du poids mais pas quand ils en gagnent (Mac Gregor, 1987a). Toutefois, une surcharge alimentaire en général n'améliore pas la production. Ainsi la production de toison des chèvres Cachemire dont le niveau d'ingestion passe de 0.8 kg MS à 3 kg MS par jour n'est pas améliorée (Mac Call et al., 1989). Norton et al. (1990) observent le même résultat sur la même race en diminuant la densité des animaux sur prairie de 60 à 15 animaux par ha. Cette absence de réponse à l'amélioration du niveau alimentaire parait être d'autant plus fréquente que la production de poil est réduite. Shalu et al. (1988), Shahjlal et al. (1990, 1991), Deaville et Galbraith (1991) ont observé une amélioration significative de la quantité de Mohair produite en augmentant la teneur en matières azotées du régime de 10 ou 12% à 18% (Tableau 3); ce qui montre bien que la quantité produite de poil est sensible à l'apport global de matières azotées mais seulement jusqu'à un taux de 18% dans le régime et probablement 20% pour les jeunes mâles (Shelton, 1979).

En réalité le caprin Angora répond à la fois aux modifications des niveaux énergétique et azoté du régime (Huston, 1980; Shelton, 1984). Il semble même comme chez le mouton (Dones, 1984), que le niveau énergétique tend à avoir un effet plus marqué que le niveau protéique. Toutefois, Shahjalal et al. (1990 et 1991) obtiennent une amélioration supérieure de la production de poil des mâles castrés Angora en augmentant la concentration protéique du régime de 10 à 18%, qu'en faisant varier la concentration d'énergie métabolisable de 10.2 MJ à 11.9 MJ ou en la maintenant à 9.6 MJ par kg MS (Tableau 3a et b). L'augmentation de la concentration protéique est de 66% et celle de l'énergie de 16% seulement. En réalité, il semble comme le souligne Shelton (1984) qu'une amélioration de la production de poil n'apparaît que dans le cas où la synthèse des protéines microbiennes dans le rumen était réduite en raison d'un déficit en énergie (PDIE) ou en protéines fermentescibles (PDIN) (INRA, 1988). L'apport du facteur limitant (énergie ou protéines) permet une amélioration de la disponibilité des acides aminés au niveau des follicules. On comprend mieux pourquoi une surcharge énergétique ou protéique n'augmentant pas la synthèse microbienne et la quantité d'acides aminés absorbés (Huston, 1980) n'améliore pas la production de poil.

Il est aussi très important de remarquer qu'à chaque fois que la production de poil est améliorée quelle que soit l'origine (niveau énergétique ou azoté), il apparait une tendance à la diminution de la qualité de la fibre (Shahjalal et al., 1990, 1991; Deaville et Galbraith, 1990; Mac Gregor, 1987a et 1987b; Müftüoglu, 1960). Le diamètre des fibres augmente et plus rarement la proportion de jarre s'élève et la longueur des mèches diminue (Müftüglu, 1960).

Tableau 3. Inluence des niveaux énergétique et azoté du régime sur la croissance et la production de poil de jeunes males castrés angora.

a. Expérience de Shahjalal et al. (1990)				
Résultats sur 112j.[1]				
Niveau énergétique[2]	Bas	Bas	Haut	Haut
Niveau protéique[3]	Bas	Haut	Bas	Haut
Gain de poids (kg)	5.4	8.9	9.9	13.0
Consommation énergétique (MJ)	851	949	1 010	1 110
Production de Fibre (g/100 cm^2)	8.9	13.4	10.7	12.9
Diamètre des fibres du flanc (µ)	29.7	35.4	32.4	35.4
b. Expérience de Shahjalal et al. (1991)				
Résultats sur 63j.[4]				
Niveau azoté (% MAT/MS)	10.2	12.6	16.5	18.5
Gain de poids (kg)	1.50	2.63	3.36	4.34
Production de fibres (g/100 cm^2)	3.43	3.99	4.89	5.20
Diamètre des fibres du flanc (µ)	29.8	31.5	36.1	33.6
c. Expérience de Galbraith et al. (1991)				
Résultats sur 70j.[5]				
Niveau azoté (% MAT/MS)	11.0	17.8		
Gain de poids (kg)	3.70	5.96		
Production de fibres (g/100 cm2)	9.84	11.2		
Diamètre des fibres (µ)	28.0	30.1		

[1] Consomation limitée à 30 g/kg PV
[2] 10.2 ou 11.9 MJ EM/kg mS
[3] 108 ou 180 g MAT
[4] Régime isocalorique de 9.6 MJ EM/kg MS rationné à 55 g MS/$kg^{0.75}$;
Sources azotées: tourteau de soja et farine de poisson.
[5] Rationnement à 37 g/kg PV.

Tableau 4. Effet de la teneur des matières azotées du régime et du traitement par la chaleur du tourteau de soja sur la production et la qualité du poil mohair (Sahlu et al.,1988).

Teneur en matières azotées du régime (%)	12	12	18	18
Traitement du tourteau de soja	Non	Oui	Non	Oui
Production de toison en 150 j. (kg)	2.57	2.70	3.00	3.42
Rendement (%)	70.1	70.5	71.6	73.5
Diamètre des fibres (µ)	34.4	36.0	37.2	36.9

Effet des sources énergétiques et azotées

Comme nous venons de le préciser, ce sont les apports d'énergie fermentescible qui ont le plus de chances d'améliorer la production de poil, mais seulement si ceux-ci sont facteurs limitants de la synthèse des protéines microbiennes dans le rumen. En général le gain de poids est amélioré par des hauts niveaux d'énergie fermentescible alors que la production de poil n'est plus modifiée (Throckmorton et al., 1982). C'est la raison pour laquelle des apports supplémentaires d'énergie, et notamment de céréales n'ont pas eu dans beaucoup de cas, l'effet escompté sur la production de poil Mohair (Shelton, 1984).

Les tourteaux (soja, coton) dans l'aliment semblent des sources azotées efficaces pour améliorer la production de poil à la différence du tourteau de tournesol (Sahlu et al., 1988; Ash et Norton, 1987). Ces sources ont une fraction protéique fermentescible dans le rumen et une autre non fermentescible qui sera digérée dans l'intestin comme chez les monogastriques. Des traitements technologiques (chaleur, tannage à la formaldéhyde...) permettent d'augmenter la fraction non fermentescible et ainsi d'éviter des pertes azotées quand les capacités de synthèse protéique du rumen sont saturées, et ainsi d'accroître la disponibilité en acides ami- nés. Les résultats semblent dépendre du potentiel de production des chèvres. Le traitement à la chaleur du tourteau de soja a amélioré la quantité produite de poil Mohair (Sahlu et al., 1981) (Tableau 4). Mais la caséine, ou les tourteaux de soja ou de coton traités à la formaldéhyde n'ont eu aucun effet sur la production de Cachemire avec des animaux à plus faible niveau de production (Ash et Norton, 1987). De même l'utilisation de méthionine protégée qui est beaucoup moins fermentescible que la méthionine libre a aussi permis d'améliorer la quantité de poil Mohair produite de 0.8 g par jour et par g de méthionine ajoutée. Ce résultat n'est pas étonnant puisque la synthèse des fibres exige une quantité relativement importante d'acides aminés soufrés. Toutefois une telle amélioration semble insuffisante pour que l'apport de méthionine soit rentable économiquement. Ainsi comme chez le mouton pour la production de laine (Hogan et Weston, 1967), le caprin Mohair peut réagir favorablement à un traitement technologique, en particulier s'il a un bon niveau de production de poil.

Comme pour les effets des quantités de nutriments, un effet positif de la nature d'une source énergétique ou azotée sur la production de poil, entraîne une détérioration, le plus souvent légère de la qualité du poil et surtout une augmentation du diamètre des fibres.

Effets des minéraux, des vitamines ou d'autres additifs

D'après Shelton (1984), les caprins producteurs de poil ne présentent pas de problèmes particuliers de minéraux et de vitamines. Toutefois, ils pourraient avoir un besoin spécifique en soufre qui favorise la synthèse des acides aminés soufrés dans le rumen, nécessaires à la synthèse de protéines microbiennes (Lu et al., 1992). En outre dans la pratique, les apports supplémentaires de sel comme chez le mouton à laine semble favorable, probablement en raison de l'augmentation des quantités d'eau bue et de la vitesse de transit qui limiterait la dégradation des protéines dans le rumen. Le phosphore qui est parfois déficitaire sur les parcours utilisés et la vitamine A qui évite la kératinisation de la peau et la baisse de l'activité des follicules peuvent être ajoutées à la ration. De même la supplémentation de certains oligo-éléments comme le molybdène pourrait être bénéfique (Galbraith et al., 1991) mais ils agiraient en interaction entre eux ou avec d'autres minéraux.

Les anabolisants peuvent aussi avoir un effet favorable sur la production de toison sans augmentation du diamètre des fibres (Snowder et al., 1982). En effet l'introduction d'implants de zéranol et de testostérone à des jeunes mâles Angora castrés ou non améliore la production de poil de 7 à 10%.

Enfin des probiotiques du type levures n'ont pas amélioré la production des mâles castrés Cachemire (Deaville et Galbraith, 1990) mais plusieurs expériences sont nécessaires pour avoir une vue objective sur l'intérêt des probiotiques.

En résumé, les effets de l'alimentation sur la production et la qualité des poils Mohair et Cachemire sont proches de ceux enregistrés sur la production de laine. Les informations disponibles actuellement ne permettent pas encore d'identifier des particularités nutritionnelles marquées chez les caprins producteurs de poil.

Stratégies d'alimentation

Influence du marché sur les stratégies d'alimentation

L'objectif des éleveurs est généralement d'améliorer leur production de poil tout en maintenant une qualité de fibres satisfaisante. En réalité l'orientation vers la production ou vers la qualité dependra du marché, c'est-à-dire du prix moyen au kg vendu et du différentiel entre les qualités. Or les facteurs alimentaires agissent de façon antagoniste sur les paramètres quantitatifs et qualitatifs. En conséquence, l'éleveur devra adapter sa stratégie alimentaire suivant les conditions du marché. Pour concrétiser cette proposition, analysons deux situations opposées:

a. Le prix moyen du kg de toison vendue est élevé avec un rétrécissement du différentiel du prix entre les qualités de fibre. Dans ce cas, l'éleveur a intérêt à opter pour une production optimale et d'utiliser les moyens alimentaires pour y parvenir: apports énergétiques et azotés suffisants et éventuellement, utilisation de sources azotées spécifiques en évitant les gaspillages.
b. Le prix moyen du kg de toison est bas, et souvent dans ce cas, la haute qualité kid fine se vendra beaucoup plus cher que la qualité grossière. L'éleveur a intérêt à abaisser au maximum ses prix de revient et à vendre le plus de qualité fine. Alors il doit limiter les aliments complémentaires distribués jusqu'à un seuil limite où les risques d'accidents sanitaires sont trop élevés: avortements, mortalité périnatale, faible protection immunitaire etc...

Cela nécessite de disposer d'animaux dotés d'une grande capacité d'adaptation autant à des programmes alimentaires restreints.

Considérations techniques pour définir une stratégie alimentaire

Compte-tenu du marché qui recherche les toisons des jeunes animaux, ne doit-on pas adopter une stratégie technique pour augmenter au maximum la production de toison de qualité kid, quitte à perdre un peu sur la production ou la qualité des toisons d'adultes?

Pour cela, il est essentiel d'optimiser sur les performances de reproduction et de réduire les pertes sur les jeunes. Les chèvres reproductrices doivent arriver à la période de lutte en état corporel suffisant. Un apport supplémentaire, surtout énergétique peut améliorer le taux de fertilité des chèvres Angora (Shelton, 1979; 1984) et le rythme de reproduction. Mais cette technique doit être bien maîtrisée pour éviter des augmentations de poids qui provoqueraient trop de naissances gémellaires. Par ailleurs, cette supplémentation doit se poursuivre pendant 3 semaines au moins après les dernières saillies afin que les pertes embryonnaires ne réduisent pas à zéro l'augmentation de la ponte ovulaire. Mais comme nous l'avons vu, la fin de gestation est une période critique. Pour éviter les avortements et les pertes de chevreaux par mortalité périnatale, mais aussi les atteintes parasitaires graves (type coccidiose) et les conséquences du stress du au froid, notamment après la tonte, une complémentation serait utile pour couvrir les besoins d'entretien et de gestation (voir recommandations NRC, 1981; INRA, 1988). En gestation, elle doit surtout être énergétique plus que protéique. Les quantités distribuées, en général de 150 g à 300 g d'aliment concentré par jour et par tête doivent être modulées selon l'état corporel des animaux, la nature et la qualité de la ration de base ou des disponibilités sur le parcours. En effet dans des systèmes utilisant du parcours, la fin de gestation peut correspondre à la fin de la période de l'arrêt de la végétation où le surpaturâge et en conséquence, les sous-alimentations sont fréquentes (Somlo et al., 1987). Un supplément minéral et vitaminique peut être utile dans le cas où les fourrages ingérés sont de faible qualité. Le début de lactation coïncide avec la période des besoins les plus élevés des chèvres reproductrices. On doit rechercher une production laitière suffisante pour bien faire démarrer les chevreaux pendant les deux premiers mois. Si on veut limiter la supplémentation, il faut faire coïncider cette période avec celle du maximum de disponibilités de la prairie ou du parcours. Sinon, un apport supplémentaire de céréales et de tourteau dans un rapport de 2 ou 3/1 est nécessaire à raison de 100 à 500 g suivant les disponibilités et la qualité des fourrages ingérées.

Comme on manque de données précises, la conduite alimentaire des mères risque d'être approximative en pratique. Pour la rendre plus rigoureuse, il nous semble important d'utiliser les suivis de l'état corporel avec des notes-cibles aux périodes critiques du cycle de reproduction: saillie, mise-bas, démarrage de la végétation etc... La méthode des palpations d'abord mise au point pour les brebis (Russel et al., 1969) a été adaptée pour les caprins et donne satisfaction autant dans les systèmes intensifs qu'extensifs (Santucci et al., 1990; Morand-Fehr et al., 1992).

Quant au jeune chevreau, il faut lui assurer un bon démarrage en période lactée. Si nécessaire, le lait de la mère peut être complétée par un aliment concentré auquel il aura seul accès. Ensuite pendant la période de croissance, il devra être essentiellement alimenté par des fourrages et des concentrés énergétiques ou azotés s'il est nécessaire d'éviter des sous-alimentations qui réduiraient trop la production de poil. Ces apports doivent être raisonnés selon la qualité et la production de poil que l'éleveur désire obtenir.

Mais en réalité pour définir une stratégie alimentaire, il ne faut pas considérer seulement les effets sur la production de toison et la qualité du poil mais aussi les effets sur les performances de reproduction et sur le gain de poids puisqu'un animal plus lourd aura une surface de peau, donc une production de poil plus importante. Or le plus souvent les facteurs alimentaires n'ont plus d'effets sur la production de poil alors qu'ils ont encore des effets favorables sur l'état corporel, la fertilité ou la production laitière des mères, et sur le gain de poids des jeunes (Sahlu et al., 1988).

Conclusions

Les caractéristiques alimentaires des chèvres Angora ou Cachemire sont assez proches de celles des moutons à laine ; toutefois elles s'en différencient par le comportement alimentaire et certains aspects de la digestion qui sont proches des caractéristiques d'autres caprins élevés dans des milieux difficiles.

La production de poil exigent des apports énergétiques et azotés permettant une synthèse optimale des protéines microbiennes dans le rumen. L'apport de protéines by-pass peut dans certains cas, être intéressante. Mais des surcharges alimentaires, ou bien des sous-alimentations en particulier en fin de gestation ou pendant la période de lutte doivent être évitées. Compte-tenu des besoins relativement limités de ces animaux, la production de poil n'est pas améliorée par des apports supplémentaires énergétiques ou azotés.

La stratégie alimentaire dépend des conditions du marché mais la recherche d'une production optimale de toisons de jeunes animaux doit être prioritaire. Cela passe par un programme alimentaire des mères précis évitant les avortements, les mortalités périnatales et les accidents sanitaires.

Dans le système extensif, la recherche de la densité optimale sur prairie ou parcours suivant le stade physiologique des mères pourrait améliorer l'efficience du système (Norton et al., 1990). De même les troupeaux mixtes (mouton, chèvre) peuvent aboutir à une utilisation complémentaire du parcours ou de la prairie à une intensité de charge précise, ou à une utilisation concurrente à une intensité supérieure (Mac Gregor, 1987c).

Dans le système intensif, la diminution des coûts alimentaires en réduisant les gaspillages et en adaptant mieux les sources fourragères à cette production afin qu'elles couvrent une plus grande proportion des besoins serait une orientation de recherche à développer.

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Comparison of Turkish angora goats with American × Turkish crossbred generations in body weight and mohair traits

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Summary

This study has been carried out at Anadolu State Production Farm near Eskisehir to compare the production levels of Turkish Angora goats with those of crossbred generations obtained from crossbreeding between Turkish (T) and American (A) strains of Angora goats. Least squares means for different traits in T, F1, F2, AB1 (backcross to American) and TB1 (backcross to Turkish) groups were found respectively as follows: birth weight 2.55, 2.63, 2.62, 2.64 and 2.60 kg, weaning (105-day) weight 15.32, 15.59, 15.27, 15.21 and 15.52 kg, body weight after shearing 31.00, 30.24, 30.26, 30.01 and 30.38 kg, greasy fleece weight 2.40, 2.81, 2.58, 2.74 and 2.59 kg, staple length 17.17, 17.50, 18.02, 18.13 and 17.67 cm, and fiber diameter 29.83, 29.37, 28.33, 28.29 and 29.60 micron. These results indicate that, by crossing Turkish Angora goats with American stock, significantly higher mohair production of better quality can be obtained at F1 and AB1 stages as compared to those in pure Turkish goats.
Keywords: crossbreeding, Angora goats, mohair traits.

Introduction

In Turkey, Angora goats are raised mainly on the Central Anatolian Plateau, about 800 meters above the sea level. The greatest part of the region is formed by poor rangelands and treeless steppes. The climate is semi-arid with dry hot summers and cold winters. During the grazing season goats depend almost completely on short and poor quality grasses on the rangelands and on cereal stubble. Animals are wintered for about 3 to 5 month in simple sheds, when they are maintained on cereal straw and poor-quality hay. In critical periods, goats in some flocks receive limited amount of concentrates. Because of this poor level of nutrition, the levels of important production traits in the Angora goat flocks in Turkey are generally low. In the producers' flock, average values for different mohair traits of breeding females were found as follows: greasy fleece weight 1.6 kg, clean mohair yield 77.0 percent, staple length 13.8 cm and fiber diameter 33.3 micron (Müftüglu and Örkiz, 1982). Corresponding figures obtained for breeding females at experimental farms are 3.0 kg, 71.5 percent, 16.4 cm and 35.8 micron.

Heritability estimates obtained for mohair traits and kid weights of Angora goats in Turkey are generally low (From 0.07 to 0.24) indicating that improving these traits through individual selection will be a slow process. (Yalçin, et al., 1979; Yalçin et al., 1989). Although selection for these traits may be made more effective by combining individual records with half-sib family averages and by using a selection index, increasing genetic variation in these traits is needed for faster genetic improvement by selection.

The existing literature indicate that markedly higher levels for mohair production and kid weights are attained in Angora goat flocks raised in the U.S.A. and in South Africa (Shelton, 1965; Shelton and Basset, 1970; Basset, 1966; Marincowitz, 1959; Uys, 1963; Van der Westhuysen et al., 1981). If the superiority of the American and South African goats to the Turkish goats is greatly genetic, crossbreeding of Turkish Angora goats with American and South African strains may directly improve the levels of fleece weight and some fleece characteristics in crossbred generations. Such crossbreeding may also be useful in increasing genetic variation in different traits and make selection more effective in the subsequent generations.

This study is concerned with a crossbreeding experiment initiated at Eskisehir-Anadolu State Production Farm, in Central Anatolia, in 1983 in order to investigate the value of y between Turkish and American strains of Angora goats in improving the productivity of the Turkish stock and for increasing genetic variation in different mohair and body weight traits.

Material and methods

In 1983, 19 bucks from American Angora goat strain were imported from Texas, U.S.A., and brought to the Anadolu State Production Farm near Eskisehir, in Central Anatolia. They were used for inseminating a random part of the breeding females present in the Angora goat flock of that farm, in the autumn of the same year. The remaining part of the breeding females in the same flock was used in purebreeding. Similar matings were made in the following years (1984 through 1987), and F1 and pure Turkish groups of kids were obtained. During the period from 1985 to 1987, F1 does were allocated into three random groups and were mated to F1, American and Turkish bucks. All of these matings were made through artificial insemination. In this way, contemporary groups of pure Turkish (T), F1, F2, AB1 (backcross to American strain) and TB1 (backcross to Turkish strain) were produced.

Kids were identified and their birth date, sex, type of birth and birth weight were recorded. They were weaned at an average age of 105 days. Animals were shorn once a year, usually at the end of March, and greasy fleece weight and body weight after shearing were recorded. Before shearing, mohair samples were taken from shoulder, rib and teigh regions. For the determination of fiber diameter and staple length, respectively 200 fibers and 10 staples from each region were measured.

Improved feeding was provided to the does from about two weeks before mating to the end of the mating season, and also during the last 6 weeks of pregnancy. They received hay during the winter and grazed on poor rangelands from April to November. The level of nutrition in the flock was generally similar to that provided to Angora goats in the majority of flocks in the region.

The effects of type of genotype and known measurable environmental factors on different traits were studied by least squares procedure, described by Harvey (1960). Interactions among the factors studied were assumed to be non-significant and therefore were disregarded. By this procedure, mean values for the genotypic groups, adjusted for the known measurable environmental factors, were obtained.

Results and discussion

Mean liveweights of kids in different genotype groups are presented in Table 1. At birth, kids in crossbred groups were significantly heavier (2.60–2.64 kg v. 2.55 kg) than pure Turkish kids. Significant weight differences among genotype groups were also present at the subsequent ages, but their magnitudes were very small. At different ages, mean values in the groups varied within the following limits: birth weight 2.55–2.64 kg, weaning weight 15.21 –15.52 kg, 6-month weight 17.50–18.43 kg and 12-month weight 24.36–25.24 kg.

Kid survival rates to weaning age and to 6 months of age were high (98–100% and 97–99%, respectively) in all groups; with few exceptions, differences between the groups were not significant (Table 2). It appears that, in respect of growth and survival rates, kids in different genotype groups perform similarly under the existing management and environmental conditions.

Table 1. Mean liveweights of kids in different genotype groups.

Genotype groups	Birth weight (kg)			Weaning weight (kg)		
	n	mean	s.e.	n	mean	s.e.
Turkish	2 394	2.55[a]	0.012	2 357	15.32[a]	0.073
F1	1 235	2.63[b]	0.014	1 217	15.59[b]	0.087
F2	133	2.62[b]	0.035	133	15.27[ab]	0.209
AB1	129	2.64[b]	0.035	127	15.21[ab]	0.210
TB1	645	2.60[b]	0.019	635	15.52[ab]	0.114
Genotype groups	**6-month weight (kg)**			**12-month weight (kg)**		
	n	mean	s.e.	n	mean[a]	s.e.
Turkish	2 194	18.25[a]	0.095	1 505	25.24[a]	0.147
F1	1 105	18.20[a]	0.114	737	24.58[b]	0.174
F2	121	17.58[b]	0.276	64	25.10[ab]	0.430
AB1	116	17.50[b]	0.279	71	24.36[b]	0.414
TB1	625	18.43[a]	0.146	391	25.09[ab]	0.214

[a,b] Differences between the means with different superscripts are statistically significant.

Table 2. Survival rate of kids in different genotype groups.

Genotype groups	Number of live kids			Survival rate (%)	
	birth	weaning	6 months	to weaning	to 6 months
Turkish	2 394	2 361	2 345	98.6[a]	97.9[ab]
F1	1 235	1 218	1 203	98.6[a]	97.4[a]
F2	133	133	132	100.0[b]	99.2[b]
AB1	130	127	126	97.7[a]	96.9[a]
TB1	645	635	630	98.4[a]	97.7[ab]

[a,b] Differences between groups with different superscripts are statistically significant.

Mean values obtained for body weight of does are given in Table 3. Among the groups, mean body weight after shearing varied between 30 kg and 31 kg, and mean body weight at mating varied between 35.2 kg and 36.7 kg. Crossbred groups had slightly lower body weights than pure Turkish group. However, this should not be considered a disadvantage for crossbreds, because Angora goats are primarily mohair producing animals.

Fleece records were obtained from does aging from one to five years old. Table 4 shows the mean values obtained for greasy fleece weight, staple length and fiber diameter. Mean values for pure Turkish, F1, F2, AB1 and TB1 groups are 2.40, 2.81, 2.58, 2.74 and 2.59 kg for greasy fleece weight, 17.2, 17.5, 18.0, 18.1 and 17.7 cm for staple length, and 29.8, 29.4, 28.3, 28.3 and 29.6 micron for fiber diameter, respectively. Crossbred groups are significantly superior to pure Turkish group in respect of greasy fleece weight and staple length and, with

Table 3. Mean body weight of does in different genotype groups.

Genotype groups	Body weight after shearing(kg)			Body weight at mating (kg)		
	n	mean	s.e	n	mean	s.e.
Turkish	1 955	31.00^{a}	0.102	1 502	36.73^{a}	0.119
F1	1 122	30.24^{b}	0.108	940	35.15^{c}	0.126
F2	41	30.26^{ab}	0.499	33	36.28^{ac}	0.585
AB1	53	30.01^{b}	0.441	33	36.58^{ad}	0.583
TB1	268	30.38^{b}	0.244	183	35.51^{cd}	0.308

^{a,b,c,d}Differences between the means with different superscripts are statistically significant.

Table 4. Mean values for mohair traits of does in different genotype groups.

Genotype groups	Greasy fleece weight (kg)			Staple length (cm)		
	n	mean	s.e.	n	mean	s.e.
Turkish	1 980	2.40^{a}	0.016	880	17.17^{a}	0.106
F1	1 153	2.81^{c}	0.017	537	17.50^{b}	0.102
F2	41	2.58^{bd}	0.080	23	18.02^{b}	0.412
AB1	57	2.74^{cd}	0.069	34	18.13^{b}	0.351
TB1	266	2.59^{b}	0.039	164	17.67^{b}	0.212
Genotype groups	**Fiber diameter (micron)**					
	n	mean	s.e.			
Turkish	880	29.83^{a}	0.137			
F1	537	29.37^{c}	0.132			
F2	23	28.33^{b}	0.532			
AB1	34	28.29^{b}	0.453			
TB1	164	29.60^{ac}	0.274			

^{a,b,c,d}Differences between the means with different superscripts are statistically significant.

the exception of TB1 group, in respect of fiber fineness. Superiorities in greasy fleece weight of F1 and AB1 groups over pure Turkish group are 17% and 14%, respectively.

These results indicate that, by crossing Turkish Angora goats with American stock, significantly higher mohair production of better quality can be obtained at F1 and AB1 stages as compared to those in pure Turkish goats, without changing the growth and survival rate in the latter. Cross-breeding between these two lines of Angora goats is also likely to increase genetic variation in the important production traits in the subsequent generations.

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Session 4

Angora and cashmere goats

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Wool and mohair production in Turkey

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Abstract

The native sheep breeds of Turkey, the majority being fat-tailed, have all mixed coarse wool. Only the Merino and its crosses which constitute about 5% of the population are fine-wooled. In Turkey the average wool yield per sheep is between 1.6–1.8 kg. and there has been no significant progress in increasing the quality and quantity. To meet the needs of the country approximately 30 000 tons of wool is imported per year, a small portion being mixed coarse wool.

Turkey is one of the three leading mohair producing countries of the world and is known as the homeland of the Angora goat. Despite of this there have been marked decreases in both the number of goats and mohair production particularly after 1980. As the number of Angora goats dropped under two millions, mohair production was at about 3 000 tons. While a considerable portion of the mohair production is exported, in recent years importations, even though in very small consignments, have taken place.

Wool production

Very large part of the world animal fiber production comes from sheep which is the species exhibiting the greatest diversity with respect to wool. Today animal fibers in different forms ranging from the hair to the fine wool easily used by the textile industry can be produced from sheep. Furthermore the fibers obtained from them show considerable variation in color. Turkey is one of the countries in which large differences in wool are observed in such important quality characteristics as color and fineness.

Contributing to this diversity in the wool produced in Turkey are both the various native breeds and types in the country and also the great number of crossbred genotypes. Some of the crossbreds mentioned were obtained by crossbreeding among native breeds. In addition to this, the importation in the first place of Merinos and various culture breeds and their use in crossbreeding have contributed to this diversely.

In Turkey there are considerable differences in wool yield, fineness, staple length and uniformity within breeds even though not at the same magnitude as among the breeds. The factors contributing to the emergence and continuation of this situation are the differences in place, system and utilization of the production in addition to that wool is not an important source of revenue in the country.

Some characteristics of various genotypes raised in Turkey show that wool yields of the native breeds are very low, their major similarity being to produce mixed coarse wool. While some part of this production is utilized in carpet-weaving a major portion is used in meeting the home needs such as beds and quilts.

The sheep population of Turkey is about 45–50 millions and 4–5% of this are Merino crosses. The production of 70–80 thousand tons of wool is far from meeting the needs of the country. Particularly almost all of the fine uniform wool required by the textile industry is imported.

The past of the intensive efforts directed to meet the needs from the country is about 60 years if the period before the Republic is not taken into account. However it is not possible to say that a significant progress has been made during this period. Various reasons can be listed for this. The most important of these is that the production conditions in regions of Turkey where seep are raised are not suitable for fine-wooled sheep such as Merinos to be raised economically. In fact, when the subsidies for wool prices were lifted the efforts of the producers to work with these animals have ended. Consequently the native breeds and their crosses producing wool of the same or even lower cash value have been preferred. In this choice the fact that working with native breeds has less risk has played an important role.

In Turkey the endeavors to produce better quality wool through crossbreeding were initiated in Southern Marmara Region. These works were carried out by applying grading-up and the German Mutton Merino was used as the improver breed. When sufficient production could not be produced from this region the projects were shifted to the Central and partly to Eastern Anatolia. Since no improvements in the environment were affected paralleling the increase in the proportion of Merino genotype the rate of mortality in lambs increased. Both this unfavorable result and also the necessity of using artificial insemination due to all breeds being fat-tailed except Kivircik; in addition to the prices of wool remaining below the level to compensate for the losses have prevented the production of wool of desired quantity and quality. As a result the proportion of Merino and its crosses in the sheep population could be raised to the level of 3–4% through the efforts of nothing but grading-up.

Although there are different figures about the productions of various types of wool in Turkey in different references, the amount of wool obtained from Merino and its crosses is estimated at only 5% of the total wool production.

The studies towards acquiring new types by utilizing Merinos have been carried out at the research institutes; but it could not be as successful to extend the harvested results to the field. Indeed, despite the fact that there are new types and breeds whose wool quality meet the demands of the industry it is not possible to say that they are raised extensively.

In recent years works on the production of quality wool have decreased very much. Both this situation and also the developments in textile industry have led to increased imports of Turkey which is a wool importing country. For example while the import of fleece and wool was 17 thousand tons in 1985, it has raised over 31 thousand tons in 1990. During the same period the import of wool yarn (tops) has increased from 800 tons to 2 775 tons. There has also been changes in the qualities of the wool imported by Turkey. For instance, in 1985 import of wool other than Merino wool was about 1 500 tons, whereas the comparable figure for 1990 has reached approximately to 10 000 tons. Thus Turkey has started to import non-merino wool in large volumes in addition to the Merino wool of various types.

Compared to the quite high volumes of import, the quantities of export remained rather low. During the years of 1985–1990 under discussion the highest amount of fleece and wool export has materialized in 1989 with about 2 000 tons.

Mohair production

Mohair is an animal fiber which is durable, lustrous, elastic, hygroscopic and more soil resistant than others. Mohair is among the natural fibers sought by the textile industry because of its quite good qualities in reflecting dyes and keeping dyes. In the textile industry mohair can be used alone or in combination with cotton, wool and synthetic fibers.

Mohair and Angora goat from which it is produced have importance for Turkey in three points. The first of these is that mohair is an easily saleable export item. The second is that Angora goat constitutes an important source of food and revenue for its keepers. As for the third, mohair production meets the need of the Turkish textile industry.

As it is known Angora goat has spread to the World from the Central Anatolian Plateua which is within the boundaries of Turkey. Angora goat breeding in other areas of the world has a past of approximately 150 years. Despite this today, Turkey ranks third among the important mohair producing countries of the world.

The most important increases in the wealth of Angora goat of Turkey have taken place between the years 1950 and 1960. The highest value in the last 150 years is six millions in 1960. In the following years a decrease is observed in the number of Angora goats. At the beginning the rate of decrease is not very much; but after 1980 it has increased quite a lot and in recent years it has dropped under two millions and became the lowest figure of the century.

There have been fluctuations in the mohair production of Turkey similar to those in the number of goats. Unfortunately this situation, which is quite natural for short periods, continues. In other words there has not been an important development in the direction of increasing yield per goat. The yield per goat is about 1.6–1.8 kg which is half of the and even less than half of the yield in two leading mohair producing countries. The natural and eco-nomical conditions of the Angora goat breeding regions are quite effective in the formation of this situation. In fact the Central Anatolian ranges, which has a high density of Angora goats, are poor in vegetation. In this region, production is almost impossible only by utilizing the ranges. On the other hand there are considerable problems in transition to the intensive or semi-intensive systems.

The first of these problems is that Angora goats under intensive or semi-intensive conditions can not compete with other lines of production in those regions. In fact it is observed that of those going out of Angora goat husbandry a great majority undertake production in other areas, sheep husbandry being at the lead.

The low and unstable prices of mohair have an important contribution to the recession of Angora goat husbandry. While the subsidy prices for mohair are quite above the export prices in other leading producer countries, it is generally lower in Turkey. In addition to these unfavorable factors, decrease in the acreage and quality of the ranges; prevention of the entrance of goats to the forest areas, and difficulties in finding shepherd accelerate the rate of decrease in the number of goats.

Mohair production of Turkey is around 3 000 tons and a great part of it is exported. The amounts of exported mohair change depending on the demands of the world markets. For example in 1985 a total of about 2 250 tons of mohair was exported, whereas the comparable figure in 1987 has reached to 3 890 tons and dropped to 1 340 tons in 1989. In the past year amount of export decreased to very low level and the exported quantity has become about 250 tons. One of the interesting developments in recent years is that despite being a traditional exporting country Turkey has imported mohair even if in a small quantity.

In Turkey goats are clipped once a year and the produce is marketed without subjecting to grading. Grading is done by the buyer or usually by the exporter.

In contrast to other countries the Angora goats raised in Southeastern Turkey produces colored mohair. This mohair is usually utilized in the region in making blanket, stockings etc.

It is hardly possible to talk about extensive and effective efforts in the improvement of mohair quality in Turkey. Nevertheless not to be ignored is that the presence of potential to make it possible to easily reach the desired quality level after quite a short period of work. Angora goat should be regarded as the cultural wealth of the country and considering that survival of it is dependent on mohair prices, efforts should be directed towards increasing income per goat.

Originalité de la production française de mohair: la valorisation des toisons par la vente directe

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Abstract

This paper deals with the present situation of Angora goat industry in France. The french production of Angora fibres reaches 2% of the world production. Feeding systems range from whole extensive grazing to zero-grazing.

The breeding stock is composed of animals imported from Texas and Australia. An improvement scheme, based on the control of quantity and quality of the fleeces, has been set up. The first results show that 50% of the fibres have a diameter smaller than 32μ.

French breeders are organized in order to master every step of mohair processing and to sell their production directly. They may sell it on the farm, in handicraft fairs, by mail or by canvassing.

Introduction

En France, l'élevage des chèvres Angora et la production de poil mohair sont très récents. Les premières importations d'animaux ont eu lieu en 1978 mais le démarrage réel se situe en 1982 /83 puis 1987/89. Cette filière présente des caractéristiques originales, malgré des volumes produits limités.

Nous présenterons la situation actuelle de la production en France, en insistant successivement sur le troupeau actuel, ses performances de production et les qualités de mohair produites, et enfin sur le système de valorisation de la production. En effet, il s'agit d'un système original, dans lequel les éleveurs se sont organisés pour contrôler toutes les étapes de la transformation du mohair et récupérer ainsi le maximum de valeur ajoutée.

Un élevage en plein développement en France

Au cours des dix dernières années, l'engouement pour la production de mohair a provoqué une croissance quasi exponentielle du troupeau français de chèvres Angora (Figure 1). Plus de 170 producteurs possèdent, en 1991, environ 9 000 animaux. La moyenne de troupeau est de 50 animaux par élevage, mais on rencontre plusieurs troupeaux de plus de 100 mères. Avec une production moyenne de 4 kg de poils par an (2 tontes tous les 6 mois), la quantité produite atteint les 35 tonnes, soit environ 2% de la production mondiale.

Les conditions d'alimentation dans les élevages sont très variables selon la situation géographique, mais aussi la taille du troupeau et la place de cette production dans l'exploitation. En conséquence, les systèmes varient du pâturage extensif intégral jusqu'au zéro pâturage (Tableau 1). La chèvre Angora a une capacité d'adaptation remarquable, mais avec des niveaux de production et de qualité très variables selon les systèmes d'élevage.

Les importations d'animaux inscrits et sélectionnés en provenance du Texas ou d'Australie constituent la base génétique du troupeau. Dès le départ, les éleveurs ont cherché à évaluer les performances de l'ensemble du troupeau. Le suivi de filiation a été mis en place en 1983, le contrôle individuel de performances en 1986. Ce contrôle porte essentiellement sur les quan-

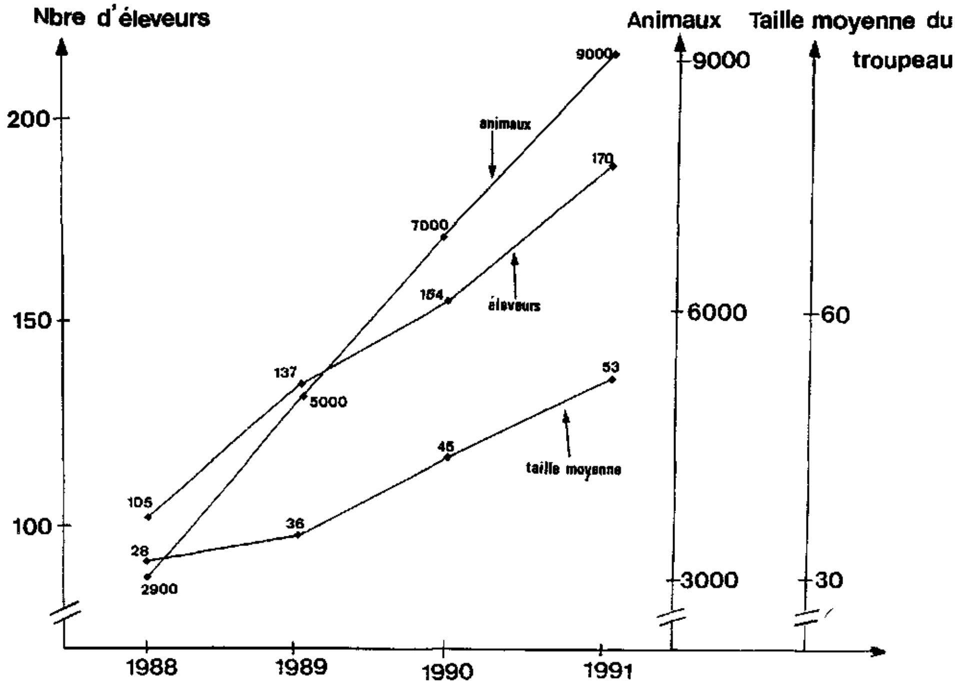

Figure 1. Evolution de la structure de l'élevage français de chèvres Angora.

Tableau 1. Taille des troupeaux et systèmes d'élevage en 1990 (sur 150 éleveurs).

	Proportion de troupeaux concernés (%)
Taille des troupeaux	
Moins de 50 chèvres	50
De 50 à 70 chèvres	30
Plus de 75 ch èvres	20
Système d'élevage	
Pâturage semi-intensif (pâturage en cultures fourragères)	50
Pâturage semi-extensif (pâturage et broussailles)	30
Zéro-pâturage	10
Autre	10

tités et qualités des toisons (finesse et absence de jarre; le jarre est une fibre cassante, sa présence constituant un caractère éliminatoire majeur dans l'évaluation de la toison). Un schéma collectif d'amélioration génétique devrait permettre d'augmenter les quantités produites, tout en conservant une qualité largement supérieure aux niveaux moyens mondiaux observés (Tableau 2).

Tableau 2. Performances moyennes des animaux de 18 mois, évolution et objectif.

	1988	1990	Objectif
Poids de la toison (kg/an)			
mâle	5.6	5.6	6.0
femelle	4.8	4.6	4.8
Diamètre de fibres (μ)			
mâle	36.2	35.7	34.0
femelle	32	31.5	31.0

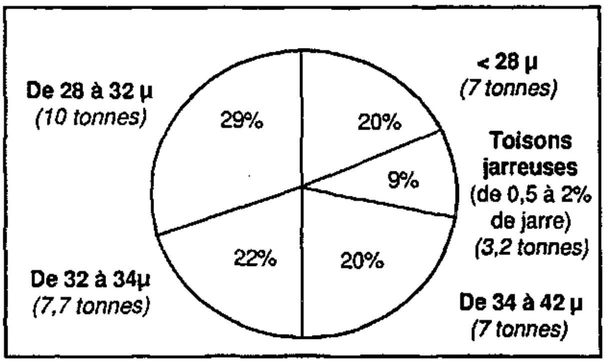

Figure 2. Qualités du mohair produit en France (diamètre des fibres en μ).

Répartie par qualités de finesse, la production française est remarquable par la proportion de fibres inférieures à 32μ de diamètre (Figure 2): près de 50%, contre moins de 25% en l'Afrique du Sud.

Une valorisation des toisons par la vente directe

Face à un marché mondial du mohair très fluctuant et des prix moyens largement inférieurs aux seuils de rentabilité dans les conditions d'élevage françaises, les éleveurs ont dû chercher une valorisation supérieure de leur production. La solution est venue à la fois grâce à une collaboration efficace avec les industries textiles et à la possibilité de toucher directement un potentiel d'acheteurs de produits finis en mohair.

Le mohair, produit de haut de gamme, avait déjà un réseau très établi d'industries de transformation et de distributeurs spécialisés. Importé d'Afrique du Sud, du Texas ou de Turquie, on estime que la consommation de mohair en France serait, au stade consommateur, d'environ 400 tonnes.

L'analyse de la chaîne des prix (Figure 3) depuis le stade 'toisons brutes' jusqu'au produit fini (exemple du fil à tricoter) nous montre les valorisations successives. Elles correspondent à chaque fois à des travaux bien déterminés (transformation textile, créations de modèles, publicité de marque, distribution,...) qui possèdent des coûts et des marges de profit. Chaque étape est néanmoins indispensable pour procurer au consommateur un produit fini achetable.

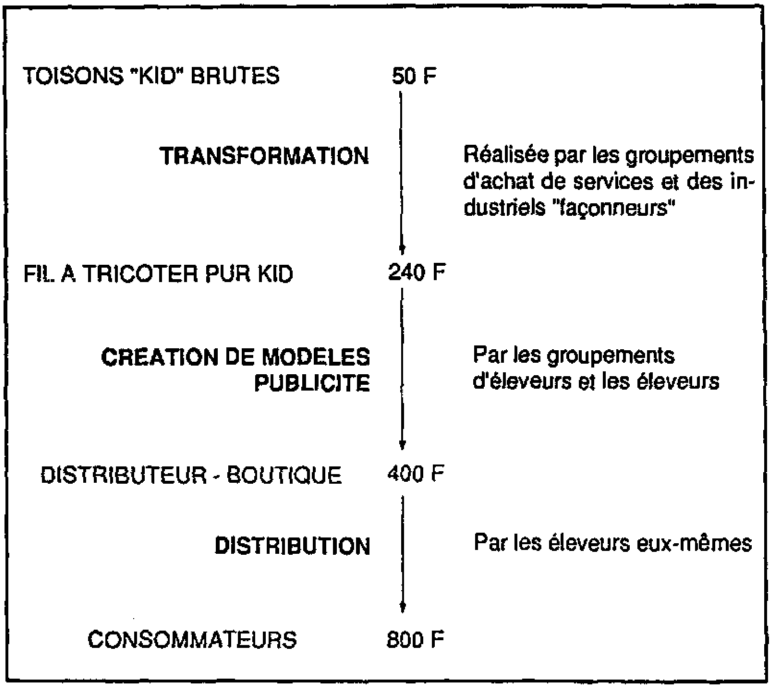

Figure 3. Les prix (par kg) et les acteurs dans la filière mohair.

Le pari des éleveurs français est de contrôler toutes les étapes de la filière afin de récupérer les valeurs ajoutées. Ceci n'est possible que par une collaboration étroite avec des industriels textiles possédant à la fois la machinerie et le savoir-faire, pour prendre en charge les différentes opérations de traitement des fibres: lavage, cardage, peignage, filature, teinture, conditionnement. Par des relations de 'façonnage', les éleveurs restent propriétaires de leurs produits tout au long de la chaîne. Il faut cependant que les quantités de matières premières soient suffisantes et de qualité homogène. Les éleveurs français se sont donc constitués en deux principaux groupements d'achat de services. L'opération de tri des toisons en fonction de la qualité permet de valoriser au mieux chaque lot (Tableau 3).

La partie essentielle demeure évidemment la vente du produit fini. Plusieurs systèmes de vente sont pratiqués par les éleveurs, pour atteindre, sans intermédiaires, le consommateur:

- vente à la ferme
- vente sur des foires et salons artisanaux
- vente par correspondance
- vente par démarchage.

L'éleveur doit donc également conjuguer des talents de commerçant. La France est sans doute le seul pays a avoir adopté ce système de commercialisation du mohair. Il permet une valorisation maximale.

Tableau 3. Différents produits finis selon les différentes qualitées de mohair.

Finesse de la toison (diamètre de la fibre)	Produits
23 à 27 µ	Ruban peigné de 26 µ – Fil 100% Super Kid – Echarpes, étoles
25 à 34 µ	Ruban peigné de 31 m – Fil à tricoter — 95% Kid Mohair – Fil à tricoter — 75% Kid Mohair + 25 % soie
34 à 42 µ	Ruban peigné de 35 m – Couvertures 100 % mohair – Plaids, tissus
Toison contenant un peu de jarre	Ruban cardé – Fil à tricoter — 80% mohair + 20 % laine

Conclusion

Ce type d'organisation de la filière porte en lui sa limite de croissance, car il suppose un double savoir-faire de la part de l'éleveur: producteur et commerçant. Or, les quantités commercialisables par chaque éleveur sont limitées. Au-delà de certaines quantités à commercialiser, il doit faire appel à des grossistes et des distributeurs qui vont diminuer d'autant le revenu de cette production.

Cashmere production in China

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Abstract

China produces 60% of the 5 000 t world cashmere production. Chinese fibre is only on average the finest, but it is mostly white and individual production is high, reaching 500g in the Liaoning breed. White males selectively-bred for improved production are distributed to peasant goat keepers in a government cross-breeding programme. Cross-bred offspring of black native goats growing 100g of fibre produce 300g of white fibre, which is harvested by combing.
Key words: cashmere, China, combing, fibre diameter, goat fibre.

Introduction

Goats were domesticated c. 9 000 BC probably where modern Turkey borders on Iraq and Iran. The bezoar wild goat *(Capra aegagrus)* was the main ancestor of the domestic goat *(C. hircus)*. There is no evidence that the markhor wild goat *(C. falconeri)* of Afghanistan contributed to domestic goats, but it is possible that the ibex *(C. ibex)* contributed to the cashmere type since it has more underwool than the other wild goats and its Asiatic range coincides with that of cashmere goats where wild ibex males are encouraged to mate with domestic females (Ryder, 1990a).

The three basic goat fibres are: ordinary goat hair, in which the outer hair rather than the underwool is used, cashmere, which is the underwool, and mohair, which lacks hair and is like the fleece of a sheep. A new fibre, cashgora originated from the 'grading-up' with the Angora of ordinary goats to mohair (Ryder, 1990b). It is appropriate to be speaking about a goat fibre in Adana because this area was famous for goat hair weaving in antiquity, and Turkey is the country in which mohair originated.

Most domestic goats have a hairy outer coat, which obscures short, fine underwool. This structure has changed little from that of the wild ancestor (Ryder, 1985). The thick 'guard' hairs of the outer coat provide physical protection, while the underwool ('down') gives thermal insulation. Cashmere fibre is the soft underwool of a double-coated type of domestic goat native to the mountainous region of central Asia. The name comes from the old spelling of Kashmir, which is where in the 18th century Europeans first encountered the fibre in woven shawls. There is no specific breed, but cashmere goats are generally white with spiral horns. They are distributed from northern China through Inner Mongolia and Xinjiang into Tibet and Mongolia, to Kirghizia in the USSR. Other down-producing goats are kept in the USSR, Afghanistan and Iran (Mason, 1981).

Chinese cashmere

Cashmere fibre has a similar diameter to the underwool of 'ordinary' goats. The mean diameter of commercial Chinese fibre, which is noted for fineness, is 15.5 microns, yet that of British dairy goats is frequently less than 14 microns (Ryder, 1985). Even the softness of Chinese cashmere is not unique since the finer any animal fibre becomes, the softer it feels.

Chinese cashmere goats have the distinction of growing more underwool than other double-coated goat. They also have more white animals. Grey fibre fetches only 80% of the price of the desired white product and tan fibre only 66%, therefore goats with a white coat have been selectively bred. The outer hairs average 15cm in length and can be coloured. Manufacturers prefer the underwool to be at least 4 cm in length. Any wool pigmentation is paler than that of the hair. The amount of hair remaining in the down after harvesting comes third after fineness and colour in the grading of the raw material.

40 million of the 70 million goats in China grow cashmere; 3 000 t of the estimated world production of 5 000 t cashmere is produced by China and its local industry uses 1 000 t. About 15% of the goat population are kept in the mixed farming area between the Yangtze Kiang and Yellow rivers, and 24% are kept in the pastoral area to the north of the Yellow river. This has hot summers and could winters and is where most of the cashmere goats are kept at an altitude of over 1 000 m. Nearly half the total production comes from Inner Mongolia. The Chinese say that it is impossible to produce cashmere at altitudes lower than 1 000 m or south of latitude 360, whereas genetic factors are important.

Although every area has its local variety of goat, from which cashmere is obtained, several breeds are known for their fibre (Jiang, 1986). These are the Mongolian breed of the north, and the Xinjiang of the region with the same name in the west, and the Tibetan breed of the south-west. The Liaoning breed is kept in the north-east and the Chengde Polled and Wuan breeds are kept in Hebei province, south of Beijing. The adjacent province to the south-east, Shandong, has the Jining Green.

Even though these breeds produce more fibre than the unimproved breeds of other countries, their production is very variable. The weight of cashmere grown by females ranges from 25–50g in the Jining Green breed, i.e. similar to the weight produced by British dairy goats, through the 120–140g production of the Chengde and Wuan breeds and the 200–300g of the Mongolian, Tibetan and Xinjiang, to the weight of 500 g grown by the Liaoning. This impressive individual Cashmere production, while maintaining fibre fineness, is double the national average of 250 g, and has been achieved by selective breeding. The Mongolian breed is also being selectively bred for increased production, and the Liaoning in particular is being used in cross-breeding to increase the amount of cashmere grown by native breeds.

Goats tend to be kept in areas with poor land that will not support more productive cattle and sheep, and despite the high price per kg, the income from cashmere per goat is low. Such areas have become economically backward because the existing native goats grow very little cashmere. There is a Government-inspired improvement programme in which males from improved breeds and in particular the Liaoning, are mated with females of local breeds in order to increase individual production. One such area I visited in 1988 was the Yanan area of Shaanxi Province in the Yen Shui valley.

Breeding

A visit was made to the local goat breeding centre run by the Yanan Institute of Animal Husbandry near Kanchuan. The improvement programme began in 1979 and although started by the Government, unlike other Communist countries, it is administered locally. Here improved animals of the Liaoning breed with at least 500 g production are being multiplied. Frozen semen as well as superior males are distributed to local peasant-owned herds. As yet embryo transfer has not been used owing to a shortage of practitioners. However, by 1988, 60 000 females had been 'overed' by the centre and 100 000 improved animals produced. Each county has a similar centre and so rapid and widespread progress is being made.

Liaoning goats are large, the females weighing 45 kg and the males over 50 kg compared with only 30 kg in native females. The local Zhi Wu Ling breed is black and grows only 100 g of fibre, whereas first-cross animals with the Liaoning are white and grow 300 g to 400 g of

Table 1. Fibre diameter measurements of Chinese cashmere goats.

Identity	Fibre diameter (microns)	Range	Means ± s.d.	Mode	Med. %	Pig. %
Wild goat						
(C. aegagrus)	9–17		12.3	11		
(C. falconeri)	7–23		12.5	9		
(C. ibex)	8–26		15.2	14		
Shah-tush	4–16		11.0	12		
Native Chinese breeds						
27/5(a)	10–20		14.0±2.8	14	0	35
		22–32	26.1±3.1	28	0	100
27/5(b)	8–18		12.8±2.4	12	0	4
		22–42	33.7±4.1	34	7	100
27/5(c)	8–18		11.1±2.4	10	0	54
27/5(d)	8–20		13.1±2.8	14	0	43
		46&56			50	50
Liaoning						
7/5 am	14–20	26–30	18.4±2.1	16	0	0
		34–58			20	
27/5 pm	12–30		14.9±3.2	14	0	0
		34–50			60	0
Native X Liaoning						
27/5(a)	10–22		13.7±2.3	14	0	0
		56			100	0
28/5(a)	10–20	24	15.3±2.6	14	0	0
		38–72			20	10
28/5(b)	10–18		14.0±2.4	12	0	0
28/5(c)	10–16	24–28	13.0±3.8	12	0	0
		34–56			100	0
Combing	10–20		14.3±2.4	14	0	0
		30&64			100	

Fibre diameters outside the main range are listed separately on the next line, and where these are hairs are not included in the mean.

cashmere. In this type of improvement, the commercial herds are also experimental. In some herds the first crosses were being crossed back to the Liaoning to give three-quarter Liaoning goats and in others the first-cross animals were being inter-bred.

Fibre diameter measurements made on samples taken in China are shown in Table 1 with some measurements from wild goats for comparison. They were from goats in the Yanan area of the Shaanxi Province taken on 27/28 May some weeks after the spring moult and combing on 10 April. The fibres were plucked from different parts of the body and so were not standard.

Separate means for the fine hairs were calculated for the first two samples, which the uninitiated observer is likely to have regarded as a single population of underwool fibres. I was led to interpret these as regrowing hairs, however, by the big contrast in pigmentation-the coarser ones being black, which is feature of hairs. A notable feature of all these samples is the narrow range of diameter. The similarity of the modes to the means indicates a desirable symmetrical distribution. The only sample with a mean diameter outside the acceptable range is one from a Liaoning, but the crossbreds are all good, having the fine diameter of the native breed and the whiteness of the Liaoning.

Chinese fibre diameter figures for the Liaoning indicate a mean of 17 microns, compared with 15 and 18 in Table 1. There were no Chinese figures for the native breed, which range from 11 to 14 microns.

The proportion of pigmented fibres ranged from 54% down to 4%, showing that even black goats can have nearly white underwool. The diameter values from the Liaoning cross native goats had an acceptable range from 13 to 15 microns.

Goat husbandry

Each 15 km-long side valley has 30–40 herds of about 40 goats, and they are grazed on the scrub above the cultivation terraces on the sides of the valley. The lack of fences necessitates continous herding and the goats are brought back to the village each night. They still go out in winter, but are then given hay and maize stalks as supplementary feed. In the goat-breeding centres alfalfa/lucerne is grown as feed. The goats spend the night in caves tunnelled into the loess of the almost vertical valley sides. This efficient system provides warmth in the extreme cold of winter and coolness in the great heat of summer.

Fibre harvesting

I also saw the way in which the goats are combed to harvest the fibre, which has also been described and illustrated by Li (1988). The combs used are made of eight metal rods, which are folded to make a handle and sixteen teeth, the ends of which are curved and sharpened. Change in the tooth gap is possible with a metal slide that moves the rods either closer together or further apart. The goats are first tethered in a standing position so that the length of the outer hair can be shortened by clipping. The animals are then tethered lying down for combing with short, pulling strokes, first with a coarse comb and then with a fine one. The great length of the teeth allows the fibre to pass up the comb, which means less frequent clearing of the comb in contrast to the shorter-toothed combs used in the West. The whole process takes 30 minutes, and is justified by the quality and value of the fibre.

In this way the fibre is combed out of the hair in a efficient system. But it is important to have hair that is longer than the down. It may well be impossible to comb cashmere goats that have been bred with down that is longer than the hair. After combing, the remaining hair is cut off, the two crops of hair providing another commodity for sale. This indicates that the hair is replaced before the down during the moult. The combing must be carried out during the spring moult (April-May) after the fibres have been released from the skin. Since the annual growth cycle is controlled by day-length and to some extent by nutrition, which stimulates the new growth, some variation in latitude is to be expected.

Around Yanan, which is towards the south of the cashmere-growing region, combing is carried out during the last three weeks of April into May, and it was said that most animals were ready for combing about the same time. Early June used to be quoted as the combing date in China, which may refer to Inner Mongolia to the north. This compares with some dairy goats studied in Scotland (Ryder, 1966), but is in contrast to deer and sheep, which begin to regrow their coat in April after the spring equinox.

Goats are combed in Siberia as early as February and are combed a second time 2–3 weeks later. These could well be goats of a different strain with a longer growth period. Trials carried out from 1984 to 1987 while I was at the Macaulay Land Use Research Institute in Scotland showed no advantage in combing a second time. There, barren females and males might be ready for combing in April, but lactating females not until june, which indicates the importance of nutritional status. Nutrition takes us back to China where goats are starved for a day before combing, which is interesting because (a) nutritional stress is known to be one cause of hair loss, and (b) the Romans used to starve animals before combing for fibre. In Afghanistan and Iran as well as in modern Australia the goats are shorn. This makes the de-hairing during textile processing more difficult.

Marketing

At the time of my visit during 1988 as part of the liberalisation of the economic system the government had given greater independence to peasant farmers, permitting them to sell direct to their customers. Although this gave higher prices to the peasants, it became difficult for buyers to obtain suitable lots of fibre through lack of a central collecting and grading agency. An unforeseen result was a deterioration in the standard of presentation of the fibre. Central control was resumed in 1991 to provide strict quality control with realistic prices, which are expected to bring back stability to the world cashmere market.

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Opportunities for cashmere production

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Abstract

Turkey has played an important part in the development of goat fibre industries. It is the home of the Angora goat which has played a significant role in the improvement of down fibre production in the USSR, the Mediterranean Basin, the Middle East and the New World. This paper reviews the influence of the Angora goat on down (Cashmere) production and possible development of down fibre production of native goats as a supplementary form of income to milk and meat. Details are provided on the down fibre production of native Turkish goats and low cost methods for selection of higher performance for cashmere production. It outlines details of experiments in Australia which increased down production by 57% by the use of cross-breeding with Angora goats.

Keywords: Cashmere, Cross Breeding, Selection, Turkey

Introduction

Turkey has played an important part in the development of goat fibre industries. It is the home of the Angora goat which has a history older than the written records of man (Tuncel, 1987). Virtually all the fibre-producing goats in Europe and Asia are found in an area roughly bordered by 35°–55° latitude north and 50°–120° longitude east. From west to east, the down production of the native goats decreases progressively as down m.f.d. Goats neighbouring Turkey, where Angoras originated, have the highest fleece weights and are coarsest. The gradual spread of Angora influence in an easterly direction explains the down production and m.f.d. gradient along with the reported high production of down the native Don and Orenburg goats. Certainly of recent years, the Russians have deliberately used Angoras in programs to increase total fibre production. However, the breeding aims with regard to fibre diameter were not clearly stated.

Cashmere

There is considerable debate and problems in defining cashmere fibre (Couchman, 1984a; Teasdale, 1988; Tucker et. al., 1988; Phan, 1988). There are also problems defining a breed type for Cashmere goats. This leads us to state that there is no such animal as a 'Cashmere Goat' but many types of goat which grow cashmere. This is a subtle but important difference.

Many animals are two-coated, producing a guard hair from primary skin follicles and down fibres from the secondary follicles. Most goats are included in this category. Angoras have highly developed secondary fibre goats (mohair), produced from secondary follicles with guard hair remnants (kemp) from the primary follicles (Duerden and Spencer, 1930; Hardy, 1927). Some goats, particularly those from Central Asia, produce sufficient down fibres to make harvesting economical. These formed the basis for supplies of fine fibre, acceptable to manufacturers as 'cashmere'.

Table 1. Reported fibre diameter profiles by author and origin.

<table>
<tr><th>Author</th><th>Type</th><th>5–10 μm</th><th>10.1–15 μm</th><th>15.1–20 μm</th><th>20.1–25 μm</th><th>25.1–30 μm</th><th>mfd</th></tr>
<tr><td>Burns et al., 1962</td><td>Chinese</td><td>5</td><td>55</td><td>34</td><td>5</td><td>1</td><td>15.1</td></tr>
<tr><td></td><td>Afghani</td><td>1</td><td>34</td><td>33</td><td>11</td><td>1</td><td>16.5</td></tr>
<tr><td>Von Bergen et al., 1948</td><td>Chinese</td><td>3</td><td colspan="2">92</td><td colspan="2">5</td><td>14.8</td></tr>
<tr><td></td><td>Iranian</td><td>-</td><td colspan="2">61</td><td colspan="2">37</td><td>19.5</td></tr>
<tr><td>Utkanlar et.al., 1963</td><td>Turkish</td><td>-</td><td colspan="2">76</td><td colspan="2">24</td><td>17.6</td></tr>
<tr><td></td><td>Indian</td><td>-</td><td colspan="2">93</td><td colspan="2">7</td><td>15.4</td></tr>
<tr><td></td><td>Pakistani</td><td>-</td><td colspan="2">99</td><td colspan="2">4</td><td>14.7</td></tr>
<tr><td></td><td>Iranian</td><td>-</td><td colspan="2">96</td><td colspan="2">4</td><td>15.2</td></tr>
<tr><td>Altinbas, 1976</td><td>Turkish</td><td>-</td><td colspan="2">81</td><td colspan="2">18</td><td>16.3</td></tr>
</table>

Mean fibre diameter has traditionally been the most recognised methods of separating fibre types and this is particularly so with Cashmere with individual animals ranging in diameter from 11 μm to 26 μm. Commercial quantities of cashmere range from 15–21 μm depending on definition, use and author (Couchman, 1984a).

Fibre diameter profiles have been used by various authers in describe cashmere form different origins. Burns et al. (1962) reported fibre distribution profiles for commercial shipments of Chinese and Afghan cashmere, over a 15 year period up to 1959, in which the percen- tage fibres falling in micron ranges were studied. Utkanlar, Imeryüz, öznacar and Müftüoglu (1963) given work by von Bergen and Mauersberger (1948) when studying Iranian down and also compared profiles of Turkish, Indian, Iranian and Pakistani down. Altinbas (1976) also reported mfd profiles.

The Turkish profile provided by Utkanlar et al. suggests an Angora influence in those goats. The mean fibre diameter found in the Iranian sample by Utkanlar et al. is finer than that reported elsewhere and that normally expected from Iranian cashmere; i.e. 19.5 μm, has adding credence to Wildman's argument that Iranian down has, in fact, been devided from animals with an outside influence. This influence may be from the Angora, due to the close proximity to Turkey, the home of the Angora.

Selection and crossbreeding over the last 50 years in Russia has resulted in increases in down production and m.f.d. In virtually all the goat strains studied the increases are relative to the initial production levels and in crossbreeding to sire types. The upper limit of acceptable mfd. for down has been 25 μm and no attempts are apparent to limit mfd. to a range accepted as cashmere by western processors, i.e. 19 μm.

Couchman (1987) warned about translations and terminology when referring to reported production levels of cashmere goats. This warning is still very relevant. Method of harvest and definition of yield is extremely important in this regard. There are huge differences between total fleece weight obtained by combing (traditional methods) and that by shearing. To illustrate this point, Couchman (1984a) combed half the body and sheared the other half, with sheep shearing equipment. The fibre harvested weighed 132 g and 217 g, giving percentage yields by weight of 67% and 47%, and total greasy down weights of 88 g and 102 g respectively. The low greasy down weight for the combed side indicates the quantity of down remaining on the animal, as the down fibres are not all shed simultaneously. These relationships were confirmed in later studies.

Crossbreeding studies

Couchman (1984a,b) reported on cross breeding in Australia between Angora and cashmere bearing goats. This led to the development of Cashgora and use of that technique in New Zealand. These methods were not dramatically different from those employed by Poloncean nearly 170 years previously. He crossed Kinghir goats with Turkish Angora's in France. Some of those goats ultimately found their way to Australia (Riley, 1982).

Couchman (1984a,b) suggested that a judicious infusion of Angora genes into cashmere goats could substantially improve cashmere production. He showed that by crossing Angoras with feral (or native type) goats then backcrossing F1 's to ferals, increases of down production of 57% ($P<0.001$) for the 1/4 Angora animals as compared to the selected feral stock occurred. This was associated with only an increase of 0.6 µm in mfd. These increases were as predicted, with increases in fibre length and yield. It was concluded that as the level of Angora infusion increases so also did all the raw fibre characteristics; total fibre, yield, down mfd, down length, and grease content. Increases in mfd are observed in crossbred progeny however differences in comeback (1/4 Angora) progeny were substantially less than in the first cross and fell between the F1 and the native/feral strains. Increases in mfd. are documented due to increased age, the increase being greater in crossbreds in pure natives.

This has been seen in Australia but under very different climatic conditions. In temperate climates where body weight increases significantly in the first year, diameter also increases up to 2 µm to subtropical climates with high moisture content pastures, animals take longer to reach the same body weight and as a consequence take longer to reach similar mean fibre diameters. This may be explained by work by McGregor (1988). He showed that energy deprived goats preferentially diverted nutrients towards cashmere growth although they grew less and finer cashmere.

Couchman (1988) also reported on cross breeding studies with Australian cashmere goats and South African Boer goats a meat breed crossbreeding increased the down producing ability of the meat goat and could provide supplementary income to the major goat enterprise without detriment. Boer females, clossed as low down producers had 13 g, of 17.7 µm down harvested. Progeny of these and selected cashmere males produced 43 g of 16.2 µm down.

It seems, therefore, that it is possible to increase down production by using either highly developed down producers or a judicious-Angora infusion to increase cashmere production.

Turkish goat fibre production

Turkish goat fibre export statistics (Table 2) for 3 years are shown with corresponding prices received in $US. Whilst the mohair prices appear to be similar to world quotations the value for cashmere appears low.

Table 2. Turkish Goat Fibre Exports Value (1987–90).

	Quantity (tonnes)			Price/kg ($US)		
Description	1987	1988	1990	1987	1988	1990
Coarse Hair	222.3	344.8	338.1	1.19	1.08	1.22
Fine Hair	29.4	57.9	196.7	9.09	15.70	11.17
Cashmere	-	0.25	1.5	-	28.50	16.33
Mohair	3781.5	1335.0	193.0	5.23	4.06	3.77

Table 3. Body measurements, down-yield and diameter from Turkish goats.

Animal	Body Measurements			Cashmere		
	Girth (cm)	LWT (kg)	Area	Yield (%)	MFD (m)	s.d.
1	77	34.0	349 981	4.4	16.31	3.50
2	67	22.6	325 801	8.1	15.32	3.50
3	81	39.1	457 796	2.7	16.68	3.69
4	61	17.0	219 930	10.3	14.18	3.51
5	79	36.5	386 252	11.3	17.17	3.32
6	90	57.3	441 514	24.6	19.01	4.08
7	71	26.9	339 283	4.7	16.65	3.52
8	78	35.3	426 995	7.2	14.53	3.11
9	72	28.0	359 916	3.4	17.30	3.48
10	68	23.6	258 394	7.6	15.12	3.10
11	83	41.7	493 772	2.2	17.80	3.68
12	71	26.9	396 396	1.8	15.84	4.50
13	78	35.3	358 070	6.8	15.45	2.98
14	74	30.3	404 813	4.1	18.77	3.94
mean	75.4	32.5	374 400	7.1	16.44	3.57
s.d.	8.26	9.93	73 722	5.83	1.47	0.40

Down production from Turkish goats is similar to that of other non-selected populations with animals producing between 50–100g combed fibre which is usually harvested in mid spring (April-May). Australian studies show approx, 67% yield from combed fleece, which translates to a cashmere production of about 33.6 g/head.

Altinbas (1976) reported down weights ranging from 36–107 gm (mean 55±13.5) from total fleece weights averaging 423 gm (i.e. 13% yield). That study of adult female Kilis goats ranging in colour from light grey to black showed no association between down production and colour nor with fibre length or diameter, Tuncel (1982) found low, but significant, correlations for down length and diameter.

Shorn fleece samples were collected from 14 females each of these animals had body measurements taken in the manner reported by Couchman and McGregor (1983) and these together with cashmere yield and diameter are shown in Table 3. Two other animals were combed and the combed fleece tested for yield (49.9% and 62.8%) and diameter (16.45 µm and 16.55 µm). Body weights were estimated using the heart girth measurement and a formula developed from studies by Couchman and McGregor (1983). The correlation between mfd and yield was low (r= 0.22) with the linear model being Y= 0.85 mfd – 0.698. The low yield was influenced considerably by the presence of extremely long guard hair. The apparently low down produc- tion could be influenced by lactation and low dietary energy both of which have been shown to be significant in Australian goats. In addition, selection for cashmere production is likely to improve down weights significantly. Higher down weights are possible as some fibre is undoubtable shed before combing. Two other samples, from these goats have shown a mfd of 14.01 and 16.40 µm with both showing a CV of 24.5%. The number of fibres >27 µm was 0.9% in both cases which indicate high quality of fibre.

Table 4. Goat numbers and production in agricultural regions of Turkey.

Region		Goats type	Goats number (10^3)	Hair/ Mohair (tonnes)	Milk (tonnes)	Meat (tonnes)
Mid-North	(I)	Hair	419.7	180	11.8	1 840
		Angora	1 072.4	1 310	12.2	1 400
Egean	(II)	Hair	2 055.4	685	61.7	4 310
		Angora	9.6	-	90.0	-
Marmara	(III)	Hair	364.4	225	16.1	1 065
		Angora	260.0	-	-	10
Medit'ean	(IV)	Hair	2 577.3	665	76.3	4 775
		Angora	1.1	-	-	50
N.E.	(V)	Hair	479.2	195	19.3	620
		Angora	900.0	-	-	5
S.E.	(VI)	Hair	2 681.7	1 325	87.6	4 945
		Angora	71.6	65	605.0	210
Black Sea	(VII)	Hair	190.9	85	5.7	670
		Angora	101.2	95	590.0	75
Mid. East	(VIII)	Hair	923.7	465	33.3	3 280
		Angora	2.1	-	-	-
Mid. South	(IX)	Hair	635.9	295	13.6	805
		Angora	354.8	305	3.3	210
Total		Hair goats	10 328.2	4 120	325.6	22 310
		Angora	1 613.9	1 775	16.7	1 955

Goat production is an important agricultural enterprise in Turkey. There are regional differences in both goat numbers, types and fibre production (Table 4). Coarse fibre is not harvested in all areas because of low value or difficulty of harvest in herding operations. Commercial dehairing of the fibre, to separate the cashmere from the coarse guard hair, should not be difficult as the diameter differential is excellent, with the guard hair being in the vicinity of 70–75 µm and 116 mm in length (Tuncel, 1982).

Differences in the statistics from Tables 2–4 appear difficult to reconcile, however it should be pointed out that data in table 2 refers to axports. Averages calculated from replies received from a survey of the Department of Agriculture in 70 provinces, indicate the coarse hair and down production to be 9 200 and 53 tonnes respectively. The 53 tonnes of down at an ACWC yields of 67% would equate to 35.5 tonnes. At world prices this would be valued at $US 3.1 m. These figures, clearly highlight the opportunity for Turkey to earn valuable export returns from cashmere and with selection within the goat population for those types which no doubt have some Angora influence to improve production levels considerably.

Selection methods do not have to rely on expensive test methods. As a result of research to investigate heritability of production traits and selection programmes, it is now possible to select with a reasonable degres of cost effectiveness on the basis of total fleece weight alone.

Couchman Wilkinson (1988) reported on the relative economic gain with the use of a series of selection indices including total fleece weight alone. Compared to a selection index which included the major production traits of total fleece, greasy yield, down weight and mean fibre diameter, greasy yield and diameter requiring relatively expensive technology.

The selection of animals on the basis of total fleece weight alone had 81% of the relative economic value and therefore little gain is lost if this trait alone is used. Use of this method of selection reduces the reliance on technology and reduces selection cases significantly.

Luxford, Scheurmann and Couchman (1988) showed that even with the use of technology it was possible to reduce the cost of selection significantly. This can occur without a significant loss in genetic gain by a series of selection procedures. These include subjective assesements of females at weaning, measurement of fibre length on animals and total fleece weight with very limited testing of young sires for mean fibre diameter.

The correlations of fibre length and down weight and mfd and yield with a limited number of animals in both the present and Altinbas' study were not good and more work is required for this relationship with Turkish goats.

Conclusion

There is ample evidence that the use of crossbreeding native breeds of goats, maintained for both meat and milk production, with improved cashmere producing goats. Of backcrossing to Angora/native goats will increase cashmere production substantially. It must be recognised however that a great deal of attention has to be paid to ensure mean fibre diameter is constrained to acceptable limits, set by the specialty animal fibre processors. There is however, considerable debate on the definition of cashmere and commercial vested interests play a large part in that debate.

As is common with all fleece producing animals, it is relatively easy to increase fibre weights, it is not so easy to achieve this whilst resthicting fibre diameter. Techniques developed in Australia and the USSR clearly indicate that significant supplementary income can be derived from goats, maintained for meat and milk production, through the production of cashmere down with little detriment to the primary income source.

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Breeding objectives for Australian cashmere goats

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Abstract

In this paper we described all the steps involved in the development of breeding objectives for Australian Cashmere goats. We also assessed the consequences of selection for a few scenarios that may be encountered in practice. The model developed enables the incorporation of additional traits that may become important, as well as the investigation of several aspects of interest, such as the effect of variations in herd composition, product values and costs, and phenotypic and genetic parameters. The objectives developed under different assumptions can be compared, thus enabling us to provide better informed answers to questions raised by breeders.

The Australian Cashmere goat industry is relatively new. The initiative and vigour displayed by its leaders augurs well for its future. It is in a unique position, being able to benefit from the experience and knowledge accumulated by other Australian livestock industries, and without any of the constraints sometimes imposed by tradition. The adoption of a scientific approach, such as that presented here, for the resolution of the problem of defining breeding objectives could have highly desirable effects in the overall efficiency of Australian Cashmere goat breeding programmes.

Introduction

The development of the breeding objective is a crucial step in the design of a programme of genetic improvement. The breeding objective is the combination of traits which we wish to improve because of their influence on the profitability or the economic efficiency of the Cashmere goat enterprise. It is important to recognise that defining the breeding objective is a question of economics, not of genetics (James, 1987). The economic value of a trait in the breeding objective does not depend on how easily it might be improved or measured, but rather, on what effect a change in the trait, if it could be made, would have on profitability or economic efficiency. By contrast, genetic considerations are relevant in the choice of selection criteria, the characters measured or assessed on individuals or their relatives, and used in the estimation of breeding values of potential replacements. Traits in the breeding objective may or may not be used as selection criteria, depending on the cost, feasibility and technical difficulty of their recording. The selection criteria may include characters not present in the breeding objective. An exact correspondence between the set of traits in the breeding objective and the set of characters used as selection criteria is very rare indeed.

Breeding objectives for Cashmere goats have been proposed by a number of authors (e.g. Gifford, 1988; MacLeod, 1988; Nicoll, 1987; Pattie and Restall, 1984, 1987a,b). In this paper we present a profit equation for Australian Cashmere goats. Economic values were derived expressing this equation as a function of biological traits. Based on procedures described by Jones (1982) and Ponzoni (1986a,b, 1988a,b) a number of refinements were used, namely:

1. Application of the discounting technique of McClintock and Cunningham (1984);
2. Separation of traits expressed in non-breeding animals (young goats, up to 12 mo of age), and breeding does (1.5 to 5.5 yrs);

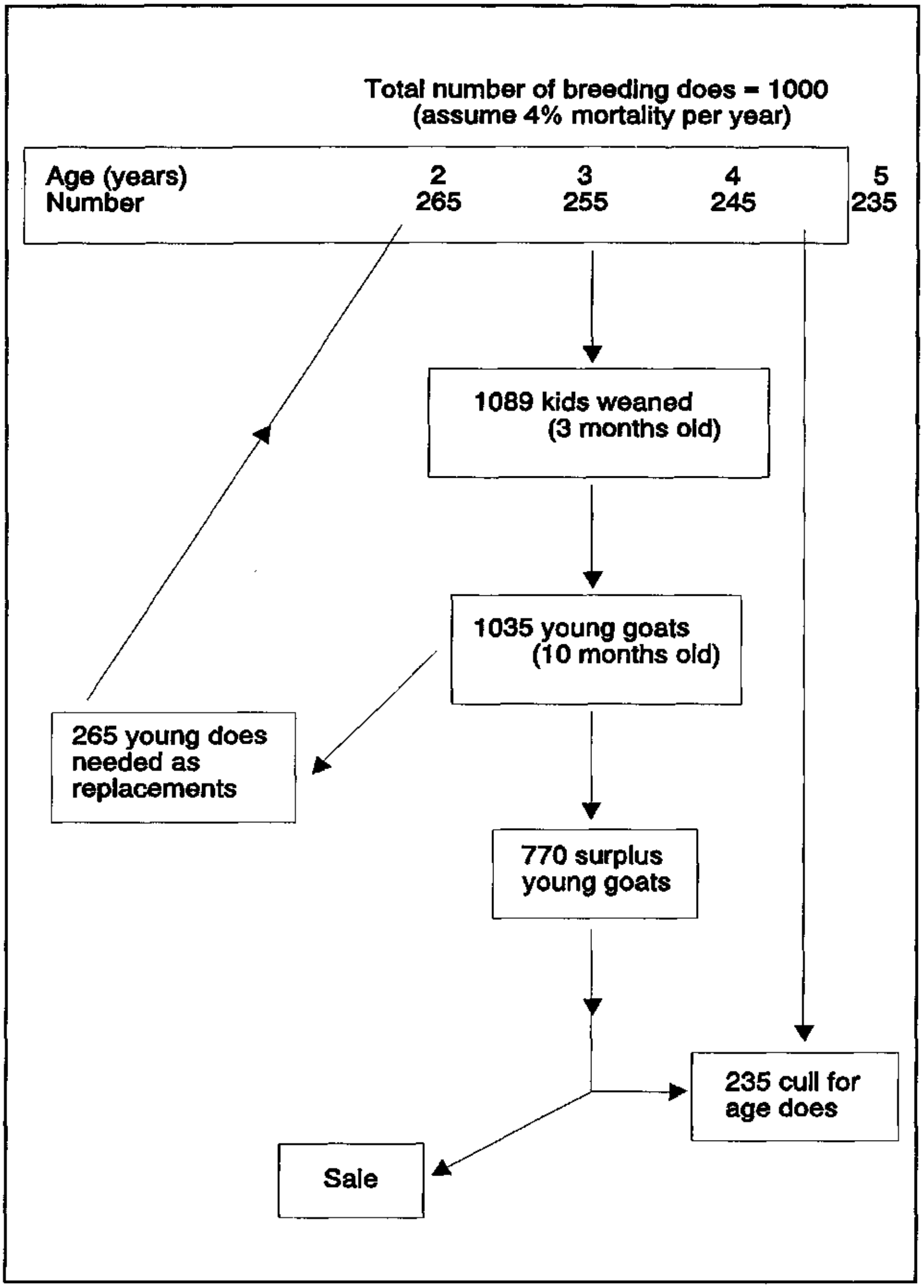

Figure 1. Herd composition.

3. Accounting for all variable costs associated with production, harvesting, and marketing of down and surplus offspring;
4. Maintaining stocking pressure (i.e. total feed intake) constant. The likely consequences of some possible selection strategies are discussed.

Development of the breeding objective

Any future large-scale Cashmere goat industry is likely to have a hierarchal structure in which breeding herds (breeding their own male and female replacements) and commercial herds (purchasing replacement males from breeding herds) can be distinguished. With such a structure the commercial herds would produce virtually all the fibre and surplus goats for slaughter, but would be entirely dependent on the breeding herds for long-term genetic improvement. Decisions on breeding objectives made by buck breeders would influence the magnitude and direction of genetic change occurring in commercial Cashmere herds. Thus, the objectives for buck breeders should be developed from a consideration of their clients' (the commercial producers) goals. The development of the breeding objective involves the following four phases (Ponzoni 1986a):

1. Specification of the breeding, production and marketing systems
2. Identification of sources of income and expense in commercial herds
3. Determination of biological traits influencing income and expense
4. Derivation of the economic value of each trait.

Specification of the breeding, production and marketing system

Australian Cashmere goats originate from selected samples of feral goats. In some instances crosses with Angora goats have taken place in an attempt to increase fleece production. However, such crosses are simply part of an upgrading programme aimed at a more productive Cashmere goat. The nature and requirements of specialised down production are similar to those of wool production. The interests of the Australian Wool Industry are well served by one breed (the Merino), which is used almost exclusively in purebreeding (for the purpose of wool production). It is reasonable to postulate that, similarly, the interests of the Australian Cashmere industry would be well served by a specialised breed (the Australian Cashmere goat) used almost exclusively in purebreeding.

Specification of the production and marketing system involves consideration of how animals are fed and managed, the age composition of the herd, the replacement policy and age(s) of the slaughter animals. We assume an established and stabilised Cashmere goat industry, such that all surplus animals from commercial herds are slaughtered for meat. The feeding regime is that of grazing animals, with the constraint that the total amount of forage is fixed. This is a justifiable constraint for a producer who wishes to maintain the total grazing pressure on his farm constant (e.g. because an increase could lead to pasture degradation, whereas a decrease would result in feed under-utilisation) (James, 1986). It was also assumed that standard management practices (e.g. drenching, lice treatment, vaccination, veterinary assistance, etc.) were undertaken. Figure 1 shows the herd composition. Defining herd composition aids in identifying age and numerical distribution of the herd, the number of replacements required each year, the number of animals of all classes available for market each year, and is required in the calculation of the economic values, as not all traits are expressed with the same frequency, or at the same time. The commercial Cashmere goat herd was assumed to consist of breeding does, with all surplus offspring being sold at approximately 10 months of age. Does are first mated when they are 18 months old, and are culled for age at 5.5 years.

Identification of sources of income and expense in commercial herds

The identification of sources of income and expense in commercial herds enables the development of a profit equation, where profit (P) is a function of income (I) and expense (E):

$P = I + E$,

which can be expanded as:

Income (I) = young goat's fibre × value per kg
+ breeding doe's fibre × value per kg
+ surplus offspring × value per individual
+ cull doe × value per individual

and:

Expense (E) = offspring (birth to young goat) feed intake × feed cost per kg
+ breeding doe's feed intake × feed cost per kg
+ kid husbandry costs
+ young goat husbandry costs
+ breeding doe husbandry costs
+ young goat's fibre × cost of harvesting and marketing per kg
+ breeding doe's fibre × cost of harvesting and marketing per kg
+ surplus offspring × cost of marketing per individual
+ cull for age does × cost of marketing per individual
+ fixed costs

Fixed costs are those incurred by the producer (e.g. rates, interest charges, business costs) independent of the level of herd production. All other costs are known as variable costs and vary with the level of herd production. Note, however, that in the present case we assume that total feed intake (i.e. offspring plus breeding does) is constant and that both classes of goats have access to feed of the same quality.

Prices of down and slaughter animals, as well as husbandry, harvesting and marketing costs are shown in Table 1. Down prices were taken from the market report of the Australian Cashmere Marketing Corporation, December 1988. Other product values and production costs were obtained from the publications "Farm budget guide 1989" (compiled by Stock Journal Publishers Pty Ltd) and Mowatt (1989).

Determination of biological traits influencing income and expense

Now the profit equation is expressed as a function of biological traits that impact on income, expense, or both. Such biological traits are listed in Table 2.

Income derived from down was assumed to be affected by the weight of fibre sold and its fibre diameter. Because of the differences between young goats and breeding does in the quantity and quality of down produced (e.g. Gifford et al. 1989), and based on evidence from sheep (Lewer et al., 1983; Atkins and Mortimer 1987) it was decided to consider the expressions in the two goat classes as separate traits (i.e. yDW and yDD for young goats, dDW and dDD for breeding does). This separation also facilitates accounting for the costs of harvesting and marketing the fibre. It was assumed that the colour of the fibre was white. This seems a reasonable assumption for long-term planning, given the widespread acceptance among processors that white fibres (this applies to wool, mohair and down) are preferable because they pose no limitation to the range of colours to which they can be dyed. The inheritance of colour in goats is not completely elucidated (Nicoll, 1987), but nevertheless some breeders have succeeded in combining acceptable levels of down production with white colour. Other quality traits such as fibre length and fibre diameter variability were not included in the breeding objective because at present their economic significance is unclear.

Table 1a. Prices of down and slaughter animals.

Product	Class of goat	Value
Down	Young goat (10 mo old)	136.48[1] ($/kg)
	Breeding doe	92.79[2] ($/kg)
Surplus offspring	Young goat (10 mo old, 16.6 kg live weight)	18.00 ($/head)
Cull for age animals	Breeding doe (34.0 kg live weight)	12.00 ($/head)

Table 1b. Husbandry, harvesting and marketing costs.

Activity	Class of goat	Cost ($/head)
Husbandry	Young goat	1.25
	Breeding doe	0.80
Fibre harvesting and marketing	Young goat	2.80[3]
	Breeding doe	3.33[3]
Marketing of surplus goats for slaughter	Young goat	4.77[3]
	Breeding doe	4.47[3]

[1] Weighted average (if the average fibre diameter is 15.8 microns (μ) and the standard deviation is 0.94 μ, then the proportion of fleeces of < 16.0 μ, 16.0 to 16.5 μ and > 16.5 μ is 0.58, 0.19 and 0.23, with prices per kg equal to $ 149.50, $ 142.30 and $ 98.10, respectively).

[2] Weighted average (if the average fibre diameter is 17.5 μ and the standard deviation is 1.28 m, then the proportion of fleeces < 16.0 m, 16.0 to 16.5 m, 16.5 to 18.5 m and > 18.5 m is 0.12, 0.10, 0.56 and 0.22, with prices per kg equal to $ 149.50, $ 142.30, $ 98.10 and $ 25.50, respectively).

[3] Some of the components of these costs are calculated on a per kg or per value ($) of the product rather than on a per head basis. This was taken into consideration in the derivation of economic values.

Income derived from surplus offspring is influenced by the number available (NKW) and their weight (yLW). The same traits affect the costs of husbandry and marketing of animals. The number of cull for age does was assumed to be constant, so income and expense from their sale is affected by their live weight (dLW) only.

Feeding represents a major cost of the goat enterprise. Feed intake of offspring (oFI) and of breeding does (dFI) were considered as separate traits, in a format equivalent to that in Ponzoni (1986b) for Merino sheep.

Derivation of the economic value of each trait

Here we define the economic value of a trait as the change in profit (P, as defined earlier) resulting from a unit change in that trait, assuming all other traits remain constant. The constraint of maintaining constant stocking pressure (oFI plus dFI) was imposed. This constraint affected the economic values of NKW, oFI and dFI, but not of other traits. All

Table 2. Biological traits included in the breeding objective of Australian Cashmere goats.

Effect on profit	Product or activity	Class of goat	Traits
Income	Fibre	Young goats	Young goat down weight (yDW), young goat down diameter (yDD), number of kids weaned (NKW)
		Does	Doe down weight (dDW), doe down diameter (dDD)
	Surplus offspring	Young goats	NKW, young goat live weight (yLW)
	Cull does	Does	Doe live weight (dLW)
Expenses	Feeding	Offspring (birth to young goat age)	Offspring feed intake (oFI), NKW
		Does	Doe feed intake (dFI)
	Husbandry	Offspring (birth to young goat age)	NKW
	Fibre harvesting & marketing	Young goats	yDW, yDD, NKW
		Does	dDW, dDD
	Marketing of surplus goats for slaughter	Young goats	NKW, yLW
		Does	dLW

Table 3. Characters chosen as possible selection criteria.

Source of information (relative)	Characters[1]
Young goat (individual)	Down weight (yDW)
	Down diameter (yDD)
	Down staple lenght (yDL)
	Live weight (yLW)
Breeding doe (dam)	Number of kids weaned — one record (dNKW)

[1] Often only a sub-set of the characters listed here would be recorded. The sub-set involved is given for the cases studied here.

economic values were calculated by evaluating P numerically at the average value for all traits, then evaluating it after incrementing by one unit the trait in question (thus obtaining P*), and taking the difference P*– P.

Not all traits in the breeding objective are expressed with the same frequency, or at the same time in commercial herds. To account for this we used the 'discounted gene flow' method (McClintock and Cunningham, 1974). A discount rate of 5 per cent was applied and a period of 15 years and all generations in which there was trait expression were considered. Details of all the calculations are given elsewhere (Ponzoni and Gifford, 1990).

Choice of selection criteria

The development of the breeding objective involves making decisions of an economic nature. It is not until we begin making considerations about the evaluation of animals that genetic considerations are strictly relevant. Some traits in the breeding objective may be difficult or expensive to measure, whereas there may be characters highly correlated genetically with traits in the objective, but that are not themselves included in it. This is the reason why only very rarely there will be an exact correspondence between the set of traits in the breeding objective and the set of characters used as selection criteria.

Table 3 shows the characters chosen as selection criteria and the information from relatives assumed available for the examination of the consequences of selection. The characters were chosen because their recording is feasible on-farm and because of their genetic correlations with the traits in the breeding objective. The heritabilities, genetic and phenotypic correlations assumed (appendix, Table A1) among all traits (breeding objective) and characters (criteria) in our calculations were chosen after a search of the literature (Gifford et al., 1989; Pattie and Restall, 1989; Restall and Pattie, 1989; Wickham and Parratt, 1988). In some instances (notably for feed intake) information was very limited and some guesses had to be made.

Results and discussion

Economic values and contribution of each trait to overall gain in economic units

Table 4 shows the traits included in the breeding objective and their economic value, the absolute value of the product of economic value and additive genetic standard deviation, and the percentage gain in economic units accounted for by gain in each trait. Selection was on an index combining information on yDW, yDD, yLW and dNKW (see Table 3). A positive (negative) economic value indicates that greater (smaller) values of the trait are associated with increased profitability. However, the magnitude of the economic values expressed in actual units of the traits is not a good indicator of their relative importance since it is affected by the units chosen for expression. For instance, yDW is expressed in grams (g), and thus its economic value is the change in profit resulting from an increase of 1 g in yDW while all other traits remain unchanged. The economic value would, of course, be much greater if we expressed yDW in kg. In order to obviate to some extent this problem we also expressed the economic values in units of additive genetic standard deviations. This way of expressing the economic values gives us an indication of the 'economic-genetic' variation that is available for selection, and it is independent of the units in which the traits are expressed.

Response to selection depends not only on available 'economic-genetic' variation, but also on our ability to accurately predict the breeding value of each trait in the breeding objective. In the present case, for example, we can measure yDW and yDD, but not oFI and dFI which are extremely difficult to record in a grazing system. Thus, the accuracy with which we are able to estimate the breeding value for the former traits is likely to be greater than for the latter. In general, traits with a high economic value and for which the breeding value can be estimated more accurately will make the greatest contribution to overall genetic gain expressed in economic units (%G). Table 4 shows that collectively down traits (yDW, dDW, yDD, dDD)

Table 4. Economic value (EV), additive genetic variation (σ_a) in economic units ($|EV| \times \sigma_a$) and percentage genetic gain in economic units accounted for by gain in each trait (%G) following index selection[1].

Trait	EV ($)	$\|EV\| \times \sigma_a$	%G
Down weight (g)			
Young goat (yDW)	104.55	2 413.50	35.9
Breeding doe (dDW)	55.31	2 098.87	25.8
Down diameter (μ)			
Young goat (yDD)	–1 310.37	870.98	10.6
Breeding doe (dDD)	–3 088.82	2 795.68	28.7
Number of kids weaned (%) (NKW)	96.63	1 894.54	0.5
Live weight (kg)			
Young goat (yLW)	641.66	948.92	–2.1
Breeding doe (dLW)	47.61	109.52	–0.3
Feed intake (kg of dry matter)			
Young goat (oFI)	–53.40	658.09	0.3
Breeding doe (dFI)	–52.45	1 904.67	0.6

1 The selection index combined yDW, yDD, yLW and dNKW as selection criteria.

Table 5. Two-stage selection — all records taken at 10 to 12 mo of age: percentage of total genetic gain in economic units achieved selecting different proportions of bucks at the two stages.

Proportion selected ($\times 10^2$)		Gain (%)
First stage[1]	Second stage[2]	
6	-[3]	27
10	60	56
20	30	76
30	20	85
40	15	90
50	12	93
60	10	95
70	8.6	97
80	7.5	98
90	6.7	99
-[3]	6	100

1 Selection criteria: length and live weight at 10 to 12 mo of age, and dam's number of kids weaned (one record).

2 Selection criteria: as for first stage plus down weight and diameter at 10 to 12 mo of age.

3 No selection at this stage.

contribute virtually all the economic gain resulting from one round of selection on index, whereas other traits contribute very little. This result is consistent with the perceived breeders' view that among Australian Cashmere goats the improvement of down quantity and quality has the highest priority, whereas other traits may remain at the current level.

Nevertheless, this does not necessarily mean those 'other' traits should be ignored in the design of breeding programmes. Quite the contrary, they should be taken into account because of their economic importance, despite the small contribution they make with current selection procedures. Completely neglecting such traits could lead to their gradual deterioration. In the example developed here the contribution of NKW to %G was positive but negligible. However, we found that ignoring NKW in the breeding objective (i.e. setting its EV at zero) could lead to a slight deterioration of that trait.

Two-stage selection

Performance recording is laborious and costly. The laboratory analyses required for the determination of down weight and down diameter are particularly expensive. MacLeod (1988) and Pattie and Restall (1987a) indicate that some form of two-stage selection could assist in reducing performance recording costs. The idea behind two-stage selection is to record all candidates in a first stage of selection based on characters that are cheap to measure, thus leaving the recording of more expensive characters for the second stage.

We assumed that information on down staple length (yDL), live weight (yLW) and dam's number of kids weaned (dNKW) was available for the first stage, whereas information on down weight (yDW) and down diameter (yDD) would be available only in a selected sample at the second stage. Table 5 shows the consequences of selecting varying proportions of bucks at the first and second stages, assuming the final proportion selected was 6 per cent. The results are total genetic gains in economic units (gain %) expressed as a percentage of that achieved by single-stage selection based on all the characters recorded. Single-stage selection based on the characters recorded in the first stage was only 27 per cent as effective as selection based on the complete set of characters. The effectiveness of two-stage selection increased with the proportion of individuals selected at the first stage. Selection of 40 per cent or more animals at the first stage resulted in 90 per cent or more of the potential gain. This means that a large reduction of the proportion of animals from which fleece samples are sent for laboratory analyses could be made without seriously reducing total genetic gain in economic units. Halving the population size at the first stage reduced gain by 7 per cent.

The results presented in Table 5 are encouraging. They are based on the predicted total genetic gain in economic units, which is a useful statistic combining genetic and economic information. Note however, that a given total gain in economic units may be achieved in many ways by different changes in the traits in the breeding objective. Table 6 shows the genetic gain per generation in each trait in the breeding objective using single-stage (yDW, yDD, yLW and dNKW) and two-stage (1. yDL, yLW and dNKW; 2. as in 1. plus yDW and yDD) indices. It was assumed that the final proportion of bucks selected was 6 per cent and that there was no selection among does. With two-stage selection 50 and 12 percent of bucks were selected at the first and second stages, respectively. Two-stage selection resulted in greater emphasis in down weight (yDW and dDW) at the expense of less emphasis in down diameter (yDD and dDD). With single-stage selection down weight and down diameter contributed 61.7 and 39.3 of the total gain in economic units, respectively (Table 4), whereas with two-stage selection their contribution was 70.8 and 30.9, respectively. This change in emphasis may be considered intuitively obvious since with two-stage selection the first round will favour heavy cutting but coarser than average fleeces, and it is only in the second round that pressure to keep diameter down can be experienced. Small as they may seem, differences such as those observed in table 6 have to be examined carefully in terms of the likely long-term consequences of alternative selection strategies.

Table 6. Genetic gain per generation using single-stage and two-stage indices assuming the final proportion of bucks selected was 6 per cent and there was no selection among does.

Trait	Single-stage[1]	Two-stage[2]
Down weight (g)		
Young goat (yDW)	9.1	9.8
Breeding doe (dDW)	12.3	12.8
Down diameter (μ)		
Young goat (yDD)	–0.21	–0.15
Breeding doe (dDD)	–0.25	–0.18
Number of kids weaned (%) (NKW)	0.13	0.14
Live weight (kg)		
Young goat (yLW)	–0.08	–0.19
Breeding doe (dLW)	–0.18	–0.29
Feed intake (kg of dry matter)		
Young goat (oFI)	–0.1	–0.5
Breeding doe (dFI)	–0.3	–1.1

1 Selection criteria: yDW, yDD, yLW and dNKW.
2 Selection criteria: first stage (50% selected), down staple length, yLW and dNKW; second stage (12% selected), as for first stage plus yDW and yDD.

Appendix

Table A1. Phenotypic and genetic parameters for Australian Cashmere goats (phenotypic correlations above diagonal, genetic below).

	yDW	yDD	yDL	dDW	dDD	NKW	yLW	dLW	oFI	dFI
Mean	96.7	15.8	58.0	170	17.5	109	16.6	34.0	150	414
h^2 [1]	0.4	0.5	0.5	0.4	0.5	0.1	0.3	0.3	0.3	0.3
σ_p [2]	36.5	0.94	16.2	60	1.28	62	2.7	4.2	22.5	66.3
yDW(g)[3]		0.4	0.5	0.7	0.3	0	0.1	0	0	0
yDD (microns)	0.4		0.3	0.3	0.7	0	0.2	0.1	0	0
yDL (mm)	0.5	0.3		0.35	0.2	0	0	0	0	0
dDW (g)	0.8	0.3	0.35		0.4	–0.2	0	0.1	0	0
dDD (microns)	0.3	0.8	0.2	0.4		0	0.1	0.2	0	0
NKW (%)	0	0	0	–0.1	0		0.15	0.15	0.15	0.35
yLW (kg)	–0.15	–0.1	–0.2	–0.1	0	0.15		0.7	0.6	0.5
dLW (kg)	–0.1	0	–0.1	–0.15	–0.1	0.15	0.8		0.5	0.6
oFI (kg DM)[4]	0	0	0	0	0	0.15	0.6	0.5		0.6
dFI (kg DM)	0	0	0	0	0	0.35	0.5	0.6	0.6	

1 = heritability
2 = phenotypic standard deviation
3 See tables 2 and 3 for meaning of symbols
4 DM = dry matter

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Phenotypic and genetic parameters for production characteristics of Australian cashmere goats

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Abstract

Presently there are few soundly based breeding programs in the Australian cashmere industry. Results arising from our study and that of Pattie and Restall (1989) provide the necessary basis for the design of efficient selection programs for the industry. Ponzoni and Gifford (1990) provided a comprehensive definition of a breeding objective for Australian Cashmere goats. The two Australian sets of phenotypic and genetic parameters now available allow the estimation of breeding values for production characteristics and the construction of selection indices. This is a most appropriate scenario for the establishment of a performance recording scheme.

The developing cashmere industry now has the ideal opportunity to develop a co-ordinated strategy for genetic improvement, based on documented research findings. Every effort should be made to maintain a close liaison between stud breeders, commercial producers and geneticists.

Introduction

The Australian cashmere industry continues to expand, but its long-term viability will be dependent on the successful establishment of a commercial sector and on an increase in the productivity of the Australian Cashmere goat. Ultimately the commercial sector will produce the majority of the fibre and meat from the industry, with the breeding sector representing only a small proportion of the total population of the breed. However, the breeding herds will control the rate of genetic improvement in the commercial herds via the supply of replacement bucks.

The design of efficient selection programs in cashmere breeding herds requires accurate estimates of heritabilities and genetic and phenotypic correlations for the characteristics chosen as selection criteria and of genetic correlations between the selection criteria and the traits in the breeding objective. Also, a knowledge of the effects of environmental factors, such as age of dam and type of birth, on the selection criteria is required prior to selecting replacement animals.

There is very little documented information on the inheritance of cashmere production throughout the world (Millar, 1986). Findings of the first comprehensive study of the genetic basis of cashmere production in Australian goats were reported recently (Pattie and Restall, 1989; Restall and Pattie. 1989). In this paper we report the results of a study in a South Australian herd including the effect of age of doe on fleece characteristics and liveweight, the effects of environmental factors on fleece characteristics and liveweight of goats at 10 months of age, estimates of phenotypic and genetic parameters for production characteristics of goats at 10 months of age and levels of reproductive performance.

Methods

The study was conducted on a private property, "Messamurray", near Naracoorte in south-eastern South Australia. Foundation breeding females were obtained from feral populations in the Cobar area of western New South Wales and the Flinders Ranges area of South Australia in 1982. Four drops of progeny, 1984 to 1987 inclusive, were involved in the study. Progeny were from single-sire matings, with does randomly allocated to sires. Thirty one sires produced 1485 progeny.

Kidding took place during the month of October each year. Kids were weaned prior to their first shearing at 4 months of age, in late January, with the second shearing occurring at 10 months of age in late July. All does were subsequently shorn in late July each year. At the first

Table 1. Least-squares means for fleece characteristics and liveweight of does of different ages.

Characteristic	Age of doe (months)				
	4	10	22	34	46
Fleece weight (g)					
No.[1]	740	721	512	318	127
Mean[2]	97.7[a]	228.2[b]	415.4[c]	434.5[d]	454.5[e]
S.E.[3]	3.27	3.24	3.86	4.69	6.97
Yield (%)					
No.	723	702	502	303	125
Mean	24.2[a]	42.6[b]	39.4[c]	40.8[c]	40.4[c]
S.E.	0.56	0.56	0.66	0.82	1.21
Down Weight (g)					
No.	719	678	492	300	123
Mean	28.3[a]	99.1[b]	168.8[c]	183.1[d]	182.6[d]
S.E.	2.16	2.17	2.55	3.12	4.59
Down diameter (um)					
No.	-	738	516	317	125
Mean	-	15.8[a]	17.3[b]	17.5[c]	18.0[d]
S.E.	-	0.05	0.07	0.08	0.12
Standard deviation of down diameter (μm)					
No.	-	735	502	317	125
Mean	-	3.8[a]	3.2[b]	3.3[b]	3.4[c]
S.E.	-	0.03	0.03	0.04	0.06
Liveweight (kg)					
No.	740	729	512	319	127
Mean	15.3[a]	15.5[a]	26.8[b]	32.6[c]	33.6[d]
S.E.	0.15	0.15	0.18	0.21	0.32

1 No. = Number of does observed

2 Within each characteristic, means followed by a common letter do not differ significantly (P>0.05)

3 S.E. = Standard error of least-squares mean.

shearing, all progeny were recorded for fleece weight (FW), yield of down (YLD), down weight (DW) and liveweight (LW). At the second and subsequent doe shearings, down diameter (DD) and standard deviation of down diameter (SD of DD) were also recorded. The measurements of down yield and down diameter of fleece samples taken from the side of animals were carried out by the Australia Wool Testing Authority, Sydney, N.S.W.

The experimental does born in the period 1984–1987 inclusive were single-sire mated for 6 weeks each year commencing on May 1, the first time at approximately 18 months of age, and their reproductive performance was recorded. Statistical analyses were not conducted on any of the reproductive variables, but means for 2, 3, 4 and 5 year old does are presented for: number of does kidding per doe joined and present at kidding (fertility, DK/DJ), number of kids born per doe kidding (fecundity, KB/DK), number of kids born per doe joined (kidding rate, KB/DJ) and number of kids weaned per doe joined (weaning rate, KW/DJ). The distribution of litter size (ie. percentage of does with singles, twins and triplets) is also given. The effects of environmental factors, including year of birth, age of dam, type of birth and sex, on production characteristics were examined by least-squares analysis of variance. All factors were treated as fixed effects, with day of birth included as a linear covariate. A model was fitted to estimate sire and error components of variance and covariance for the characteristics described earlier. The model included the effects of sire group (this classification is the year of birth of the sire), sire nested within sire group, year of birth, period of birth in the kidding season, age of dam, type of birth and sex. Except for sire nested within sire group, which was treated as random, all other effects in the model were treated as fixed. Variance and covariance components were estimated by restricted maximum likelihood. Heritabilities and the phenotypic and genetic correlations between production characteristics were estimated from paternal half-sib correlations. Estimates were based on 29 sires. The total number of observations varied from one characteristic to another from 1 320 to 1 421. Average sire progeny group size was at least 45.5, with group size ranging from 4 to 95. Some of the heritability estimates may be biased downwards to a small extent because the sires used were not chosen completely at random, but rather were selected by the breeder primarily on the basis of down weight, down diameter and liveweight.

Results and discussion

Production levels and age effects

The fleece characteristics and liveweight of does varying in mean age from 4 to 46 months are given in Table 1. Significant annual increases in liveweight of does occurred between the ages of 10 and 46 months. The liveweights of these does were slightly greater than those of the goats observed at equivalent ages by Restall and Pattie (1989). Significant annual increases in some fleece characteristics were also observed; for fleece weight from 10 to 46 months, for down weight form 10 to 34 months and for down diameter from 10 to 46 months. Similar trends in these characteristics were observed by Restall and Pattie (1989). The mean fleece weights, down weights and down diameters of the South Australian does at the various ages were higher than those of the corresponding goats run at Wollongbar, N.S.W. The observed differences in fleece characteristics and liveweight between the two groups of goats could be due to the fact that the foundation goats of the two groups came from different feral goat populations or due to differences in the environmental conditions under which the goats were run.

Effects of environmental factors

The effects of some environmental factors, including type of birth, sex, age of dam and day of birth, on fleece characteristics and liveweight of goats at a mean age of 10 months are presented in Table 2. For the analysis of the effects of type of birth, all kids born as triplets were treated as twin-born animals. Type of birth had a significant effect on all characteristics recorded except down yield. Single-born animals were heavier, grew more down and had coarser down than twin-born animals, these findings being similar to those of Restall and Pattie (1989). The variability of down diameter, measured as the standard deviation of down diameter, was significantly greater in fleeces of twin-born goats than in fleeces of single-born goats.

Male goats were heavier and produced more fleece than females, but the yield of down in their fleeces was lower. The down diameters of males and females were similar, again consistent with the findings of Restall and Pattie (1989). In our study, the males and females were separated soon after weaning, with the two groups being subjected to as similar management conditions as possible.

Age of dam had a significant effect on liveweight, fleece weight, down weight and variability of down diameter. Goats from young dams (1 or 2 years old) and from old dams (6+ years) tended to be lighter at 10 months of age than those from three-and four-year-old dams. Down diameter variability was significantly less in fleeces of progeny from mature dams than in the progeny of young dams. There were no significant differences due to age of dam in yield and down diameter.

Table 2. Least-squares means for fleece characteristics and liveweight of bucks and does at their second shearing, adjusted for day of birth.

Environmental factor	Characteristic[1]					
	FW [2] (g)	YLD (%)	DW (g)	DD (µm)	SD of DD (µm)	LW (kg)
Type of birth						
Single	252.6[a]	40.9	105.0[a]	15.9[a]	3.7[a]	17.8[a]
Twin	236.0[b]	41.9	100.2[b]	15.7[b]	3.8[b]	16.3[b]
Sex						
Female	231.6[a]	42.8[a]	100.7	15.8	3.8[a]	15.5[a]
Male	257.0[b]	40.1[b]	104.5	15.8	3.7[b]	18.6[b]
Age of dam (yr)						
1	249.9[ac]	46.0	118.3[a]	15.7	3.9[ab]	17.0[abc]
2	223.1[b]	41.6	90.6[b]	15.8	3.8[b]	16.2[a]
3	241.6[a]	41.5	100.2[c]	15.9	3.8[b]	17.3[bc]
4	252.9[c]	40.5	104.6[ac]	15.9	3.7[a]	17.6[c]
5	254.4[c]	39.2	102.9[ac]	15.8	3.6[a]	17.4[bc]
6+	243.8[ac]	39.7	98.9[c]	15.8	3.7[a]	16.9[b]
Regr.coeff. on day of birth	–0.13	0.01	–0.02	*** –0.01	0.001	*** –0.05

1 FW, fleece weight; YLD, yield of down; DW, down weight; DD, down diameter; SD of DD, standard deviation of down diameter; LW, liveweight

2 Within each characteristic, means not followed by a letter or followed by a common letter do not differ significantly (P>0.05)

*** P>0.001

Day of birth significantly influenced liveweight and down diameter of progeny at 10 months of age. Kids born earlier in the kidding season were heavier and had coarser down than those born later. In contrast to the findings of Restall and Pattie (1989), the early born kids did not have greater down weights.

The environmental factors above are important sources of variation in fleece characteristics and liveweight of cashmere goats at 10 months of age. When selecting breeding herd replacement animals at 10 months of age allowances should be made for :

- twin-born animals
- progeny of maiden and very old does
- animals born later in the kidding season.

Adjustments for sex effects are usually not necessary because selection normally takes place within sex groups.

Phenotypic and genetic parameters

Heritability estimates for fleece characteristics and liveweight of male and female goats at 10 months of age are presented in Table 3.

The estimates ranged from 0.23 (± 0.11, standard error) for down yield to 0.70 (± 0.19) for down diameter. Down yield and liveweight could be classed as moderately heritable, while fleece weight, down weight, down diameter and variability of down diameter could be classed as highly heritable. Pattie and Restall (1989) also found down weight and down diameter to be highly heritable, and liveweight to be moderately heritable. Our heritability estimate for down yield (0.23) varied from the N.S.W. estimate of 0.90.

Our results and those of Pattie and Restall (1989) indicate that there is considerable scope for the genetic improvement of down weight, quality of down and liveweight in cashmere goats. All characteristics measured would respond readily to mass selection.

Most of the phenotypic correlations are of moderate magnitude (Table 3). The phenotypic correlations between fleece weight and down weight, down diameter and liveweight indicate that selection of an animal with above-average fleece weight relative to its contemporaries will also result in the selection of an animal with above-average down weight, down diameter and liveweight. Similarly, animals with above-average down diameter are likely to be heavier and produce more down.

The strong genetic relationship between fleece weight and down weight in our study (Table 3) suggests that fleece weight could be used as a selection criterion for the genetic improvement of down weight. Fleece weight is easier and cheaper to measure on the animal than down weight. Our finding contrasts with that of Pattie and Restall (1989) in this respect. Unfavorable genetic associations exist between some characteristics measured in our goat population, and have also been reported by Pattie and Restall (1989). The negative genetic relationship between down weight and liveweight is an example. However, the genetic correlation estimates from both studies are not large enough to preclude the simultaneous improvement of down weight and liveweight. Detailed scrutiny of both data sets has shown that there are sires that produce offspring with above-average down weight and liveweight. Use of an appropriate selection index would combine the simultaneous genetic improvement of down weight and liveweight in an optimum way.

The genetic correlation estimates between down weight and down diameter obtained from our study and by Pattie and Restall (1989) differ, being 0.04 and 0.62 respectively. Our estimate has a very large standard error (± 0.23) so we can place only limited confidence in it. The estimate of Pattie and Restall (1989) has a lower standard error (± 0.10). If the two cashmere goat estimates were considered together we could reason that the 'true' value in cashmere goats might approximate +0.3. If this were the case, the relationship would be in an unfavorable direction, but not of sufficient magnitude to preclude the simultaneous genetic improvement of down weight and down diameter. Sires existed in the two populations studied that would

Table 3. Phenotypic variance, heritability (± standard error) and phenotypic and genetic correlation estimates for production characteristics of down-producing goats.

	FW[1] (g)	YLD (%)	DW (g)	DD (μm)	SD of DD (μm)	LW (kg)
Phenotypic variance	2 568.7	129.6)	1 333.9)	0.89)	0.36)	7.37)
Heritability (± SE)	0.42 (0.16)	0.23) (0.11)	0.36) (0.13)	0.70) (0.19)	0.38) (0.14)	0.26) (0.11)
FW[2]	-	0.14)	0.67)	0.36)	–0.07)	0.36)
YLD	0.39 (0.25)	-)	0.79)	0.25)	0.29)	–0.12)
DW	0.83 (0.08)	0.85) (0.08)	-)	0.39)	0.15)	0.12)
DD	0.12 (0.23)	0)	0.04) (0.23)	-)	0.25)	0.23)
SD of DD	–0.14 (0.26)	0.46) (0.23)	0.14) (0.26)	0.06) (0.23)	-)	–0.12)
LW	0.17 (0.27)	–0.39) (0.26)	–0.13) (0.27)	–0.16) (0.23)	–0.48) (0.30)	-)

1 FW, fleece weight; YLD, yield of down; DW, down weight; DD, down diameter; SD of DD, standard deviation of down diameter; LW, liveweight

2 Phenotypic correlations above the diagonal, genetic correlations (standard error) below the diagonal.

Table 4. Reproductive performance of cashmere goats.

Characteristic	Age of doe at kidding (years)			
	2	3	4	5
Number of does joined	696	437	252	75
Fertility (DK/DJ)[1]	0.73	0.83	0.89	0.83
Fecundity (KB/DK)	1.59	1.76	1.77	1.87
Kidding rate (KB/DJ)	1.16	1.46	1.57	1.55
Weaning rate (KW/DJ)	0.98	1.29	1.40	1.28
Litter size distribution (%)				
singles	42	27	29	22
twins	57	70	66	68
triplets	1	3	5	10

1 DK, does kidding; DJ, does joined; KB, kids born; KW, kids weaned.

have improved down production in their offspring while maintaining or decreasing down diameter. Our genetic correlation estimate between down diameter and liveweight (–0.16) is weak but in a favorable direction.

Reproductive performance

The fertility, fecundity, kidding rate and weaning rate levels of the adult does were higher than for the maiden does (Table 4). In broad terms our figures are consistent with the generalised industry perception that Australian Cashmere goats have a high reproductive rate. Note that these results were achieved under single-sire mating, and that, everything else being equal, multiple sire mating could have resulted in improved performance.

Distribution of litter size varied between the age groups of does, with the three-and four-year-old does having a greater proportion of twins than the maiden does. Note that few does of any age group produced triplets. Reasons for the preponderance of twins, whether it be due to a high incidence of twin ovulations or to an inability of the uterus to support more than two kids, have since been investigated (Kleemann et al., these Proceedings).

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Session 5

Wool and fleece characteristics

Chairman: T. Treacher
Co-chairman: E. Tuncel

Wool associated to other sheep products in different production systems and breeding programmes in Europe

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Summary

A questionnaire on domestic wool production elaborated for EAAP was sent out in 1988 to the EAAP Member Organisations. It requested information about production volume and quality of wool, its use, economic importance in national economy, and interest of sheep farmers in wool production in different sheep husbandry systems.

A preliminary comparison of wool production and its conditions based on the responses received from 3 main regions of Europe i.e. North-West, Mediterranean, and Central-East, could be concluded as follows:

1. Net self-sufficiency in wool varied widely from country to country in the same region and seemed not characteristic trait of any region.
2. The relative economic importance of income from wool sales when compared to the total income from sheep farming occured to be characteristic. It was the biggest in C-E region (20–60%). In recent years in this region the situation has changed. Introducing the market economy, coincident to dramatic drop of wool prices in the world market, resulted in decline of demand for domestic wool, what in turn cause a deep decrease in national sheep populations.
3. In some of the responding countries even the decrease of the volume and quality of wool produced could be accepted on farms specialized in either meat or milk + meat production.
4. Programmes of genetic improvement of wool productivity exist now in a few countries only.
5. In N-W region, the intensive production of slaughter lambs predominates over other systems. C-E countries in general will also follow this model. In Mediterranean countries and along Balkan-Carpatian mountain chain sheep milk + lambs production, based on summer mountain grazing is the most characteristic system.

Keywords: wool production, regions of Europe, sheep farming systems

Introduction

Wool is not at present the main product of sheep farming in most of European countries, but in many it is a much appreciated by-product of lamb and/or sheep milk production. For many years, however, domestic wool is only a very marginal matter of concern of European international bodies, interested in sheep production.

It was only in 1987 that the EAAP Sheep and Goat Commission created the Wool and Hair Expert Working Group, which was charged with the organization of a survey on wool, goat's hair and other hair fibre production in Europe. A questionnaire was elaborated and sent to all member organizations. It consisted of 4 main parts: 1. Volume and quality of fibres produced and their use, 2. Interest in the concerned country in wool/hair production and its economic importance, 3. Existing programmes and activities leading to increase/improvement of domestic wool/hair production and its better use, 4. Sheep/goat production systems adopted in the country, with special reference to wool or hair produced.

The figures and conclusions presented in Table 1 summarize the results of a survey conducted in 1988–1991 by the EAAP Sheep Wool experts in 3 main regions of Europe: North-West, Central-East and Mediterranean. The Soviet Union and Turkey were surveyed separately, as bicontinental countries, adjacent to the Central-East and Mediterranean regions, respectively.

Results and discussion

This information based entirely on FAO data collected from all countries belonging to regions or groups, shows differences between regions, where wool is concerned. The USSR and other Central-East European countries are the best in wool production, but the poorest lamb and mutton producers. The East European countries, namely Bulgaria and Rumania are nearly as good in sheep milkproduction as neighbouring Mediterranean countries.

Countries of the N-W region are by far the best in lamb and mutton production and quite good wool producers, especially when clean fleece weight is compared. This region does not produce any significant quantity of sheep milk. The poorest wool producers are the Mediterranean countries, but they are the best in sheep milk production and fairly good in meat production .

Table 1 shows the quantitative image of sheep productivity in the 3 main regions of Europe and adjacent areas, but it gives only a little information on the average quality of wool produced there. The highest clean wool yield /rendement/ appeared in the N-W region of Europe. It may mean that wool produced in that region is stronger than in other parts of Europe. Indeed, very few merino sheep are bred there and their influence on wool traits is negligible. On the other hand, the sheep housing period in most countries of this region is shorter in comparison to the Central East region. In the latter region some 50–60 years ago many native, coarse wool breeds of sheep were improved by means of crossbreeding: with merino rams in a more dry environment, or with West European breeds in more humid areas. In later years (1960–1980) crossbred wool producing sheep (Corriedale type) were widely introduced in the whole area of the region to improve fleece weight and staple length as well as body conformation and

Table 1. Sheep productivity in 3 regions in Europe, in Turkey, and in the USSR (source: FAO Production Yearbook, 1989).

	Region or country				
	North-West[3]	Mediterranean[2]	Turkey	Central-East[1]	USSR
1. Total sheep number (10^3)	47 300	66 300	34 850	37 700	139 500
2. Total greasy wool prod. (MT)	113 900	86 700	49 000	118 900	474 000
3. Average clean wool yield (%)	69.7	54.3	55.0	54.8	60.0
4. Average greasy fleece wt. (kg)	2.41	1.31	1.41	3.15	3.40
5. Average clean fleece wt. (kg)	1.68	0.71	0.77	1.73	2.04
6. Average meat production per 1 sheep (kg)	12.3	8.5	9.8	6.7	6.1
7. Average milk production per 1 sheep (kg)	0.0	42.4	28.8	21.2	0.6

[1] Bulgaria, Czecho-Slovakia, German Democratic Republic, Poland, Rumania
[2] Albania, Southern France, Greece, Italy, Portugal, Spain, Yugoslavia
[3] Other European countries, not mentioned above.

growth potential. Coarse wool breeds remain mainly in more difficult mountain and hill countries. Improvement of wool quality in the whole region could be illustrated with figures published by Vasiliev (1964) for the USSR. During a period of 10 years (1954–1964) the total volume of wool produced increased by 80% and at the same time the contribution of fine wool increased from 17% to 43%, while the contribution of coarse wool dropped from 61% to 37%.

In the Mediterranean area, which many centuries ago was the world centre of fine and semi-fine wool, where the merino breed of sheep, famous for its woolproduction, was created, wool seems less important now than anywhere else in Europe. Opinions of our respondents, summarized in Table 2, fully confirm this. Wool produced in West-Mediterranean countries on the average is finer and shorter (Ryder, 1978) than that produced in the East Mediterranean, where it is mainly semicoarse and coarse.

Interest in wool production existing in the 3 regions of Europe could be roughly measured by the number of responding countries compared to the total number of countries in the region. The percentage figures were 22%, 17% and 50%, for the North-West, Mediterranean and Central-East regions, respectively.

In Table 2 a summary of all responses to the questionnaire is shown. When comparing responses according to the region from which they came, it can be stated that net self-sufficiency in wool varied widely from country to country in the same region and seems to be not characteristic for any region as a whole

On the contrary the economic importance of income from wool when compared to total income from sheep farming varied from region to region. It was the highest in the Central-East region (20%→60%) and the lowest in the Mediterranean countries (4%). If the ranking lists according to economic importance of sheep products were compared, in the C-E countries wool took 1st or 2nd place, while in N-W Europe only 2nd place and in the Mediterranean area usually 3rd place.

As a consequence of the economic indices mentioned above, no interest in increasing the volume of wool production occurred in the North-West and Mediterranean regions. On the contrary, an increase in wool production was desired in most of the C-E countries. It was not the case in Hungary, where in general wool production remained stable.

Interest in improving wool quality generally accompanies positive trends in the volume of wool production. In this respect an exceptional situation could be observed in Iceland. Income from wool sales received by Icelandic sheep farmers is low, typical for all N-W countries. The interest in good quality and growth of wool in this country could be linked with better survival of lambs covered with a rich fleece when grazed during summer on mountain pastures.

In some of the responding countries, mainly N-W and Mediterranean, even decrease of the volume of wool produced and its worse quality were accepted, on farms specializing in either meat or milk + meat production.

Programmes of genetic improvement of wool productivity were widely adopted in the sheep industries of the C-E counries. Programmes or activities aimed at better fleece evaluation and purchase operated in most of North-West and Central-East countries. They seem not to exist in the Mediterranean region. The opposite situation could be observed in the North-West and Mediterranean regions as far as domestic wool or hair marketing programs are concerned. They usually exist in North-Western countries, but are absent in the Mediterranean region.

In former Comecon C-E countries with their non-market economy, marketing itself did not existed. This was especially true where raw materials such as wool were concerned. As to production systems, in the North-West region intensive production of slaughter lambs predominates, but in particular conditions, for example in Scandinavia, extensive summer grazing of ewes and lambs could be included into this intensive system. In the Mediterranean area as well as in C-E countries the most important were either intensive systems of lamb production or systems of intensive production of milk + lambs. In some Mediterranean countries and along the Balkan-Carpatian mountain chain, the sheep milking period coincides with summer

Table 2. The economic importance of wool production, interest in increasing it or improving the quality of wool, activities in this field, wool in different sheep production systems in 3 regions of Europe. Summary from the responses to the questionnaire of EAAP wool experts working group (received 1988/1989).

Region/Country:	North-West[3]	Mediter-ranean[2]	Turkey	Central-East[1]	USSR
A. a. Place of wool among all sheep products (ranking)	2	2–3	3	2–1	1
b. Contribution of wool to total income from sheep farming (%)	5–7	4	9.1	20→60	>60
B. Interest in:					
a. increasing wool prod.	–	–	–	+	+
b. improving wool quality	–/+	–	–	+	+
c. increasing milk/meet prod. and keeping wool prod. and its quality on a constant level	–/+	+	–/+	+	–
d. like c. but accepting a decrease in wool prod. and quality	–/+	–	+/–	–/+	–
C. Programmes of:					
a. genetic improvement of wool prod.	–/+	–	–	+	+
b. better evaluation and purchase of wool	+/–	–	–	+	+
c. better marketing of domestic wool	+/–	–	–	–	–
D. Production systems:					
a. extensive apparel wool production	–	–	–	–/+	+
b. special wool prod. in family flocks	–	–	+	–	–
c. intensive prod. of slaughter lambs	+	+	+	+	+/–
d. intensive prod. of milk and lambs	–/+	+/–		–/+	–
e. any other system	–/+	–	+/–	–	–

1 Bulgaria, Czecho-Slovakia, German Democratic Republic, Poland, Rumania
2 Albania, Southern France, Greece, Italy, Portugal, Spain, Yugoslavia
3 Other European countries, not mentioned above.

grazing of ewes on extensive mountain pastures, while the weaned lambs are fattened in the valleys, more or less intensively.

The specialization of sheep flocks in extensive wool production which existed in some C-E European (former Comecon) countries should be stressed. In former GDR in these flocks merino wethers were kept up to 4–5 years of age for wool production before they were slaughtered. They were grazed on stubble and during winter fed cheaply with agricultural by-products. Such flocks could be shepherded by less skilled people. The low percentage of ewes in the GDR national sheep population show that such wether flocks were numerous in the GDR. All these flocks disappeared after reunification of Germany in 1990 because they became unprofitable in new market economy conditions (Strittmatter, 1991). Another example of extensive wool production could be observed in many ewe flocks in the USSR, where young ewes are usually mated for the first time at 2,5 years of age (Vasiliev, 1964).

The image of wool production in Europe shown above, was true up to the autumn of 1989. Political changes in Central and Eastern Europe, which began at that time, resulted in progress from a centrally planned to a market economy. Wool prices, subsidied earlier, suddenly became dependent on world prices. According to Strittmatter (1991), the reunification of Germany caused a dramatic change in the GDR in the wool to lamb meat price ratio from about 6:1 to 0.7:1. On the other hand the changes in C-E Europe coincide with a complete breakdown of the Soviet economy and serious problems in the Chinese economy. Both these countries were huge importers of wool from the Southern hemisphere. These imports of wool abruptly decreased, which was the main cause of a breakdown of wool prices on the world market. All these events resulted in a considerable decrease of national sheep flocks and wool production. In the former GDR, from 1989 to 1990, a 44.5% drop in sheep population was registered. In Poland in the same period, a 5.7% decrease in sheep number was observed, but in 1991 a more severe drop is expected.

In the future the eastern part of Germany, Czecho-Slovakia, Hungary and Poland will follow more or less the development of sheep production in North-Western Europe. Bulgaria and Rumania may develop their sheep production similarly to neibouring Turkey and Greece. Only the southern territories of the Ukraine and Russia, having natural conditions for extensive fine wool production, would keep their sheep industry nearly unchanged. However, even there an intensification of slaughter lamb production seems necessary.

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Objective measurements of wool: state of the art

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Abstracta

The main characteristics of keratinic fibres may be estimated by objective measurements internationally admitted. The first difficulty consists in the guarantee of the test specimen representativity. Official procedures are described for each stage of the sampling. The principle of standardized and experimental methods is given for fineness, length, strength, feltability, colour, couloured fibres compressibility, yield.

Introduction

There is a general trend in all industrial branches to offer the right quality to the right price. Textile Industry, and wool trade particularly involves in that strategy. Towards sheep, to be a marked increase in the designation of fabrics and knittings, yarns, fibres. So, the grower is induced to offer on the market perfectly described lots, with wellknown criteria. Objective measurements help him also to survey the quality of his flock and clip. We examine the main methods used in wool trade and industry.

Method of sampling raw wool in bulk for fibre diameter and/or length measurement (IWTO 13-64)

All methods of test wool fibre properties require selection of a comparatively small number of fibres from a large bulk or lot of fibres. Thus the lot may consist of at least 400 kg (e.g 8 × 109 fibres) whereas the sample tested is unlikely to exceed a few grammes (e.g 4 × 104 fibres). The act of selecting this small number from the lot is called sampling'. It is usually assumed that the results of tests on the small sample of fibres also apply to the whole lot. For this assumption to be true it is necessary that the sampling method gives a truly random sample from the lot, that is a sample in which each fibre in the lot has an equal chance of being represented in the sample. In general there will be variations from place to place within a lot of raw wool. It is not possible to give generally applicable figures for variances since these will depend on the history and origin of the lot.

Definitions

Lot: The whole bulk or population of fibres available for sampling. *Zone:* A place in the bulk from which fibres are taken.

Principles of sampling

For a truly random sample the difference between the estimate of the measured property (e.g. fibre length) obtained from the sample and the same property measured on the whole lot will be the well-known statistical sampling error, which can be calculated. If the difference between the property of the sample and that of the lot is significantly greater than that due to random sampling, the sampling procedure is said to be 'biassed'. Bias occurs in three ways:

a. if the property of the lot varies from place to place but the sample is taken from only one or two places, the sample is likely to be biassed.
b. Nearly all methods depending on personal choice of fibres lead to biassed samples. For instance, fibres selected by eye are often the thickest, probably because they are easy to see.
c. If fibres are taken by pulling them from the outside of the lot they are likely to be partially length-biassed, since the chances of fibres crossing a particular place are greater for long fibres.

Sampling method

This procedure will often be required for lots of 500 kg and above, which will consist of a large number of fleeces or parts of fleeces. The total variability may be considered in two parts:

a. The variability within a fleece or part fleece. This will be termed within-zone variation
b. The variability between fleeces or part fleeces. This will be termed between-zone variation

It cannot be assumed in general that the lot is homogeneous and it is thus necessary to sort through it to obtain an unbiassed sample. Consequently it is generally convenient to carry out the following sampling method while the lot is being transferred to a hopper, bin or lattice for the next stage of processing.

Choice of number of zones

Let V1, be the residual variance within zones of the property to be measured. Let V2, be the variance between zones. Let n be the number of zones. Let N be the total number of fibres to be tested, N/n will be the average number of fibres to be taken from each zone. The standard error of the mean value for the N fibres (length or diameter) will be given by:

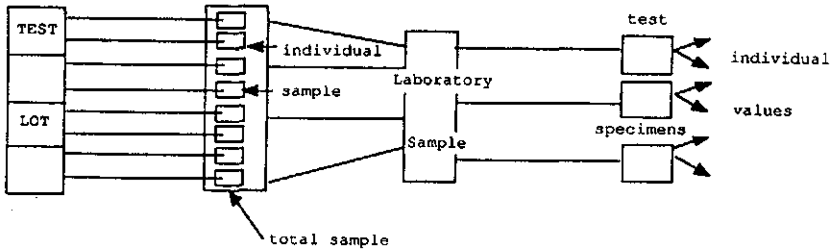
$$S.E. = \left(\frac{V_1}{N} + \frac{V_2}{n}\right)^{\frac{1}{2}}$$

It may be seen from this that to obtain a small standard error the number of zones n should be as large as possible.

Selecting the zones

The procedure to be described uses the simplest apparatus. Mechanical handling equipment such as conveyor belts may possibly be used to make it quicker. Decide on the total number of fibres to be tested N and the number of zones n. Obtain a cardboard box which will hold about 0.5 kg of fibres. If the weight of the lot is W kg it will consist of 2W boxfuls, and of these n are required to be taken uniformly thoughout the lot. Calculate the nearest whole number to 2W/n. Fill the box repeatedly with fibres and discard the fibres until box No 2W/n is reached.

Fill this box with handfuls of fibre, then reduce the number of fibres in the box by the procedure described above. Again fill the box with fibres and discard until box 4W/n is reached and reduce this by the procedure described. Continue the procedure, reducing boxes 2W/n, 4W/n, 6W/n, 8W/n until the whole lot has been sorted through.



Alternative method for fibre diameter

If the wool is being sampled for fibre diameter only (projection microscope method), the zones may be selected by core-boring the bales. In this case cores should be taken at several different positions from each bale and the total number of zones taken from the whole lot should exceed 100.

Reducing the fibres from the zones

Each boxful or core-boring is quickly divided into two halves by hand and the right half retained. The retained half is again divided into two halves and the left half retained. Since the fibres are often naturally grouped in a parallel arrangement the division into two halves is made lengthwises, i.e. in a direction which avoids breakage and selection by fibre ends. This process of reduction is continued until as judged by eye approximately the number of fibres required per zone (N/n) has been arrived at. These fibres are transferred to a velvet-covered board and covered with a transparent plate.

Final sample

The final sample will consist of a number of groups of fibre on the velvet board and to avoid bias it is essential that all the fibres in each group be tested.

Determination of fibre diameter in wool and other animal fibres by the microscope projection (IWTO 8-89)

Concerns the diameter and the medullation of wool and other animal fibres such as mohair, cashmere, alpaca, camel's hair, in their various forms, by means of microscope measurements on individual fibres.

Outline of the method

Magnified images of the profiles of short lengths (snippets) of fibres are projected on a screen and their widths measured by using a graduated scale. The individual fibre measurements are recorded and when sufficient fibres have been measured the arithmetic mean, standard deviation, CV of the f distribution are calculated. A histogram may be drawn. At the same time the number of medullated and unmedullated fibres may be counted : the degree of medullation is the number of medullated fibres counted, exprimed as a percentage of the total number of fibres counted.

Cutting

For cutting the fibres to predetermined length the fibre holder and pushers described must be provided. The holder is a short piece of smooth steel.

Mounting media

Provide a mounting medium with following properties
- a refractive index between 1.43 and 1.53
- suitable viscosity
- does not absorb water

Cedar wood oil and liquid paraffine are examples of suitable media.

Focusing

When the microscope objective is too near the slide the edge of the image shows a white border. When the microscope objective is too far from the slide the edge of the image shows a black border. When in focus the edge of the image shows a fine line with no border. However in general both edges of the image will not be in focus together, since wool fibres are in general non-circular in cross section. When measuring an image whose edges are not in focus together, adjust the focusing so that one edge is in focus and the other shows a white line. Measure the width from the edge that in focus to the inside of the white line.

Use of reference wools

To assist in reducing differences that may occur between operators and between laboratories, Interwoollabs supplies three Reference slivers covering a range of mean diameter along with their agreed values. These should be measured at intervals by operators engaged in routine measurements.

Exemple of calculation

The major source of variance in wool is the between-fibres component and is not correct if 400 or more snippets are measured (usually 600 snippets are measured):

	95% Confidence limits	
	Wools to 26 µm	Wools above 26 µm
400 fibres	0.6	1.2
1 000 fibres		1

The microscopic fineness is the reference method. It is tedious and expensive, due to time and technician immobilisation with a low productivity. For theses reasons other methods were investigated.

Fibre Diameter Analyzer (FDA)

Needs a similar test specimen, but snippets are introduced in a flow of a non swelling agent (isopropylic alcohol) and measured in a cell by a laser radiation. The attenuation of this depends on the snippets dimensions, in few minutes 2000 crossings are occured. Each is stored in the system which calculates continuously the average and distribution. With the large number of individual measures in time unit the subjective influence and fatigue operators, focusing, bias, are suppressed. The apparatus needs calibration with each type of fibres measured: wool, angora, cashemere. Nevertheless the system doesn't 'see' each quality and is not able to distinguish other else than diameter. The method is in experimental phase before standardization.

Image analysis (ASTM D 3510-81)

The measurement of mean fibre diameter and diameter distribution of fibre snippets mounted between two glass slides, is performed using a charge coupled device (CCD) camera interfaced to a P.C. Prior to any measurement, fibre snippets are collected using a micro coring device and are mounted on a microscope slide using a spreading device which randomly distributes snippets in a single layer of even density over the whole slide. The camera image is captured using an analogue to digital converter which digitises the light intensity values to 128 grey levels and stores them in computer memory. Each snippet can be measured several times along its length. The mean fibre diameter and diameter distribution information are calculated for the whole slide. A histogram can be produced showing the distribution of diameter. The instrument is initially calibrated using reference wools or etched graticule which contains a serie of lines of known widths ranging from 8 to 132 µm. This calibration is stored as a look-up table in computer memory.

Determination of the mean fibre diameter by air-flow (IWTO 28–89)

When a current of air is passed through a mass of fibres packed in a chamber with perforated ends the ratio of air-flow to differential pressure is primarily determined by the total surface area of the fibres. This was predicted from the hydrodynamic equations. For fibres of circular or near circular cross-section and constant density, such as non-medullated wool, the surface area of a given mass of fibres is inversely proportional to the mean fibre diameter. This principle can be utilised to construct an apparatus giving estimate of MFD. The Air-Flow Method is simple and rapid. Since the method is indirect, the apparatus must first be calibrated, using fibres of known mean diameter. It has been shown that the estimate of MFD given by the Air-Flow Method is $d(1+c^2)$ where d is the MFD given by the microscope and c the fractional CV. Since c normally lies within comparatively small limits it is usual to calibrate directly in terms of d. Raw wool must be scoured, cleaned to remove vegetable matter, opened and randomised. At least two 2,5 g test specimens must be measured, with two readings on each of two Air-Flow Apparatus (IWTO 28–89 standard). Laboratory samples must be conditioned to equilibrium with measurements made in this atmosphere 20°, 65% HR. The estimates of the 95 % confidence limits of the MFD are ± 0.2 µm for MFD 26 µm and ± 0.3 µm for MFD 26 µm. The current of air may be replaced by ultrasonic vibrations and the loss sound wave passing through a plug of wool fibres converted to give a mean fibre diameter, the apparatus being calibrated with standard wools of known mean diameter. For all these methods the standard conditions for testing are 20° C ± 1° C and 65% HR ± 2 %. If tests are carried out in a non standard atmosphere, the results in micrometers may be corrected by a factor. For example: with RH of

- 40 % « factor = 1.022
- 65 % « factor = 1
- 85 % « factor = 0.969

Determination of percentage of medullated fibres (IWTO 8-89)

Immersion liquids with a refractive Index close to that of wool are used to render the wool substance invisible. The medulla is exposed by the reflection light at the keratin/air interface. Advantage of this principle has been taken by several researchers who have developed instruments with an appropriate optical arrangement based on a light source and photodiode. These instruments can be calibrated against the direct methods of medullation measurement such as the IWTO 8. This later is tedious, relies heavily on operator diligence and because the mass of the wool mounted on a slide it raises the question of representation. NIRA is known to be sensitive to particle size differences as well as to the presence of chemical bonds. The instrument measures the reflectance at up to 19 discrete wavelengths. The medullation results are regressed on the NIR absorbance data corresponding to selected wavelengthes, these made by purely on statistical performance.

The precision of the estimates using this technology is very strongly influenced by the reference methods used in the calibration. The standard error of prediction between NIRA estimates and direct projection microscope results has been calculated on NZ wools giving a 95% Confidence Limits of ± 5.7% by number, the range of wool tested being from 0 to 40%.

Determination of the kemp

There is, as yet, no standard or universally accepted definition and practical test method for measuring kemp. From international kemp round trials made by CSIR of S. Africa it appears, for the mohair, and considering various instrument methods, that FDA and Medullameter reading hold the most promise. The percentage of fibres coarser than 2 × diameter is the best estimate of the relative kempiness of the sample, the absolute values matching the average percentage by number values, determined visually fairly closely.

Wool fibre length distribution (IWTO 5-66)

No automatic apparatus but a manual one, on fibres sampled from the lot or fleece. The whole available bulk is spread on a large table and about 40 handfuls are taken, equally spaced throughout the bulk. One of each handful is carefuly divided in two , and half rejected. This procedure is continued until about 20 fibres are left. Each of the handful is reduced in this way, the 40 remaining group of fibres being stored separately on a large velvet covered board and covered with glass plate. The groups of 20 or 30 fibres are then transfered separately to a small velvet-covered board; from where two means of measure can be used.

- WIRA machine: each fibre taken with forceps is introduced under controlled tension and the lengths classified in 0.5 cm groups.
- GILLS System: with 1 cm interval (Zweigle comb sorter) where the web of fibres are put aligned, then extracted by group and weighed.

The length distribution may be expressed in different following ways for example.

- A frequency polygon showing the percentage, in number or weight, in each 0.5 or 1 cm length interval, plotted against the fibre length.
- A cumulative frequency curve showing the number (or weight) of fibres greater than a given length plotted against the fibre length. Confidence limits as Percentage of average fibre length:
  ± 10 % with 60 measured fibres
  ± 5 % with 250 measured fibres
  ± 3 % with 700 measured fibres

Bundle strength of wool fibres (IWTO 32-82)

According to some experiments, there is a fairly good correlation between the tenacity of fibre bundles and that of single fibres. It should be noted, however that the mean strength of a bundle of fibres depends not only on the tenacities of the individual fibres, but also on the mean extension of the individual fibres, its CV and the slope of the mean rheological curve of the individual fibre in the plastic zone. This is why the mean strength of a fibre bundle is always lower than the sum of the strengths of the individual fibres constituting the bundle. Tenacity is defined as the ratio of breaking force to linear density; it depends on the type of strength tester used, the duration of breaking test. This is why the results obtained on different types of apparatus are note necessarily identical.

Principle: A bundle of several hundred parallel fibres, cut to equal length, is drawn from a representative sample, inserted in the special clamps with a uniform pre-tension, just sufficient to remove any crimp, and then broken on a strength tester. After breaking the fibres are weighed. If

L: Bundle length in µm, to which the fibres are cut, measured under the initial tension

G: Weight in mg of the bundle of length L

F: Breaking force of the bundle in CN

T is the linear density in Tex = $G/L.10^3$. Tenacity is = F/T in CN/Tex

Obviously sampling requires special preparation. A representative bundle may be obtained by mixing and parallelisation on the Zweigle comb sorter by repeating several times the alignment and drawing of fibres. The number of bundles to be tested depends on the precision required. The CV is generally less than 3% and obtained with 10 tests.

Determination of the felting properties (IWTO 20-69)

Principle: One gramme of wool is shaken for a specified time with 50 ml of a felting medium, buffer solution , in a standard container on a shaking machine with three dimensional movement. The loose fibre is formed into a felt ball, the diameter of which is measured. A small diameter felt ball indicates good felting properties, and a large diameter felt ball indicates poor felting properties. Standardised procedure exists to: Prepare samples — Set and adjust the shaking machine (Aachener Filz Test) — Determine the diameter of the ball — Calculate and express the results

Measurement of the colour of raw wool (IWTO - E. 14-88)

The eventual requirements for sample preparation for colour measurement are that the wool shall be cleaned of contaminants (grease, dirt, vegetable matter) well blended , and conditionned. The procedures used in sample preparation — scouring, removal of vegetable contamination, drying, conditionning in a standard laboratory atmsophere of 20° C ± 2°, 65 % HR ± 2% — should be such that modification of the colour of the test specimen is kept to a minimum. The prepared test specimen is measured to give the CIE tristimulus values X, Y and Z for illuminant C and the 2° observer. Between instrument variations are reduced by the use of a reference wool to calibrate the colorimeter. A working calibration tile which has been measured against the reference wool may be used. For spectrophotometers, which cannot be calibrated in this way, the manufacturer's calibration is checked at least every four hours of operation. The system of co-ordinates CIELAB, where:

L represents the brigthness.

a* represents the green-red axis,

b* represents the blue-yellow axis,

gives a more understandable expression of colour. Also a degree of whiteness may be calculated following formula:

$$W = \left((100-0.94Y)^2 + (2.84X-2.35Z)^2\right)^{\frac{1}{2}}$$

representing the colour difference from a white standard reference, lower is W more white is the wool.

Coloured fibers (IWTO - E. 13-88)

The determination of the existence and level of coloured fibre contamination is a complicated problem for several reasons. The diversity of the contaminant fibres found — the difficulty of defining and describing them precisely — the difficulty for the operators to work along a day without ocular fatigue and loss of repeatibility To day, lone a test method under examination is available before registration after interlaboratory trials succeed in achieving results. *Principle:* Wool is opened, either mechanically or by hand to a web area density whereby coloured fibre faults may be detected and counted. Illumination of the opened web is by uncoloured light adjusted so that uncoloured are not visible. A scale for grading black and brown fibres is described. Five levels (4 → 8) with tristimuli data (X,Y,Z) are defined and also dye recipes to prepare these reference fibres, detection apparatus (CSIRO Dark Fibre Detector) conditions of illumination, work site, conditions of contamination, counting, are given.

Bulk and resistance to compression

There are various ways of quantifying the bulk of wool, the two most often-used methods being the measurement of the resistance to compression (Australian principle standard) and the measurement of the space filling properties (New Zealand principle standard). Generally it consists of a cylinder into which the wool is introduced and a piston which lowered on the wool. For one, the force required to compress a test specimen to a fixed volume is measured and converted to kilopascals. For the other, after a short cycling routine, the height of the occupied space is measured and the bulk of the wool can be then be expressed in cm^3/g. However these two methods are not yet internationally accepted and almost more suitable for wool growers than for commercial objectives.

Determination of wool base and vegetable matter base-yield (IWTO19-90)

Principle. A representative sample of raw wool is obtained from each bale in the lot by coring methods. Representative subsamples of the cores are weighed, scoured, dried and reweighed. Tests specimens are then taken from each scoured subsample for the separate determination of vegetable matter (which can be exprimed as Vegetable Mater Base), ash and ethyl alcohol extractives. The percentages of these non-wool constituents found are need to determine the dry mass of wool fibres free from all impureties which, when expressed as a percentage of the mass of the sample is the Wool Base. Methods for scouring the subsamples, determining mass of scoured sub-sample.

- The Oven dry
- The Ash Content
- The Ethyl Alcohol extractable
- Total Alkali Insoluble impureties and Vegetable matter are standardised

Analyse colorométrique et détermination quantitative des mélanines dans le manteau de chèvres avec differents genotypes de pigmentation.

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Abstract

A colorimetric analysis (Munsell method) and chemical determination of melanines were carried out using 15 samples of pigmented goat hair of long coated goats from Southern Italy. The quantity of melanine was determined by permanganate oxidation of eumelanines in 2,3,5-tricarboxilic pyrrolic acid and by hydriotic acid hydrolyse of phaeomelanines in amino-hydroxyphenilanine. Liquid chromatography at high pressure was used for the determination. The black and white samples are achromatic; the others vary between 'red' 2.5 YR 4/6 and 'reddish yellow' 7.5 YR 6/8. Eumelanines as well as phaeomelanines were present in all samples; the ratio varied between 224.3 and 0.54. The black phenotype is characterized by strong activity of the eumelanine synthesis. The existence of a small activity of biosynthesis seems to prove that motley colours are the result of the local inhibition of the activity of melanocytes. It seems that a distinction between red and brown phenotypes cannot be made when using these two methods; their genetic definition remains uncertain.

Introduction

L'éspèce caprine se caractèrise par une variation de phénotypes de coloration notable. Jusqu'à présent presque une dizaine de patrons pigmentaires (noir, rouge, badger face, noir et feu, mantelé, mantelé inverse, oeil rouge, gris, sauvaae), différents types d'altérations de la pigmentation de base (blanc uniforme, grisonnement) et quelques types de panachure (irrégulière, cinture) ont éte inventoriés (Lauvergne & Howell, 1978; Lauvergne, 1983; Millar, 1986). Dans son dernièr rapport le Cogovica (1989) a recensé 4 loci (Agouti, Brown, Frosting et Roan) tous bialleliques sauf l'Agouti qui presente trois allèles bien identifiés (badgerface black and tan et nonagouti) et une série qui nécèssite encore d'analyse de segrégation. Ce notable polymorphisme a été d'abord utilisé pour l'étude des populations caprines traditionnelles selon la definition donnée par Lauvergne (1982, Renieri et al., 1986; Lauvergne et al., 1986; Lauvergne et al., 1987; Matassino et al., 1984). L'autre domaine de recherche est représenté par les animaux spécialisés pour la production de fibres et fourrures, notemment les races qui appartiennent au groupe 'cachemire' et l'angora pour les lignées naturellement colorées. Il est Possible à present d'associer pour l'étude de la coloration des mammifères le simple examen colorimétrique avec une série d'analyses chimiques, physiques et microscopiques, indispensables pour une définition correcte de l'aspect biologique et génétique des phénotypes colorés (Renieri, 1990). Une première ébauche a été realisée sur les races Angora et Toggenburg des Etats Unis par Sponenberg et al. (1988). Cet article représente une contribution ultérieure à l'interpretation de la coloration des chèvres à travèrs l'étude de la correspondance existante entre un examen colorimétrique réalisé avec un atlas et la détermination chimique des mélanines présentes dans différents patrons Piqmentaires.

Matériel et méthodes

L' analyse a été realisée sur 15 femelles à poil long échantillonées dans deux élevanes de la région Campanie, dans l'Italie du Sud, et classées en 4 groupe: noirs, blancs, rouges et marrons. Les échantillons de poil ont toujour été prélevès dans la region des flancs. Pour l'examen colorimétrique, une méthode de repèrage visuel des coleurs à partir de l'atlas Munsell (1975) a été utilisé. Dans cette méthode, basée sur une comparaison visuelle directe des couleurs par l'oeil humain, chaque teinte est décrite par trois variables: la teinte, 'Hue', qui défini la couleur et varie entre 0 et 10 en fonction de l'augmentation du jaune et la réduction du rouge; la valeur, Value', qui permet de distinguer une couleur claire d'une couleur foncée et qui varie entre 0, noir absolu et 10, blanc absolu; la saturation 'Chroma' qui permet de différencier les couleurs ternes des couleurs vives et qui varie entre 0 et 20. L'atlas se présente comme une suite de planches colorées et permet de donner à chaque teinte une-ualeur ou un degré de saturation. La nomenclature de la couleur est donc constituée par le nom et Par la notation Munsell. Les tables utilisées pour les mammifères varient entre Hue 5R et Hue 5Y. La définition de la couleur est faite directement par l'observateur sur un échantillon de poils deposés sur fond blanc et éclairé par la lumière artificielle d'une lampe de 60 watt qui se trouve a 20 cm de distance. Le noir, le blanc et les variations absolues du gris sont des couleurs achromatiques (no Hue, Chroma = 0) pour lesquelles une notation spécifique existe (N). La détermination des mélanines a été obtenue avec la méthode proposée par Ito et Fujita (1985). Elle se caractèrise par l'oxidation permanganatique des eumélanines en acide pyrrole-2,3,5,-tricarboxilique (PTCA) et par l'hydrolyse iodhydrique des phaeomélanines en aminohydroxiphenilalaníne (AHP). Les rendements sont, respectivement, du 2% et du 20%. Les standards utilisés ont été l'acide 5-hydroxi 2-indocarboxilique pour les eumélanines et la 5-S-cysteinildopa pour les phaeomélanines. La détermination a été realisée avec la chromatographie liquide à haute pression (HPLC).

Résultats et discussion

Les résultats de l'examen colorimétrique sont présentés dans le Tableau 1. Quatre échantillons, deux noirs et deux blancs, sont achromatiques. Tous les autres sont classés à l'intérieur de la variation de teinte 2.5–7.5 YR. Les valeurs obtenue pour le PTCA et pour l'AHP sont présentées dans le Tableau 2; ces valeurs, transformées en eumélanines (PTCA × 50) et phaeomélanines (AHP × 5), sont mises en relation avec la nomenclature Munsell,des couleurs, dans le Tableau 3.

Tout d'abord il faut noté la puissance pigmentaire des échantillons noirs en ce qui concerne les eumélanines; le taux de ces piqments est énormement plus grand de ceux qu'on observe dans tous les autres patrons et les rapports eu/phaeo sont les plus hauts. Au contraire, les échantillons blancs présentent la plus faible quantité de pigments; de toutes facons, l'existance même des pigments qui peuvent etre releves nous explique que la panachure en question a été produite par une inhibition locale de l'activité des mélanocytes qui ont pu donc migrer de la crete neurale. Les rapports eu/phaeo ne nous permettent pas d'interprèter la coloration de base éfasée par la panachure. A l'intérieur de la variation de teinte 2.5–7.5 YR des situations biochimiques trés différentes existent. Dans 4 cas, la quantité des phaeomélanines dépasse celle des eumélanines. Ceci arrive avec des situations de teinte trés differentes, 2 étant des échantillons 'yellowish red' 5 YR qui varient seulement pour value et chroma et 2 des échantillons 'reddish yellow' 7.5 YR qui varient seulement pour la valeur de chroma. Dans tous les autres cas, le rapport eu/phaeo est très proche à l'unitè (variation entre 1.05 et 3.77) et la quantité de melanisation semble etre semblable. La seule exception est donnée par un échantillon 'reddish yellow' 7.5 YR 6/8 qui présente une énorme supériorité quantitative des eumélanines (eu/phaeo = 33.35).

Tableau 1. Analyse colorimétrique. Pour la nomenclature on utilise la notation anglaise.

Nom		Hue		Value/Chroma
1	Black	-		-
2	Black	-		-
3	Red	2.5	YR	4/8
4	Yellowish red	5	YR	3/6
5	Yellowish red	5	YR	4/6
6	Yellowish red	5	YR	4/6
7	Yellowish red	5	YR	4/6
8	Reddish yellow	5	YR	6/8
9	Strong brown	7.5	YR	5/6
10	Strong brown	7.5	YR	5/6
11	Reddish yellow	7.5	YR	6/6
12	Reddish yellow	7.5	YR	6/8
13	Reddish yellow	7.5	YR	6/8
14	Whithe	-		-
15	Withe	-		-

Tableau 2. Les valeurs de PCTA et AHP.

Phénotype		PTCA ng/mg	AHP ng/mg
1	Black	783.5	31
2	Black	647.6	31
3	Red 2.5 YR 4/8	65.1	509
4	Yellowish red 5 YR 3/6	57.5	597
5	Yellowish red 5 YR 4/6	57.15	545
6	Yellowish red 5 YR 4/6	86	1175
7	Yellowish red 5 YR 4/6	52	394
8	Reddish yellow 5 YR 6/8	52.6	139.5
9	Strong brown 7.5 YR 5/6	28.25	138
10	Strong brown 7.5 YR 5/6	33	279.5
11	Reddish yellow 7.5 YR 6/6	58	1 068.5
12	Reddish yellow 7.5 YR 6/8	99.75	1 158.5
13	Reddish yellow 7.5 YR 6/8	170.1	51
14	White	32	34
15	White	24.75	33

L'interpretation de ces résultats est très difficile. Les échantillons qui possèdent une majorité de phaeomélanines pourraient représenter les phénotypes 'jaunes-rouges' génétiquement determinés, mais la quantité des eumélanines reste encore très élevées. Dans les mammifères ou il a été démontré (souris, homme), le phénotype 'jaune-rouge' se caractèrise toujours par un rapport nettement favorable aux phaeomélanines. Il faut considérer à part l'échantillon 'reddish brown' 7.5 YR 6/8 qui se caractèrise par un papport eu.phaeo de 33.35 et qui présente

Tableau 3. Les valeurs corespondence des eumélanines et des phaeomélanines.

	Phénotype	Eumélanines ng/mg	Phaeomélanines ng/mg	Eu/Phaeo
1	Black	36 925	155	224.3
2	Black	32 380	155	209
3	Red 2.5 YR 4/8	3 258.7	2 545	1.3
4	Yellowish red 5 YR 3/6	2 875	2 985	0.96
5	Yellowish red 5 YR 4/6	2 857.5	2 725	1.05
6	Yellowish red 5 YR 4/6	4 300	5 875	0.73
7	Yellowish red 5 YR 4/6	2 610	1 970	1.32
8	Reddish yellow 5 YR 6/8	2 630	697.5	3.77
9	Strong brown 7.5 YR 5/6	1 412.5	690	2.05
10	Strong brown 7.5 YR 5/6	1 650	1 397.5	1.18
11	Reddish yellow 7.5 YR 6/6	2 900	5 342.5	0.54
12	Reddish yellow 7.5 YR 6/8	4 987.5	5 790	0.86
13	Reddish yellow 7.5 YR 6/8	8 505	255	33.35
14	White	1 600	177	9.4
15	Withe	1 237.5	165	7.5

una très faible quantité de phaeomélanines (255 ng/mg); il pourrait représenter le patron brun lié à l'action des mutations au locus Brown. Les résultats obtenus sont en accord avec ceux décrits par Sponenberg et al. (1988); la plupart des échantillons analisés par ces Auteurs (et classés subjectivement rouge et marron) présentent un rapport eu/phaeo qui se dispose autour de l'unité; les noir sont tres fortement éumélaniques; l'échantillon blanc presente une melanisation reduite.

Conclusions

Une série de conclusions nous semble possible. D'abord, la caractérisation colorimétrique et biochimique du phénotype noir est assez claire, étant donnée l'énorme quantité d'eumélanines qu'on peut retrouver. La couleur blanche de la panachure ne correspond pas à l'absence totale de pigments qui sont toujours relevables, meme si en quantité très faible. Il est trés difficile de différentier le phénotype rouge du marroni ces phénotypes sont determines par des systèmes génétiques differents. A ce propos, il faut observer que ni l'examen colorimétrique ni celui biochimique semblent etre capables de permettre cette différentiation, parce que tous les deux présentent un polymorphisme puissant; la plupart des phénotypes classés jaune-rouge ou marron se caractèrisent par un mélange de eu et phaeomélanines presque paritaire, ce qui complique la possibilité d'interpretation génétique; très peu d'échantillons avec une prépondérance de phaeomélanines (possible phénotype phaeomélanique) et seulement un qui apparait marron avec une forte quantité d'eumélanines (possible phénotype brun) ont été observés. En général, donc, la correspondance entre analyses colorimétrique et biochimique reste très faible et limitée seulement aux phénotypes noir et blanc. Leur utilisation contemporaine semble donc inutile et, de toute facon, la distinction entre jaune-rouge et marron peut etre faite seulement avec une analyse au microscope électronique pour mettre en évidence le type de mélanosome plus représenté dans le mélanocyte. En conclusion, donc, pour une approche correcte et complète à l'analyse biologique et génétique de la coloration des mammifères il faut utiliser en meme temps soit l'analyse biochimique soit l'analyse microscopique ou ultramicroscoipque, parce que la plupart des variations qu'on observe sembent etre liée aux modifications mélanosomiales et mélanocytaire et non aux variations biochimiques.

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Carpet wool, production and requirements

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Summary

Indigenous breeds of sheep in the Mediterranean basin and Middle East vary in their fleece type, where some high quality carpet wool is produced.

In carpet wool breeds, increasing fleece weight should be the main selection target, with improvement of bulk and whiteness as the next more important. Kemp fibres are objectionable and should be eliminated. The birthcoat of lambs, at an age of one month, might serve as an aid for early selection of adult fleece type.

A regional plan for improvement of carpet wool would include the storage of potential breeds in reservoir flocks. Carpet wool stud ram flocks would be established and selection would be within and amongst breeds. Combination of local genetic resources of potential breeds (Awassi, Karaman, Karakul, Kurdi) might contribute towards increasing productivity, while retaining adaptability.

An integrated marketing system, composed of harvesting, clip preparation and packaging, is recommended. It is suggested to establish a carpet wool marketing organization on a regional basis, that would market wool on behalf of producers and maintain liasion with all processors. Sale by sample of carpet wool would be based on a certified test and visual appraisal of a grap sample. Marketing would be assisted through the introduction of objective measurement as well as reserve price sheme by the organization.
Keywords: fleece weight, kemp, birthcoat, carpet wool marketing organization, objective measurments, sale by sample.

Introduction

Sheep and goat raising forms an important economic activity in the Mediterrnean basin. In 24 countries of the Mediterranean basin and Middle East, the total average greasy fleece weight of 1.594 kg produced was very low in comparison with the world total average of 2.712 kg and those of 5.708 kg and 5.531 kg in Australia and New Zealand, respectively (F.A.O. Yearbook, 1990). This would invite efforts to improve wool productivity of these indigenous breeds. The area under study produce some high quality carpet wool which is in high demand on the world market. It is therefore that this work is presented to outline information required for improving and promoting carpet wool in the region under study.

Carpet wool

Carpet wool breeds have a relatively low secondary to primary follicle (S/P) ratio and a high ratio of primary to secondary follicle diameter.

Carpet production is one of the most important end uses of wool and manufacturers usually spin blends of different types of wool, in a ratio depending on availability, characteristics required in the completed carpet and price. In the carpet wool blend, three categories of wool are used:

1. Speciality carpet wool; usually highly medullated and frequently very bulky.
2. Basic or general purpose wool; of good colour, strength and spinnability as coarse crossbred fleeces.
3. Filler wools; cheap types that are usually short, tender and are of ten pigmented such as crutchings, pieces, bellies and poor oddments.

In carpet wools fibre length is much more important to the manufacturer than that of mean fibre diameter. Medullation in carpet wool blends is more favourable in woollen processing than that of the semi-worsted. Wickham (1978) associated medullation in speciality carpet wools with resilience that allows recovery of the pile following treading. Resilience and the ability to withstand hard wear are the two special requirments for carpet wool. Bulk is associated with resilience and gives better cover to the carpet and with helical crimp and medullation.

Marketing system

It is recommended to use an integrated marketing system composed of harvesting, clip preparation and packaging. Harvesting would use an efficient way of shearing in which mobile electric shearing machines are used.

To develop efficient wool clip preparation, one has to consider the important characteristics, their sources of variability and the ability of growers, classers and buyers to influence this variability. Work on clip preparation emphasies the role of raw wool characteristics on processing.

It is necessary to estsablish 'a carpet wool organization', on a regional basis, in the Mediterranean basin and Middle East. The organization should be independent and aware of the international atmosphere. It would market wool on behalf of producers and maintain liasion with all processors. It would infrom producers, processors and the community of developments in the carpet wool industry. It would have a responsibility to sell and set down principles for growth, and preparation and have power over the fibre once it moved from the farm into its orbit. It would organize extension to carpet wool producers on clip preparation. It is recommended to produce a few standard grades which could be reliably standardised. Guirgis (1973) devised a simple grading system for coarse wool Barki, composed of three grades, based on staple length and kemp content, and that produced lines different in length, diameter, their variability and fibre type percentages.

The major task ahead is that of developing an integrated total specification system that fully exploits all available information to reduce marketing costs and simultaneously provide a product whose performance is highly predictable. The introduction of objective measurements into greasy wool marketing and the introduction of a reserve price scheme at about the same time represent two of the most significant changes in wool marketing.

Trading would be carried out on the basis of specification of characteristics of raw wool that are directly related to its processing potential. Work in New Zealand (Edmunds, 1990) led to the establishment of six essential parameters for specifying a blend for making a satisfactory carpet yarn meeting specific processing performance criteria at optimum raw material cost. Parameters are, mean fibre diameter, colour, length-aftercarding, bulk, vegetable matter base, and medullation content.

In the area under study, where wool is sold on a greasy basis, clean yield would be added to a test certificate, performed by an independent authority, and visual appraisal of a grab sample. Parameters required for specifying carpet wool would be "mean fibre diameter, colour, % clean yield, staple length, staple strength, bulk, vegetable matter base and medullation content".

Potential breeds

Potential breeds of the region could be used to improve productivity of the local stock(Guirgis, 1988). The establishment of breeding stud flocks would produce superior sires, for distribution to flock owners. The storage of potential breeds (Awassi, Karaman, Karakul, Kurdi, Baluchi, Churra) in reservoir flocks on a regional basis under the auspices of some regional organization is suggested. This would be financially supported by member countries, from certain percetages on their sale of carpet wool, and the sires would be made available for breeding purposes throughout the region. Well organized research programmes coordinated through regional, and international organizations, would expand the contribution of potential breeds of the Mediterranean basin and Middle East on an intra-regional basis. Turner (1987) postulated a 20 percent increase in clean wool weight in 10 years, through selection.

Breeding objectives to imporve carpet wool

In carpet wool breeds, Ross et al. (1980) reported that increasing fleece weight should be the main selection target, with improvement of bulk and whiteness, as the next more important. Kemp should be largely eliminated and the proportion of very heavily medullated fibres reduced. However, formation of breeding schemes requires knowledge of the estimates of economic importance and genetic parameters of many carpet wool traits. In New Zealand, the main selection traits in the breeding of the speciality carpet wool Drysdale breed are the number of lambs born (or reared), fleece weight and fleece grade.

Guirgis (1988) drew attention to the role of fleece in thermoregulation and recommended selection for increased wool production based on greasy fleece weight through increased fibre length. This would be favourable to that based on increased fleece density, the latter would be undesirable in hot humid climates as it would encourage the faulty canary yellowing. Heritabilities and repeatabilities of fibre length range from medium to high.

Acharya (1986) recommended the selection for first six monthly greasy fleece weight and against medullation percentage in extremely hairy breeds. This would improve greasy wool production and quality towards better carpet wool. The organization of sheep breeders into cooperatives which would undertake genetic improvement programmes, improve feed resources, provide health care and marketing expertise may be an effective system for raising productivity, Acharya added.

Kemps are short, heavily medullated shed fibres and Ross (1978) suggested that 4 percent by weight is the maximum that should be present. However, Guirgis and Galal (1972) found that kemp showed highly significant positive correlations with birth and weaning weights, as indicating the animal vigour, and was negatively correlated with fleece weight. Guirgis et al. (1982) reported a high heritability estimate of kemp score, of 0.43, in Barki coarse wool breed. Thus, the possibility of genetic improvement, through selection against kemp, could be easily obtained, but one has to consider its positive correlation with body weights.

Requirements

Ross (1978) summarized specifications required by the industry and producers, to maximise financial returns. To the carpet mill: staple length of about 10 cm; fibre diameter, high preferably 36μm or more; medullation, as medullated as possible, provided fibre strength and elasticity are satisfactory; no kemps; reasonably sound; high spinnability; high settability; helical crimp as high as possible for bulk and resilience; free from vegetable matter and other contaminants; maximum fleece openness, with no cotts. To the farmer, high fleece weight, high fertility of the sheep and consistent acceptable price premium.

An important requirement for almost all styles of carpet would be high yarn bulk (covering power), leading to good apparent value in the carpet, that gives the feeling as if there is plenty of wool in the pile.

Ince and Ryder (1984) found a good correlation between wool bulk and yarn set figures. The bulky or crimpy wools, which produced the better-set yarns, in turn produced carpets with a preferred appearance. Settability (fixation of yarn twist) affects the important aspect of appearance retention which is considered a significant determinant of good appearance.

Ross and Carnaby (1978) looked at the behaviour of a range of carpet wool fibres when spun into a woollen carpet yarn and reported a distinct effect of fibre type and diameter. The fine components of the Welsh Mountain fleece were much closer to the centre of the yarn than the medullated fibres and those again than the kemps. These findings were significant in relation to the appearance and handle of the yarn; kemps or medullated fibres in the blend end up on the outside of the yarn and give a distinct hairy appearance and a harsh handle.

In a study of the cortical structure of coarse wool Barki (BB), Merino (MM) and some of their crosses (3/8M, 1/2M, 5/8M), Guirgis (unpublished) found that percentages of fibres with radial cortical disposition comprised 34–35% of total fibres in BB, 3/8M, 1/2M afterwhich a drop to 20 and 3% occurred in 5/8M and MM, respectively. Radial fibres were coarser than those with bilateral structure. Diameter of bilateral fibres corresponded to 70, 63, 71, 68 and 94% of that of radial fibres in BB, 3/8 M, 1/2 M, 5/8 M and MM, respectively. Therefore the ortho-para-cortical distribution might be expected to affect yarn setting, where hairy fibres, mostly radial, would be mostly distributed on the outside of the yarn and that fine fibres, mostly bilateral, would be close to the centre of the yarn. When forming the right carpet wool blend, one would consider the cortical structure differentiation and distribution of the component wool types.

Early selection

Lambs born in adverse conditions, mountains and deserts, as most of the breeds under study, require a hairy birthcoat for survival, especially during their early post-natal life. Usually in coarse wool breeds, hairy birthcoats develop into kempy adult fleeces; kemp fibres are objectionable to the carpet industry. Kemp content showed a high heritability of 0.43 in coarse wool Barki (Guirgis et al., 1982) and could be easily bred out. The birthcoat of lambs, at an age of 4 weeks, might serve as an aid for early selection, against kemp in the adult fleece (Guirgis et al., 1979 a,b) and for some carpet wool characteristics (Guirgis, 1979), in potential breeds.

Recommendations for research

For local carpet wools, it is required to conduct work on:

1. Spinning trials to evaluate different blends of local carpet wools with imported speciality carpet wools, in an effert to achieve the optimum blend for different types of carpets.
2. Commercial objective tests for:
   a. Medullation, the estimate of a medullation index (Guirgis, 1978) to quantify medullation, as it varies from kemp to medullated fibres with different volumes of medulla whether continuous or interrupted. The important item is cortex to medulla ratio. Very coarse fibres with little fibre cortex in the cross section can have adverse effects when fibre strength and elasticity are required.
   b. Kemp, a score of 4 grades (0, no kemp to 3, excessive) would be useful to evaluate kemp. Kemp should be kept at a very low level.
   c. Bulk characteristics (resistance to compression).
3. Estimate of genetic parameters for different characteristics as medullation, bulk, kemp and variability of fibre diameter.

4. Development of suitable selection criteria for improving important indigenous carpet wool. Heritability estimates of birthcoat and that of survival rate. Effect of selection for and against hairy birthcoats on growth rate, fleece characteristics and survival rate.
5. Processing trials to evaluate the role of the different characteristics in carpet performance as medullation, fibre diameter and distribution, crimp, cortex/medulla ratio and ortho/paracortical distribution in the carpet wool blend.
6. Studies for early identification, at the birthcoat level, of adult fleece characteristcs required in the carpet industry.
7. Small scale industries (carpets and rugs) using local material (wool and natural dye stuff from local plants) for rural development.

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Investigations on the suitability of wool, for textile product and carpets, obtained from improved sheep in Western Turkey

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Abstract

By this study, the suitability of wools of newly developed sheep types like Tahirova, Acipayam and Sönmez for textile products and carpets have been investigated.

According to the obtained results; Tahirova wool is suitable for woollen and semiwortsted, Acipayam and Sönmez wools are suitable for standard carpet production. On the other hand the wools of these types can be used for hand knitted yarn production by mixing them with other fibres.
Key words: Tahirova, Acipayam and Sönmez, sheeptypes, wool characteristics.

Introduction

In Western Turkey the pasture and meadow areas have been declining so the need for improved sheep types and advanced management techniques is growing.

Sheep improvement studies have been carried out in Western Anatolia by the Faculty of Agriculture, Department of Animal Science, University of Ege. The main new sheep types of these are Tahirova, Sönmez and Acipayam. Tahirova type was produced by crossing Kivircik ewes with East Friesian rams in Tahirova State Farm which is located in the South Marmara. Sönmez type was improved by crossing Sakiz × Tahirova breeds in the experimental farm of the University of Ege which is located in Ege region.

Acipayam type was improved by crossing East Friesian × Awassi × Dagliç in Acipayam State Farm which is located in inner parts of Ege (Sönmez et al., 1981; Sönmez et al., 1987; Kaymakçi et al., 1989). Although the studies were done on meat, milk and others yields of the new types, there is no research on the characteristics of wool. By this study, the suitability of the wools of these newly developed sheep types for textile products and carpets have been investigated. Thus, the wool characteristics of these types are defined.

Material and methods

The materials of the study are wool samples of Tahirova, Sönmez and Acipayam types. Maximum 30 samples of wool were taken from every type. The physical characteristics have been analyzed such as fineness (micron), length (cm), breaking strength (g) and elongation (%). The measurement of fineness have been made by the short section method with lanametre. In order to determine fiber diameter we measured 300 fibres for each sample. The measurement of stable length and real length have been made by two pincers method. For the measurement 100 fibres from each sample have been chosen. The measurement of the breaking strength and elongation have been made by Fafegraph Strength Testing Gear. We tested 25 fibres for one sample to determine strength and elongation (Harmancioglu, 1974; Sönmez, 1985).

Results and discussion

Fineness

The fiber diameter values of Tahirova, Acipayam and Sönmez sheep types are given in Table 1. As shown in Table 1, the average fiber diameter of Tahirova is 34.37±0.50 micron. And fineness changes between 28.40 micron and 42.00 micron. Similar results are reported by Erdem (1990). The variation coefficient of fiber diameter values of Tahirova is 8.09%. This result shows us that the fineness of Tahirova wool is uniform. The average fiber diameter of Acipayam is 37.63±0.54 micron and it changes between 43.54 micron and 32.20 micron. According to the results the fineness of Acipayam wool is in the same group with Dagliç sheep breed which gives standard carpet wool. In our research it is determined that the average fiber diameter for Sönmez wool is 39.08±1.13 micron and changes between 50.36 micron and 34.18

Table 1. The fiber diameter values of newly improved sheep types in Western Turkey (micron).

Types	N	X ± Sx	S	Max.	Min.	V%
Tahirova	30	34.37 ± 0.50	2.78	42.00	28.40	8.09
Acipayam	30	37.63 ± 0.54	2.69	43.54	32.22	7.87
Sönmez	15	39.08 ± 1.13	4.37	50.36	34.18	11.18

Table 2. The average length values (staple and real) of newly improved sheep types in Western Turkey (cm).

Types	N	Characteristics	X ± Sx	S	Max.	Min.	V%
Tahirova	30	Staple	11.18 ± 0.39	2.18	15.88	7.06	19.50
		Real	16.76 ± 0.35	1.92	21.02	12.83	11.46
Acipayam	30	Staple	18.70 ± 0.91	4.96	32.20	6.38	26.52
		Real	19.92 ± 0.56	3.09	27.54	13.68	15.51
Sönmez	15	Staple	9.89 ± 0.59	2.29	14.43	6.73	23.16

Table 3. The mean values of breaking strength (B.S.) and elongation (E.) (%) for newly improved sheep types in Western Turkey.

Types	N	Characteristics	X ± Sx	S	Max.	Min.	V %
Tahirova	30	B.S.	25.36 ± 0.77	4.29	37.50	20.40	16.92
		E.(%)	43.59 ± 0.37	2.03	47.60	38.90	4.66
Acipayam	30	B.S.	30.74 ± 0.94	5.16	40.17	19.29	16.79
		E.(%)	45.88 ± 0.57	3.12	50.77	39.20	6.80
Sönmez	15	B.S.	21.14 ± 1.65	6.40	33.15	13.68	30.27
		E.(%)	42.21 ± 1.41	5.46	48.60	28.70	12.94

micron. The variation coefficients of Acipayam and Sönmez (7.87%, 11.18%) do not exceed the limit which is informed for carpet wool. But in fact Acipayam and Sönmez wools generally have fine fibres, they also contain some medullated fibre, heterotype fibres and few kemp fibres.

Length

The average length values (staple and real) of newly improved sheep types in Western Turkey are given in Table 2. As shown in Table 2 the staple length of Tahirova wool changes between 7.06 cm and 15.88 cm and the average is 11.18±0.39 cm. Also the real length of Tahirova changes between 12.83 cm. and 21.02 cm. and the average is 16.76±0.35 cm. The variation coefficients of staple and real lengths are 19.50 % and 11.46 %, respectively.

In our study it is determined that the average staple length for Acipayam is 18.70±0.91 cm., real length is 19.92±0.56 cm. and the variation coefficients of these values are 26.52% and 15.51%, respectively. The staple length of Sönmez wool ranges between 6.73-14.43 cm. (V. 23.16%) and the mean staple length is 9.89±0.59 cm.

Breaking strength and elongation (%)

The mean values of breaking strength and elongation for Tahirova, Acipayam and Sönmez types are shown in Table 3. As can be seen in Table 3, breaking strength and elongation (%) of Tahirova wool are 25.36±0.77 g. and 43.59% respectively. ahinkaya (1957) suggests that breaking strength is 9.90±0.99 g. and elongation (%) is 46.20±2.76 % in the wool which is obtained from Kivircik herd. When compared with Kivircik wool breaking strength of Tahirova is extremely high, but elongation (%) is low. The breaking strength of Acipayam wool is 30.74±0.94 g. and elongation (%) is 45.88±0.57%. In Sönmez wool these values are determined as 21.14±1.65 g. and 43.21±1.41%, respectively. The mean values of breaking strength for Acipayam and Sönmez wool which are determined in our study are extremely near to Dagliç wool (Utkanlar et al., 1965).

Conclusions

The results which are obtained in our study can be summarized as follows;

1. Tahirova wool which was produced by crossing East Friesian rams with Kivircik ewes is in the same quality of Kivircik wool, it is extremely uniform the point of view of fineness and length and because of these characteristics Tahirova wool is suitable for woolen and semiwortsted production like in Kivircik wool. Also it does not contain medullated fibres.
2. The staple lengths of Acipayam and Sönmez wools exceed the limit of staple length of minimum 10 cm. which is declared for carpet industry and they are in the same group of Dagliç wool values. The variation coefficients of staple length exceed the limit of 20% very little which is desired for staple length of good quality carpet wool.
3. The mean values of fiber diameter for Acipayam and Sönmez are in the average limits which is desired for the ideal carpet wools. The variation coefficients do not exceed the maximum limit of 15% which is declared for carpet industry.
4. Also Tahirova, Acipayam and Sönmez wools can be used for hand knitted yarn production by mixing them with other fibres.

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Etude bibliographique concernant le poil et la peau du dromadaire

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Summary

There is but little information on dromedaries' wool production in bibliographies. Most studies deal with the bactrian camel and of course South American camelids, the Alpaca in particular. This certainly results from two main causes:

- the commercial value of camel wool is, except in rare cases, neglected by producers,
- the hot and arid climate in which dromedaries live does not favour wool production as opposed to bactrian camels who are well adapted to cold weather.

Most authors report that the dromedary provides 0.5 to 1 kg of wool per year whereas the bactrian camel's production can be as high as 3 to 4 kg per animal and per year.

Clipped when two years old the dromedary provides 2 to 3 kg of wool whereas around 7 or 8 its coat may weigh 5 or 6 kg. Yet, the quality of the wool diminishes when the animal gets older, as much as far as wool percentage is concerned, as concerning its fineness: 85% of the coat of a one year old animal is made up of very fine wool with a diameter of 16–18 m. The quality of the wool also depends on the sex of the animal. Whereas male production is higher by 30%, a female's wool is finer. Moreover, the quality of the wool depends on the parts of the body and the finest wool is to be found at the level of the animal's shoulder. Some authors observe a relationship between the animal's diet and the production and density of the wool.

The variation factor which seems the most important is breed but no systematic study has been made on that point.

Dromedary's hair is particularly insulating, is easily woven and is traditionally used to cover family needs to make tents, rugs and clothes. It is not usually sold except under the form of craft products. The hide generally is of poor quality and used to produce harnesses or whips and, in some cases, sandals locally.

To conclude, the wool and to a lesser extent the hide of dromedaries are not used as much as they should be at the moment and studies should be conducted in order to enhance the values of these products which are far from being negligible.

Introduction

La production de poil de dromadaire reste, à ce jour, mal connue. Bien que les récentes bibliographies (T. Wilson et al., 1990; G. Saint-Martin et al., 1990) fassent état d'une cinquan- taine de références sur le poil de dromadaire, un examen plus approfondi montre que, très souvent, elles concernent soit une mention des poils à l'occasion d'une présentation de l'élevage camélin dans une région ou un pays (exemple: Ben Aïssa, 1989), soit des observations manquant parfois de précisions. Cela explique que la revue du CIPEA (E. Mukasa- Mugerwa, 1981) ne consacre que moins d'une page sur cent au poil et que Richard (1985) dans son livre bien documenté sur le dromadaire n'évoque le poil qu'en une demi-page parmi les autre productions. Cette situation semble imputable à deux causes principales:

- la valeur marchande de la laine de dromadaire est négligée par les éleveurs (Knoess, 1977) et la commercialisation ne concerne qu'une très faible part de la production à l'exception de l'Inde qui exporte 50 p.100 des 360 tonnes de poil produites annuellement (Krishnamurthii, 1970);
- le climat chaud et aride qui caractérise la zone naturelle d'élevage du dromadaire ne favorise pas la production de poils contrairement au cas du chameau qui est adapté au froid ou aux camélidés sud-américains notamment les alpacas.

En ce qui concerne la peau, tous les auteurs s'accordent pour souligner sa qualité très moyenne.

Production de poils

Quantité

Il existe de très grandes variations dans l'estimation de la récolte de poils chez le dromadaire comme le montre le Tableau 1 établi par Richard (1985). En général chez le dromadaire, la production annuelle varie ente 0.5 et 4 kg par tonte, qui se fait traditionnellement au printemps, alors que Leupold (1968) signale une production de 5 à 12 kg par tête chez le chameau. La production est variable avec l'âge. Elle augmente chez le dromadaire jusqu'à 7 à 10 ans (Dong Wai, 1980) et diminue après. Chez l'Alpaca, Bustinza (1980) présente une courbe de la production de laine, en fonction de l'âge (Figure 1). Velazco (1976) signale chez cette espèce l'influence de l'âge de la mère sur la production du jeune (Figure 2).

La production des mâles est supérieure d'environ 30% à celle des femelles. Elle peut, à l'extrême, être le double (Doncenko, 1956).

L'alimentation et les conditions climatiques peuvent très vraisemblablement influer sur la production de poils, mais nous ne disposons d'aucune étude systématique. Il en est de même de la race qui constitue le facteur le plus important de variation de la production de laine.

Tableau 1. Productions annuelles de poils de dromadaire (selon Richard, 1985).

Afrique			
Soudan	'très rare'	Cauvet	1925
	0.5–1 kg	Elamin	1980
Mauritanie	1–3 kg	Diagana	1977
Tunisie	3–4 kg	El Fourgi	1980
	3 kg (jeunes)	Burgemeister	1975
	1–2 kg (adultes)	Burgemeister	1975
Algérie	3–4 kg	Cauvet	1925
Libye	1.5–2 kg (adultes)	Karam et coll.	1981
Asie			
Inde	0.9–1.35 (max. 5.4 kg)	Krishnamurthi	1970
Pakistan	1 kg	Yasin - Wahid	1957
Arabie saoudite	1 kg	Cauvet	1925
	1.5 kg	Italconsult	1969
Syrie	2–3 kg	Hirsch	1932
	3–4 kg	Sakkal	1945
U.R.S.S.	4 kg (males)	Doncenko	1956
	2 kg (femelles)		

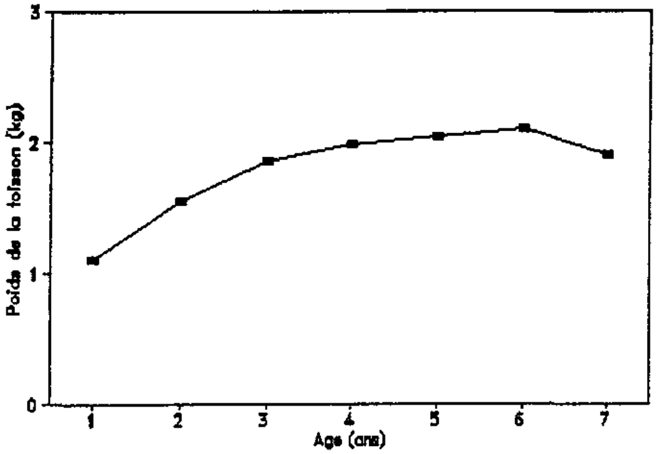

Figure 1. Poids de la toison de l'alpaca en fonction de l'âge.

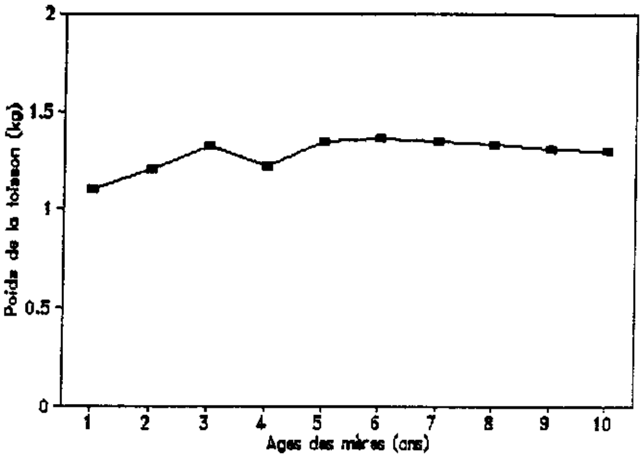

Figure 2. Effet de l'âge de la mère sur le poids de la toison des jeunes alpacas.

Qualité

La laine de dromadaire est réputée de bonne qualité, en particulier à cause de sa finesse et de son fort pouvoir isolant (Dong Wai, 1980), mais elle ne constitue qu'une partie de la toison; les fibres représentant 85% de la toison et la laine 70% des fibres. Si la production de poils augmente avec l'âge, la qualité de cette toison diminue aec l'âge; elle est supérieure chez les femelles par rapport aux mâles (Tableau 2).

Chez l'Alpaca, Bustinza (1980) signale que la finesse de la laine évolue de 17 microns à l'âge d'un an à 27 microns à 6 ans. La qualité de la laine diminue du haut vers le bas de l'animal, et de la tête à la queue, la laine la plus fine se trouve au niveau de l'épaule (Dong Wai, 1980).

Tableau 2. Caractéristiques du poil de chameau (Dong Wai, 1980)

	Mâles adultes	Femelles adultes	Mâles castrés	Jeunes
Pourcentage de laine	76.2	79.8	83.6	88.3
Finesse (micron)	18.3	14.7	14.9	14.9
Densité du poil (par cm^2)	2 730	3 205	3 201	4 522

Après la tonte, il faut prendre des précautions et garder les animaux fraîchement tondus à l'ombre pour éviter d'éventuelles boursoufflures. Le traitement de la peau avec du pétrole suivi deux jours plus tard de boue, retirée 3 jours après, permet d'éviter les infestations de parasites (Nanda, 1957; Singh, 1966).

Utilisation de la laine

La laine de dromadaire est utilisée pour la confection d'une grande variété d'objets : vêtements en particulier burnous, tentes, couvertures, sacs (El Amin, 1980), et pour ce qui concerne les fibres longues des cordages (Ben Aïssa, 1989). Il y a aussi une production de tapis. Toutefois, à part ces données, la production artisanale est en grande partie utilisée pour l'usage familiale des éleveurs.

La peau

De l'avis de tous les auteurs, la peau de dromadaire, beaucoup plus épaisse que celle des bovins, (Ben Aïssa, 1989) est de qualité médiocre (Mukasa-Mugerwa, 1980), elle est utilisée localement pour confectionner des pièces d'harnachement et des sandales (Diallo, 1989).

Conclusion

Cette brève revue montre que les éleveurs accordent peu de prix aux poils et à la peau des dromadaires. Sans aller jusqu'à préconiser une sélection sur la qualité de la laine et la finesse de la peau, il serait peut être intéressant de promouvoir une étude pour avoir une meilleure connaissance des caractéristiques du poil et de la peau des différentes races de dromadaire et des facteurs susceptibles de les améliorer. Il faudrait peut être mettre en oeuvre des structures permettant de valoriser mieux ces productions secondaires, certes, mais loin d'être négligeables chez le dromadaire.

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Fleece characteristics of Moroccan breeds of sheep

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Summary

The study is based on 2 873 fleeces collected from ewes of six Moroccan breeds of sheep. The Beni Ahsen breed had the heaviest fleece (2.64 kg) and the D'Man breed, the lightest fleece (0.98 kg). The coarsest wool was that of Timahdit breed with a spinning count of 48's and an average fiber diameter of 31.6 micron, while the other breeds had a fiber diameter on the order of 26 micron. The Beni Guil, Sardi, and Boujaad breeds had the least kempy fleeces and the D'Man breed had the most kempy fleeces. The percentage of medullated fibers ranged from 1.3 (Beni Guil) to 4.8 (Boujaad). The Timahdit breed had the largest staple length (9.6 cm) and the Boujaad breed, the smallest staple length (6.1 cm). Fleece yield ranged from 62.5% (Timahdit) to 57.3% (Beni Ahsen). This variation between breeds offers a wide range of possibilities for fleece utilization in Morocco.

Introduction

The various sheep breeds in Morocco fall into the category of 'wooled thin-tailed sheep'; they are mainly dual-purpose animals with meat being the most essential product, and wool a secondary product. A survey done by the Ministry of Agriculture indicated that 39% of the wool produced in Morocco is used in cottage industries, making blankets, rugs, and clothing such as the commonly used djellaba. The 61% that goes into commercial channels is sold to the textile industry (22%), and to wholesalers (39%); the last part was mainly used for mattress and pillow stuffing.

It is interesting to study wool traits of Moroccan breeds of sheep in view of the fact that little is known of the wool characteristics of these breeds and that wool is important for Moroccan carpets, which are in fairly high demand both in national and in international markets.

Material and methods

The present study is based on 2 873 fleeces collected from ewes of Moroccan breeds of sheep at two experiment stations (the Gharb with 5 breeds and 1913 fleeces, and the Tadla with 2 breeds and 843 fleeces), and from some flocks having a breed (the Boujaad) that was raised at neither station. The breed distribution of the fleeces was 339, 192, 877, 363, 985, and 117 for Timahdit, Beni Ahsen, D'Man, Beni Guil, Sardi, and Boujaad, respectively. The shearing time ranged from June to July.

Seven traits were studied: (1) Greasy fleece weight. After shearing fleece weight was recorded to the nearest 10 g. (2) Spinning count. A washed mid-side sample was graded by comparison to samples of known British spinning counts; the higher the count, the finer the wool and the more yarn could be spun. (3) Fiber diameter. Since Moroccan breeds have in general coarse wool, the diameter of 300 fibers was measured using a projection microscope (lanameter) according to the standards of the International Wool Textile Organization (IWTO) and the American Society for Testing and Materials (ASTM); kempy fibers were not measured. (4) Kemp. A sample was taken just before shearing from the left mid-side of each animal. The amount of kemp was assessed by using a six grade scale with 0 being no kemp and six the most kemp. (5) Percentage of medullated fibers. In a sample of 300 fibers, non-medullated fibers (fine wool) and medullated fibers with the exception of kemp (coarse wool) were counted under the projection microscope; the percentage of medullated fibers was estimated. (6) Staple length. The length of 100 fibers was measured by stretching the fibers against a ruler. (7) Wool yield was determined according to the procedure described by Ryder and Stephenson (1968, p. 725–726). The data were analyzed by the least squares method of fitting constants.

Results and discussion

Breed had significant effects on the seven wool traits studied. Means, standard errors, and numbers of observations are presented in Tables 1 and 2.

There were large breed differences in the average fleece weight. The six breeds of ewes differed noticeably in litter size; the D'Man ewes were the most prolific. Multiple births are highly demanding and could cause a loss of wool by shedding prior to shearing. The fleece weights shown in Table 1 are the reflection of wool growth differences as well as shedding differences between the breeds involved. The fact that the prolific D'Man ewes had the lightest fleeces is in agreement with the finding of Wiener (1967) that litter size was associated with shedding; that is, the larger the number of lambs born, the greater the amount of wool shed prior to shearing. As pointed out by Wiener (1967), it should be emphasized that prolificacy can only be an additional cause of variation of breed differences in shedding.

The importance of individual quality characteristics of wool is dependent on the end use for which a particular fleece is intended. With regard to wool manufacturing, fiber diameter is generally considered as the most important characteristic; finer wools enable a better spinning performance and give a softer handle to the product. For carpet wool, where fiber diameter is of little importance, fiber thickness can be predicted by using the spinning count method. In Morocco, the latter technique can be accurately, quickly, and cheaply utilized by trained observers under practical field conditions, where ease and speed of assessment are the key tools in the early steps of a wool selection program.

The variability in fiber diameter could be partially explained by the percentage of medullated fibers. In addition to true wool, heterotypes, or fibers possessing both medullated and non-medullated regions along their length, were included in the present study of fiber diameter. The percentage of medullated fibers is at a satisfactory level in the breeds studied, given that the end use of wool is carpet production.

In coarse wool breeds, fiber diameter could change as a correlated response to selection for color. In the case of Morocco, Ryder and Stephenson (1968) reported that in Berber breeds, black, white, and variegated sheep represented 20, 20, and 60 percent, respectively. The Siroua breed, from the fleece of which the rug of Tazenakht is produced, is believed to have derived from the Berber sheep by selection based on black wool in particular (Bourfia, 1989). The associated correlated response in fleece fineness would be of little consequence in a such a carpet wool breed.

In terms of yarn strength, longer fibers are preferable because of the more points of contact they have with other fibers (Ryder & Stephenson, 1968). While measurements of staple length may be of assistance in recording the fleece characteristics, the use of this trait as a selection criterion is not necessary in view of its positive genetic correlation with fleece weight (McGuirk, 1983).

Yield is of great importance in pricing raw wool, given that the processor of wool is only interested in the percentage by weight of clean fibers in a fleece. The fact that in the present study animals were managed in a common environment implies that the observed differences in yield may be due to genetic variation. As a general rule, breeds with coarse fleeces tend to yield more than breeds with finer fleeces, and breeds with long staples tend to yield more than

Table 1. Least squares means and standard errors of breed effects on greasy fleece weight, spinning count, and fiber diameter.

Breed	Fleece weight		Spinning count		Fiber diameter	
	n	mean (kg)	n	mean	n	mean (μ)
Timahdit	320	2.13 ± 0.03	303	49.41 ± 0.25	116	31.64 ± 0.30
Beni Ashen	176	2.64 ± 0.05	167	54.28 ± 0.33	-	-
D'Man	817	0.98 ± 0.02	749	50.79 ± 0.16	155	25.42 ± 0.26
Beni Guil	330	1.83 ± 0.03	342	53.85 ± 0.23	110	26.59 ± 0.31
Sardi	961	1.84 ± 0.02	872	56.17 ± 0.14	195	25.29 ± 0.23
Boujaad	81	2.04 ± 0.07	116	58.05 ± 0.39	72	26.18 ± 0.38
Total	2 685	1.91 ± 0.02	2 549	53.76 ± 0.10	648	27.03 ± 0.14

Table 2. Least squares means and standard errors of breed effects on Kemp score (0–6), percentage of medullated fibers (%), staple length (cm), and wool yield (%).

Breed	Kemp score		Medullated fibers		Staple length		Wool yield	
	n	mean	n	mean	n	mean	n	mean
Timahdit	303	1.82 ± 0.08	116	3.8 ± 0.5	75	9.6 ± 0.2	103	62.5 ± 0.8
Beni Ahsen	167	1.99 ± 0.11	-	-	-	-	55	57.3 ± 1.1
D'Man	749	3.60 ± 0.05	155	4.1 ± 0.4	214	6.7 ± 0.1	72	58.2 ± 1.0
Beni Guil	342	1.49 ± 0.07	110	1.3 ± 0.5	54	7.1 ± 0.3	87	57.9 ± 0.9
Sardi	872	1.49 ± 0.05	195	2.9 ± 0.4	166	6.4 ± 0.1	125	60.5 ± 0.7
Boujaad	117	1.40 ± 0.13	72	4.8 ± 0.6	117	6.1 ± 0.2	-	-
Total	2 550	1.96 ± 0.03	648	3.4 ± 0.2	626	7.2 ± 0.1	442	59.3 ± 0.4

breeds with shorter staples (Botkin et al., 1988, p. 432). Accordingly, the Timahdit breed, which had the coarsest wool and the longest staples, presented the highest yield.

In dual purpose sheep, the crucial question that must be faced is the relative cash values of meat and wool products. In Morocco, there is a lack of economic incentives for wool production. Returns of US $2 per fleece makes wool less attractive to producers. Bourfia (unpublished data) compared the prices in Morocco of lamb meat with wool over the last three decades and found that the overall trend was for wool prices to decrease consistently relative to lamb prices. There is reason to believe that this trend will continue at least for the current decade. Returns from wool were higher when Morocco was exporting scoured wool during the 1940's, 1950's, and 1960's. At the present time, Morocco is exporting carpets, but the carpet industry cannot find suitable wool in quantities large enough to meet its needs, even though Morocco has some fourteen million head of sheep distributed over more than twenty breeds (Bourfia, 1989).

In Morocco, there is a large variation in rug production and use. Moroccan rugs are generally made by hand using the technique of knotted pile weaving which is believed to have originated in Asia. The amendment (Dahir) of April 23, 1974 defined the standards that a carpet of a given quality should fulfill. One of those standards is wool quality. According to the statistics of the Ministry of Handcrafts, the production of carpets fulfilling the requirements of the State Stamp is approximately 1.7 million square meter per year.

There has been considerable discussion over the usefulness of medullated fibers for carpet production. While the presence of medullated fibers seems to be critical to the appearance of a carpet, if the proportion of medullated fibers is too high the uptake of dye and the final appearance can be adversely affected (McGuirk, 1983). Ross (1978), cited by Guirgis et al. (1982), summarized the technical aspects of wool requirements for the carpet industry as a kemp free wool with staple length ranging from 7 to 17.5 cm. According to Epstein (1987), an ideal carpet wool should have an average fiber diameter of 30μ, a mean staple length of 10 cm with a 20 percent variation in length, and kemp should not exceed 4 percent by weight. Moroccan wools comply in general with these requirements, but the staple length is somewhat shorter and kemp contents are higher.

The occurrence of kemp was assessed by weighting the fleeces according to the incidence of kempy fibers just before shearing. However, kempy fibers are known to break easily, so that any breed difference in the shedding of kempy fibers could introduce a bias when comparing the breeds with regard to kemp score. In spite of this potential bias, the present estimates of kemp could give a fairly good indication of the level of kemp in the six breeds investigated.

The heritability estimates of kemp score reported in the literature were found to be on the order of 0.4 (Guirgis et al., 1982), indicating that the amount of kemp in fleece can be reduced through selection to meet the requirements of carpet wool in particular. Using a measure of wool fiber medullation in young lambs, and selecting either for increased medullation score (Hairy line) or decreased medullation score (Fine line), Cue (1983) reported that selection for medullation had no correlated response in lamb mortality and found little evidence for the difference in lamb mortality between Hairy and Fine lines.

The mean kemp score of the D'Man breed was the largest. This highly prolific breed, which possesses the ability to lamb all year around, is raised in the southern oases of Morocco where the animals can be exposed to high degrees of sunlights and temperatures. Heat tolerance, i.e. ability for an animal to maintain deep body temperature during severe heat exposure, is an important characteristic in hot areas. Oasis sheep, such as the D'Man, have presumably been subjected to some natural selection for heat tolerance, and as a result they perform more efficiently in such an environment. While information is needed about the insulative value of kemp and other medullated fibers under oasis conditions, it is possible to assume that kemp in the fleece would play a protective role and help pregnant ewes and new-born lambs resist heat stress.

In spite of traditional complaints about kemp, it is felt that the genetic improvement of the D'Man sheep in the oasis context should secure the characteristics related to heat adaptation. It can be concluded that although it is possible to get rid of kemp through selection, it is perhaps better to keep a small amount of kemp in D'Man fleeces. Indeed, with such a high level of kemp score in D'Man fleeces, it is too early to be concerned about the complete disappearance of kemp from the D'Man wool; it can be reasonably assumed that it is possible to carry out selection against kemp fibers for few generations without affecting the level of hardiness of the D'Man breed.

Conclusions

The present study has been made prior to any organized selection program; nevertheless, there is reason to believe that the observed breed differences in fineness could well be the result of a selection that was applied by farmers to meet their needs on clothes. The results of this paper are to be interpreted as broad guidelines for stimulating further work on fleece characterization and implementing a policy to improve wool production of Moroccan breeds of sheep.

On the basis of existing evidence, it seems that greasy fleece weight is the major factor influencing gross returns from the sale of wool. At least for the present, there is no economic reason to base selection on other criteria. The available information from the literature substantiates the choice made in view of the fact that fleece weight was found to be at least moderately heritable in a wide range of breeds and that selection for increased fleece weight is expected to lead to increases in staple length and follicle density as correlated responses. Fiber diameter variability is likely to increase as a consequence of selection on fleece weight, but the problem is of little relevance in the case of Morocco where the main end use of wool is carpet production. Selection for increased fleece weight is also expected to boost the national economy since wool production at present does not exceed 18 000 tons of greasy wool per year, in spite of the relatively large number of the sheep population. The rationale behind the consideration of the traits investigated is merely for contribution to breed characterization; extensive fleece measurements other than greasy weight may not be justifiable at this stage of selection on the ground of cost.

The available evidence suggests therefore that a good start in Morocco would be to increase fleece weight by mass selection and remove animals with excessive amount of kemp by independent culling levels. It can be said with confidence that the implementation of such a breeding program is already in process at the national level. It is hoped that it will be sustained and result in a more profitable wool production.

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Session 6

Carpet and rug production

Chairman: B. Markotic
Co-chairman: H. Ipek.

The history and present situation of Turkish carpet industry

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Summary

It seems quite apparent with the discover of the carpets during the excavations of the Pazyryk tombs in the foothills of the Altai mountains in Siberia that the Turks were acquainted with the Turkish knot carpet technique during the time of the Huns, that is the 3rd or 2nd century BC. The next discovery of early carpets was made by Sir Marc Aurel Stein in 1906–08 in East Turkestan east of Lake Lop at Lou-Lan. Than Later A. von Le Coq in 1913 found small woven pieces of carpets dating from the 3rd to 6th century AD at a shrine in Qyzil near Kutsha during excavations in the Tarim basin also in Turkestan. These latter were woven with a simple knotting technique on a single weft and indicate that perhaps during this long period the advanced technique of the Pazyryk carpet may have been forgotten or lost.

The simple knotting technique of East Turkestan next appears in some carpets found in Fosfat (an ancient site near Cairo), carpets of the Abbasid period reflecting Islamic influences with their geometric designs.

It is a pity that there are no examples of carpets from Iran during the Selçuk Sultanate. The oldest carpets which we can examine carefully from the Anatolian Selçuk period are those with Turkish knots of the 13th century woven in Konya.

The animal-figured Anatolian carpets predominantly appeared in the 14th century and have their origins also in the Selçuk Period. In order to have achieved the fame and popularity they seem to have gained in Europe based on the frequency of their representation in the paintings of this period, the carpets must have been introduced into Europe during Selçuk times.

Beginning in 1451 with the reign of Sultan Mehmet the Conqueror and through the 16th century, these in paintings executed first by Italian and later by Flemish and Dutch painter. They most frequently were used by Holbein in his works and there by as a group, bear his name.

Alongside the development of the geometric type carpets of the 16th century there was at the same time the beginning of a new and exciting period in the art of Turkish carpet weaving. This started in Usak and grew out of an interest of classic Ottoman art. The development of Turkish carpet weaving continued until the end of the 19th century.

In the Konya, Kayseri, Sivas and Kirsehir regions, and in Isparta, Fethiye, Dösemealti, Balikesir, Yagcibedir, Usak, Bergama, Kula, Gürdes, Milas, Çanakkale and Ezine in western Anatolia and in Kars and Erzurum in Eastern Anatolia there are creative endeavors at revitalizing the art of Turkish carpet weaving.

Introduction

It seems quite apparent with the discovery of the carpets during the excavations of the Pazyryk tombs in the foothills of the Altai mountains in Siberia that the Turks were acquainted with the Turkish knot carpet technique during the time of the Huns, that is the 3rd or 2nd century BC. The next discovery of early carpets was made by Sir Marc Aurel Stein in 1906–08 in East Turkestan east of Lake Lop at Loulan. Then later A. von Le Coq in 1913 found small woven pieces of carpets dating from the 3rd to 6th century AD at a shrine in Qyzil near Kutsha during excavations in the Tarim basin also in Turkestan. These latter were woven with a simple knotting technique on a single weft and indicate that perhaps during this long period the advanced technique of the Pazyryk carpet may have been forgotten or lost.

The simple knotting technique of East Turkestan next appears in some carpets found in Fostat (an ancient site near Cairo), carpets of the Abbasid period reflecting Islamic influences with their geometric designs.

The early carpetmaker

It is known from historical sources that carpets during the 10th century were woven in Bukhara and other places in West Turkestan and that they were exported to other countries. This continued until the period of destruction by the Mongols in the 13th century.

There is in the Islamic Art Museum, Cairo a wool carpet (from Fosfat), one woven with palmettes on a red field and tied with the Turkish knot which J. Zick-Nissen after careful examination has suggested is among the first of the knotted carpets to have been woven in the Islamic world during the Middle Ages. This carpet has a band of Kufic writing in the border. Further speculation is that it was imported in the 7th to 9th century during the Abbasid Period from west Turkestan (Maveraünnehir). This indicates that Bukhara, not East Turkestan was the first weaving center.

Another fragment, this time with intricate designs and different border motifs which is in the National State Museum, Berlin, was acquired by Kühnel and is believed to have been imported to Egypt from West Turkestan (Transoxiana) and Bukhara. Since there are no other extant examples from this area other design variations cannot be cited.

There are however other early carpet fragments which were found in Egypt. These employ the knot on a single weft as used in the carpets of the East Turkestan group and usually they have a dark blue field. Two fragments from Fosfat are in the Benaki Museum, Athens and have been carefully examined by J. Zick-Nissen. Another recently found in the town Tulunlu el-Katai (near Cairo) and now in the Cairo University Collection carries the same characteristics, Kufic borders and pearl-lined connecting motifs. It seems apparent that when the Tulunids under Humaraveyh spread out from Egypt into Syria and the Adana region their weaving and carpet art developed. However it is a pity that there are no examples of carpets from Iran during the Selçuk Sultanate. The oldest carpets which we can examine carefully from the Anatolian Selçuk period are those with Turkish knots of the 13th century woven in Konya.

After F.R. Martin's discovery of eight Selçuk carpets in the Alaeddin Mosque, Konya in 1905, R.M. Riefstahl found three more in 1930, and in 1935 and 1936 seven others were found in Fosfat bringing the total of this collection to eighteen.

The art of carpet weaving which the Turks brought to the Islamic world extended the technique of single knotted wefts as far west as Spain. These pieces were greatly admired by the Europeans as can be attested by the frequency of their representation in the paintings by artists of the period.

Iranian carpets as such only appear after the 15th century for in the 14th and 15th century miniatures we find representations of carpets with borders of the Kufic design and motifs in common with those used on the 13th century Selçuk carpets. It is obvious that the development in Iran was influenced by the Turks. Original Iranian carpets only started to be produced in the 16th century. The Kufic borders of the Selçuk carpets which later developed into intertwining and floriate borders became an enriching element of Spanish and Caucasian carpets.

The animal-figured Anatolian carpets predominantly appeared in the 14th century and have their origins also in the Selçuk Period. In order to have achieved the fame and popularity they seem to have gained in Europe based on the frequency of their representations in the paintings of this period, the carpets must have been introduced into Europe during Selçuk times. One of these original carpets was brought to the Berlin Museum by W. von Bode from Rome in

1890. It has a dragon-phoenix combat composition (Ming). Another with bird figures flanking a tree was found in 1925 in a village church in Marby, Sweden. Later more examples of animal-figured carpets have come to light in Fosfat, Istanbul and Konya.

The 'Holbein' group of carpets

After finding the three Selçuk carpets in Beysehir, R.M. Riefstahl found a fourth carpet of the 15th century which can be designated as the beginning prototype of the later famous Holbein group of carpets. These carpets with geometric and intertwining floriate designs and Kufic-like borders originated during the Ottoman Period. Beginning in 1451 with the reign of Sultan Mehmet the Conqueror and through the 16th century, these appear in paintings executed first by Italian and later by Flemish and Dutch painters. They most frequently were used by Holbein in his works and thereby as a group, bear his name. Though not all are typical of Holbein representations, these carpets have been classified into four groups. The oldest and most characteristic group has small patterns of octagons and diamonds with submerged contours alternating in offset diagonal raws on a background of rumi palmettes. The second type, which in fact was not used by Holbein, consists of diamonds and cruciform-like devices of floriate motifs and octagons without contours. Since these are seen frequently in Lorenzo Lotto's paintings they are also called 'Lotto' carpets. These two groups were especially important elements in the development of the later Usak carpets.

The third and fourth groups of Holbein carpets have simple designs consisting of squares and rectangles with fillings of octagons. These designs which are related to the animal figured carpets became perfected during the 15th century and have continued in use until recent years. The Holbein carpets consisting of squares and rectangles with two small octagonal devices above and below, relate back to the carpets with border motifs of the Selçuk times. The large-pattern Holbeins are a transitional development leading to the Bergama carpets. In these, the geometric and sometimes strongly stylized floriate designs predominate. The oldest group of these carpets dates to the 16th century. In the 18th century animal figures were again introduced as filler motifs thus establishing a link to their predecessors, the animal-figured carpets.

Classic Ottoman art

Alongside the development of the geometric type carpets of the 16th century there was at the same time the beginning of a new and exciting period in the art of Turkish carpet weaving. This started in Usak and grew out of an interest and resurgence of other aspects of classic Ottoman art, particularly that of architecture. This rich and varied group of Usak carpets has been collected and thoroughly studied. From the two typical classic forms, the Star and Medallion Usaks, variations with rich motifs mark the beginning of a new period. These include carpets of the medallion type of up to ten meters in length in which the central medallions are flanked on each side by cut-off medallions thus signifying an endless expanse of composition.

The Tabriz medallion carpets are inspired by the decorative motifs on book bindings and covers. But the confined, static quality of this design has been given a new expansiveness by the use of these motifs on Turkish carpets. The Turks, not confined to the art of the book, preserved in this endless continuum the essence of the plasticity of the textile medium. The creation of Usak carpets continued from the 16th century through the middle of the 18th.

The eight-pointed star motif alternating with diamond-shaped medallions in offset rows, the composition of the Star Usak carpets, is the best expression of this feature. Excellent examples of small carpets of this type from the early 16th century can be seen, but later examples are not available since they ceased to exist by the end of the 17th century.

Simultaneously with the development of traditional Anatolian carpets a completely new type of carpet using naturalistic motifs emerged in the 16th century, the Ottoman Palace carpets. Using the Persian (Sine) knot instead of the traditional Turkish (Gördes) knot these weavers were able to produce a close-woven pile which had a texture similar to that of soft velvet. This was the beginning of a naturalistic style which pervaded all phases of Ottoman art. The ornamentation using all forms — tulips, hyacinths, roses, carnations, budding flower stems, graceful twisting leaves — continued to an increasing degree until the end of the 18th century.

The conquests by the Ottomans of Tabriz in 1514 and later Cairo in 1517 are important dates in Turkish carpet history. Under the influence of the Mameluke use of color and techniques in their carpets, the naturalistic and flower motifs became more evident and gave way to a new form of expression.

It was first thought that these carpets were produced on Mameluke looms and shipped to the court in Istanbul but from examination of sample carpets sent from Istanbul, E. Kühnel later modified his theory acknowledging that because of technique it was quite possible that some of these carpets were produced in Istanbul and in the famous silk center, Bursa. There is data to support this.

Sultan Murad III by Imperial Edict in 1585 had ordered eleven Egyptian weavers (one was Turkish, Arslan by name) to come to Istanbul together with their silk-like fine wool for weaving. This included the beautiful red, yellow, deep blue and fresh-green yarns used in Mameluke carpets. Customarily the warp and weft of these carpets were of natural white wool or the warp was sometimes of red wool, whereas the Ottoman Palace carpets woven in Istanbul and Bursa used silk in the warp and weft.

Except for two rather damaged large carpets (8.8 × 4.65 m and 4.28 × 4.8 m) and one prayer rug in the Museum of Turkish and Islamic Arts, Istanbul, and another prayer rug in the Topkapi Palace Museum, Istanbul no other examples are left in Turkey. These carpets having been generally exported are now in museums and private collections around the world. The two museum carpets were found in the Seyyid Battal Gazi Türbe, Eskisehir and were brought to the Museum of Turkish and Islamic Arts, Istanbul in January 1911 (10 Kanunu-sâni 1329) where they were inventoried as Nos. 768 and 153. The large one, No. 768 has a composition of five rows of diamond devices alternating in color from yellow to dark blue. The diamonds are connected to each other by two winged extensions. This baroque composition of connected diamonds is very common in Ottoman Palace carpets and can be found in another carpet, for example, in the Victoria and Albert Museum, London with exactly the same field composition as the one above except that medallions have been added.

From the middle of the 16th to the end of the 17th century these Ottoman Palace carpets continued to be woven though they were constantly declining in quality. The traditional compositions were carried on in a rather poor group of Usak carpets, a group which became known in the 19th century as the Izmir carpets.

On the other hand the vigorous character of the Ottoman Palace prayer rugs continued to live on in the 18th century in the wide variety of prayer rugs from Gördes, Kula, Ladik and Usak. There is an excellent example of an original palace prayer rug, one belonging to Sultan Ahmet I which is now in the Topkapi Museum, Istanbul. In spite of the fact that it was probably used under a brazier and has some burned areas in the center, it still is fit for the use of a sultan.

One other palace prayer rug is in the Berlin Museum. On the upper border the date of H 1019 (1610) has been woven as a chronogram which helps both to establish the fact that these rugs may have begun to be exported at the beginning of the 17th century and also to date the Sultan Ahmet piece.

The oldest known group of prayer rugs unique in Turkish carpet weaving is from the 15th century. The three rugs of completely distinctive composition now found in the Museum of Turkish and Islamic Arts, Istanbul attest to the lively creativity shown by this group, Other examples of this period can be seen in the Renaissance paintings of the Bellinis, Carpaccio and L. Lotto. In the Museum of Islamic Art, Berlin is a prayer rug which is identical to one found spread under the table in Giovanni's 1507 painting of the Venetion Doge, Loredan. One of the earliest representations is in a painting by Gentile Bellini in the National Gallery, London.

There is an exquisite Usak prayer rug of the early 16th century in the Berlin Museum which has in the depressed area at the bottom a very large palmette device not unsimilar to the one in the Bellini prayer rug. In the Bode Collection an Usak prayer rug of the 1600s is one of the examples of those woven with a very wide border and a single medallion in the middle of the field which contains o double mihrab. It is unfortunate that we have so few examples of the 15th and 16th century prayer rugs.

In the 17th century there was a sudden resurgence both in number and in variety of prayer rugs, most notably being those from Gördes with finely stepped mihrabs and undulating contours which at the same time reflect a continuation of the Ottoman Palace style. North of Gördes in Kula similar rugs with similar mihrab niches and borders containing up to as many as ten thin stripes should be noted. Kula also produced landscape-patterned rugs which included a composition of small houses and trees. Third in importance came the prayer rugs of Ladik. These were striking because of their soft texture and vivid colors and characteristic rows of long-stemmed tulips above and below the mihrab.

There are rugs with two-or three-contoured mihrabs in two or three colors of red that are products of Kirsehir and nearby Mucur. Milas prayer rugs on the other hand using motifs from the Gördes rugs are bright and many colored and have been influenced by the Usak and Bergama traditions.

The Transylvanian church carpets found in museums and collections around the world mostly date from the 17th century. These single and double-niched mihrab rugs are related to the Usak and Bergama groups. Besides these, there are numerous other types of prayer rugs which, though unique in their own way, reflect various influences.

The later years of carpet making

The development of Turkish carpet weaving continued until the end of the 19th century. In 1891 Abdülhamid II added a hundred carpetlooms to the fabric-looms which were set up in 1844 by Abdülmecid in Hereke, and started the production of the well-known Hereke carpets. Today in the same place, carpets are produced in the same style under Sümerbank Management.

In the Konya, Kayseri, Sivas and Kirsehir regions, and in Isparta, Fethiye, Dösemealti, Balikesir, Yagcibedir, Usak, Bergama, Kula, Gürdes, Milas, Çanakkale and Ezine in western Anatolia and in Kars and Erzurum in eastern Anatolia there are other creative endeavors at revitalizing the art of Turkish carpet weaving.

The epitomy of the unique contribution of Turkish carpet weaving lies in a continuity, one which builds and discards as it develops. In the process of giving and taking the uniqueness is matched by a firm grasp of the traditional. This freedom of expression has given rise to the vast variety which is the essence of art at its finest.

The carpet production and possibilities of improving production in Eastern Anatolia

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Summary

The Eastern Anatolia has 1/4 of sheep population of Turkey. The dominant sheep breed is Morkaraman. The wool colour in Morkaraman sheep changes from light brown to dark brown. In a Morkaraman flock there is also black, dark-yellow and violet (purple) coloured sheep. The Morkaraman wool is carpet type of wool and used in manufacturing touristic goods. There are also in small number of Akkaraman and Tuj sheep in this region of Turkey. The wool of these sheep are also used in carpet textile industry. The wool is white in this type of sheep.

Morkaraman wool is used in natural carpet manufacturing. Akkaraman and Tuj wool is dyed with natural dyes and used in making knitting handcrafts such as sweaters, cardigns, folkloric sacks etc. Natural colour Morkaraman wool is also used in making ehram (ihram) which is special type of Afghan made by hand and carpet textile. The fine type of Morkaraman wool can be used in manufacturing natural (Scottish type) cloth.

Introduction

The Eastern Anatolia is among the greatest parts of Turkey with its 1662.16 square miles (Tellioglu, 1983). This part of Turkey is covered with mountains. It's hot in summer and cold snowy in winter. The natural structure of the region is suitable to raise primitive sheep breed. Karaman which is a main primitive sheep breed, has been adapted to this region after a long selection. Karaman has white and red varieties. Red Karaman fleeces consist of the under coat with fine and short fibers and the outer coat with coarse and long fibers. Beside these two types of fibers, medullated and heterotype fibers are also present in the fleece (Tellioglu and Emsen, 1976).

The Eastern Anatolia has 25 percent of Turkey's sheep population (Anon, 1970). The income obtained from Karaman is 71 percent meat, 22 percent milk and the remaining 7 percent wool (Karatas, 1973). Because of this reason it takes a great part in agricultural economy of the region. White Karaman is better than Red Karaman. Its wool fleece is longer and rougher than the others. The coat fibers of fleece is fine and helix form (Tellioglu, 1983).

Fibres and colours

There are medulla and kelp fibres in addition to these fibres (Tellioglu and Emsen, 1976). The colour in Red Karaman sheep changes from light brown to dark brown (Tellioglu, 1983). There is also violet, brown, yellowish and dark sheep in a flock. The black one is called as 'Black sheep' (Batu, 1953). Red Karaman wool is dyed with dark colour because it is not suitable for light colour (Zakhary, 1973). In addition, color bleaching can not be done in Red Karaman wool because of this wool property. The 25 percent of Red Karaman wool is added to tops. ayak is a type of wool manufactured from these tops.

Classification

The carpets are classified according to the production techniques into two groups such as hand-made and machine-made carpets. The production techniques of hand-made carpet is primitive and this industry does not need a great deal of investment. The manufacturing of this carpet is the result of knotting of the each loop by hand (Tellioglu, 1983).

Hand-made carpet, kilim and ehram are woven traditionally in Bayburt, Gümüshane, Erzincan and Erzurum, the Eastern part of Turkey. This kind of weaving technique has not been changed much more than before. In order to improve this weaving industry belonging to the Eastern Anatolia with the parti- cular consideration of both technology and art, "Woolen Handcrafts Institute" was established in 1962, Atatürk University (Girisken, 1974). The above mentioned organization makes researches on old carpets and also teaches young girls how to make carpet, kilim and other touristic goods. This enables them to earn money and contribute to their family income. In order to improve hand-made carpet in this region, weaving techniques of carpet, kilim and touristic goods have to be taught the unemployed people and the government must make investment to encourage them. They also have to organize co-operative business to support themselves.

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The preservation of the traditional characteristics of hand-woven Turkish carpets and the importance of natural dyes

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Abstract

This paper consists of two parts. The first part includes an exposition of the traditional characteristics of hand-woven Turkish carpets in their historical development. The second part deals with one of the most important characteristics of those carpets, that is the use of natural dyes and dyeing methods and other characteristics related to dyeing.
Key words: Hand-woven Turkish carpets, traditional characteristics, natural dyes, dyeing methods.

Introduction

A short summary of the historical development of Turkish flatweaves will be useful in explaining the importance of Turkish carpets. Carpets are first included in the history of art by Robinson, but the development of research on this subject has began by Erdman. These researches have proved that the art of carpet weaving had been developed by the Turks and introduced to the world civilization by them (Aslanapa and Durul, 1973). The beginnings of the art of carpet weaving can be traced back into three sources:

1. The pazyryk carpet which was found by Rudenko during 1947–1949 is the oldest known example. Its technical characteristics are still a matter of discussion, but they are accepted as an accomplishment of Turkish Huns and as a product of great mastery yet to be outshined (Yetkin, 1991).
2. The carpets which were found by Sir Aurel Stein during 1906–1908 in Lou Lan kurgans in Eastern Turkestan and in a stupa in Lop-Nor are dated back to the first century BC.
3. Two fragments of rugs found by Lomm in Fustat are accepted as products of Abbasids. They bear some technical resemblance to those found in Eastern Turkestan and are dated back to the second part of the ninth century.

From the eleventh century on, under the reign of Anatolian Seljuks, the art of carpet weaving has begun to spread westward from Central Asia. Some examples of those rugs which show an incredible richness of colour and design are in museums in Turkey as well as in other parts of the world. Later on, other examples of Seljuk carpets were also produced in Konya and Beyshehir until the fourteenth century.

The pictorial representations by European painters show that animal designs had been introduced into fourteenth century Turkish carpets and these figures had been enriched towards the end of the fifteenth century. These carpets are called "Holbein" after the name of the painter who depicted them.

The Anatolian carpets which were produced throughout a period of 200 years were the basis of Turkoman and yoruk carpets. The carpets depicted by the painter Lorenzo Lotto are known as "Lotto". The Holbein and the Lotto provided a transition into another type of carpets named "Ushak" after the name of the region. Ushak carpets marked the beginning of the second brilliant period of Turkish carpets during the sixteenth century. These were produced during the seventeenth century and began to decline in the eighteenth century. Other important Turkish carpets were the sixteenth century Ottoman court carpets where different techniques and designs were used as well as the seventeenth century prayer rugs.

The geographical and geological conditions of Turkey and the role of Turkey as the cradle of various cultures through the ages are the main factors that constitute the technical variety and the richness of design and colour of the Turkish rugs and carpets.

We have given a slice of information about the history of the Turkish hand-woven carpets above. The source of their well deserved fame is their traditional characteristics. Below is a brief enumeration of these characteristics.

Material

Turkish carpets were woven with a specific wool taken from certain parts of the sheep in certain seasons. This is known as the kirmen (wooden spindle) wool. The way wool is spun is very important in determining the quality of the carpet.

Dyes and dyeing methods

Before the introduction of the first synthetic colouring matter by the famous chemist Perkin in 1860, natural dyes were used in carpet making. Various sources explain that natural colouring had been spread from Anatolia to the West. This was important for the Turkish economy. It is a well known fact that Turkey was once a producer and exported of natural dyes. The main colouring plants exported from Turkey were rubia tinctorum which is known as the oldest source of colouring matter for red and violet and cartamus tinctoria for yellow.

The richness of colour and design and weaving techniques

Another superior characteristic of Turkish flatweaves is the traditional richness of design with an exquisite knowledge of colour which can be taken as a reflection of the impact of old cultures. The knot-techniques and the amount of knots in a square centimeter are the components of these traditional characteristics. The ensuing part of this paper deals with natural dyes and dyeing methods which are important traditional characteristics.

The research on natural dyes began with the transition of mankind from covering their bodies into dressing themselves and continued in an ever growing speed. Although the history of textile colouring is considerably old, the textile material is not solid enough to stand unimpaired through the ages and we can only trace this history as far back as 2500 BC.

The efforts that began with the introduction of the first chemical dye and the recently found dyes have diminished a great deal the efforts to research of natural dyes and their use. Turkey who used to export natural dyes in the past, ceased the growing of the plants from which these dyes were produced. Recently developed dyes are easier to use and therefore they superseded the natural ones. Other important factors that force people to quit natural dyes are the collapse of some traditions under the impact of changing social and economic conditions and the damages inflicted on the ecological balance by using natural resources irresponsibly. Some examples of this development were the use of synthetic indigo instead of indigoferro which was the most important source of blue; the introduction of alizarin in 1864 instead of rubia tinctorum and the introduction of synthetic carmen in 1894 instead of cochincal and kermess.

With the beginning of the use of synthetic dyes, some problems arose in loop colouring and the traditional colours have decayed. The main reason for this development was the faulty use of dyeing methods due to lack of experience. In small workshops and houses, traditional natural dyeing methods have mistakenly been applied to synthetic dyes and the result was unintended colours. In addition, new techniques have been developed in order to make these spoilt colours resemble to the natural ones. Although detrimental for the wool fibres and hence for the quality of the carpet, they became very popular. Another important matter to be discussed is that these primitive methods of colouring and of making them seem faded and aged are very harmful for the health of people. But since the synthetic dyes are derivatives of tar which is known as a factor causing cancer, it is not difficult to see how dangerous those dyeing methods applied under unhealthy conditions are. These mistakes have continued until the beginning of the attempts to revive natural methods of dyeing in the last 5–10 years. The beginning of the revival of natural dyeing in many regions and the increasing number of researches conducted by the universities are hopeful developments. Lack of information and shortcomings due to an interruption in the transfer of sources are to overcome through researches. I would like to give some examples of these researches conducted by Çukurova University, Faculty of Science, Department of Chemistry:

- Research for new sources of natural colouring matter and development of new ways of colouring (Paksoy, 1983).
- Research for new mordants and new methods of treatment with mordants (Paksoy, 1983).
- Research for determining whether the colouring methods have any impact on the wearing away of the black looms that generally begin to wear away in 50 years in Turkish carpets (Paksoy and Düzemli, 1989).
- Specification of colours obtained by natural dyes.
- Research for emphasizing the importance of the purity of colours.

The most important problem for the Turkish carpet weaving industry today is the impossibility of maintaining a standard of quality and the stability of prices in supplying the rapidly increasing domestic demand. Such a rapid production creates a pressure on raw material supply and results in the production of expensive carpets of low quality.

Conclusions

The lack of sources which is the most important problem of natural dyes of the day can be related to the interruption in the transfer of sources. A failure in maintaining national values and the secretly kept dyeing methods as a family tradition are the main reasons of the inter- ruption in the transfer of sources. Relying on the present sources and researches, we can reach some conclusions and suggest the following solutions:

1. It is possible to get many colours from a plant by changing the way to obtain the colouring matter and dyeing methods, mordants, their concentration and ways of treatment with mordants. The conditions of reaction influences the quality of the colour.
2. The black wool which is used as contour in Turkish carpets is coloured by tannin (Paksoy, 1985). This ferro-tannin composite is called tannin black and the way it coloured the fibre changes according to the method of treatment with mordants.
3. Wools coloured by tannin black wear away easily and the corrosive influence of ferro oxide is not the only reason for that. The duration necessary for the traditional dyeing methods is rather long and this is a factor that makes the fiber less firm and easily breakable (Paksoy, 1986).
4. The continuation of natural dyeing depends on the preservation of natural dyeing resources and the use of material without exhausting the ecological system (Paksoy and Düzemli, 1989).
5. Lack of a specification of natural dyes reduces the resources and causes loss of labour, time and money. That is why the obtained colours should be specified according to one of the international colour scales like Munsell system.
6. The purity of the obtained colours should be tested and the colouring matter that does not fit the standards of TS 626 should not be used.

All these conclusions are derived from experimental data. The preservation of the traditional characteristics of Turkish carpets and rugs is possible only through the survival of natural dyeing and by securing the standards of quality. Today the main shortage is lack of a research institution on Turkish rugs and carpets.

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Research and development of the natural dyes used for traditional carpets in the Aegean region "Dobag project"

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Summary

Dobag project is designed to promote the Turkish carpet and kilim tradition and has been founded by the Faculty of Fine Arts of the Marmara University, Istanbul. The word DOBAG is the abbreviated from of the "Dogal Boya Arastirma Gelistirme" natural dye research and development. Objectives:

1. To revive the tradition of carpet and kilim weaving in the areas, where these are forgotten and with very low agricultural income.
2. To give the villagers artistic and scientific support while producing new carpets with mostly natural coloured hand spun wool with the traditional patterns of that region.
3. To research and identify the natural dyes and traditional patterns of different regions.
4. To control, supervise and expertise the production in the villages in order to run the project true to its objectives.
5. To give a guarantee certificate for those carpets and kilims, which have been produced according to DOBAG's objectives. To make publications about the scientific and artistic qualities, to exhibit and give lectures about the product.

Cooperation With The Village Cooperatives: The DOBAG project is carried out in two regions; in Çanakkale under the name 'Sleymanky and Surrounding Villages Development Cooperation' and in Manisa-Yuntda 'Production and Marketing Cooperation of the Weaving with Natural Dyes'. The cooperation in anakkale with 221 members from 26 villages is occupied only in producing DOBAG carpets. Yuntda Cooperation which is founded by village women, has 72 member weavers from 6 villages.

The finished carpets are evaluated by the tutorial staff of the Faculty of Fine Arts. The evaluation and classification is carried out at the Cooperation Centers in Ayvack and Yuntda, according to the quality of the natural dyes patterns and weaving. After this expertise the carpets are being tagged and the ones which are going to be sold abroad are given a guarantee certificate by the Faculty of Fine Arts of the Marmara University.

Scientific Research: Research on natural dyes is done in the natural dye laboratory of the faculty by a foreign colour expert, a dozent, an assistant dozent and a research assistant. The research on traditional patterns is run by members of tutorial staff or other personnel, appointed to that region. The origin of plants and insects used in natural dyes are being researched all throughout Turkey. The results are worked into natural dye formulas to derve the villagers.

Introduction

DOBAG Project aims to give life again to the traditional Turkish hand-made rugs. The word DOBAG is used as the short form of Natural Dye-Research and Progress.

The main discrimination between the traditional rugs and the undiscriminated rugs woven without traditional methods is the dying technology and the dyes which give the colour to the thread of the rug. Even if the technique, the design and the raw materials used in weaving the rug is appropriate to the tradition, the use of the synthetic chemical dyes is one of the most important factor which caused the traditional rug to lose its value. Therefore, in order to produce a rug of a traditional value, the thread of the rug should be coloured with a natural dye.

The Academy of National Applied Arts (Devlet Tatbiki Güzel Sanatlar Yüksek Okulu) took steps to establish a research laboratory in 1976 on natural dyes. (ANFA) Academy of National Applied Arts, in cooperation with (Gesellschaft für Technical Zusammenarbeit GTZ) the technical cooperation of the Federal Republic of Germany succeeded in appointing Dr. Böhmer, to be on duty in Turkey. Dr. Böhmer, started working in the Textile Department of this association in March 1980 and thus established the core of the Natural Dye researches. The Chemistry engineers hand been appointed to help Dr. Böhmer parallel to natural dye researches carried out in the laboratories of the textile division, other researches carried on traditional kirkitli textiles of various districts and their designs were densified upon main districts.

The first experiments were held in Toros Mountains in cooperation with the Karatepe Village Cooperative; the villagers received help in weaving traditional rugs. The rugs with traditional designs, coloured with natural dyes drew attention both in Turkey and in foreign countries. After this experiment, serious actions were taken to establish a Research Center or at least a project to produce traditional Turkish rugs. Nevertheless, a School of Higher Education did not have the chance to establish an institute or a research center, therefore, these activities were entitled as the project of the textile department. In short, the (Natural Dye Research and Progress Project) were titled as DOBAG in 1981.

The aim of the project

1. To enliven and give life to the traditions in villages with insufficient incomes where traditions in weaving rugs and carpets are nearly forgotten.
2. To provide both artistic and technological aid to peasants in order to enable them to produce new rugs and carpets woven in traditional designs of their districts dyed in natural dyes with hand-twisted pure wool.
3. To carry on researches and determination studies on natural dyes and traditional district designs.
4. To carry on with the necessary control, expertise processes and thus control the production of the rugs in order to carry on the production of rugs with operations to control suitable to the aim of the project.
5. To give a guarantee certificate to certify and prove that the carpets produced serving to the aims of the project and also arrange publications both scientific and artistic, for introducing the project world wide.

Nine Pilot districts were chosen to carry out on the project. Nine Districts chosen were: Çanakkale, Manisa, Bursa, Balikesir, Bergama, Izmir, Gördes, Usak, Karatepe. The first experiments were made in Çanakkale, Ayvacik, in cooperation with cooperative aiming to aid the Süleymanköy and near by villages. Efforts and studies made on this area by the Governor of Çanakkale, Mr. Nurettin Turan and the Orköy administration, gave birth to the Rug weaving School in Ayvacik, and thus, these activities were overtaken by DOBAG to carry on further researches. The same year, the Governor of Manisa started the second project in the hereby villages of Yuntdag upon the proposal of Manisa Yuntdag Cooperation in charge of Tourism development.

Till the end of 1982's, DOBAG activities were carried by the limited availabilities of the School of Fine Arts, with great efforts of the academic staff, without any budget or a regulation. In July 20, 1982, after Devlet Tatbiki Güzel Sanatlar Yüksek Okulu (Faculty of National Applied Arts) became the Faculty of Marmara University, efforts to conduct the DOBAG project towards a project to be applied at least within the regulations of a research center were made. The Faculty took necessary steps to develop a Handcraft and Industrial Products Planning, Researching and Developing Center and the result proved to be very successful.

In the meantime, the Faculty established a DOBAG Central Administrative Committee and a Working Group while the activities were going on. Since 1983, DOBAG activities are carried by these organs. The Head of the Central Administrative Committee is the Dean of the Faculty. The experts and the faculty members participating in the organizations are pointed as the members of these committees since the development of the project.

The working group consists of three natural dye exports and three textile designers chosen among the faculty members. A staff member of the faculty resides continuously in Ayvacik DOBAG Center in order to make researches in the area and control the work done in the villages. I would like to underline Dr. Serife Atlihan's name here and express my appreciation to her who is the symbol of a great self-sacrificing and loyal faculty member.

Working together with the village cooperatives: DOBAG activities in Ayvacik and Yuntdag Villages

The DOBAG project is realized with the joint venture of Süleymanköy and Cooperative (in charge of developing nearby villages) and Manisa Yuntdag Cooperative (aiming to help Tourism). The Cooperative in Çanakkale has 340 members in 32 villages and is aiming only to produce DOBAG rugs. Eventhough the Manisa and Yuntdag now has aimed to produce DOBAG rugs only. It has 150 members in 16 villages.

1. The work done in this field has started with determining the traditional characteristics of the regional carpets. The photographs of the rugs present in the mosques, tombs and houses were taken to be closely examined. The designs were chosen out of the ones which were public and regional colours and designs were thus determined.
2. In order to profit of the ability and know now of the peasant women who already knew how to weave traditional rugs, first lessons were on 'how to use natural dyes' and traditional designs were given to these women; and they also taught whet they have learnt to their neighbors. Because the peasants were unwilling to send their daughters to the Rug Teaching School which started working in Ayvacik by the Governor of this district, the attempt proved to be a failure. But the presence of our faculty members who taught with a direct method carried into the villages was a real success and gave its results in a very short time.
3. The production carried in the villages are continuously kept under control by the working group, the Director, group members and by the faculty members working on this area.
4. The completed rugs, after been expertized are classified in Ayvacik Dobag Center and Manisa Yuntdag Cooperative. The Group Director and the members, visit the nearby villages at least two times a week.
5. After expertizing procedures are completed, the rugs are been labelled and a guarantee document is labelled on those sold outside Turkey by the Fine Arts Faculty of the Marmara University. The labels indicate where the rug is woven, who has woven the rug, the number of loops, date and the number. The guarantee document which is printed on leather carries the DOBAG amblem on it. And the characteristics of the rug, such information as to whether the colours of the rug is obtained by indigo or natural dye, whether the design is traditional or hand-made by pure wool thread is also indicated both in Turkish, English and German on the guarantee document.
6. In determining the natural dye plants, our faculty is in joint venture with the faculty members of other universities. I would like to underline the scientific contributions made by Prof. Dr. Hüsnü Demiriz and Prof. Dr. Baytop and my deep appreciation. According to the plant map of the Turkey, the cooperatives were aided as to where they could find the searched plant and it was also provided the production of some plants in Technical Agricultural

Sections and Plant Producing services and in some villages. Important part of dye plants are obtained from wild plants easily.

7. It was a problem to set up a market for the DOBAG rugs at the beginning. It was figured that these rugs could find their value outside Turkey and a publication campaign started in foreign countries. The scientific publications of our faculty members in foreign countries both in journals and bulletins, and with the aid of the foreign country rug sellers, the DOBAG products were exhibited in Federal Germany, Switzerland, Australia, Belgium, Arap Confederates, England, USA, Japan and Norway. Conferences were given by experts and faculty members in these countries. Publications, exhibitions and conferences enlarged and these activities still take their places in many foreign countries. These activities which are for the benefit of the foreign country sellers and the rug customers have proved very successful results. Today, all of the DOBAG rugs are sold in foreign countries.

The state's role in the Turkish carpet sector

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Abstract

The materials, the colors, the designs, the texture, the production, the maintenance, the restoration, the purchase and the sale of the carpets are related to most of the main fields of scientific activity. These fields are Material Knowledge, Dying Chemistry, Basic Design, Art History, Textile Technology, Production, Restoration, Marketing and Economy. Thus, handwoven carpet making finds itself in this interdisciplinary area. For this reason, it is obligatory to include carpet making within the programs of the universities. On the other side 100% pureness of the woolen thread should be checked by the Turkish Institute of Standards. Woolen thread production should be supported. Natural carpet dyes should be encouraged and after a certain period, the use of this system must be obligatory. Carpet production should be oriented towards larger workshops. For smaller carpet production enterprises, low interest credits should be issued by banks.
Keywords: Problems; sizes; design; knot count.

Introduction

When we take a look at the carpets and rugs woven in Anatolia, we observe that the problems and deficiencies concerning the carpets woven at workshops are fewer in number than those woven in villages. These carpets are generally small in size. Except those called side carpets which cover a room when placed side by side, areas of the carpets are usually 2.5 m^2. Very few of them have an area of 6 m2. Some regions do not have any designs to cover the 6 m2 area of a carpet plain. Likewise in most of these carpets knot cound is about 30×35 per dm^2. The three facts mentioned above show the present situation of the carpets as well as indicate their deficiencies.

Discussion

In my opinion, these deficiencies stem from the following facts:

- There are very few large-size looms in villages.
- There are no designs left in the hands of weavers for large carpets.
- Weavers tend to weave using their memories instead of looking at cartoons.
- Even though the weavers desire to weave a different carpet each time has brought vividness into design and color arrangements and thus diversity, there has been a certain degeneration in color and design.
- The tendency to lower the cost value of the carpets has led the weavers to decrease the knot count in each unit plain.
- It has not been possible to establish workshops where weavers can work all together.
- The high cost value of large size carpets is beyond the investment capacity of producers.

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These reasons and their negative consequences make us think of the golden age of the Turkish carpet making. The carpet workshop in Hereke had been established in 1891 in order to prevent the degeneration of carpets during the two previous centuries but this measure had not been effective due to the fact that the Ottoman Empire had come to the point of disintegration. However, this initiative, the positive consequences of which have survived up till now, should be remembered with appreciation. The present problems of the Turkish carpet sector can be summed up in three groups:

1. Problems in design and color;
2. Problems in technology and production;
3. Problems in finance.

These problems have been relatively minimized and beautiful carpets are now being woven in workshops owned by Ssmerbank, State Private Institutions, some universities, prisons and private companies. Nevertheless the state should deal with these three main problems, as the above mentioned production of carpets makes up only a very small part of the total production capacity in Turkey. The weavers working in their homes as well as in workshops will thus benefit a great deal from state support. In this connection the Prime Ministry, the Ministry of Culture, the Ministry of National Education, the Ministry of Agriculture, the Universities and the State Banks all have a certain responsibility in fulfilling their seperate tasks. These tasks may be listed as follows:

1. Tasks to be fulfilled by the Prime Ministry

   The following are the services in the carpet sector that could be rendered by the Prime Minister's office:

   1.1. To establish a research institute on hand-weaving;
   1.2. To take measures towards ensuring the use of natural dyes throughout the country and to appoint the Turkish Institute of Standards to impose that after a certain period it will be obligatory to use natural dyes;
   1.3. To exhibit and to protect the original samples by establishing carpet museums in each city and town;
   1.4. To take more effective measures against smuggling these carpets out;
   1.5. To initiate the production of 100% pure wool thread and to encourage the private sector in this field;
   1.6. To provide facilities in order to encourage carpet production in workshops;
   1.7. To provide low interest credits to all kinds of carpet producers and to provide facilities in purchasing thread, dyes and looms.
2. Tasks to be fulfilled by the Ministry of Culture:
   2.1. To compile a catalogue of Turkish hand-woven samples found in the museums in foreign countries;
   2.2. To compile a catalogue of Turkish hand-woven samples found in the museums in Turkey;
   2.3. To compile a catalogue of Turkish hand-woven samples found in mosques;
   2.4. To compile a catalogue of Turkish hand-woven samples found in private collections;
   2.5. To conpile and sell the cartoons of the hand-woven samples in the catalogues mentioned above;
   2.6. To organize contests in order to encourage the creation of new designs;
   2.7. To introduce the hand-woven samples to the general public by organizing mobile exhibitions;
   2.8. To organize seminars and/or symposiums on hand-weaving.
3. Tasks to be fulfilled by the Ministry of National Education:

   That hand-woven products such as carpets, "kilim", "cicim", "zili", and "sumak" are part of our national culture should be included in the curricula of educational institutions and thus a general information should be given on this subject. In addition to the tasks above, the following should also be fulfilled:

- 3.1. Small-scale implementations on hand-weaving should be carried out in Arts and Crafts courses.
- 3.2. Optioal cources on this subject should be included in the curricula in secondary schools.
- 3.3. Carpet Departments should be established in Vacational High Schools for girls;
- 3.4. Wooden and metallic loom manifacture should be taught at Vocational High Schools for Industry;
- 3.5. Practical courses on carpet making should be opened in villages and cities by the Office of Popular Education.

4. Tasks to be fulfilled by the Ministry of Agriculture:
   - 4.1. The plants and insects used in obtaining natural dyes may be reproduced in state production farms;
   - 4.2. The species can be improved and the seeds can be distributed by the Ministry;
   - 4.3. Natural dye production can be taught to the people by the Offices of the Technical Agriculture.
5. Tasks to be fulfilled by the universities:

   The foundations most closely related to the carpet sector are the universities.

   The materials, the colors, the designs, the texture, the production, the maintenance, the restoration, the purchase and the sales of carpets are related to most of the main fields of scientific activity. These fields are Meterials Knowledge, Dying Chemistry, Basic Design, Art History, Textile Technology, Production, Restoration, Marketing and Economy. Thus, hand-woven carpet making finds itself in this interdisciplinary area. This is why the development of this craft cannot be left to the experience and skills of the local weavers. Thus, it is obligatory to include carpet making within the programs of universities. Although some universities have included carpet making in their programs, it is still necessary to make these more effective and to expand them to cover the other universities. Hand-weaving should be included in the associate, undergraduate and graduate degree programs, which should be reinforced with workshops at each level.

   When the Higher Education Authority was founded in 1982, we had proposed establishing carpet-making departments at Higher Vocatioal Schools, which had been approved. First of these departments was established at éanakkale Higher Vocational School of Trakya University; the second at Kirklareli High Vocational School of the same university; the third at Isparta High Vocational School of Akdeniz University; and the fourth at Karaman High Vocational School of Selçuk University. I personally observed the benefits gained from these schools because I taught at two of them, which had been established by my own efforts. In the courses of Design Research, classical designs were studied; ways of transforming these designs into more effective arrangements by using the old samples were investigated and experiments were made on obtaining new designs by simplifying traditional ones. I'd now like to demonstrate some of these samples. I believe that such studies will revive the past of Turkish carpet making and contribute to its future success.
6. Tasks to be fulfilled by the state banks:

   The state banks should issue low-investment credits for the productions of raw materials for carpets and rugs, such as wool, cotton and silk, and for the production of thread using these materials, and for dying the thread. Such credits should be available for the individual weaver working on his own, or for the producers who have the carpets woven in homes or workshops, and for those who deal in purchasing and selling carpets. The state should support such banks to issue the credits. Some suggestions on the type of support to be given by the state to the carpet making sector have been mentioned above. Many other suggestions may be added for this authentic craft which originated in the steppes of Central Asia, to continue to yield ever beautiful products.

Production et transformation artisanale de la laine locale en Algerie

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Summary

In this study the authors purpose an evaluation of the wool production and its utilization in Algeria. The principal points developed concern an analysis of the wool circuit, a qualitative approch, and an estimation of the commercial value of the wool and its sub-products. The methodology used is based on a serial of observations in situ,a survey and examination of some local wool results. The wool production is concentred in high lands. However the transformation is maked at two levels:
- familial level where all traitments are realized;
- semi-industriel level constitued by specialised manufactures which transform different products.

The authors try to make an economic approch about the wool comparatively to products given by the flock or elabored in the wool circuit.

Introduction

En Algérie l'élevage du mouton constitue une activité importante pour la majorité des familles qui vivent dans les régions steppiques et agro-pastorales. Dans cette région de la rive sud de la méditérranée, il y a quelques décennies, le mouton était considéré à la fois comme un animal fournisseur de viande, de laine et de lait. Cette triple vocation était liée au parfait équilibre qui existait entre les trois principaux élements de l'écosystème qui sont la végétation, l'animal, et l'homme. Grâce à cet équilibre l'ovin garantissait la survie du pasteur et celle de sa famille en fournissant la viande et le lait pour leur alimentation et la laine pour la confection d'habits, de tapis et de couvertures. Cependant, on assiste actuellement à un bouleversement du système pastoral qui se traduit par un antagonisme biologique (augmentation de la charge animale et dégradation des parcours) accentué par la persistance de la sécheresse. Cette situation a engendré le développement d'activités spéculatives sur les produits ovins. La laine reste un produit très recherché sur le marché, mais qui est faiblement valorisé par l'éleveur. Dans le présent travail nous tenterons d'étudier l'importance de ce produit qui continue pourtant à jouer un rôle appréciable dans le maintien d'une activité d'élevage très ancienne et d'un artisanat local qui a ses particularités et ses traditions sociales.

Méthodologie

L'analyse proposée porte essentiellement sur la laine locale destinée à l'artisanat traditionnel. La démarche utilisée consiste en une série d'enquêtes d'une part au niveau des institutions nationales et des centres d'artisanat et d'autre part au niveau des élevages et de quelques familles en zones pastorales. Par ailleurs nous avons procédé à une recherche bibliographique afin de rassembler les informations disponibles sur la filière de la laine. La réalisation des enquêtes est faite de la manière suivante: Une série de visites réalisées par nous mêmes selon

Tableau 1a. Mensurations des principales races ovines algériennes (selon la littérature).

Races	Longueur tronc (cm)	Hauteur garrot (cm)	Tour poitrine (cm)
Ouled Djellal	90	75	85
Hamra	80	70	90
Rembi	85	75	90

Tableau 1b. Caractéristiques des toisons des pricipales races ovines algériennes (selon la littérature).

Races	Poids toison (kg)	Longueur brin (cm)	Lavée à fond (%)	Finesse (µ)
Ouled Djellal	1.5	7–8	53	23–27
Hamra	2.0	5–6	43	25–30
Rembi	1.6	6–7	50	24–26

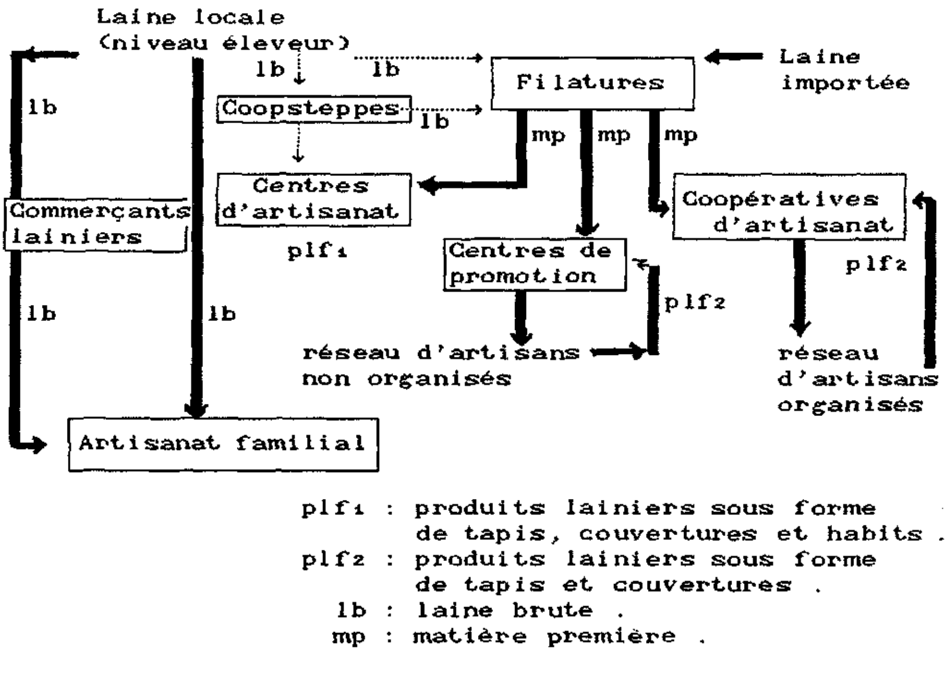

Figure 1. Circuit de collecte et de transformation artisanale de la laine en Algérie.

des itinéraires qui comprennent les chefs lieux de wilaya ou de communes suivantes: Nedroma, Tlemcen, Saida, Naama, Méchéréa, El-Bayadh, Arbaouat, Aflou, Laghouat et Ghardaïa (sud ouest, et sud centre). Des enquêtes similaires ont été effectuées par nous-mêmes et avec la collaboration de collègues opérant à Alger, Djelfa, M'sila , Aïn El Beida, Biskra, Khenchela, Meskrana, Constantine et Aïn Mlila (centre et est du pays).

Caractéristiques du système de production de laine

La production de laine est fournie principalement par trois races qui sont la Ouled Djellal (8 millions de têtes), la Hamra (4 millions de têtes) et la Rembi (2 millions de têtes). Ces trois races ont ensemble des traits communs qui concernent la faiblesse du poids de la toison (1.5 à 2.5 kg) et du rendement aprés lavage (43 à 53%); mais aussi une grande finesse de la laine (23 à 30µ) (Tableau 1). Chez la race Ouled-Djellal les toisons sont blanches alors que chez les races Hamra et Rembi elles sont plutôt tachetées ou piquées chamois et parfois complètement roussâtres. Les zones de production de la laine sont les hauts plateaux steppiques et céréaliers qui se caractérisent par un climat aride: chaud et sec en été, très froid en hiver. Les températures peuvent descendre au dessous de 0° C en hiver et dépasser les 45° C en été. La pluviometrie varie entre 200 et 400 mm par an sur les hauts plateaux céréaliers et entre 100 et 200 mm sur la steppe .

En milieu steppique les ressources alimentaires du cheptel sont constituées par deux types de vegétations:

- Les plantes pérennes dont les plus importantes sont l'alfa *(Stipa tenacissima)*, le chih *(Artemesia herba alba)*, le drin *(Aristida pengens)*, le guettaf *(Atriplex halimus)* et le sennagh *(Lygeum spartum)*,
- et les plantes annuelles qui sont représentées par différentes espèces (céréales et légumineuses) qui se caractérisent par des cycles vegétatifs relativement courts.

Dans les zones céréalières les ressources alimentaires des ovins sont constituées principalement de fourrages secs (association céréales-légumineuses) de grains, pailles, chaumes et de jachère pâturée. Les ovins sont expoités selon plusieurs variantes d'un même système extensif: le système transhumant est dominant dans les zones du centre et de l'est de la steppe. Il s'agit d'une tradition qui semble s'expliquer par une adaptation saisonnière aux conditions climatiques du milieu. A l'ouest le système se caractérise par une transhumance de faible amplitude. Il a la particularité d'évoluer parfois vers une conduite totalement sédentarisée en hors-sol durant certaines périodes de l'année (fin Automne et hiver). Les éléments qui conduisent à une telle pratique concernent souvent l'insuffisance des pâturages en période difficile. L'alimentation est alors basée sur des apports de fourrages secs, de paille et d'aliments industriels. Dans les zones situées plus au nord et notamment les hauts plateaux céréaliers, le système d'élevage pratiqué est dominé par le type biennal archétype qui se caractérise en général par une conduite sur chaumes de céréales en été et en automne et sur jachère en hiver et au printemps.

Commercialisation et transformation de la laine

Le circuit de collecte et de transformation artisanale de la laine est assez complexe. A partir des élements de l'enquête nous avons tenté de visualiser les différentes situations observées (Figure 1).

Circuit de collecte

L'estimation du niveau de production de la laine est basée sur les hypothèses suivantes:

- l'effectif est considéré de l'ordre de 16 millions de têtes (données statistiques);
- la part des animaux producteurs de laine est de 60%;
- et le poids moyen de toison par animal est de l'ordre de 1.5 kg (estimation faite à partir de mesures réelles sur un échantillon de 5 000 toisons d'animaux de races locales).

Sur la base de ces hypothèses la production lainière est estimée égale à 14 400 tonnes par an fournie par le troupeau à laquelle s'ajoute une quantité de 3 500 tonnes de laine résultant du traitement des peaux lainées issues des mégisseries, soit un volume global de 17 900 tonnes par an à l'echelle nationale qui sont destinés essentiellement vers l'artisanat local.

Il y a lieu de préciser que l'approvisionnement des complexes lainiers industriels se réalise essentiellement à partir de laines d'importation. Le volume moyen annuel de ces importations est estimé à 100 000 tonnes. La collecte de la laine produite localement est caractérisée par trois niveaux:

- les commerçants qui viennent en première position dans le ramassage de la laine mise sur le marché.
- les ateliers familiaux qui s'approvisionnent soit auprès des éleveurs, soit au niveau des marchés locaux.
- les coopsteppes qui participent dans la collecte de la laine en assurant également des services d'appui et de commercialisation d'autres produits.

L'importance de chaque niveau du circuit de collecte est lié en général au prix offert aux producteurs de laine. Ainsi les commerçants lainiers, grâce à un système de concurrence, arrivent à ramasser de grands tonnages de laine produite. A titre indicatif nous avons constaté lors de nos enquêtes que l'offre faite par ces derniers en matière de prix d'achat de la laine était supérieure de 30 à 40% au prix payé par la coosteppe. Le niveau éleveur de la filière se caractérise par l'absence de stockage de la laine. Ce qui pourrait expliquer le courte période de transaction de ce produit entre le producteur et les differents acquéreurs. L'enquête a révélé par exemple dans la région de Méchéria et d'El-Bayadh que plus de 70% de la laine produite est mise en vente durant une période de 6 semaines (entre début juin et mi-Juillet). Cette situation profite en premier lieu aux commerçants qui tirent des revenus importants et qui forment un réseau solide de transfert de la laine des zones de la steppe (Méchéria El-Bayadh, Aflou, Laghouat) vers les zones du nord (Tlemcen, Oran, Alger, Annaba).

Circuit de transformation

Le circuit de transformation de la laine se caractérise par deux variantes:

- la transformation artisanale familiale qui absorbe plus de 80% de la laine locale mise sur le marché;
- et la transformation artisanale semi-industrielle qui prend le reste (soit 20%). Cette dernière est alimentée aussi par les filatures.

En ce qui concerne la transformation de la laine locale au niveau familial, elle aboutit à la réalisation de rembourrage de matelas (50%), à la fabrication de tapis (35%) et à la confection de vêtements (15%). A ce niveau toutes les opérations de traitement et de transformation de la laine sont réalisées à l'aide de matériel typiquement traditionnel. Quant à la transformation semi-industrielle qui utilise à la fois la laine importée et la laine locale, on distingue deux niveaux: l'un concerne les filatures où la laine subit une série de traitements jusqu'au stade matière première, elle-même livrée sous différentes formes (laines lavées, laines cardées, laines filées écrues ou colorées). L'autre se situe au niveau du réseau de centres d'artisanat où la matière première est transformée en produits divers (tapis, couvertures, habits). L'organisation de ces centres diffère selon que leur objectif est commercial ou promotionnel:

a. Les centres d'artisanat rattachés aux coopsteppes qui sont à caractère commercial, disposent d'ateliers où sont fabriqués des tapis et d'autres articles lainiers. Ces ateliers fonctionnent essentiellement au moyen de laines filées fournies par les filatures. La commercialisation des produits se fait soit sur place au niveau des centres soit au niveau des points de vente dans les grandes villes.
b. Les centres de promotion de l'artisanat lainier, subventionnés par l'Etat,sont chargés de la préservation des types et des motifs traditionnels. Ils utilisent la matière première en provenance des filatures pour la fabrication de divers produits lainiers parmi lesquels les tapis d'appelation locale (Djebel Ammour, Melgout, Beni-Isghen, Maâdid). Dans le fonctionnement de ces centres de promotion deux systèmes sont rencontrés: un système où la matière première est transformée dans des ateliers de tissage et un autre système qui fait appel à des femmes artisans qui exercent le métier chez elles. Chaque centre établit pour cela un contrat de travail avec ces artisans par l'intermédiaire de monitrices qualifiées qui assurent aussi la coordination et le suivi technique et logistique des foyers d'artisanat. La matière première est d'abord achetée par le centre de promotion auprès des filatures puis elle est remise aux artisans qui la transforment en tapis ou en couvertures moyennant les charges de réalisation des produits. La production est collectée alors par le centre pour être par la suite commercialisée. A titre d'exemple le centre EPGAT de Laghouat qui dispose de deux monitrices exerce cette activité avec plus de 300 femmes-artisans qui produisent annuellement plus 1 500 m^2 de tapis variés.
c. Les coopératives d'artisanat lainier dont la vocation principale est la transformation. Elles fabriquent à leur niveau divers produits finaux de la laine. Pour atteindre ce but chaque coopérative regroupe un certain nombre de familles qui exercent le métier d'artisan, dans ce cas, dans un cadre organisé. Chaque famille adhérente reçoit régulièrement un quota de matière première pour la réalisation de travaux en fonction des orientations de la coopérative. C'est le cas de la C.A.T de Ghardaia qui regroupe 350 familles adhérentes

Formation des prix

Marge brute de l'éleveur

Au cours du processus de commercialisation et de transformation la valeur de la laine évolue de façon plus ou moins importante en fonction du niveau du circuit. En amont, à l'échelle du troupeau, l'éleveur obtient en général 1.5 kg de toison par tête d'ovin soit une valeur de 45 dinars algèriens (DA). La tonte est pratiquée couramment en Algérie selon un système traditionnel qui se caractérise par l'utilisation de forces comme matériel de tonte et par le recours à une main d'oeuvre occasionnelle pour la préparation et la tonte effective des animaux. Dans un tel système appliqué à un troupeau ovin de 300 têtes, le prix de revient d'un kilogramme de toison est de l'ordre de 14.5 DA (Tableau 2).

Mais du fait de la complexité du système d'élevage ovin et en l'absence de comptabilité analytique du troupeau, il n'a pas été aisé de fixer dans ce travail préliminaire sur la laine, une estimation de tous les frais financiers et notamment ceux liés à l'entretien et aux soins des animaux dans l'élaboration du prix de revient de la laine brute. Néanmoins des valeurs approchées ont été obtenues. La marge brute qui revient à l'éleveur est de l'ordre de 52% des recettes de la laine locale obtenue par animal et par an (Tableau 3). La faible marge obtenue par l'éleveur de la steppe s'explique par l'importance des charges de tonte qui sont liées à la fois à la technique de tonte utilisée et au faible poids de la toison d'une part et aux pratiques coutumières dans l'organisation de la tonte et du marché de la laine d'autre part. A titre de comparaison la marge brute 'laine' est relativement très faible (23.3 DA) par rapport à celle de la viande (1 163 DA).

Tableau 2. Charges de tonte et valeur de la laine dans un système traditionel (cas d'un troupeau de300 têtes de race locale).

Frais de tonte	4 500	DA
Frais de repas et de transport	1 500	DA
Autres frais	520	DA
Frais totaux	6 520	DA
Frais par tête ovine	21.7	DA
Prix de revient de 1 kg de laine brute	14.5	DA

1 FF = 3.5 DA (juillet 1991)

Tableau 3. Formation des marges brutes 'laine' et 'viande' par brebis de race locale.

Critère	Laine	Viande (carcasse)
Production (kg)	1.5	11.2
Valeur (DA)	45	1 568
Charge de production	21.7	405
Marge (DA)	23.3	1 163
Marge en % de valeur	52	74
Marge 'laine' en % de la marge 'viande'	2	-

DA = Dinar algérien
1 FF = 3.50 DA (juillet 1991)

Tableau 4. Valeur ajoutée de la laine transformée en tapis selon la modèle Djebel Ammour (données rapportées au mètre carré de tapis).

Critères	Coût (DA)	Valeur (%)
Laine brute	163.6	19.6
Lavage	40	4.8
Filage	87.3	10.4
Teinture	37.3	4.6
Tissage-Finition	186.7	22.4
Taxe	154.6	18.5
Prix de revient	670	-
Marge fabricant	97	11.6
Marge détaillant	67	8.1
Prix de vente	834	100

Coût de fabrication de tapis

En aval du circuit de transformation de la laine on a tenté d'évaluer les coûts liés à la fabrication des différents produits lainiers. Mais l'enquête n'a pas rendu possible l'obtention d'estimations détaillées pour tous ces produits et pour les opérations de traitement qui leur sont liées. Cependant une synthèse a été réalisée sur la base de données collectées auprès du centre d'artisanat d'El-Bayadh (spécialisé dans la fabrication du tapis type Djebel Ammour) et relatives à l'année 1982.

Les résultats du Tableau 4 indiquent que le prix de cession du tapis Djebel Ammour sur le marché est de 834 DA le mètre carré. L'opération la plus coûteuse dans le processus de transformation est le tissage, soit 22.4% du prix de cession. Quant aux opérations de lavage et de teinture, elles représentent respectivement 4.8% et 4.6% du prix de cession du mètre carré de tapis. La part de la laine brute nécessaire pour la fabrication d'un mètre carré de tapis est de l'ordre de 19.6% .

L'examen de l'évolution de la valeur de la laine du stade 'laine brute' au stade 'tapis' nous permet de constater qu'une marge importante de progrès est à la portée des éleveurs s'ils se donnent une organisation appropriée pour couvrir l'ensemble de la filère lainière. Ceci suppose une intensification des opérations de production, de collecte et de transformation. Cela devrait conduire à une amélioration des rendements des troupeaux et à une réduction des charges de tonte. L'instauration d'un système efficace de collecte et de transformation de la laine est possible grâce au processus associatif mis en oeuvre actuellement dans le pays en faveur des produits d'origine agricole. Mais la dynamique d'un tel réseau dépend des producteurs et des responsables élus à vouloir résoudre collectivement des problèmes liés à leurs activités de production et de transformation en prenant en considération la valorisation des circuits de formation et d'information .

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Discussion pannel and conclusion

Chairman: J. Boyazoglu
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Dans quelle mesure la production de laine, poil, cuir et peau presente-t-elle un interet economique pour les eleveurs: une introduction au debat

(The extent to which wool, hair, hide and skin production are profitable for farmers: an introduction to the discussion)

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Abstract

Industrial production today provides mass supplies of cheaper substitutes for the traditional products obtained from ruminants: hide, fibre, manure and traction. Meat itself, an important sub-product of the rearing of such animals, is now mass-produced by poultry and pigs. Only cow's milk is now mass-produced in developed countries where production provides the richest urban areas.

Other products from the rearing of ruminants have a smaller market, supported by high-income clientele seeking specific qualities: lambs and kids, sheep and goat's cheese, fabric and leather. These farms are therefore multi-purpose (producing meat, milk, hair and skin), requiring that their complexity be taken into account when analysing production costs and drawing up genetic improvement policies.

Once obtained from the animal, all these products are subject to successive technical transformations and commercial transactions. The authors will discuss under what conditions the farmer can carry out all or part of these procedures himself.

Only a joint effort by all those in the chain to ensure the quality of products, their identification and their legal protection will be abble to guarantee this prospect specifically in the disadvantaged areas of the Mediterranean basin and the Middle East.

Introduction

A côté de ses finalités principales l'activité d'élevage aboutit à des co-produits qui peuvent faire l'objet de transactions commerciales importantes à l'échelle internationale alors que l'éleveur individuel peut fort bien ne percevoir qu'une rémunération faible ou implicite pour eux et donc ne pas les intégrer dans sa stratégie. Pourtant son intérêt peut être attiré vers ces produits secondaires lorsque la valeur économique du produit principal fléchit.

S'agissant des produits textiles et des cuirs et peaux, ils subissent tout une gamme de transformation et de transactions commerciales avant d'aboutir au produit fini payé par le consommateur. L'analyse des filières montre que si l'éleveur désire en retirer un profit, il lui faut intégrer une partie de la valeur ajoutée, notamment par la réalisation de fabrications plus personnalisées. Mais dans ce cas il s'agit de 'petites séries' qui ne peuvent avoir la prétention de toucher une large clientèle.

Les systemes d'élevage dans leurs relations aux marchés

L'élevage des ruminants présente, au niveau mondial et dans l'histoire, une triple diversité:
- diversité des conditions techniques: du plein air intégral à la stabulation permanente,
- diversité des conditions économiques: de l'élevage de case au ranching,
- diversité des produits: travail, lait, cuir, poil, laine, viande, fumier.

Cependant, la spécificité des ruminants, est d'être nourris principalement à partir de ressources non cultivées, non concurrentes avec l'alimentation humaine directe, sauf dans les très rares cas où leur produit est bien valorisé et où l'alimentation humaine est largement assurée (par une agriculture efficace ou par des importations). Malgré leur diversité, on peut dire que toutes les formes d'élevage ressortent de trois grands types:
- *Elevage paysan:* petits troupeaux à multiples fins, dont les produits sont auto-consommés ou vendus localement, et qui s'insèrent dans un ensemble très diversifié d'activités agricoles et domestiques.
- *Elevage extensif spécialisé:* grands troupeaux exploités par des éleveurs spécialisés. Dans les cas les plus traditionnels, les animaux sont le seul moyen de survie de leurs détenteurs, et le produit principal est le lait, autoconsommé. Historiquement, ces troupeaux se sont développés pour fournir à un marché dynamique un de ses produits (laine, cuir, chevaux de guerre, boeufs de trait), appuyé par un pouvoir politique qui sait lui garantir l'accès au pâturage et qui recueille les bénéfices économiques de son activité. Plus récemment, l'élevage de bovins (ranching) s'est développé sur de grands espaces peu peuplés (hémisphère sud) pour fournir de la viande au marché mondial en expansion, de même que l'élevage ovin pour la laine.
- *Elevage intensif de masse:* fondé sur une alimentation à base de céréales ou de fourrages cultivés intensivement, il ne se développe que pour satisfaire une demande abondante, et dans un contexte de grande disponibilité en céréales (production locale ou importée).

Les deux premiers types d'élevage peuvent fournir au marché des produits à des coûts peu élevés, mais le volume de leur production est limité par les superficies disponibles. Aujourd'hui l'internationalisation des échanges, et les progrès industriels, permettent de produire *en masse* des substituts à la plupart des produits de l'élevage des ruminants:
- les moteurs et le pétrole remplacent le travail des bovins, camelins et chevaux,
- les engrais chimiques remplacent le fumier,
- le caoutchouc et les matières synthétiques remplacent le cuir,
- les fibres synthétiques et le coton remplacent la laine et les poils: les fibres animales de toutes origines ne représentant plus que 5% de la consommation mondiale de textile,

Seul le lait n'a pas encore de substitut végétal ou synthétique: sa production de masse a pu se développer en ateliers intensifs dans les régions les plus riches du globe. L'augmentation de la demande mondiale en viande est couverte principalement par le développement de la production de masse de volaille et de porc, sur la base d'une alimentation composée principalement de céréales, que ces espèces valorisent mieux que les ruminants. L'engraissement intensif de jeunes ruminants se développe sur la base d'approvisionnement en jeunes issus soit du troupeau laitier, soit d'élevages extensifs.

En admettant que les élevages extensifs ou paysans trouvent des conditions de développement favorables en combinant un accès à des espaces pâturables et un marché favorable à l'un de ses produits, l'accès aux parcours est d'autant moins nécessaire que plusieurs produits (par exemple lait et laine, ou viande et lait) trouvent une bonne valorisation: l'éleveur pourra donc dépenser (autofourniture ou achat) de l'alimentation cultivée pour une partie des besoins de ses animaux. Mais dans tous les cas ces produits devront être vendus beaucoup plus cher que leurs substituts industriels : ils ne pourront intéresser qu'une clientèle aisée, dont les besoins de base (nourriture, logement, habillement) sont déjà satisfaits, et qui est sensible à l'attrait des produits traditionnels. Il s'agit donc de marchés très étroits en quantité. Dans certains cas il existe des réussites certaines: des produits très bien valorisés peuvent constituer le moteur du développement d'une région: c'est le cas du Roquefort en France ou du Pecorino romano (Italie + USA), ou du jambon ibérique, ou dans une moindre mesure, du feta grec, vendu en Europe de l'Ouest et en Amérique du Nord aux populations d'origine grecque et turque. Il semble que la région d'origine soit un élément important dans l'attrait exercé par le produit.

Dans tous les cas, l'élevage de ruminants aboutit à deux produits, la viande et la peau, même si très souvent le produit principal est autre,tel que laine ou lait. Il en résulte que le coût de production de l'un de ces co-produits est impossible à calculer sans faire d'hypothèse sur les prix de vente des autres. De fait, selon les zones, les systèmes de production, et les marchés, certains des produits peuvent être considérés comme 'gratuits': c'est le cas des peaux d'ovins et de bovins en Europe de l'Ouest, ou des veaux de l'élevage laitier néo-zélandais. Ils ne sont payés que le prix que le marché local veut bien leur attribuer, mais leur existence est de toutes façons induite par la finalité principale de l'élevage. Ces produits font très souvent l'objet de transactions à l'échelle du marché international.

Mais pour l'éleveur, et pour le développement d'une région, il peut être important de chercher à mieux valoriser ces seconds ou troisièmes produits, surtout si le marché du produit principal s'oriente à la baisse: c'est le cas de l'élevage laitier des pays méditerranéens de la CEE par exemple. Il devient donc essentiel de tenir compte de cette fin multiple de l'élevage lorsqu'on raisonne les objectifs du progrès technique et notamment de l'amélioration génétique: tel mode d'alimentation, tel croisement, préconisés en vue d'augmenter la production laitière, sont-ils compatibles avec la qualité de la peau, avec la production de laine?

L'implication des éleveurs dans les filieres de mise en valeur

Les produits de l'élevage font l'objet, avant leur consommation, d'une série de transformations techniques, dont le résultat est un nouveau produit: exemple laine, tissu, vêtement (Figure 1). L'éleveur peut-ou non-effectuer lui-même ces opérations. Il peut aussi n'en effectuer qu'une partie et, tout en conservant la propriété du produit, faire faire certaines opérations à façon par des professionnels (cas de la tonte par exemple). Il peut aussi vendre le produit après un certain nombre d'opérations. Sa décision ne dépend pas seulement de sa compétitivité technique dans l'une ou l'autre opération. Elle dépend aussi de sa position sur le marché de l'un ou l'autre des produits successifs de la transformation: vendra-t-il mieux du fil ou une veste?

En effet, parallèlement aux transformations techniques, le produit subit aussi une série de transactions commerciales qui l'amènent des lieux de production vers les lieux de consommation. Si ceux-ci sont éloignés, ce qui est généralement le cas, il existe au moins trois transactions:

a. collecte en zone de production et expédition en zone de consommation
b. réception en zone de consommation en grande quantité (grossiste) et approvisionnement du commerce de détail
c. distribution aux consommateurs (détaillant)

Les opérations techniques peuvent avoir lieu à l'un quelconque des stades de la filière: le consommateur achète généralement le vêtement tout fait, mais il peut aussi acheter le fil et confectionner lui-même son vêtement.

Le commerce international, qui a généralement lieu au stade b ci-dessus à l'import comme à l'export, peut porter sur l'un quelconque des produits de l'élaboration technique: toison, laine lavée, fil, tissu, vêtement.

Tout au long de son cheminement, la valeur du produit augmente, par une combinaison des effets des transformations techniques, et des transactions commerciales, qui toutes les deux ont un coût (Tableau 1). Le coût de chaque opération technique, ou de chaque transaction commerciale, peut être différent selon qui l'effectue (industriel ou artisan, professionnel ou occasionnel) et selon la région (coût d'approvisionnements en outillage et matériaux, coût d'implantation de l'atelier, coût de la main d'oeuvre, fiscalité).

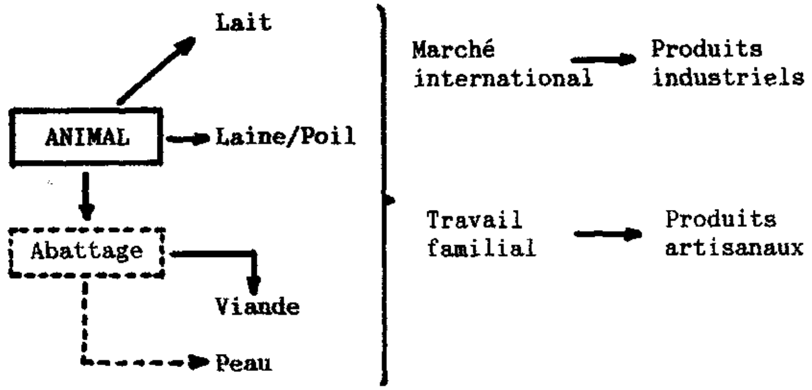

Fig. 1. Schéma d'implication des produits animaux dans les filières économiques.

Tableau 1. Décomposition du prix au détail d'un pull 'Mohair' en France (Francs français 1991).

Opérateur Opération	Produit	Coût industriel	Coût commercial	Prix[c]	%
Eleveur	Laine lavée	120[a]		40[b]	
	400 g.	(300 F/kg)			4
Filature		40			
	Fil	(100 F/kg)		80	8
Façonnier		100	36		
	Pull-usine			216	21
Grossiste			216		
	Pull-grossiste			432	42
Boutique			608		
	Pull-détail(TTC)			1 040	100

[a] prix considéré par les producteurs comme nécessaire
[b] prix à l'importation
[c] sur la base de 400 g/pull
Source: Association des éleveurs de chèvre Angora et des Utilisateurs de Mohair. Paris (communication personnelle).

En ce qui concerne le coût de la main d'oeuvre il peut devenir un gain si c'est l'éleveur lui-même qui effectue les opérations techniques. Ce gain doit être comparé non pas aux salaires pratiqués dans la région ou dans l'industrie en général, mais au gain qu'il obtiendrait par d'autres activités alternatives (si elles sont possibles. Dans le cas contraire il s'agit d'une réelle création d'emplois). Ce raisonnement s'applique également aux autres intervenants de la filière: l'activité d'un maillon peut être décidée si elle crée des emplois, même si elle est moins efficiente que dans d'autres lieux.

Face à ces coûts, le marché attribue, à chaque étape technique un prix au produit qui en résulte, prix variable selon l'époque (variations saisonnières, tendances du marché, évolution des modes) et le lieu (habitudes de consommation, présence d'une industrie, fiscalité, ouverture au marché mondial). Tout au long de la filière des rapports de prix s'établissent donc entre les différents niveaux techniques et commerciaux.

Sur les grands marchés (zone de forte population urbaine) les prix s'établissent souvent en fonction du prix de l'un des stades, par exemple, la laine cardée, qui devient alors le prix directeur. Au niveau d'un pays le choix des opérateurs s'inscrit entre deux limites

- à l'amont le prix du principal produit faisant l'objet de commerce extérieur, par exemple en France la laine lavée d'importation, ou en Turquie le poil de chèvre Mohair,
- à l'aval le prix que la demande (nationale ou d'exportation) attribue au produit fini.

Entre ces deux prix, sur lesquels les pouvoirs publics peuvent jouer (fiscalité, réglementation douanière) les opérateurs nationaux sont obligés de déterminer leurs décisions. Les éleveurs, ou des artisans locaux, ou des coopératives, peuvent tenter de s'approprier une partie de la valeur ajoutée:

par des coûts inférieurs:	proximité, savoir faire, installations moins coûteuses,
par des prix supérieurs:	fabrications plus soignées, fabricationsplus personnalisées, petites séries mettant en valeur l'hétérogénéité de la matière première.

Par exemple dans le cas du pull mohair en France (Tableau 1), l'éleveur peut valoriser sa laine à 300 F/kg (laine lavée) alors qu'elle est disponible à 100 F/kg à l'importation, s'il parvient à réduire de 80 F/pull les coûts commerciaux qui s'élèvent à 800 F/pull, ce qui est possible par des circuits plus courts mais ne peut représenter qu'une faible part du marché. L'autre solution peut être de vendre 80F plus cher son produit au consommateur (soit + 8%) par une promotion appropriée fondée sur une qualité objective et/ou une origine.

En effet les filières de mise en valeur des produits de l'élevage, peaux et poils, sont de deux sortes.

- *Les filières industrielles* travaillent sur de grandes quantités, mettent en oeuvre les techniques les plus performantes, jouent sur les différences de prix du marché mondial. Elles fournissent en grandes quantités des produits de bonne qualité moyenne mais ont besoin d'un approvisionnement homogène et ne peuvent valoriser de petites quantités de qualité exceptionnelle.
- *Les filières artisanales*, de petites dimensions, fondées sur un énorme savoir-faire, gèrent l'hétérogénéité. Elles peuvent optimiser la valorisation d'une livraison hétérogène, qu'elles peuvent donc rémunérer plus cher que la filière industrielle.

Puisque les besoins de base autrefois satisfaits par les peaux et poils sont aujourd'hui satisfaits la production industrielle de masse, les éleveurs ne peuvent valoriser ces produits que par des filières artisanales soit en effectuant eux-mêmes les opérations (si le marché est proche) soit en les confiant à une série d'artisans au métier reconnu et efficace. Cela comprend jusqu'à la vente au détail qui ne peut pas se faire dans le commerce intégré des pays développés (car il a besoin d'homogénéité, de quantité et de prix pas trop élevés) mais par des boutiques spécialisées. Au total cette stratégie vise une clientèle étroite, fortunée, et attachée, par sa nature ou par une promotion médiatique (mode), à ce type de produit. Mais si le marché se développe, si les prix augmentent à cause d'une forte demande, le risque est grand de voir se développer soit une production de ces produits dans des zones agricoles plus riches, soit de produits similaires fabriqués industriellement (soie artificielle). D'où la nécessité d'une protection légale de ces produits (label, marque, appellation d'origine).

Conclusions

Dans quelle mesure la faible productivité des couverts végétaux et du matériel animal des systèmes d'élevage méditerranéens ou du Moyen-Orient, conduits en sec, peut-elle être compensée par la haute valeur marchande de produits de qualité. Il peut s'agir d'une préoccupation poursuivie par des éleveurs individuels (ou en groupe), ou d'une option de politique nationale ou régionale se traduisant par l'organisation d'une filière en vue du maintien d'une activité d'élevage et de transformation dans des conditions difficiles.

L'étude économique de situations concrètes montre que la valorisation des peaux et des poils peut effectivement apporter aux éleveurs un revenu additionnel à ceux de la viande et du lait, et donc globalement créer ou maintenir des emplois. Mais cela n'est possible que si la matière première produite n'a ni concurrence sur le marché international, ni substitut industriel. Les pouvoirs publics peuvent favoriser un tel développement par:

- la politique douanière (taxation des importations pour les ramener au prix souhaité à l'intérieur, ou subvention aux exportations),
- la politique fiscale (action sur les coûts intérieurs de transformation et de commercialisation)
- la création des conditions d'une activité artisanale dynamique (transformation et commerce): transparence des marchés, libre accès, cotations, bourses, marchés physiques, marchés à terme,
- la protection légale de la qualité et de l'origine des produits, à l'intérieur du pays et à l'exportation.

Les opérateurs économiques doivent mettre en oeuvre et contrôler la qualité des produits au long de la filière puique c'est sur elle que se fonde leur activité et leur différence par rapport aux marchés internationaux.

L'action technique et les programmes de recherche peuvent être conçus selon deux types d'objectifs:

- s'il s'agit d'un coproduit pour lequel l'éleveur n'est que faiblement rénuméré, il faut s'assurer que l'action sur le produit principal, notamment en termes de quantités, ne détériore pas la qualité du coproduit,
- s'il s'agit du coproduit principal, l'accent doit être mis sur la détermination des critères et des facteurs de qualité qui soutiennent la valeur du produit.

Poster presentations

Coordinator: O. Biçer

Analyse genetique du poids de la laine en suint et de la croissance des agnelles de race Gentile di Puglia

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Abstract

The study was undertaken with data collected from a flock of the merinised breed Gentile di Puglia, raised at the Experimental Institute for Animal Husbandry in Foggia, Italy. The weight of the greasy wool (kg 3.32±0.01) only diminishes in 9.5 years old animals; the year of shearing has a significant effect; heritability is 0.22±0.06, repeatability is 0.24±0.03. The following analyses were carried out: weight of female lambs at birth, at 30, 60, 90 and 120 days of age; the lambing type has the strongest effect; the phenotypic correlations between female lambs born from single or twin births are different; heritability of weight at birth is very weak (0.028 ±0.135).
Key-words: growth, wool, heritability, repeatability.

Introduction

La race ovine Gentile di Puglia, crée dans le XV siecle avec l'utilisation de béliers espagnols, représente la race mérinisée italienne plus importante. Dans les derniers temp, la crise nationale de la production de la laine a provoqué une reduction progressive du nombre des animaux exploités; un essai de transformation en race bouchière est en place. La croissance et la production lainière des femelles de la race sont analysées dans ce travail.

Matériel et méthodes

L'analyse à été realisée sur les données recueillies dans l'Institut Expérimental pour la Zootechnie de Foggia, Italie. Les poids à la naissanse, et ceux à 30, 60, 90 et 120 jours de 1 033 agnelles exploitées entre le 1971 et le 1985 et le poids de 3 435 toisons en suint de 991 brebis exploitées entre 1972 et 1986 ont été examinées. Pour les poids à la naissance et à 30 jours un modèle trifactoriel sans interaction à été utilisé; les effets considerés ont été le type de mise-bas et l'année de naissance de la brebis (effets fixes) et le père de la brebis (effet aléatoire). Parmi les poids de la méme agnelle âges différents le coefficient de corrélation a été calculé. Un modèle trifactoriel avec deux effets fixes (année de naissance de la brebis et année de tonte) et un effet aléatoire (père de la brebis) a été utilisé pour l'analyse du poids de la laine en suint. Les moyennes estimées des productions selon l'année de naissance et selon l'année de tonte et l'héreditabilité ont éte estimées. A partir des effets significatifs à l'analyse de la variance, les coefficients de correlation entre les différents productions ont été estimés.

Résultats et discussion

En ce qui concerne le poids des agnelles à différents âges, le type de mise-bas a presenté l'effet plus important; le père de l'agnelle a présente un effet significatif seulment pour le poid à 30

Tableau 1. Analyse des modèles utilisés pour l'étude des poids.

	Poids			
	naissance	30 jours	60 jours	90 jours
Moyenne (kg)	3.721	9.690	14.095	17.262
C.V. (%)	14.42	11.15	11.40	10.46
Effets (P de F)				
père	0.2885	0.0090	0.4567	0.4547
type de mise-bas	0.0001	0.0001	0.0344	0.1842
année de naissance	0.4466	0.0001	0.0001	0.0001

Tableau 2. Correlations phénotypiques entre les poids en function du type de mise-bas (au dessus de la diagonale: mise-bas gemellaires; au dessous: mise-bas uniques).

	naissance	30 jours	60 jours	90 jours	120 jours
naissance	-	0.221*	0.134	0.087	0.413
30 jours	0.006	-	0.753***	0.420***	0.347
60 jours	0.056	0.815***	-	0.705***	0.519
90 jours	0.061	0.530***	0.706***	-	0.784**
120 jours	0.175	0.394*	0.670***	0.752***	-

* P≤0.05 ** P≤0.01 *** P≤0.001.

Tableau 3. Moyennes estimées pour la laine en suint selon l'année de naissance et celui de tonte (kg).

Année	année de naissance	année de tonte
1971	3.09 ± 0.10	-
1972	3.18 ± 0.09	-
1973	3.18 ± 0.07	3.53 ± 0.11
1974	3.36 ± 0.08	3.48 ± 0.09
1975	3.24 ± 0.07	3.43 ± 0.08
1976	3.49 ± 0.08	3.46 ± 0.08
1977	-	3.29 ± 0.08
1978	-	3.31 ± 0.07
1979	3.56 ± 0.11	3.43 ± 0.07
1980	3.45 ± 0.12	3.52 ± 0.07
1981	3.35 ± 0.14	3.62 ± 0.07
1982	-	-
1983	-	3.97 ± 0.07
1984	4.03 ± 0.56	3.23 ± 0.07
1985	-	3.19 ± 0.08
1986	-	2.65 ± 0.08

jours, tandis que l'effet de l'année de naissance a été significatif pour tous les poids à l'exception de celui pris à la naissance (Tableau 1).

Les correlations phénotypiques entre agnelles nées uniques où gemellaires ont été différentes; parmi les premières, le poids à la naissance n'a présenté de correlations significatives avec aucuns des poids suivants, tandis que pour les jumelles il est correlé avec celui à 30 jours; à partir des 30 jours, les correlations ont été en général toutes significatives pour les agnelles nées uniques, et pour celle nées jumelles entre 30 et 60, 30 et 90, 60 et 90 et 90 et 120 jours.

Le coefficient d'héritabilité du poids à la naissance a presenté une valeur tres faible (0.028±0.135). Bien que le poids à la naissance ait été influencé surtout par le type de mise-bas, cet effet n'a détenu aucune influence sur les âges succèssifs. Le poids de la laine en suint (3.32±0.01 de moyenne) a subit une réduction seulement à partir de l'age de 9.5 ans.

Tous les effets considerés ont été significatifs. Le coefficient d'héritabilité a été de 0.22± 0.06, valeur qui est de peu inferieure à celle presentée dans un travail précédent (Pilla et. al., 1976) et qui se place parmi les valeurs plus basses existantes pour les races mérinisées (Rae, 1982); la répètabilité a été de 0.25±0.03.

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Postnatal development of wool follicles of Pramenka sheep breed

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Summary

Investigations of wool follicles of Pramenka were done on skin samples in the age of six, 12, 18 and 24 months. Characteristics of density decrease from six to 24 months; nP–21.18, nP+S–30.20 and S/P–13.58%. Diameter of fibres shows an opposite trend and it grows; dP–6.44, dS–31.12 and dP+S–22.89%, but dP/dS was lower by 19.14 percent in oldest, compared to youngest category which indicates that wool with the age increase becomes more uniform. Medulla appears in P follicles, primarily in PC, while S fibres have low percentage of medulla. Shedding increased with the age increase, being 1,71, 4.14, 5,98 and 23.08 percent in P follicles. Multiple fibres in P follicles were recorded only in oldest category due to interrelation to shedding. Multiple fibres in S follicles appear in all ages. Formation of trio groups, couplet and solitary in P follicles is permanent in Pramenka after partition. Correlative analysis of investigated parametres showed various directions and values, as well as full connection only between small number of characteristics. Total results indicate that full development of wool follicles of Pramenka completes in the age of 12 months. Recorded variabilities show large heterogeny among investigated animals, thus acknowledging that Pramenka represents a specific level in the evolution of domestication of wild ancestors up to present pure breeds.
Keywords: wool follicles, diameter of fibres, medulla percentage, shedding

Introduction

Coarse wool Pramenka is the mostly represented sheep breed in Yugoslavia. Due to low wool productivity on one hand and its importance on the other, the objective of this paper is to determine and investigate all parametres of the postnatal development of wool follicles on the example of relatively numerous population of Pramenka in the age of six, 12, 18 and 24 months through skin samples. Therefore, the scope of this paper is to provide answers to the question in which age Pramenka sheep breed completes its full development of wool follicles, i.e. birthcoat.

Material and methods

Investigations were done on skin samples taken by biopsy from the mid part of Pramenka's body in the period of regular shearing. At the moment of samples taking, animals were in the age of six (N=25), 12 (N=21), 18 (N=21) and 24 months (N=48). After the biopsy skin samples were laboratory prepared, cut and investigated according to standard methods. The following features were acknowledged on skin samples in the position of sebaceous glands: total number of follicles (nP+S), number of primary follicles (nP), ratio of number of secondary (S) and primary (P) follicles, (S/P), diameter of primary fibres (dP), diameter of secondary fibres (dS), diameter of all fibres (dP+S), ratio of diameter of primary and secondary fibres (dP/dS), appearance of medulla in fibres; percentage of primary fibres in medulla (MP), percentage of secondary fibres with medulla (MS) and percentage of all fibres with medulla (MP+S). Kemp fibres, appearance of shedding, multiple fibres and the way of follicles grouping were recorded in paricular. Correlative and regressive analyses on the basis of single relations were done in

Table 1. Mean values of investigated characteristics of wool follicles and fibres

Age (M)	N	nP+S	nP	S/P	dP	dS	dP+S	dP/dS	MP	MS	MP+S	kemp %
6	25	7.45	1.70	3.46	64.12	25.48	34.30	2.56	93.41	3.74	24.17	14.62
12	21	6.76	1.38	3.98	55.79	21.56	28.52	2.55	97.50	0.00	19.99	6.00
18	21	7.26	1.68	3.40	66.65	26.04	35.00	2.54	99.83	3.17	25.94	6.50
24	48	5.20	1.34	2.99	68.25	33.41	42.15	2.07	79.81	11.31	28.90	30.45

order to determine mutual relations of investigated characteristics of wool follicles and their fibres. These investigations were done under equal conditions at the sheep farm in Central Bosnia, at 1 200 m approx. from sea level in the period 1986/90.

Results and discussion

Analysing histological skin samples, large number of relevant parametres of wool follicles and fibres was determined, in this paper, expressed in their mean values (Table 1). By the age increase from six to 24 months, all characteristics of density decrease so that mean values nP+S and nP decrease accordingly, except the group with 18 months, whose values are larger than in the group with 12, but still lower than in the six months age group. Mean S/P value is largest in the group with 12 months, but with the age increase, i.e. growth of animals, as well as skin development and exoansion, this value decreases. Average diameter of fibres in follicles, per investigated groups shows an opposite trend in respect of density (it grows), being dP–6.44, dS–31.12, and dP+S–22.89%, but ratio of dP/dS decreases by 19.14% in oldest, compared to the youngest category, acknowledging that with the age increase Pramenka's wool becomes more uniform. Appearance of medulla in the fibres is primarily connected with fibres in P follicles, first in PC while the percentage of S fibres in medulla is low (medulla was recorded in none of the samples in the group with 12 months), except oldest group of animals (11.31%). Mean values of medulla fibres percentage (MP+S) show a tendency of growth, except the group with 12 months, being a result, or interrelated with the diameter (fineness) of all fibres (dP+S), showing the same trend. Therefore, with the age increase, the usability of Pramenka wool decreases. In these investigations, kemp was recorded only in P fibres which coincides with former investigations of breeds in the world. Largest percentage of P fibres with kemp was recorded in oldest group with the age of 24 months (30.45%). Analysing the results obtained in the participation of P fibres with kemp, per groups, and making comparisson per years of investigations, it could be stated that in animals which had improved breeding at farm conditions, the percentage of kemp fibres, compared to initial material, gradually, but significantly decreased.Initial material in the age of 24 months was supplied by private farmers. Their offsprings are composed of animals, six, 12 and 18 months. Changing — shedding of wool follicles was recorded only in P follicles, but in S follicles shedding was not recorded in any of samples. With the age increase mean values of shedding considerably increase, being (1.71, 4.14, 5.98 and 23.08%). By skin samples analysis, the appearance of multiple fibres was was recorded in follicles of Pramenka wool. Multiple fibres in P follicles were recorded only in oldest group (1.68%). This appearance is most probably, a result of an abundant shedding. Multiple fibres in S follicles were recorded in all age groups. Their values, from youngest to oldest group, were within the range of 2.01, 1.00, 0.61 and 0.83%. In these investigations, the formation of P follicles in the formation of trio groups was 93.57, 93.37, 92.77, and 93.62%, but in the formation of couplet and solitary 6.43, 6.63, 7.23 and 6.38%, which indicates that they are constant in the postnatal period. This acknowledges former investigation results obtained in the world for other breeds, based on the statement that final P follicles development completes substantially earlier (intra uterine), compared to secondary follicles. Since it is not possible to present a detailed correlative and regressive analyses of investigated characteristics here, so it could only be stated that single correlative relations have various signs and values, complete only among small number (dP and dP+S–0.90, 0.91, 0.92 and 0.91, and dS and dP+S–0.90, 0.91, 0.91 and 0.90). The analysis of synthetized results and observations presented in this paper, indicates a conclusion that full development of wool follicles, i.e. birthcoat of Pramenka completes in the age of 12 months, thus being identical to the findings of investigations done for other breeds. Wide heterogeny of all investigated characteristics of Pramenka population thus requires the application of well planned breeding and selection work for improvement of yield and wool quality. Observing the obtained results in general, it could be stated that investigated parametres are very important for the knowledge of wool structure, evaluation of yield and wool quality in this most widely represented sheep population in the country.

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Heredity of wool fineness of different sheep breeds and their crosses

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Summary

The program of establishing domestic meat sheep is based on the application of combinatory crossing procedure. Investigations were done at the farm, located at 1 200 m sea level, approx. Besides domestic Pramenka, combined Wurttenberg-Merinolandschaf, high prolific Romanoff and meat Ile de France breeds were used as well. Production and meat quality were observed for the above four breeds and three generations of produced crosses and fineness of wool fibres on the samples taken from left mid body position was analysed as well. Samples were analysed in the staple base by the method of short cut. Fibres diameter was measured on fibre gauge. Mean values are obtained by biometric preparation. and after that statistically studied according to breed groups of animals and presented in this paper. Investigations showed that new meat and wool sheep type, suitable for hilly-mountain regions in Yugoslavia could be established by aforestated procedure.
Keywords: Diameter of wool fibres of Pramenka, Merinolandschaf, Romanoff, Ile de France breeds and crosses.

Introduction

Various Merino breeds were imported in Yugoslavia in the past in order to produce domestic fine wool sheep. Breeding was based on crossing, mainly with Merinolandschaf breeds, but the obtained results did not meet the requirements. Method of housing, feed shortage and severe continental climate largely affected low productivity of produced crosses. They particulary affected low yield of relatively fine but non-uniform wool. The experimental investigations on establishing domestic meat sheep type has started recently. The increase of meat production and quality was observed and fineness of wool fibre was investigated on purebreeds and produced crosses as well, being a subject matter of this paper.

Material and methods

Investigations were done in Central Bosnia under severe continental climate, at 1 200 m approx from sea level. Combinatory crossing procedure was applied, where, besides domestic Pramenka (P), combined Wurttenberg-Merinolandschaf (M), high prolific Romanoff (R) and meat Ile de France (I) breeds were applied. Fineness of wool fibres was analysed for four purebreeds and three generations of produced crosses (F1 generation — two-breeds MP/2, II generation — three-breeds MP2R/4 and III generation — four-breeds MP2R4I/8). Number and age of animals are shown in the table. Wool samples were taken before shearing (end of June) from the mid left side in the position of last rib. Investigation of wool fineness was done by the method of short cut in a staple base. Diameter of fibres was measured on fibres gauge. Mean values were obtained by biometric samples preparation and then statistically prepared according to breed groups of animals. Investigations were done in the period 1986/91 at a farm under almost equal housing and nutrition conditions. Frequent lambing was accomplished with the application of hormones, used for induction and estrus synchronization. Therefore, crossbreeds from the generations II and III were sheared in the age of 14 and 8 months, when the wool samples were taken for analysis.

Results and discussion

Statistical parametres obtained for wool fineness of investigated purebreeds and various types of crosses show large non-uniformity not only in average mean values but also in standard disorder, variation coefficients and wide range of variations (Table 1).

Mean value of wool fineness of autochtonous Pramenka being recorded 35.88 micrometers is classified into a medium coarse wool (class C, i.e. 48–56 S). Although it seems suitable for textile production it is rather non-uniform, ranging from 19.78 to 65.87 micrometers. It should be emphasised in particular that in every specific sample, i.e. hair of animals wool fibres, belonging to various classifications were found. If, besides the above, various length is taken into consideration then it could be concluded that this wool is good only for production of coarse fabrics and other types of industrial production. The results show that well planned breeding and selection work for improvement of wool quality was not applied in the investigated population of Pramenka. Wool fineness of Romanof breed rams is only 2.70 finer than of Pramenka, but variations are much lower, ranging from 29.12 to 39.41 micrometer. This type of wool is characteristic for hair hides because of selection ratio of primary fibres to halo-hair. It should be emphasised that Romanoff breed was used for the increase of both prolificy and early maturity increase, as well as changing of insemination seasons. By the selection of combined Wurttenberg-Merinolandschaf and meat Ile de France breeds, in the procedure of combinatory crossing, we tried to provide, besides meat production increase high quality wool for industrial production. Characteristic of the above breeds is a medium fine wool (25.48 and 25.92 mμ), as well as very low variations (21.36–30.20 and 24.36–28.49 mμ). Produced types of crosses show that F_1 crosses, compared to Pramenka, have finer wool by 24.58, II by 27.76, and III generation by 16.81%. Variations also were lower and decreased according to the following order:

- Pramenka: F1 generation 47.10%
- Pramenka: II generation 56.02%
- Pramenka: IIIgeneration 76.96%

Coefficients of variabilities in II and III, compared to F1 generation also decreased, which shows the influence of paragenetic factors on the wool fineness. Fining of wool in newly established types of crosses occured as a result of the application of rams having finer wool, in the procedure of combinatory crossing. It also should be emphasised that numerous physical factors affect the wool fineness. These are mainly climate, sex, age, physiological condition

Table 1. Wool fineness of purebreeds and various crosses.

Breeds & crosses	n	Age	$\bar{x} \pm s\bar{x}$	s	s%	Variations
Pramenka ewes	664	24	35.88 ± 0.21	5.46	15.22	19.78–65.87
Merino rams	8	18	25.48 ± 0.95	2.71	10.63	21.36–30.20
PV/2 crossbreed ewes	206	18	27.06 ± 0.30	4.34	16.05	15.04–39.42
Romanoff rams	11	18	34.91 ± 0.99	3.27	9.37	29.12–39.41
PV2R/4 crossbreed ewes	109	14	25.92 ± 0.27	2.78	10.72	16.49–36.76
Ile de France rams	5	18	25.90 ± 0.72	1.62	6.25	24.36–28.49
PV2R4I/8 crossbreed ewes	20	8	29.85 ± 0.51	2.27	7.60	24.90–35.52

and nutrition of animals. This matter was studied and presented by many authors present here. The above investigations indicate on the conclusion that it is possible to successfully establish new meat and wool type of sheep, suitable for hilly-mountain regions in Yugoslavia by the procedure of combinatory crossing of domestic Pramenka with combined, high prolific rams and meat breeds. This should be of interest not only for sheep breeders, but meat processing plants from a viewpoint of slaughtering values and quality as well. However, it is of particular interest for processors of wool fibres in the production of various fabrics.

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The comparative study of wool follicles of Pramenka, Merinolandschaf and Romanoff sheep breeds and their crosses

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Summary

Sheep production in Yugoslavia is based on the application of combinnatory crossing procedure. Besides the emphasis on meat production, the wool production will be observed as well. In order to introduce the most actual standards for the evaluation of production, the investigations of wool follicles has started according to the standard methods. Only first results are presented here since further investigations, besides the above mentioned breeds, included the Ile de France breed and investigations for its crosses has not been completed yet. The increase of follicles number per a size unit and the improvement of wool fineness, i.e. the decrease of both fibres diametar and medulla fibres percentage were recorded from Pramenka breed, through its crosses, to Merinolandschaf breed. The results suggest a need for further investigations on the characateristics of secondary follicles and fibres of Romanoff breed, which, in respect of quantitative features, shows characteristics similar to that of wild types of sheep. It could be concluded that these investigations will contribute not only to the establishment of required and planned standards, but to the specific bases for wool genetics as well.
Keywords: wool follicles, diameter of fibres, medulla percentage.

Introduction

The investigations on wool production potential on skin samples were conducted in order to establish meat sheep type, suitable for hilly-mountain regions through the procedure of combinatory crossing. Wool follicles were investigated on skin samples and the obtained results are presented in this paper.

Material and methods

Skin samples are taken from mid body position of Pramenka rams and ewes as well as Pramenka and Merinolandschaf crosses (PV/Z) and PV/2 ewes with Romanoff rams (PV2R/4). At the moment of samples taking all animals were in the age of 18 months, and number per breeds is shown in the table. Biopsy taken skin samples are laboratory prepared, cut and studied according to the standard methods. The following was recorded on the samples: total number of follicles n(P+S), number of primary follicles (nP), ratio of number of secondary (S) and primary (P) follicles (S/P), diameter of primary (P) fibres (dP), and diameter of secondary (S) (dS), diameter of all fibres (d(P+S)), ratio of diameter of primary and secondary fibres (dP/dS), appearance of medulla in fibres, and (MP) primary fibres with medulla (MS) secondary fibres with medulla and kemp. Kemp fibres, appearance of multiple fibres, and the way of follicles grouping were recorded in paricular.

Table 1. Mean values of investigated characteristics of wool follicles.

Breed Type & sex	N	nP+S	nP	S/P	dP	dS	dP+S	MP	MS	MP+S
Pramenka rams	6	4.52	1.15	3.03	73.54	34.45	44.18	85.52	5.94	27.37
Merinolandsch. rams	8	15.91	2.26	5.98	30.17	23.93	24.83	20.32	5.46	5.55
Romanoff rams	12	13.04	1.79	6.70	56.35	18.90	24.01	86.71	0.25	11.93
Pramenka ewes	21	7.26	1.68	3.40	66.65	26.04	35.00	99.83	3.17	25.94
PV/2 cross.ewes	17	12.52	2.30	4.45	46.19	22.33	26.67	70.03	2.05	14.33
PV2R/4 cross. ewes	23	16.12	2.16	6.47	52.91	21.07	25.34	69.58	0.70	9.96

Results and discussion

Very large number of information was obtained by the analysis of histological samples, but only basis indicators, expressed as the mean values, are presented in this paper. Detailed statistical analyses are available with the authors and those interested in can get them. Since this paper is only an introduction to a series of further papers to be published upon the completion of investigations, so the results presented and discussed here are only preliminary. (Table 1).

Besides the presented results, it is necessary to emphasise the presence of kemp fibres as well. Similar to former investigations conducted on other breeds in the world, this type of fibres was recorded only in P follicles in this paper as well. Highest percentage of primary fibres with kemp was recorded in Romanoff rams (40.3%) and Pramenka rams (31.7%). In Pramenka ewes this percentage was 6.5, Merinolandschaf rams 2.32, and crosses PV2R/4 very high 16.51%. Kempe fibres were not recorded at all only in crosses PV/2. Observing the obtained results in general, it could be concluded that they are similar to that obtained by other authors who investigated same or related breeds. Such impression one may have if observes the results individually. But, observing the results synthetically, aiming not only to create the standards based on morphological feature, it is possible to establish a base for investigation of wool genetics as well. Final objective of these investigations is to produce more productive animals from the viewpoint of meat and wool production by the application of breeding methods. From the viewpoint of wool production, expressed by a total number of follicles (nP+S) both breeds used for crossing are superior, compared to Pramenka breed, so the produced crosses PV/2 showed better results in this feature, and three breeds crosses PV2R/4 were better than two breeds. The trend is identical for the total wool fineness (dP+S). Compared to Pramenka, this characteristic is better in crosses. Total medulla percentage (MP+S) was improved in crosses, i.e. it decreased. Thus, observing in general, the obtained results on wool characteristics, studied on wool follicles, a conclusion is thus indicated that the increase of wool production on one hand, and quality improvement on the other were recorded in crosses, compared to domestic Pramenka. However, observing specific structural elements of wool separately, i.e. primary and secondary fibres, (to remind that this is possible only through skin samples), then the above conclusion on the improvement of wool production and quality is not disturbed. However, other discussions are imposed as well. Namely, total diameter of fibres for breeds which have to improve this feature is almost same in Pramenka, while for Merinolandschaf rams it was 24.83 and in Romanoff rams 24.01 micrometers. The value of P diameter and secondary fibres shows a small variation in Merinolandschaf (dP=30.17, dS=23.93), but in Romanoff it was larger, being (dP=56.35, dS=18.90). It should be emphasised that, of all investigated groups, Romanoff breed has the finest secondary fibres. Also, Romanoff has highest percentage of kemp fibres (40.33%) in primary fibres with medulla. Although Romanoff breed was widely studied in USSR from the viewpoint of wool production, and through skin samples as well, not many papers on its evolution position in a series of wild ancestors to fine wool breeds are available. Also, genetic arguments for its wool inversion, i.e. deep secondary and shallow primary follicles are not available. These characteristics, i.e. fine secondary fibres and high percentage of kemp in primary fibres indicate that Romanoff breed is close to wild sheep, whose primary fibres are only of kemp type, but secon- dary of an extraordinary fineness. Such observations and results make a basis for a question when to observe production and quality of woolwhether Romanoff, even besides generally good results in its crosses, shall make a regression in details to the values of wool follicles. Surely, it is necessary to look for types of crosses which will show rather considerable trans- gression of fineness curve of primary and secondary fibres, i.e. decrease of variation of their mean values. Also, it will be necessary to think of the appearance of kemp fibres, since, as already stated, this type of fibres was not recorded in crosses of Pramenka and Merinolandschaf, while offsprings, produced from these crosses, inseminated with Romanoff breed re- ceived, to a certain percentage, kemp fibres in primary follicles (18.51%). Therefore, the ob- tained results provide wide possibilities for the selection of more suitable types, and besides selection among pure breeds, on the basis of variations, rather large possibilities for the selec- tion of more suitable crosses are thus provided.

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Use and production of Angora rabbit hair in Italy

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Summary

Italy is one of the most important countries manufacturing valuable animal textile fibres for production of both underwear and fashionable clothes. Among these fibres Angora rabbit hair or angora wool plays an important role.

The estimated amount of angora wool utilized by Italian textile industry is about 2–3 millions kg per year (the world production is estimated by Melchers as 4–5 millions kg in 1990 and the European one as 200 000 kg). Nevertheless Angora rabbit breeding is not widespread in our country, so that there isn't a market for the national Angora rabbit hair and the national production, located particularly in the North as well as the industry, covers only 1% of the needs. The amount left over is imported from other countries, mostly from China (about 80%), Germany, Great Britain, Chile, France, etc.

The quality of imported Angora wool is generally low and only 5% of the amount is classified as Super, 1st or 2nd class. In Italy the biggest handicap for Angora rabbit breeding is the high productive cost, given especially by labour, to have a high quality product. It could be interesting however to evaluate the possibility of rearing rabbits with double productive aptitude, in which wool is subordinated to meat production, so to increase the in- comes of the breeders and to supply the low quality wool needed by the market.
Keywords: Angora rabbit, angora wool.

Introduction

Italian textile industry is specialised in manufactoring noble textile fibres, both of animal and plant origin, for the production of underwear and fashionable clothes. Among the animal fibres, besides silk and special wools — such as cashmere and mohair, obtained by goats, and alpaca and vicuna, obtained by camelids — it is worthwhile mentioning the angora wool, obtained from the hair of the homonymous rabbit. Although it does not represent an important quantitative production, angora wool shows some qualitative characteristics, such as fineness, lightness and nonconductivity, that make it very interesting for high quality products. No impediments can be found to Angora rabbit breeding in Mediterranean countries, at least from the environmental and climatic point of view, because domestic rabbit (Oryctolagus cuniculus), bred now all over the world, takes its origins from the Mediterranean basin, and the same is for its genetic mutation Angora (also found in goats and cats) responsible for the peculiar characteristics of the hair.

Production and trade in the world

Statistical data show that in spite of a predicted world production of angora wool, evaluated by the Melchers & Co. of Bremen as approaching 4–5 millions kg for the year 1990 — mainly produced by China (3–4 000 000 kg), Chile (350–360 000 kg), Argentine (150 000 kg) — the European production amount to only 200 000 kg (about 4–5%), mainly from Hungary, Czechoslovakia, France and Germany (Gallico, 1990), while Italy plays an unsignificant commercial role, with its production corresponding to 1% of the needed quantity.

In 1989 our textile industry was therefor forced to importing 3 472 891 kg of angora wool, representing 70–85% of the world production (ISTAT, 1990). After examining the data regarding the Italian import of angora wool in the ten-years period 1980–1989 (Castellani, 1990) it can be pointed out that our suppliers are mainly China, from which we import directly 70–90% of the total needs (2 427 900 kg corresponding to 69.9% in 1989), Germany with 6–11% (405 800 kg corresponding to 11.7% in 1989), Great Britain with 4–8% (285 100 kg corresponding to 8.2% in 1989), Chile with 2–3% (119 300 kg corresponding to 3.5% in 1989), France with 1–2% (18 500 kg corresponding to 0.5% in 1989), Argentine with 1% (29 600 kg corresponding to 0.9% in 1989).

It must be mentioned that the main quantity of the imported angora wool is of low quality: only 5% is classified as Super, I or II grade and the remaining 95%, utilised for products with low angora wool percentage, is classified as III, IV or Off grade (Gallico, 1990). This both for economical reason (as the Super costs twice the Off grade) and for requirement of the textile and fashion industries, which do not ask for yarns with marked 'woolly' angora effect.

Italian situation

Starting from these data we wanted to verify 1) the present situation of breeding units and their consequent production of hair in Italy, as the last official data date back to 1981, and 2) the true amount of national consumption.

In Italy Angora rabbit breeding is not widespread at the present, and indeed it is decreasing, since its trend to produce high quality angora wool, scarcely demanded by the market, so that even by interviewing the National Rabbit Breeders Association we could identify only 19 breeding units, which are located in the North and Centre-North regions (Piemonte 7, Lombardia 4, Veneto 2, Emilia Romagna 3, Toscana 2, Marche 1), as the 40 manifacturing firms (Piemonte 21, Lombardia 3, Veneto 2, Emilia Romagna 1, Toscana 9, Marche 1, Umbria 2, Lazio 1). The identified breeding units are mainly small or medium-small ones and they are specialised not in hair production, but rather in animal selection for high quality hair, contrasting so with the demand of the national and world market.

In order to obtain more information on Italian producers and on the origin and quality of the angora wool utilised by our firms, we tried to contact the breeders and the firms' managers, but the results are frustrating, since only 3 firms replied to our letter, asking for general and non-economical informations. However, despite the discoraging results obtained by our interviews, we can state that in Italy Angora rabbit breeding plays a critical role, but at the same time the large demand for angora wool of medium-low quality is putting pressure for a decisive change in this situation, even in a short time. In fact an inversion of trend from our breeders from a superior qualitative production with high and uncompetitive costs to a lower quality but more cheap production, combined to meat production too, could raise the level of Italian Angora breeding, and on the other hand give us the possibility to reduce our import from the Far East. Similar observation could be made for all European and Mediterranean Countries, which could successfully enter in the world angora wool market and supply the strong demands of the Italian textile industry.

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Mohair production districts and consumption of mohair in Turkey

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Abstract

Outside the province of Ankara, Angora goats are bred in the provinces of Eskisehir, Konya, Çankiri, Afyon, Kastamonu, Mardin, Kütahya, Bolu and Çorum. 60% of the total mohair production is exported. The rest is being utilized locally for handcrafts: blanket weaving; scarf weaving; soft products weaving; socks, bags, etc.
Key words: Mohair Angora goat, production regions

Introduction

Until the 17th century Angora goats have been raised only in the Ankara region. Outside Turkey they have been bred for the first time in France. Today they are kept also in the South African Republic, United States of America, Argentina and Oceania. Turkey's production ranks third in the world. It is believed that Turkey has some 2 180 000 Angora goats. An Angora goat produces 2.2 kg/year mohair approximately. The total amount of the mohair production of Turkey is 3.5 ton approximately.

Results and discussion

The provinces where Angora goats are kept and the amount of the mohair products are:

Provinces	Product rank	Number of Angora goats	Amount of mohair (kg)	Amount of total product (%)
Ankara	1	590 364	974 101	28.95
Eskisehir	2	316 576	552 350	16.40
Konya	3	181 128	298 861	8.88
Çankiri	4	180 610	298 008	8.85
Afyon	5	153 822	253 741	7.51
Kastamonu	7	119 304	196 652	5.84
Mardin	6	130 946	216 062	6.42
Kutahya	9	90 048	148 579	4.41
Bolu	8	118 610	195 798	5.82
Çorum	10	77 426	127 754	3.79

Sixty percent of the total mohair production was exported. The rest was utilized by the handcraft industry:
1. Blanket weaving
2. Scarf weaving
3. Soft products weaving
4. Socks, bags, etc.

Mohair blanket weaving is very important in Turkey. The famous mohair blankets are called Siirt blankets. Siirt blankets are gaining more importance in and out of Turkey.

Conclusion

Mohair has a very important place in the Turkish economy, its relevant value cannot be fully exploited. It is necessary to give a real importance to this production in the future.

A research on some physical properties and principal utilization of mohairs produced in Ankara and Bolu districts

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Abstract

The Ankara and Bolu regions are the most important mohair producing districts of Turkey. In this research some physical characteristics such as fineness, crimp depth, resistance, elongation rate, kemp, medullated and coloured fiber percentages were studied. Physical characteristics of the principal mohairs produced in Ankara and Bolu districts were determined. Regional utilization of mohair was also studied.
Key words: Mohair, fiber, physical properties, utilization of mohair.

Introduction

In our country the human growth ratio is 0.28 %. It is thus necessary to increase the production in every field because of this very high ratio. The production in the weaving and clothing industry can be easily increased. It seems that mohair products have a chance in the market: weaving and clothing industry. The province of Ankara is the most convenient region to keep Angora goats; but they are also bred in the province of Bolu that has a very different climate from the province of Ankara.

Purpose of this research was to determine the physical characteristics and to show the differences of the mohairs that have been produced in these two different regions.

Materials and methods

40 animals from Bolu districts and 30 animals from the Ankara districts were used as a sample. Properties were tested for these samples according to the relevant standards.

Results and discussion

In this research the following properties were determined on the mohairs from Ankara and Bolu districts; fiber thickness, staple length, single fiber length, number of folds, crimp depth of fibers, resistance of fibers, elongation rate of fibers, kemp, medullated fibers ratio, coloured fiber percentage. Regional utilization of mohair was also determined.

Physical Properties	Ankara (n=21) x	Sx	%V	Bolu (n=21) x	Sx	%V
Fiber thickness (μ)	30.316	0.92	13.90	31.39	0.70	10.22
Staple length	14.500	0.29	9.16	14.03	0.51	16.63
Single fiber natural length (mm)	119.329	3.36	12.91	109.32	3.62	15.16
Single fiber real length (mm)	166.552	4.14	11.39	153.23	4.24	12.66
Single fiber natural length after real length (mm)	125.627	3.50	12.75	115.75	3.82	15.10
Number of folds (100 mm)	5.449	0.18	15.41	6.05	0.22	16.79
Crimp grade	1.420	0.01	3.80	1.44	0.02	7.36
Crimp kept rate (%)	88.330	0.37	1.91	85.03	0.75	4.07
Crimprate (%)	28.485	0.57	9.20	29.27	1.08	16.98
Resistance of fibers (gr)	17.974	1.30	33.04	15.39	0.60	17.75
Elongation rate of fibers (%)	44.27	0.94	9.69	41.80	0.9	10.58
Crimp depth of fibers (mm)	1.922	0.06	14.12	2.02	0.05	10.54

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Cashmere fibre production from Australasian and Siberian (Gorno Altai) goats in a cross breeding programme

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Abstract

The production of cashmere is a possible means of diversification on hill and upland farms in Scotland. There are no native types of goat in Scotland bearing economic quantities of cashmere. However, the native feral goat and some of the dairy breeds have been found to have small quantities (<50g) of very fine fibre (<16μm) (Russel, 1989). These goats have been used as foundation stock in a crossbreeding programme using imported Australasian and Siberian sires aimed at improving cashmere production.

Methods

In November 1989, 196 does consisting of 126 ferals, 10 dairy does and 60 F1 (Australasian × feral or dairy) were inseminated with fresh semen taken from 8 Australasian and 8 Siberian bucks. The mean fibre diameter of the Australasian and Siberian bucks spanned the range of diameters available in each genotype and were therefore taken to be representative of their respective breeds. Dam type was allocated equally across both sire breeds.

Australasian bucks were used to mate any does not conceiving to AI for the first cycle after insemination only. A further 32 9-month-old F1 (Australasian × feral or dairy) doe kids were inseminated with semen taken from two Siberian bucks. A total of 268 kids resulted from this breeding programme. Numbers of each cross are given below in Table 1.

Kids were patch sampled at 10 months of age at three sites — neck, mid side and hip — and a combined equal weight sample was obtained for fibre testing. All fibre samples were analysed at the fibre laboratory of Whatawhata Research Centre, New Zealand. Fibre lengths were also measured at these three sites. Kids were shorn at 10–11 months of age and fleeces weighed.

Results

Siberian cross kids had down of significantly higher diameter, higher fleece weights, higher yields and, consequently, higher calculated down weights (Table 2.) Siberian cross kids had significantly longer cashmere than Australasian sired kids at all three sites of measurement (Table 3). Correlations between down lengths at all three sites and calculated down weights were positive and similar for the two genotypes (Table 4). Mean down diameters of Australasian and Siberian cross females were higher than that of their male contemporaries. Fleece weights did not differ between sexes within genotypes but down yield was lower for female Australasian kids compared to their male contemporaries (Table 5). Single and twin reared kids did not differ significantly in any of the fleece characteristics measured apart from fleece weight, which was 4% greater for singles. Single reared kids were 6% heavier at weaning.

Table 1. Number of kids of each genotype.

Dam type	Sire type	
	Siberian	Australasian
Feral	75	99
F1 Australasian	43	51

Table 2. Mean cashmere diameter, fleece weight, yield, calculated down weights and weaning weights for Siberian and Australasian cross kids adjusted for sex and dam type.

	Sire type		SED
	Siberian	Australasian	
Mean down diameter (μm)	16.6	16.1	0.11***
Fleece weight (g)	307.1	232.4	9.7***
Down yield (%)	42.6	32.8	1.24***
Calculated down weight (g)	131.4	76.1	4.7***
Standard deviation of mean down diameter	3.96	3.81	0.04***
Weaning weight (kg)	15.7	14.9	0.3**

Table 3. Down lengths measured at three sites in January adjusted for sex and dam type.

Down length (cm)	Sire type		SED
	Siberian	Australasian	
Hip	5.3	3.4	0.19***
Mid side	6.5	4.5	0.21***
Neck	6.9	5.0	0.24***

Table 4. Correlations between down length measurements and calculated down weights.

Measurement site	Sire type	
	Siberian	Australasian
Hip	0.57	0.51
Mid side	0.71	0.65
Neck	0.74	0.64

Table 5. Fibre characteristics and weaning weights of male and female kids of differing genotypes adjusted for dam type.

	Sire type							
	Siberian				Australasian			
	Male	Female	SED		Male	Female	SED	
Mean down diameter (µm)	16.1	17.3	0.16	***	15.6	16.4	0.13	***
Fleece weight (g)	293.9	326.3	17.3	NS	237.3	227.4	11.3	NS
Down yield (%)	43.7	42.2	1.8	NS	35.3	30.1	1.7	**
Calculated down weight (g)	128.4	139.4	9.1	NS	81.4	68.9	4.7	***
Weaning weight (kg)	16.8	14.5	0.55	***	15.6	14.0	0.42	***

Conclusions

Siberian cross kids were superior to Australasian sired kids in all the components of down weight measured in this experiment ie down length, diameter, yield and fleece weight. However, their higher mean down diameter may limit their use in a breeding programme since both Australasian and Siberian studies have shown that cashmere could be expected to increase in diameter by at least 1.5µm from the yearling to the 2-year old stage; e.g. Pattie and Restall (1990), Gifford et al. (1990) and N. Wray (personal communication). Such an increase would bring a greater proportion of these crossbred 50% Siberian animals over the upper limit (18.5 µm) of fibre diameter for cashmere.

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Angora goats breeding in Italy: preliminary data

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Summary

This study aims to acquire know how on Angora goats potentiality in Italy, mainly to utilize this species in marginal and unproductive agricultural areas. Productive [PP] and reproductive [RP] performances have been evaluated on 60 Angora Goats, bred in semi-extensive way in Italy. For each animal fibre production quantity (average fleece weight [AFW]) and fibres quality (average diameter [AFD] and type of fibres) has been evaluated. Further evaluations (AFD, average lenght [AL] and related coefficient of variation [CV], number of kemp [K] and number of pigmented fibres [NPF]) have been carried out on pooled fleeces, processed in tops. A mating group has been established (43 females, 1 male) for evaluating main reproductive performances (pregnancy rate [Pr] detected by ultra-sound real-time scanning, fertility [Fr] and prolificacy [Pf]). In the end, new born kid average weight [BKW] and daily average weight increase [DAW] have been evaluated. PP: fibre individual results are: AWF: Kg 2.1; AFD: µ30, 42±10.25; medullated fibres: 6.37 percentage (%). Tops performances: the pooled fleeces were divided in two categories: Young Goat Quality: AFD: µ31.7, AL: mm 94.1 and CV: 59%, K: 15, NPF: 187. RP: Pr: 88.4%, Fr: 84.2% and Pr: 118.8%. Kid performances: BKW: Kg 2.07±0.43, DAW: g 84.53±21.08. In conclusion, obtained results show that Angora Goats did not have adaptation problems to the climate-enviromental condition of center of Italy. Further studies will be performed to obtain a better fibre quality nearer to industrial requirements. Actually we are performing more studies about nutrition, quality of kid fleeces and reproductive aspects of the Angora Goats.

Introduction

This study aims to acquire know how on Angora goats potentiality in Italy, mainly to utilize this species in marginal and unproductive agricultural areas.

Material and methods

Fibre production quantity (average fleece weight) and fibre quality (average diameter and type of fibres) have been evaluated on 60 Angora goats. Samples washed with petroleum ether, dried in oven for 30' at 100° C, prepared according to UNI standards 5423-64 were observed at 500X with microscope (MP3, Polskie Zaklady Optyczne). Average length and related coefficient of variation, number of kemp and number of pigmented fibres have been carried out on pooled fleeces, processed in tops by industrial methods with Dark Fibre Detector (CSIRO). A mating group has been established (43 females, 1 male) for evaluating pregnancy rate, detected by ultra-sound real-time scanning (Toshiba Sonolayer Sal 32 A), fertility rate and prolificacy. New born kid average weight and daily increase have also been evaluated.

Table 1. Tops analyses.

	YGQ	AQ
Diameter (μ)	31.7	35.6
Average length (mm)	94.1	105.8
Coefficient of variability (%)	59	56.2
Black hair	57	61
Coloured hair	130	136
Kemp	15	17

Table 2. Reproductive performance.

Pregnancy rate	88.40%
Fertility rate	84.80%
Twin rate	18.80%
Prolificacy rate	118.80%

Results

Productive performances: fibre individual results are: average fleece weight Kg 2.1; average diameter μ 30.42±10.25; medullated fibres 6.37%. Tops analyses: the pooled fleeces were divided in two categories: Young Goat Quality (YGQ) and Adult quality (AQ) results are reported in Table 1.

Reproductive performances: see Table 2. Kid performances: new born kid average weight Kg 2.07±0.43, daily increase g 84.53±21.08.

Discussion and conclusions

The animals produced medium and good quality fibres, but with a remarkable amount of kemp and coloured fibres. In spite of their moving from southern to northern hemisphere, the animals showed sexual activity synchronized with their country of origin. However sexual activity was shorter (1 month) than normal (3–4 months) because of Italian increasing photoperiod. Angora goats had no adaptation problems to Italian climate and enviromental conditions. Further studies will be performed to obtain a better fibre quality nearer to industrial requirements.

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Ovulation rate of maiden and mature South Australian cashmere does

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Abstract

This paper reports the distribution of ovulation of South Australian Cashmere does and establishes whether the preponderance of twin births observed by Gifford et al. (1989), in the same herd of goats, was due to a high incidence of twin ovulations or to an inability of the uterus to support more than two kids. Such basic information will be relevant in deliberations about increasing the reproductive performance of the Australian Cashmere goat, whether it be by genetic or other means.

Introduction

Reproductive rate has a marked influence on income derived from a commercial Cashmere goat enterprise. Ponzoni and Gifford (1990) proposed reproduction rate, defined as number of kids weaned, as a trait in the breeding objective of a Cashmere goat herd.

The successful exploitation of the reproductive potential of the Cashmere goat demands a knowledge of its intrinsic reproductive physiology and modulation by environmental and other factors (Restall 1987). Although little research has been conducted in this area, it appears that the Australian Cashmere goat has reasonable fertility (pregnancy rate) and has a moderate incidence of multiple births, of which the overwhelming majority are twins (Eady and Rose, 1988; Saithanoo et al., 1988; Gifford et al., 1989; Gherardi and Johnson, 1990). In contrast to the distribution of litter size in the Australian Cashmere goat, many highly prolific breeds of sheep and goats produce some triplets and quadruplets (approximately 15 to 20% of births). Examples include Javanese sheep and goats (Obst et al., 1980) and the Booroola Merino (Bindon, 1984).

Material and methods

The study was conducted on a private property "Messamurray", near Naracoorte, in south-eastern South Australia.

Maiden (18 months old) and mature (30 to 66 months old) does were isolated from bucks and rams for at least four weeks prior to teasing. Teaser bucks (2%) were placed into five mixed-aged groups of does on day 0. Teasers were removed on day 5 and replaced with fertile bucks. Ovulation rate was determined on day 10 by laparoscopy, the does having undergone an overnight fast. The effect of age of doe on the distribution of ovulations was analysed using the Chi-square test.

Table 1. Distribution of ovulation rate (%) and mean ovulation rates of Cashmere does.

Age of doe	n	No. of females (%) with ovulation rate of:			Mean ovulation rate
		1	2	3	
Maiden	129	37	60	3	1.66
Mature	133	24	70	6	1.82

Results and discussion

The distributions of ovulation rate (%) and of mean ovulation rates for maiden and mature Cashmere does are given in Table 1. The ovulation distributions of maiden and mature does were significantly different (P=0.05), with mature does having a greater proportion of multiple ovulations. The mean ovulation rates of the maiden and mature does were both moderately high, and in both groups of does twin ovulations were commonplace. Our data indicate that the moderate fecundity of the Australian Cashmere goat, in which multiple-born kids are predominantly twins (Eady and Rose, 1988; Saithanoo et al., 1988: Gifford et al., 1989; Gherardi and Johnson, 1990), probably results from a high incidence of twin rather than higher-order (>2) ovulations. Further information on litter size distributions at mid-pregnancy and at birth will be collected to test the foregoing proposition.

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The relation between aptitude for transhumance and fleece characteristics in seven French sheep genetic types

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Summary

Heat production (HP) of groups of four ewes exposed to climatic conditions simulating those met in the Alps during transhumance was determined by indirect calorimetry. At an environmental temperature (Ta) of 15° C, HP of ewes averaged 15 KJ/Kg $P^{0.75}$/h. A reduction of Ta by 5° C or an increase in air speed (to 2–4 m/s) induced 9% increases in HP. With both rain and wind, HP increased in 1.5 hour by 71, 101 and 120% in the Communes des Alpes (CA), Préalpes (P) and Mourérous (M) ewes respectively; these breeds seemed to adapt rapidly to bad weather as HP increased only about 40% on the second day. The Mérinos related breeds increased their HP more slowly (in 3–4 hours) and to a lower extent (by 22–78%) whitout any adaptation. The Mérinos d'Arles (MA) and Est à Laine Mérinos (ELM) ewes had a thick and dense fleece which covered the belly and the legs. Local alpine breeds (CA, P, M) have the shortest fleece with the lowest thermal insulation, and the highest radiative heat losses specially on the belly. Raising Ta to 31° C and relative humidity (RH) to 85% during six hours induced increases of 20% in HP. The MA and ELM ewes increased their rectal temperature by 0.45° C and their respiration rate 4.2 and 5.8 times respectively. In conclusion, the Mérinos related genetic types (specially ELM and MA) seemed to be better adapted to bad wheather than alpine breeds. In contrast, the ELM ewes are unfair to a muggy wheather.
Key words: sheep, climatic conditions, energy metabolism, thermoregulation.

Introduction

Sheep from south-east of France are exposed to rain and wind, and also to high temperatures and storms during transhumance in the alpine mountains. The main breeds which move to mountain pastures are MA and local alpine breeds: CA, P and M. The ELM and Ile de France (IF) breeds are interesting to improve meat production whereas crossbreed F1 Romanov × Mérinos d'Arles (RO×MA) ewes are used to increase prolificity. Therefore, an experiment was performed to study the relation between aptitude for transhumance and fleece characteristics in the seven french sheep genetic types cited above. Groups of four ewes from each genetic type were exposed in calorimetric chambers to climatic conditions simulating those met in the Alps during transhumance. HP was determined by indirect calorimetry. Fleece characteristics (radiative heat losses (RHL), thermal fleece insulation) and blood parameters were also measured.

Results and discussion

Experiment 1

Ewes were exposed to the following treatment: calm air with Ta = 15° C (day 1), wind (2–4 m/s) and rain during six hours at 15° C and wind alone during the night (day 2), calm air with

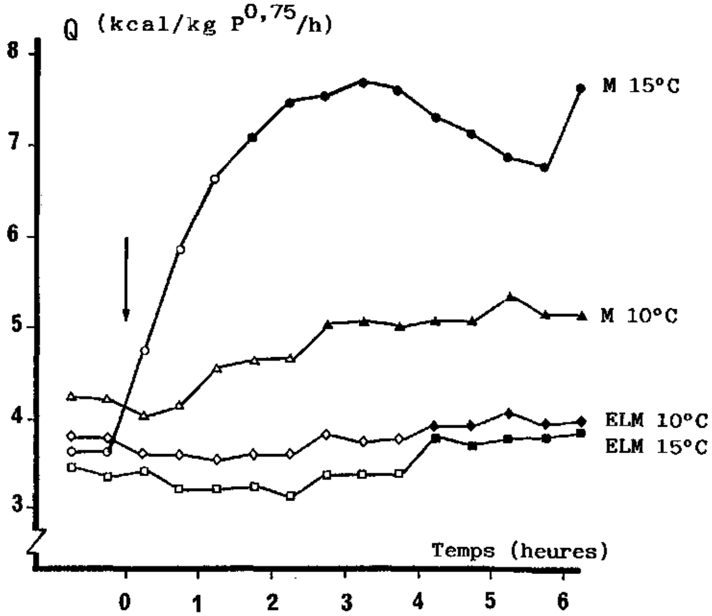

Figure 1. Changes in HP with rain and wind for two groups of ewes. M: Mourerous with Ta = 15 °C (day 2) (○,●) or Ta = 10 °C (day 4) (△,▲), ELM: Est à laine Mérinos with Ta = 15 °C (day 2) (□,■) or Ta = 10 °C (day 4) (◊,♦). Symbols are full when HP becomes stable and fluctuates around a mean value.

Table 1. Variation in HP with rain and wind and fleece characteristics of the ewes.

	Increase in HP with rain and wind				Fleece thermal insulation ($C.m^2.W^{-1}$)	RHL with calm air (W.m–2)	
	15° C		10° C				
	A	B	A	B		back	belly
MA (M)	22	34	29	25	0.231^{d}	43.9^{a}	67.3^{a}
MA (F)					0.119^{ab}	61.5^{f}	94.0^{b}
ELM	32	21	18	21	0.168^{cd}	29.6^{a}	70.6^{a}
IF	-	46	-	32	0.137^{bc}	54.7^{de}	117.8^{c}
RO×MA	78	36	45	27	0.129^{bc}	47.9^{b}	82.3^{ab}
M	114	123	39	47	0.117^{abc}	55.2^{de}	118.6^{c}
CA	76	66	40	44	0.121^{abc}	56.6^{e}	142.8^{d}
P	104	-	39	-	0.098^{a}	51.2^{cd}	140.9^{d}

Increase in HP is expressed in % of HP with calm air. A and B: Values for ewes nine weeks (A) or fourteen weeks (B) after shearing. '-': missing values. A value followed by a superscript differs significantly from all other values in the same column not followed by the same superscript. MA ewes from Le Merle (M) are used to transhumance whereas MA ewes from Fréjorgues (F) are always kept in the valley. HP of MA ewes from Le Merle or Fréjorgues is not different.

Ta = 10° C (day 3), wind and rain during six hours at 10° C and wind alone during the night (day 4).

At 15° C in calm air, HP of ewes averaged 15 $KJ/Kg^{0.75}/h$. HP of ewes nine weeks after shearing (groups A) is 11% higher than HP of ewes fourteen weeks after shearing (groups B) ($P<0.01$). A reduction of Ta by 5° C or an increase in air speed induced 9% increases in HP ($P<0.01$). With both rain and wind, HP increased in 1.5 hour by 71, 101, 120% in the CA, P and M ewes respectively (day 2) ($P<0.05$); these breeds seemed to adapt rapidly to bad wheather since HP increased by only 40% on day 4 despite reduction in Ta (Table 1 and Figure 1).

The Mérinos related breeds increased their HP more slowly (in 3–4 hours) and to a lower extent (by 22–78%) whitout any adaptation except for RO×MA ewes ($P<0.01$) (Table 1 and Figure 1).

The Mérinos related breeds are characterized by a thick and dense fleece which covers the belly and the legs, whereas local alpine breeds have the shortest fleece which does not cover the whole body. Fleece thermal insulation was the lowest for P ewes and the highest for Mérinos related breeds (Table 1). RHL were highest for local alpine breeds than for Mérinos related breeds, and this difference was greater on the belly than on the back. Blood concentrations of calorigenic hormones increased for all genetic types between day 1 and day 4: +26% for thyrotropin and +15% for thyroxine ($P<0.01$). Blood energetic substrate concentrations also increased: +8% for glucose and +56% for non esterified fatty acid (NEFA) ($P<0.01$).

In conclusion, resistance to inclement weather depended mainly on fleece thickness and characteristics: the Mérinos related genetic types (specially ELM and MA) seemed to be better adapted to bad wheather than alpine breeds because they have the most insulating fleece.

Experiment 2

MA, RO×MA and ELM breeds were exposed to the following treatment : 1) calm air with Ta = 15° C and RH of 70% (day 1), 2) calm air with Ta = 31° C and RH = 85% during six hours followed by either 2a) Ta = 15° C RH = 70% (day 2) or 2b) Ta = 10°C RH = 70% (day 3) or 2c) Ta = 10° C with rain and wind during six hours simulating a storm after high temperatures (day 4 except for ELM ewes).

Raising Ta to 31° C and RH to 85% induced increases of 20% in HP and decreases of 69–75% in RHL ($P<0.05$). The MA and ELM ewes increased their rectal temperature by 0.45° C and their respiration rate 4.2 and 5.8 times, respectively ($P<0.05$). The RO×MA ewes did not increase their rectal temperature and increased their respiration rate 2.5 times on days 2 and 3 and 5.1 times on day 4 ($P<0.05$). The plasma NEFA levels were not significantly altered, but glycaemia was decreased by 6 to 13% ($P<0.005$). Plasma T3 and T4 levels decreased by 34 and 20%, respectively ($P<0.05$). Catecholamin plasma levels decreased in the MA and RO×MA ewes (–11 to –63 %) but increased in the ELM ewes (+9 to +58%) ($P<0.05$).

Fall of Ta from 31° C to 15° C and of RH from 85 to 70% induced decreases of 10–16% in HP ($P<0.05$). When the ewes were submitted to cold (10° C), rain and whirling wind after a six hours exposure at 31° C and RH 85% (simulation of storm), panting stopped immediately. HP decreased by 14% during the first hour ($P<0.05$). Then it increased linearly up to 80% and 47% above the values recorded at 10° C without wind for the MA and RO×MA ewes respectively ($P<0.05$). For MA ewes, this increase was higher than that observed in the first experiment with rain and wind after calm air and Ta = 10° C RH = 70% (+30% vs +80%). This is suggesting a reduced fleece insulation in the MA ewes that might have resulted from sweating during exposure to high temperature.

In conclusion, ewes with a high fleece thermal insulation (ELM and, to a lower extent, MA) are unfair to a muggy wheather.

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Phenotypic correlations and productive wool traits of Australian Merino and Polwarth breeds raised in Brazil

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Summary

The objectives of this study were to evaluate the wool production performance and to estimate phenotypic correlations among the considered traits, from 22 Australian Merino and 22 Polwarth ewes, raised at an altitude of 623m, 48°24'3" of west longitude and 22°48'0" of south latitude. All of them reared lambs in the two years of the study. They grazed rotationally in a *Cynodon dactylon* pasture, with a stocking rate of 1.67 animal units per ha. The animals were shorn in the last day of march. The following traits were determined: greasy fleece weight (GFW), yield (Y), clean fleece weight (CFW), fibre diameter (FD), staple length (SL) and staple strength (SS).

The results revealed a satisfactory performance of both breeds. Meanwhile, the high yield values obtained were ascribed to the rain concentration before shearing, indicating that one should shear the flock immediately before the rainy season (late spring). Concerning phenotypic correlations, it was concluded that greasy fleece weight is a good selection criterion, but one have to attend to the risk of excessive increase of fibre diameter.
Keywords: sheep, wool production, wool traits, phenotypic correlations

Introduction

The wool is a textile fibre that is physically and chemically complete and has propers characteristics which increases the value of its end products (Bonifacino and Larrosa, 1985). Meanwhile, the wool production systems involve inexorable complexity due to the great variability of environmental and genetic factors, that affect several characteristics related to the performance of the fibre industrial process.

Nutritional level, health conditions and physiological status, besides climatic variables, are responsible for the changes in the fibre structure, which can alter the quality of the end product.

Results and discussion

The wool production performance of the studied breeds was satisfactory considering the environmental conditions (Table 1). One emphasize meanwhile, the yield values obtained, higher than the verified by Sanderson et al. (1976), Donelly et al. (1983), Rodriguez and Camiou (1985). These results were ascribed to the rain concentration in december, january, february and march (770 and 439 mm for the first and second year, respectively). Very high yields may be associated with a minor protection of the fibres, due to the suint washing (Cardellino and Ponzoni, 1985). After that, one suggest to shear in november, before the rainy season (late spring), in order to avoid possible damage of the fibres, due to the excessive moisture.

The phenotypic correlation coeficients among the wool traits (Table 2), evidence the strait relation between GFW and CFW, corroborating the recomendation of Cardellino and Ponzoni (1985) to use the GFW in the genetic improvement, when it is impossible to mesure the CFW. Similar values were determined by Mullaney et al. (1970), White and McConchie (1976),

Table 1. Means standard errors of the wool traits from Australian Merino and Polwarth breeds (two years means).

	GFW (kg)	CFW (kg)	Y (%)	FD (m)	SL (cm)	SS (NKtex−1)
Australian Merino	2.88±0.08	2.28±0.07	78.96±0.68	20.50±0.19	8.90±0.19	52.62±2.34
Polwarth	3.13±0.08	2.51±0.07	80.17±0.60	22.08±0.23	10.83±0.21	62.10±1.49

Table 2. Phenotypic correlation coeficients for Australian Merino and Polwart wool traits, respectively (two years data).

	CFW	Y	FD	SL	SS
GFW	0.98***	0.50***	0.33*	0.37*	0.39**
	0.97***	0.24ns	0.60***	0.31*	0.46***
CFW		0.67***	0.32*	0.32*	0.43**
		0.48***	0.56***	0.29ns	0.58***
Y			0.18ns	0.12ns	0.48***
			0.08ns	0.04ns	0.61***
FD				0.33*	0.12ns
				0.16ns	0.20ns
SL					0.14ns
					0.40**

*** = P<0.001 ** = P<0.01 * = P<0.05 n = P>0.05

Cardellino et al. (1981). The correlations between GFW and the other variables were not antagonistics. Meanwhile, the positive phenotypic relation between wool quantity and fibre diameter, considering the fleece weight as the main selection objective, allows to deduce that one must check the diameter in order to avoid the overcome of the standard limits. Nevertheless, according to Garcia (1985), this care is essential when the greasy fleece is heavy, weighing more than 5.40 kg, in the Corriedale breed.

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Repeatability of wool characteristics and body shorn weight in ewes of five breeds, raised in intensive grazing system

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Summary

This study was conducted for two years with five sheep breeds, to estimate the repeatability of wool traits and body weight. Data were obtained from 98 ewes (18 months of age). The experimental group consisted of 10 Ile de France ewes and 22 for each of the following breeds: Australian Merino, Polwarth, Corriedale and Romney Marsh. All ewes reared lambs in both years of the study. They grazed rotationally in a *Cynodon dactylon* pasture, with a stocking rate of 1,67 animals units per ha. Wool samples were taken from the right midside position of the ewes and sent to laboratory for analyses. The LSMLMW program *(Mixed Model Least Squares and Maximum Likelihood Computer Program)*, by Harvey (1987), was used to estimate the repeatability, including year and breed as fixed effects and ewe as rondom effect. The repeatability estimates of the studied traits were high, except for staple strength and extensibility. The estimate obtained for yellow discolouration incidence showed that it must be included in the genetic improvement programes.
Key words: sheep, wool traits repeatability.

Introduction

The repeatability coeficient is a phenotypic parameter dependent on the population genetic patrimony and specific environmental conditions, although the estimates for wool traits made by various workers were very similar (Cardellino and Rovira, 1988). In adittion, according to Cardellino et al. (1983), the repeatability tend to be lower under adverse environmental conditions. The difference between repeatability estimates of adult and young ewes is not great in magnitude, so measurements accomplished in the first fleece, could predict the subsequent animal performance (Young et al., 1960; Mullaney et al., 1970). Concerning breed differences, Mullaney et al. (1970) concluded that one may use the same estimate, to predict gains in the productive life of Australian Merino, Polwarth and Corriedale breeds. Among several fleece traits, yellow discolouration is a serious fault that affects the wool industrial value. Wilkinson et al. (1985) reported the occurrence of high repeatability estimates in Australian Merino, Polwarth and Corriedale flocks, from different environments.

The objective of this study was to attain repeatability estimates of wool traits in ewes raised in a sub tropical environment, in Brazil.

Results and discussion

Repeatability estimates of median to high magnitude were verified, except for staple strength and extensibility (Table 1). The fleece weight (greasy and clean) coeficients were fitted in the same range of 0.50 to 0.60, reported by Cardellino and Rovira (1988), based on various workers data. Yield repeatability estimate was lower than the values obtained by Australian researcher (Young et al., 1960; Beattie, 1962; White and McConchie, 1976). Probably, this discrepancy is due to the rain incidence, low in Australia, but high in the conditions of this study. Otherwise,

Table 1. Repeatability estimates of wool traits and body shorn weight, in ewes of five breeds.

Traits	Repeatability	Standard error
Greasy fleece weight	0.55	0.071
Clean fleece weight	0.56	0.070
Yield	0.46	0.080
Fibre diameter	0.84	0.030
Staple length	0.53	0.073
Crimps frequency	0.78	0.040
Yellow discolouration incidence	0.55	0.071
Extensibility	0.19	0.098
Staple strength	0.24	0.096
Body shorn weight	0.75	0.045

the rain intensity differed between both years, such an occurrance promoting a great variation in the yield, which contributed to the low repeatability estimate obtained.

The low repeatability estimates for staple strength and extensibility were ascribed to the oscillation in the helminthic infection between the two years in the Corriedale breed. Although this infection didn't cause serious damage to the fibre resistence, promoted differences in this characteristic between the two years of the study.

The fibre diameter and the crimp frequence showed very high repeatability estimates. It seems that the environment, especially the pasture nutritional value, offered satisfactory conditions for the diameter and crimp frequency uniformity, in both years. The high estimate obtained for body shorn weight, also confirms the little environmental variation. This conclusion is based on the fact that adverse environment favor low repeatability estimates, according to Cardellino et al. (1983).

The yellow discolouration incidence repeatability estimate, was also high, confirming the observations of Wilkinson et al. (1985). Considering the heritable nature of this abnormal manifestation, it could be convenient to include it in the wool sheep genetic improvement programmes, mainly in the humid regions, where the environmental effect elevates yellow discolouration frequency.

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The Sarda sheep breed and the local carpet industry

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Summary

The Sarda sheep breed with 4 700 000 heads is the most important Italian sheep population. Its originally came from Sardinia, but now is widespread also in many regions of the Italian peninsula, especially in the central area The animals are of medium size with annual milk production of 150 to 250 l depending on the husbandry conditions. Their fleece weight ranges from 1.1 to 1.8 kg for the females and 1.5 to 2.5 kg for the males Their wool is characterized by long staples with a relatively large diameter. In Sardinia, the tradition of wool spinning and weaving dates back to prehistoric times This is a traditional activity, which is still thriving, since it accounts for a specific sphere of production on the Sardinian local handicraft. Weavers make blankets, carpets and tapestries following ancient patterns of composition, using both vertical and horizontal looms conceived according to archaic tecnology.

Introduction

Sardinia, an island located in the middle of the Mediterranean sea (Lat. 40° N), is an Italian region with a surface area of 24 809 square km and 1.6 million inhabitants. Most of this surface is covered by hills and mountains (max height approx. 1 800 m). The pasture area is about 1.27 million ha (Bullitta, 1980), but 75% of the surface of this island may be exploited extensively considering woods and the brushwood. Sardinia has a Mediterranean, warm and temperate climate with the lowest temperatures in winter (0 to 5° C) and the highest ones in summer (27° to 33° C). The mean rainfall is 600 mm in the costal plains and 1 500 mm in the central mountainous areas. Precipitations are concentrated in autumn and winter while summer is a nearly dry season.

Origin and distribution of the Sarda sheep breed

The Sarda sheep breed, indigenous to Sardinia, seems to come of the large Asian stock, like most of the Mediterranean milk sheep (Owen, 1976). It is the largest Italian sheep breed (41% of the national sheep stock) with its 4.7 million heads, 3.8 millions of which are bred in Sardinia. The rest is bred in the peninsula, especially in its central regions (Latium, Tuscany, Umbria, Emilia Romagna).

Morphological and production characteristics

The Sarda sheep is a medium size animal (60–70 cm in withers heigth),with a live weight ranging from 60 to 80 Kg for the males and from 35 to 45 Kg for the females. It has light, polled head with straight or slightly ram-like profile and extended trunk, deep thorax, straight back, broad abdomen. Its udder is well-developed, globular, with great sinuses, suitable for both hand and machine milking (Casu et al., 1983) After weaning (25–40 days after lambing), this sheep gives a milk production ranging from 150 to 250 l per lactation, depending on the extensive or semi-intensive husbandry conditions The average milk fat content is 6.0–6.5%, while the protein content amounts to 5.0–5.3%.

The annual fertility rate is about 95% with a 120–150% prolificacy rate lambings occur mainly in autumn for adult sheep and late winter for first lambings.

The white, open fleece with pointed staples stretches half way down the forleg and a little further up the hock.Its weight ranges from 1.1 to 1.5 Kg for the females and from 1.5 to 2.5 for the males The wool charateristics are:

Staple length (mm)	187.8
Crimps/25mm	1.1
Fibre thicknes (m)	44.2
Yeld 16% RH	56.7

Animal husbandry

Sheep industry in Sardinia traditionally follows a typically extensive system, with flocks living free range throughout the year, making use of the fodder from natural pastures. Milk yield is dependent on grass growth (Casu, 1971), which shows a productive cycle typical of many mediterranean areas, with herbage production mostly concentrated in the spring months. For this reason and due to most of the lambings occurring in late autumn, milk yield shows a characteristic trend, with 25% of the total produced in winter months(December–February), while 50% is produced in two spring months(April–May).

Since several years the traditional system is undergoing a profound change, making available sown pastures (autumn-spring temprary meadows; Bullitta, 1976) wich supply the flocks with plentiful herbage during the critical periods (late pregnancy, lambing, early lactation). Even the supplementary concentrate is provided at different extent according to the intensification rate of the management (Sanna et al., 1990).

After weaning (lamb 30–40 days old) the milking starts usually twice a day, and lasts up to the beginning of summer. The gross income of the flock derives for 75–80 % from milk, 25–20 % from suckling lambs slaughtered when 30–40 days old, and only for 0.5 % from wool!

Wool utilization

In the past the wool of the 'Sarda', the sole breed raised in Sardinia, was home utilized to manufacture the 'orbace' to make the traditional costumes or parts of them besides the every day items like paksaddles and bags. However the wool, often mixed with vegetable fibers (flax, cotton) was usually and still is processed into blankets, carpets and tapestries.

To improve the quality fine wool breeds (like the Merinos), were introduced for crossbreeding (Passino, 1931) but due to the droping milk yield this scheme didn't go on for long time: consequently the breed was and still is a coarse wool producer.

The effect of crossbreeding on quality and kind of wool is reported in Figure 1, and refers to the effect of crossbreeding with Friesian at increasing levels (Boyazoglu et al., 1979). The exposed figures stress clearly that as the textile quality improves the carpet making worsens. Such crossbreeding doesn't seem advisable in areas like Sardinia where the traditional carpet handicraft thrives fairly well; if not properly planned, this could jeopardize the characteristics of the traditionally manufactured goods.

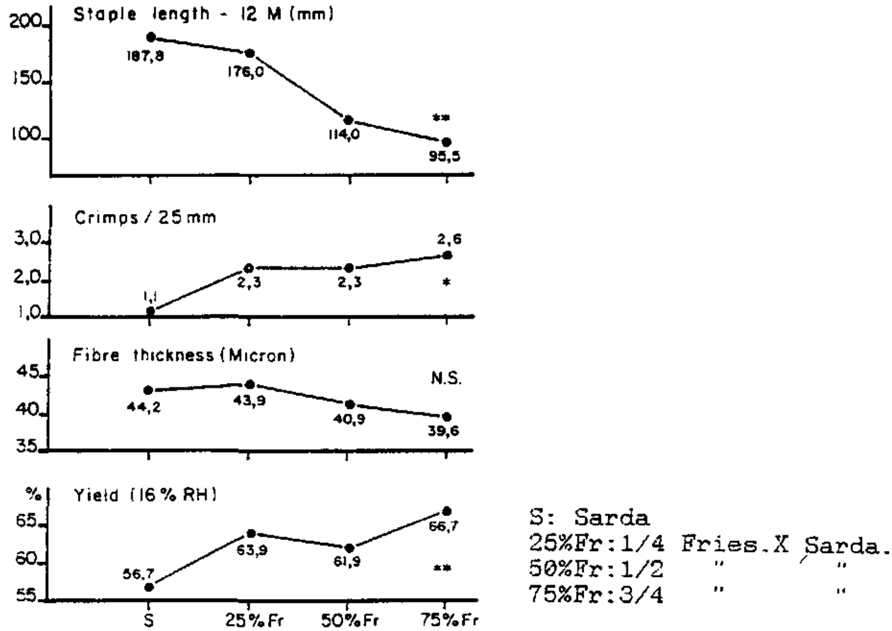

Figure 1. Wool characteristics of Sarda breed and crossbred Friesian × Sarda (Boyazoglu et al., 1979).

Wool and the weaving tradition in Sardinia

The cultural heritage of sheep breeding in Sardinia dates back to prehistoric times (Neolithic Age, 4600–3800 BC; Lilliu, 1988). This heritage is made up of knowledge of ethnoveterinary science, empirical husbandry and milk processing. Among the other things, weaving traditions have developed according to which women do woolwork as a form of domestic handicraft (Satta, 1983).

As happens in other countries whose cultures centres on sheep breeding, in Sardinia wool processing is divided into a series of technical operations being constant anthropological factors before it results in the final product. Actually the sequence of weaving operations is the following: shearing, wool sorting and scouring and carding, spinning, throwing, hank winding, preparation of the bobbins, preparation of the warp, laying of the warp on the loom, drawing-in and finally actual weaving (Balzano and Biddoccu, 1983; Mantiglia, 1987). During the last stage, the fabric takes shape according to the design which one wants to produce. Again, to this end a series of constant operations is performed varying on the basis of the different designs. Precise calculations are made to establish the points where the weft is interwoven with the warp (Arata and Biasi, 1935; Loddo, 1987). Furthermore, some wool hanks are suitably dyed mainly red, dark blue, brown, yellow as well as black and white, in order to create sharper colour contrasts between patterns.

The Sardinian textile tradition uses two kinds of loom: the vertical one and the horizontal one, excluding each other in their respective areas of diffusion. Thus, specific and different skills are needed to operate them, with the result that once who can use the vertical loom are not able to use the other one and viceversa.

As is well-known, the vertical loom is technically based on the elementary principle of tension by means of two bars, one located at its top on proper supports and the other at its bottom, fastened to rods or counterweights exerting a counterforce. Material culture scholars think this is the most archaic weaving system. It is used in some inland areas of Sardinia with a greatly conservative and pastoral tradition, such as Goceano and Barbagia (Pinna, 1990). So-called 'double face' carpets, in which the interlacement of weft and warp does not create a right side and a back side, are produced in these areas being rather small in comparison with the ones where the orizontal loom is widespread.The patterns peculiar to these carpets are very simple. They are structured according to sign representations based on multy-coloured stripes where lozenges and stars or sinusoids and broken lines with oscillographic structure are inserted. These elements aim at chromatic effects because of their being probably the result of a primitive cultural context which remained uniconic for a longer time. For this reason and due to these carpets being produced by means of the vertical loom, we may conjecture that their patterns and production techniques are more ancient than those decorating the carpets from other Sardinian areas, where it is possible to find more elaborate influences marked by a higher naturalistic realism.

The horizontal loom, a more complex mechanism than the technically simple vertical loom, was possibly brought in during the Middle Age by the monastic orders following the Benedictine rule. The technical system of the horizontal loom, which probably came to Europe from Asia, is an important innovation since it makes possible to speed up the weaving process by opening the shed through the warp with treadles that move the heddles upwards and downwards and thus make the passage of the shuttle easier. The floral patterns, made with the horizontal loom, are the most widespread. Among them, the most peculiar ones portray bunches and libertystyle compositions of carnations, poppies daisies and lilies hanging from stylized vine-shoots. Sometimes within the floral patterns, stylized simbols of the monstrance and of the cross are portrayed, as well as stylized zoomorphic shapes of peacocks, sparrows, hoopes, deers, mouflons and horses. Whereas, the stereotype of the anthropomorphic patterns is the 'round' dance with dancers all along the border and the hunter-driver reasing his rifle.

Compositions and genres vary in the different historical and cultural areas of this island: in some of them carpets prevail, in some others tapestries or blankets. Generally, as regards the different characteristics of traditionals patterns, some comunities stand out where the handicraft textile production is still quite active, with reference to the demand both of the home and the external and tourist market, which developed after Sardinia got into the great route of the international tourism. In Sardinia, a special regional body, the "Istituto Sardo Organizzazione Lavoro Artigiano", has been concerned with the traditional textile handicraft and the other sectors of the artistic handicraft industry from 1957, as regards both the preservation of cultural traditions and financing programmes. Handicraft firms and the many textile cooperatives turn to this body as the most important reference for product marketing. However, under the present market conditions, also the demand by private pourchasers always exceeds the supply. This means that the handicraft textile industry in the island could be developed further in order to make it an outlet especially for the female labour.

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Present situation and future of hand woven wool carpets

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Summary

History of hand woven carpet making is a very old art. Thousands of families from Hereke, Bali- kesir, Izmir, Usak, Konya, Lake District, Kâyseri, Nevsehir, Erzurum, Sivas and Antalya have been engaged in this activity and they are earning money from this art. A large part of thousands of tons of spring short fleece produced in our country are used in hand woven carpet making. Hand woven carpet making has a special importance for making use of rough and mixed spring shorn fleece which is not possible to make use of in other branches of textile.

However, it is a fact that this old art has some problems nowadays. Bad quality and non-compliance with standardization as far as the threads are concerned, simplicity and primitiveness of the looms, degeneration of motives and designs, problems of dyes and dyed threads, scarcity of scientific research in the field of carpet making, problems of training and education, inability to make quality control before, during and after weaving, problems of cooperatives, all sorts of legislative bottlenecks and similar problems are putting the future of hand woven carpet making in jeopardy, if not now in future.

In order to prevent this danger it would be appropriate to take measures to overcome the problems cited above starting from raw material and in fact from sheep breeding up to sales and marketing, that is in every stage of hand woven carpet making.
Keywords: Hand woven wool carpet.

Introduction

One of the handicrafts used to extensively in our country and making use of the free workforce in the best way is handwoven carpet making. All of the operations in handmade carpet making are done by hand. Carpet requires hand work only from being thread to becoming a covering material. That is why although it is offered for high prices in the market it has found buyers easily almost in every age. Also, for this reason the machine-made carpets that have come about in the last years attract less attention although they are made of with better material, they have better design and more important they are cheaper.

Carpet making has been a handicraft in our country for a long time and presently it is eptended to all regions. There are thousands of families who derive their livelihood from handwoven carpet making. Despite all these increased demand towards handmade carpets in our country there are some bottlenecks preventing development. These bottlenecks bring some limitations to the development of handwoven carpet making. We can summarize these bottlenecks as follows.

Raw material

The raw material used comes as the most important factor in addition to the workmanship and design that effects the quality and marketability of a handwoven carpet. A large part of wool produced in our country are rough and mixed. And rough mixed wools are the best for production of handwoven carpets. However, it is not possible to say that all the wool yarns are in the same quality. Wool carpet yarns produced in our country are produced in varied forms varying with regions. The quality of both factory produced wool carpet yarns and traditionally produced ones show different qualities. Therefore, standardized yarns have to be produced.

Tools and design

A large part of the looms used in our country are made by the users and as such they are primitive. They must be improved. Because, a quality product (carpet) is produced with quality raw material, careful workmanship and right tools looms. Motifs and designs seen in handmade wool carpets are very varied. There are some designs prepared by some special institutions, Sümerbank, Ministry of Agriculture and Rural Affairs and Ministry of Culture. Weavers make use of these designs. However, there are also designs prepared in accordance with the wish of the market and demand of the businessmen and carpets woven with these designs. Therefore instead of following the degenerated designs required by the market we make our traditional designs and quide the market both internally and inter- nationally.

Education and research: In order to enable our carpets to attain its value both in home and foreign markets they must be woven in good quality and good design. And this can be realized only with the work of specialized people who know the aspect of carpet from raw material to marketing. Such people can be brought up with good education. Unfortunately, the number of institutions, research people and research in the field of handwoven carpet is almost none. It is a fact that education without research is not possible.

Coordination and cooperation

There are many establishments in our country who are engaged in carpet business. However, as there is no coordination between these bodies, labour, knowledge, money and time is wasted. Therefore, it would be useful to combine carpet making under a single public body and carry out all the works by this centralized organ. Cooperatives are an effective tool to develop the rural areas from socio-economic point of view. Carpet cooperatives which come under Development Cooperatives could not complete their upper organization and therefore they could not set up their unions. Therefore, they can not function effectively. In order to make the carpet cooperatives effective there needs to be long-term, low interest loans extended to such cooperatives. Hence, the financial problem of the cooperatives will be solved.

Other problems

The wages received by the weavers are determined by lump-sum system or by the number of knots. Although there are very many and different applications, the wage paid to the weavers by knot is very low. Also, a large part of carpet weavers in our country are not covered by health insurance.

No serious quality control is done on the carpets produced by those other than Sümerbank, Development Fund of Turkey and some serious workshops. This fact means that erroneous carpets come on to the market. Therefore, on auto-control system to inspect carpet quality must be set up and developed. Also hand-woven carpets must have and extensive propaganda and promotion both at home and abroad, hence other problems of carpet trade will be solved.

We have the opinion that taking important measures in the field of raw material and even sheep breeding as well as sales and marketing would be very appropriate for the development of handmade carpet trade which has and important place in the socioeconomic life of our country.

Design characteristics in Anatolian carpets

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Abstract

Among the carpets woven in various production centers in different regions of Anatolia, there are typical differences as well as similarities of characteristics in general, in terms of materials, colors, designs and sizes. The main differences seem tolerate to designs rather than the other factors. The majority of the carpets woven in most of these regions display similarities in well-known elements such as the 'mihrab' in Medallions and in each carpet the plain is framed by large and small borders. In spite of these commonly shared similarities in the motifs of borders and medallions, there are some regional differences in characteristics. The motifs on the borders make the region of the carpet easily known. Some carpets can be differentiated by their medallions or the motifs used in their medallions.
Keywords: Weaving region; similarities in form and character; differences in design.

Introduction

I have surveyed over fifty carpet-and rug-weaving regions in Anatolia. In general, there are similarities both in form and in character between the carpets woven in each of these regions. However, in spite of the general similarities, each one of these carpets is different from the others. The differences in design will be studied in this article.

Design characteristics

The differences in appearance between the Anatolian carpets may be grouped under four points: differences in material; differences in color; differences in size; differences in design. Only the differences of design will be studied in this article:

1. Although borders which are among the elements commonly used in the carpet design compositions exist on carpets of all regions, there are differences between their geometric forms, flower patterns and branches that are used in the borders of most regions. Where the differences are very clear, the borders indicate the region where the carpet has been woven. Some famous examples are the following: 'Gemi' (Ship), 'Karanfil' (Carnation) and Cafer borders in Milas carpets; 'Heybe' (Saddle-bag) border in Yagcibedir carpets; Halielli border in Dösemealti carpets; 'Çift Ayak' (Double Feet) border in Yahyali carpets; 'Narli' (Pome-granate) and Çubuklu border which consists of the fine borders of Gördes carpets; 'Yan Yaprak-Bardak' (Serrated leaf with wine-glass), Goldür and 'Makas' (Scissors) borders in Çanakkale carpets. Similarly, Kirsehir, Nigde, Karaman, and Obruk carpets have specific borders of their own.
2. An inner border, which is found only on Taspinar carpets, forms a second frame between the main border and the plain of the carpet. A long motif, called Sallama, within his frame is a characteristic of Taspinar carpets.

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3. The 'mihrabs' in carpets also differ according to the regions.
    3.1. The corners of the mihrab arch on the historical Gordes carpets are bevelled.
    3.2. The mihrabs on Ladik carpets are single, triple-or quintuple-arched.
    3.3. 'Hamayel' motifs on the arch of Milas carpets make the mihrab nodose.
    3.4. The last stage of the mihrab is kept long on Kirsehir carpets.
    3.5. The mihrab is double and symmetrical on the Yagcibedir and Ortaköy (Altinhisar) carpets. The same feature exists on Yahyali and Kula carpets. However, the parts of the plain remaining within the mihrab are quite different from each other.
4. Some carpets are differentiated with their medallions and the motifs forming their medallions.
    4.1. Interlinked hooks form a big medallion on the Karakeçili carpets. These are used either as single medallion, or whole medallion with two halves, or as a double medallion.
    4.2. The lozenge-shaped medallion decorated with flower patterns is the characteristic of the Kiz Bergama carpets. These carpets are woven by the Yagcibedir Yürüks (Nomadic Turkmen) settled in the vicinity of Dikili.
    4.3. The motif called 'civa' found in the double mihrab plain of the Yagcibedir Yürük carpets in Sindirgi is used only in this region with variants.
    4.4. The medallions found in the carpets woven in the Çanakkale region are not common in places outside this region. But a different variant of the medallion called 'Çarkli Elek' is used in Malatya. Oklu (Arrowed) and Turnali (Crane) medallions are found only in this region.
    4.5. A special group of motifs found in a symmetrical arrangement above and below the middle plain of the Saribas (Yellow-headed) carpets woven in the Çanakkale region, are specific only to the carpets in this region.
    4.6. The medallions of Taspinar carpets are authentic in that these medallions which are called 'Civil Göbek' cotain tiny flowers and forms.
    4.7. The form of the medallion in the Yahyali carpets is also authentic, the motifs of which are not found in other regions.
    4.8. The medallion of the Ortakyö (Altinhisar) carpets surrounded by hooks has a very vivid appearance. Another difference between this medallion and those of the other carpets is that it is adjacent to the borders.
    4.9. The Maden (Çamardi) carpets have authentic medallions as well. These medallions are easily distinguished from those of other regions with their cornered shapes and the 'semse' (head of the medallion) at each ends.
5. The most important characteristic of the old Kula carpets which are called the Kömürcü Kula, is that the motifs found in the plain within the mihrabs are completely woven with black thread.

Many other similarities as well as differences can be found when the details of the carpets woven in Anatolia are examined. Here, because of the limited time, only the most general characteristics have been mentioned.

Summary and conclusions

Summary of symposium sessions

O. Kaftanoglu

Introduction

This summary attempts to highlight some of the major issues which were discussed during the Symposium. The programme was well balanced and the organizers were congragulated for the preparation of such a good symposium. The historical, cultural, sociological and economic context of the production and of the use of hides, skins, wool and hair, mohair and cashmere were underlined and the end products such as leather, carpets and confection were presented. The informative and authoritative papers stimulated fruitful discussions. The symposium also brought the scientist and authorities together to exchange ideas and developed scientific cooperation.

Introductive session

Mr. Krostitz summarized the current situation and recent developments in the markets of hides, skins, wool, hair and derived products and gave information on the supply and demand as well as their implications for international trade.

The developing countries keep the larger part of global population of ruminant animals; however, the developed countries produce more meat, milk and wool. Hide and skin production is about the same in developed and developing countries but these two outputs account only for a relatively small proportion of the total value of the animals. Hides and skins are therefore considered to be the by-products of livestock breeding for other purposes.

The cattle numbers and consequently slaughtering and hides and skins output have decreased in almost all developed countries. The majority of the world goat population and the output of goat skins are concentrated in the developing countries. Wool production is much more in the developed countries than the developing countries. Australia and New Zealand produce over 40% of the world's wool.

The short term outlook is for little change in demand and supply of hides and skins in the next couple of years. With global supplies exceeding demand, wool prices will remain relatively small in the short term. A certain increase in prices will occur in the long term.

Prof. Pekel gave a brief description of sheep production in Turkey. He indicated that Turkey is among the first 10 countries with a population of 45 million sheep. About 97% of the sheep population are native breeds and the remaining 3% are merino and merino crosses. Sheep is kept for meat and milk production. Wool is used for textile, carpet and kilim industry. In Central Anatolia, most of the sheep are fat-tailed. In the Trace, Marmara and Aegean Regions sheep are kept under intensive farming conditions. However in the East, they are kept under extensive conditions.

Numerous breeding experiments were conducted to increase the meat, milk and wool production in Turkey since 1934. Recently some exotic breeds were imported from Europe and they were distributed to various farmers in the country. Also selection and breeding programmes were initiated to improve the qualities of Awassi sheep in the Ceylanpinar State Farm.

Prof. Sönmez complained about the problems related to the transfer of the results of experiments and scientific work to the farmers. He indicated the importance of extension besides the scientific work.

Prof. Eliçin complained about the state policy in importing some exotic breeds and distributing them among the farmers. He emphasized that the adaptation studies should have been done at the universities and research institutes before they were given to the farmers.

Mr. Kosar asked if there were any breeding work aimed at increasing the quality of hides and skins. Prof. Boyazoglu explained the risk of changing the local genetic material and indicated the negative aspects of intensification. Mr. Fevrier advised to get lessons from the developed countries in terms of intensification and environmental pollution.

Session 1

Dr. M. Eskolin explained the anisotropy of physical characteristic functions of sheep leather. She compared the Australian and Finnish leathers in terms of breaking load, the percentage elongation at break, the sample thickness and the tensile strength. Eventhough the Australian sheep leather had higher sample thickness values, breaking load, elongation at break than the Finnish sheep leather, she stressed that there were no remarkable differences between them.

Dr. L. Blajan explained the effects of diseases on the production of hides, skins and animal fibers. All conditions affecting the general health can cause a visible defects of the skin. Especially skin diseases such as sheep pox, goat pox, contagious ecthyma, lumpy skin disease, dermatophilosis and parasites such as mange, mycosis and myiasis which cause the depreciation of hides, skins and animal fibres.

Dr. L. Blajan also gave a paper on the effects of abattoir procedures on the quality of hides and skins. He emphasized that the most common deffects of hides and skins are caused at the time of slaughtering and carcass flying of the animal. He also explained that hides and skins may also deteriorate from too much drying, salting, faulty folding and during storage or transport. He emphasized that the improvement of quality of the hides and skins during in the abattoir and warehouse storage depend on the skill of the workers, grading of the hides and payment according to quality.

Prof. T. Yakali gave a brief information about the investigations on the hides and skins from farmers to the industry in Turkey. He showed the different qualities of leather and explained the genetic and environmental factors which affect the leather production and quality. He emphasized that when the wool gets thinner and tighter, the leather becomes weaker and more porous. The leather which has rough and mingled wool is considered to have better quality and more value than that having thin and tight wool like merinos.

He demonstrated the effects of diseases, parasites and environmental factors on the quality of leather. As being the protection organ of the body, the skin and the leather reflect all signs of the strugle that the animal faces during its life. All these environmental factors including inadequate storage and conservation lower the quality of leather.

Prof. Eddebarh spoke on the use of hides in Morocco and on the characteristics of the sector. The leather industry has an important place in Morocco. There are about 40 tanneries in the country and they produce 80 million square foot of leather.

The leather industry can be divided into 3 groups such as, small traditional enterprises, semi-industrial and industrial enterprises. Finesse and strength are the major properties of the Moroccon leather. The industry is becoming more attractive for the farmers and wholesalers.

Mr. T. Kosar explained the problems and expectations of the Turkish private leather industry. There are over 400 000 people working at the sector. The export value of the leather products, which comes after the textile, is closed to $1 billion. The sector has been changing its structure since 1985. The historical Kazliçesme leather industry is moving to organized leather industry district in Istanbul. All other leather industries are also moving to organized industrial places in different cities.

One of the main problems of the Turkish leather industry is the shortage of raw material. The yearly increase of number of head of cattle and small ruminants (sheep and goat) is not sufficient. The animal statistics and the number of slaughtered animals are not known precisely. Consequently the raw leather production is not sufficient for the needs of the industry. The quality of raw leather is low and about 50% of the leather value is lost due to uncontrolled and faulty slaughtering and flying.

Prof. Artan presented the place of Turkish leather industry within European Comunity, its future and the possibilities for its competitiveness with the industry in European Community.

Turkey occupies the 3rd place in terms of numbers of large ruminants, the 1st place in small ruminant numbers, the 5th place in the production of raw hides from large ruminants and the 1st place in the production of raw skins from small ruminants. In other words Turkey has 13.5% of the total number of cattle, 39.5% of sheep and 10.6% of goats with reference to the EC countries.

The leather sector is one of the oldest sector of the Turkish industry. The establishments are mostly small and they are labour oriented. In order to increase the capacity and to modernize the leather sector, there are 4 big projects ongoing. By the realization of the projects the exportation value of the sector is expected to reach up to $3 billion in 1995.

Leather technology and leather technician training courses have been given at the Ege University and Istanbul University to meet the manpower of the industry. The raw material availability and low labour cost are important factors which provide a competition superiority to the leather sector. Therefore, the Turkish leather sector has an outstanding performance and competition capacity in Europe.

Prof. Eliçin asked why organized leather industry is being established in the surroundings of Istanbul which will be the center of the city in the near future due to the uncontrolled expansion. He also asked if they could be established in the East. Mr. Kosar answered that there is not enough promotion in the East and there are some advantages being in big cities. He also said that in the newly established organized leather industry the utilization of water will be reduced from 80% to 15%, there will be waste water treatment units and re-use of solvents, bromium and the solid waste material etc.

Prof. Artan also said that Turkish leather industry need to bring the new technology in order to increase the quality of leather products.

Session 2

Dr. Simoncini talked about the scientific and technical innovation for controlling the environment and the quality of waste water in the leather industry. The Italian leather industry is in a leading position as regards the work performance and according to the results of the studies concerning waste water treatment, depletion of emissions, sludge disposal and recovery of by-products. Chemical reagents have to be used for processing hides into leathers, therefore, technologies are being developed to reduce the pollution to the largest possible extend.

There are about 13 000 tanneries in the world and 500 000 people work in that industry. About 300 million m^3 water/year are used for the process of tanning in the world. Italy uses 35 million m^3 water/year. Tanning is done by means of chromium salts. Raising the temperature of drums to 40–45° C reduces the use of chromium salts to 33%. The finishing water contains formaldehyde which also create ecological problems. The future prospects of tanning process from the ecological and economic viewpoint must follow recent innovations which must be introduced in the tanneries.

Prof. Sari explained the possibilty of reduction and re-using the wastes of Turkish leather industry that causes environmental pollution. The leather industry showing a rapid development in the last 20 years, has not had its own infrastructure or educated personnel. When the sector's polluting characteristics were noticed it was already very late for applying preventive measures.

Most of the establishments are found in cities and towns. Most of them do not have any waste treatment plants, therefore, all liquid effluents are directly discharged to the environment, thereby causing pollution. The Turkish leather industry in general has no possibilities to treat its own effluents with the exception of 5–10 treatment plants. Some of the problems can be solved by educating the leather manufacturers and people working in the sector. At least 50% of the water can be saved and the volume of the effluent can be decreased by optimizing processes. This can be done by eliminating the superflous washings and rinsings.

Session 3

Dr. Allain explained the physiological basis and genetics of wool and hair production in small ruminants and rabbits. He described two types of hair follicels in the fur. The first one is the epidermal hair follicels which originate from the primitive epidermis and produce coarse fibers. The second is the derived hair follicle which produce the finest fibres.

In sheep and Angora goat the number of derived hair follicles is low and constant. Whereas in Angora rabbit the number of derived hair follicles is high and variable. The angora character is determined by a pair of autosomal recessive genes. Great a number of factors influence the quality and quantity of fibre production in the sheep, Angora goat and Angora rabbits.

Dr. Ryder gave a very interesting talk on the production of desired wool characteristics during fleece growth. The wool buyers usually pay for fine fibres in clothing wools, lack of kemp and pigment in carpet wools. However, in all systems a heavy fleece is more economic for the producer since price/fleece is more important than price/kg. The most fleece characteristics are highly heritable and therefore heredity contributes more to fleece type than does the environment, such as day length and nutrition.

The fleece weight equals mean fibre length (L) multiplied by fibre diameter (A) multiplied by fibre density (N) multiplied by density of wool multiplied by total area of skin. According to the formula in order to get more wool, we should grow larger sheep with longer and denser wool.

Feeding and breeding influence the components of fleece weight. Good nutrition and extra food stimulates wool growth, enlargement of body size and skin area, therefore, causing the increase of the fleece weight. Breeding also increase, almost all the components of fleece weight.

Dr. Morand Fehr talked about the nutritional characteristics and feeding strategies for Angora goats. The Angora goats produce more fibre than Merino sheep if the fibre production is calculated in kg/kg of metabolic weight. The efficiency of feeds for fibre production in Angora goat is higher than in Merino sheep.

Energy and protein supplies can improve angora fibre production if the supplementary energy or protein allows to increase the syntehsis of microbial protein in the rumen. The supply of formaldehyde treated protein or protected methionine in the diets of animals being about an increase of the fleece weight. However, when the fleece weight production per goat increases, fibre quality decreases.

A satisfying feeding strategy must be applied particularly to the gestating goats in order to reduce the abortions and perinatal mortality. This practice increases fibre production from kids which is the highest quality and is sold at a higher price.

Prof. Yalçin compared the Turkish Angora goats with the American × Turkish crossbred generations in respect of body weight and mohair traits.

The Angora goats are raised mainly on the Central Anatolian plateau in Turkey. The greatest part of the region is formed by poor rangeland and treeless steppes. The climate is semi-arid with dry hot summers and cold winters. Because of the poor level of nutrition, the production traits of Angora goat flocks are generally low, in Turkey.

In order to increase the productivity of Turkish stocks and to increase the genetic variation, 19 bucks were imported from the USA and a crossbreeding experiment was conducted in Central Anatolia in 1983. Crossing Turkish Angora goats with American stocks, significantly increased the mohair production, compared to the pure Turkish goats. It was found that the kids in the crossbred groups were significantly heavier than the pure Turkish kids. Also crossbred groups were significantly superior to pure Turkish group in respect of greasy fleece weight and staple length.

During discussions, Prof. Eliçin indicated that physiological characteristics depend on genetics. He asked if physiology is different from genetics? What are the genetic and physiological characteristics of wool and hair? Dr. Allain indicated that a correlation exists between physiology and genetics, e.g. if one wants to improve the quality of mohair one can improve the fineness of the wool. He also said that physiology depends on genetics.

Prof. Özcan asked how Prof. Yalçin determined the kemp and medullated fibers. He also asked how we could improve the Angora goats in Turkey? Is it possible to select the best material from the farmers and have an elite flock? Prof. Yalçin agreed with Prof. Özcan and indicated that the productivity of Turkish Angora goats can be increased by crossbreeding, selection and the development of farmers organizations i.e. breeders associations.

Mr. Flamant asked if crossbreds are economic or not? Prof.Yalçin answered that they can be economic.

Dr. Erdem indicated the importance of kemp fibre ratio and she said that the crossing Angora goat with Hair goat increases the kemp fibre ratio.

Prof. Pekel classified the Turkish Angora goats according to the ecological regions, such as Gerede region (pine forest area) with black and greasy hair, Beypazari region (oak forest area) with medium greasy hair and central Anatolia Plateau. He asked where the research material came from? Prof. Yalçin said that they were brought from the surroundings of Ankara.

Prof. Eliçin indicated that there were not much difference between the American and Turkish Angora goats. He asked for the reason. Prof. Yalçin indicated that the pure Turkish Angora goats had also good, desirable qualities.

Session 4

Prof. Eliçin gave a brief talk on wool and mohair production in Turkey. The sheep population of Turkey is about 45–50 millions and 4–5% of them are Merino crosses. The majority of the native sheep breeds are fat-tailed and they all have mixed coarse wool. The average wool yield is between 1.6–1.8 kg/sheep and the total wool production is about 70–80 thousand tons which is far from meeting the needs of the country.

For the last 60 years there have been numerous studies on how to increase the quality and the quantity of wool in Turkey. However these studies could not be successful due to unsuitable management and feeding conditions for fine wooled-sheep such as Merinos, instability in wool prices and the easiness of working with native breeds which means less risks. Moreover in recent years the production of quality wool have decreased greatly. Consequently Turkey imports most of the requirements of its textile industry.

Angora goat production is important for Turkey as mohair is an export commodity which sells easily. The Angora goat is an important source of food and revenue for the farmers, and mohair production meets the need of the textile industry.

There has been fluctuations in mohair production. The low and unstable prices of mohair have an important effect on the recession of Angora goat husbandry. Moreover, decrease in acreage and quality of the ranges, prevention of bringing goats into the forest areas and difficulties in finding shepherds accelerate the decrease of the number of goats.

Miss Joly and Mr. Billant gave an interesting talk on Angora goat and mohair production: history and analysis of a new alternative farming in Western Europe. The mohair production was started about 10 years ago in France, U.K., Spain and Germany. Eventhough more than 500 breeders are involved, less than 10 % of them have their main income from Angora goat husbandry.

The average mohair production is over 5 kg/year. The farmers either sell the products to the consumers directly or to the textile plants. Therefore all French production is classed, processed and sold under breeders structures.

Dr. Ryder presented the cashmere production in China. China produces 60% of the world production. Chinese cashmere fibre has a diameter of about 15.5 microns which is similar to the under-wool of ordinary goats. The national average cashmere production is 250 gr/goat and it reaches an average of 500 gr in the Liaoning breed.

There are 70 million goats in China and 40 million of them grow cashmere. The chinese cashmere production in about 3 000 tons and 1/3 of it is used by the Chinese industry. In order to increase the cashmere production native breeds are crossed with Liaoning breed. The crossbred offspring of black native goats producing less then 100 gr of fibre grow at least 300 gr of white cashmere.

Prof. Tuncel presented the opportunities for cashmere production. The goat production is an important agricultural enterprise in Turkey. There is a good evidence that the use of crossbreeding native breeds of goats with improved cashmere producing goats will result in increased both meat and milk production; as well as cashmere production. Backcrossing to Angora/native goats will increase cashmere production substantially, causing supplementary income for the farmers.

Prof. Özcan indicated that the population of Angora goat is declining. A wool and mohair research institute should be established and studies should be conducted on rearing, selection and breeding, disease control, marketing products etc. Prof. Eliçin replied that a gene pool should be established for the purpose of conserving them.

Dr. Erdem indicated that the textile industries do not want fine wool. Dagliç and White Karaman wools' are used for carpet-making. However recently the characteristics of Dagliç wool is deteriorating. Prof. Eliçin answered that the textile industries should indicate the needs and requirements to the research institutes.

Mr. Flamant asked Mrs. Joly if all the Angora goat keepers are farmers? She said that only 50% of them are farmers.

Session 5

Prof. Jankowski presented the paper entitled "Wool associated to other sheep products in different production systems and breeding programmes in Europe". He indicated that the EAAP Sheep and Goat Commission created the wool and hair experts working group in 1987. The commission surveyed the production of wool, goat's hair and other fibre in Europe.

According to the surveys and FAO statistics, the Central-East (C-E) European countries are the best in wool production, but the poorest lamb and mutton producers. The North-West (N-W) European countries are the best in lamb and mutton production and quite good wool producers. The poorest wool producers are the Mediterranean countries, but they are the best in sheep milk production and fairly good in meat production. In the C-E countries wool took the 1st place, in N-W Europe the 2nd place and in the Mediterranean area the 3rd place according to the economic importance of sheep products. Programmes of genetic improvement of wool productivity were widely adopted in the sheep industries of C-E countries.

Dr. Sergent gave an interesting talk on the "objective measurement of wool: state of the art". He explained the principles and the methods of sampling, determination of fibre diameter in wool by the microscope projection, determination of the main fibre diameter by air-flew, determination of percentage of medulated fibres, determination of the kemp fibre, wool fibre length distribution, bundle strength of wool fibres, determination of the felting properties, objective measurement of the colour of raw wool, the determination of the existence and the level of coloured fibre, quantification of the bulk of wool and resistance to compression, and finally determination of wool base and vegetable matter base-yield.

Dr. Trabalza presented a paper titled "Colorimetric analysis and melanine quantitative determination in hair of goat with different pigmentation genotypes". The high performance liquid chromatography (HPLC) was used for melanins and the Munsell method was used for the determination of colorimetric characteristics of 15 pigmented hair samples from the South Italian long hair goats. Eumelanins and pheomelanins were detected in all samples. The black phenotype presented a large amount of eumelanins and the white phenotype showed a limited biochemical activity. No colorimetric or biochemical differences were found between the red and brown phenotypes, indicating uncertainity of the genetic make-up.

Dr. Guirgis presented the carpet wool, production and requirements. He explained the characteristics of carpet wool which is classified into 3 groups such as special carpet wool, general purpose wool and filler wool. In carpet wools the fibre length is much more important than the mean fibre diameter. Medullation is a desired characteristics in carpet wool blends.

For an efficient marketing , it is necessary to establish a "carpet wool organization" on a regional basis in the Mediterranean Basin and Middle East. Potential breeds of the region such as Awassi, Karaman, Karakul, Kurdi, Baluchi, Churra could be used to improve the productivity of the local stocks. The requirements of the carpet industry can be summarized as follows: staple length of about 10 cm, fibre diameter high, medullation as much as possible, fibre strength and elasticity are satisfactory, no kemps, reasonably sound, high spinnability, high settability, helical crimp as much as possible, free from vegetable matter and other contaminants, maximum fleece opennes. Dr. Guirgis also gave a list of recommendations for research in this field.

Dr. Erdem talked on "the investigations on the suitability of wool for textile products and carpets obtained from newly improved sheep in Western Turkey". Three sheep types, Tahirova, Sönmez and Acipayam were developed in Western Anatolia by the Dept. of Animal Science, University of Ege. Wool samples were taken from these sheep types and the physical characteristics such as fineness, length, breaking strength and elongation were determined.

Dr. Tisserand gave information on the camel wool and hide. He indicated that the studies and the literatures on the camel wool and hide were limited. The dromedary provides 0.5–1.0 kg wool/animal/year whereas the Bactrian camels produce 3–4 kg wool/year. The quality of the wool depends on the breed, sex, age, nutrition and of the parts of the body and it diminishes when the animal gets older. The camel hide is considered to be of poor quality and is used to make harnesses whips and sandals.

Dr. Bourfia gave a talk on the fleece characteristics of Moroccon breeds of sheep. He presented the results of research on the fleece characteristics of Moroccon breeds of sheep from 1983 to 1987. The Beni Ahsen breed had the heaviest fleece among other breeds.

There were several questions to Dr. Sergent about the preparation of the samples and objective measurements. Dr. Sergent indicated that training of the technicians is very important. Application of computers and sharpening of microscope are also very important for accurate measurements.

Prof. Yalçin asked Dr. Erdem if the samples were taken from the same farm or from same age animals. Prof. Sönmez indicated that the wool production which has the least economic value was too much emphasized in Merino breeding. The aim of the study was to develop new types of sheep suitable for the region and for the needs of the farmers. The wool production was not considered to be the main goal. Dr. Erdem also indicated that the meat and milk production of newly developed types were studied extensively. However there were no studies on the wool characteristics of these sheep types. The aim of the project was not to increase the wool quality but it was to investigate the wool characteristics of these types.

A question was asked about the future of camel breeding in the Middle East. Dr. Treacher said that the natural habitat has been destroyed. The modern pick-up, tractors and cars replaced the camels in these countries and the camel population has declined greatly. Dr. Tisserand added that the natural balance is being destroyed, consequently the camel population is declining and the sand hills are increasing in the deserts.

Session 6

Dr. Aslanapa gave a presentation of the history and present situation of the Turkish carpet industry. Carpet has been practised by Turks since the period of Huns, that is since the 3rd and 2nd century B.C. The animal-figured Anatolian carpets predominantly appeared in the 14th century and originated in the Selçuk period. With the development of the geometric type carpets of the 16th century, the Turkish carpets gained good reputation and the development of Turkish carpet weaving continued until the end of the 19th century.

In the present time, Kayseri, Konya, Sivas, Kirsehir, Isparta, Fethiye, Dösemealti, Balikesir, Yagcibedir, Usak, Bergama, Kula, Gördes, Milas, Çanakkale, Ezine, Kars and Erzurum carpets are reflecting the art of Turkish carpet-weaving.

Dr. Paksoy presented a paper on the conservation of traditional characteristics in hand-woven Turkish carpets and in importance of natural dyes. She explained the unique characteristics of Turkish carpets due to the material used, to the dying methods applied, as well as to the richness of dye and ornamentto the and weaving techniques. One of the most important characteristics of the Turkish carpets is the natural dyes used and the dying methods applied.

Dr. Aslier gave a presentation on the research and the development of the natural dyes used for traditional carpets in the Aegean Region "DOBAG Project". The objectives of Natural Dye Research and Development (DOBAG) project is to review the tradition of carpet and kilim weaving in the regions where these activities are forgotten, to give the villagers artistic and scientific support while producing new carpets, to investigate and identify the natural dyes and traditional patterns, to give a guarantee certificate for the carpets and kilims which are produced according to the DOBAG's objectives.

Dr. Güngör gave a paper on the role of state policy in Turkish carpet sector. He explained that hand woven carpet making has an interdiciplinary area which include the chemistry, basic design, art history, textile technology, production, restoration, material knowledge, marketing and economics.

He also indicated the roles of the government in the research and developments of Turkish carpets. He listed the problems of Turkish carpet industry, problems of villager carpet makers, responsibilities of Universities, Ministry of Culture, Ministry of Education and The Ministry of Agriculture for the survival and development of this fine art.

Dr. Benyoucef talked on the production and local transformation of wool in Algeria. He mentioned that the surface area of Algeria is 2 834 000 sq.km. and that 3% of land is arable. The wool production is therefore concentrated in highlands. However the transformation is made at two levels such as familial level and semi-industrial level. He also made an economic analysis of wool.

There were several questions raised to Dr. Paksoy, one of which was the origin of natural dyes. Are the natural dyes all vegetable origin? Are there any animal originated dyes being used in carpet industry? She answered that both animal and vegetable originated dyes are used. What kind of extraction methods are used for dying? She said that both hot and cold extraction methods were used.

Miss Joly asked if there is any inventory studies in natural dye resources? Her answer was "not yet". However Dr. Erdem indicated that the Ministry of Agriculture and Rural Affairs initiated such an inventory.

Poster session

The quality of the poster presentations was excellent. In the first session, Dr. Marinucci presented the genetic analysis of greasy fleece weight and ewe lamb growth on "Gentile di Puglia" sheep breed. The flock was bred in the "Instituto Sperimentale per la Zootecnia" of Foggia in Italy. The average weight of greasy fleece was found to be 3.32 kg which decreased only in 9.5 years old animals.

Dr. Vegara presented the "Postnatal development of wool follicles of Pramenka sheep breed", "Heredity of wool fineness of different sheep breeds and their crosses" and "The comparative study of wool follicles of Pramenka, Merinolandschaf and Romanov sheep breeds and their crosses". Pramenka is a mountainous sheep with a population of 7.9 million heads. The Romanovs were used for the formation of Pramenka sheep. The experiments and the methodologies used were very interesting.

Dr. Lazzaroni presented the use and production of Angora rabbit hair in Italy. Italy uses about 70–80% of the world Angora rabbit hair production. It is very important for the Italian textile industry. Angora rabbit production is not widespread because of the high production cost. However it could be interesting for some farmers to increase the income and supply the low quality wool needed by the market.

In the second poster session, Dr. Yildirim's poster the mohair production districts and consumption ways of mohair in Turkey was shown. The mohair production is concentrated in the Central Anatolia. Most of the production is exported and the rest of the mohair is used for the manufacture of blankets, scarfs, soft weavings and for making socks, bags etc. Dr. Yildirim also presented a poster entitled "a research on some physical properties of principal mohairs produced in Ankara and Bolu districts".

Dr. Roger presented a poster on Cashmere fibre production from Australasian and Siberian (Gorno Altai) goats in a crossbreeding programme. The cashmere fibre of Siberian cross kids was significantly longer than Australasian kids, the latter had significantly finer fibre, lower yields, lower gross fleece weights and calculated down weights than Siberian cross kids.

Mr. Antonini presented the Angora goat breeding in Italy. Angora goats did not have any adaptation problems in the center of Italy. Studies on nutrition, reproductive aspects and quality of kid fleeces are ongoing.

Dr. Cappai presented the Sarda sheep breed which is the most important one in Italy and the local carpet industry. Traditional designs and weaving practices and patterns in the island of Sardinia were shown.

Dr. Kayabasi and Dr. Ilgaz presented the present situation and the future of hand-woven wool carpets in Turkey.

Dr. Güngör presented a paper on the design characteristics in Anatolian carpets. He showed different carpet and kilim designs.

Conclusions

J. Boyazoglu, J.C. Flamant.

Ce Symposium a été conçu pour attirer l'attention des zootechniciens sur l'intérêt de la production de cuirs, de peaux, de laine et de poil dans le contexte de l'élevage des pays méditerranéens et du Moyen-Orient, sujet peu souvent pris en considération dans les réunions internationales et dans les équipes de recherche européennes.

Un second objectif était d'amorcer, à l'intérieur de ce Symposium un dialogue entre des spécialistes de l'élevage, de l'industrie du cuir, de l'artisanat des tapis ou encore mieux de l' histoire de l'art dont les préoccupations sont généralement disjointes.

Beaucoup de participants ont insisté dans leurs interventions sur l'enjeu d'une telle rencontre: assurer la survie et l'avenir, en Méditerranée et au Moyen-Orient, d'activités d'élevage multimillénaires aujourd'hui menacées par les évolutions de l'économie internationale et des sociétés locales!

Une hypothèse forte est en effet que la faible productivité technique du matériel animal et des systèmes d'élevage de ces régions pourrait être compensée par des productions dont les marchés n'admettent certes que de faibles quantités mais qui peuvent bénéficier de valeurs marchandes élevées.

Nous proposons d'organiser la très grande richesse des informations collectées au cours de ces trois jours, des rapports présentés comme des débats, en trois rubriques:

- La prééminence du concept de qualité
- Les processus technologiques gérés par les opérateurs économiques
- La valorisation des acquis du Symposium

La prééminence du concept de qualité

Il est évident que le concept de qualité est central pour évaluer l'avenir et les chances que représente pour l'élevage Méditerranéen la production de peaux, cuirs, laine et poil. En fait il faut avoir conscience que ce concept est probablement le seul point commun identifiable entre les diverses productions dont il a été question au cours de ce Symposium. En effet les espèces animales impliquées sont diverses (les petits ruminants, les bovins, les camélidés, les lapins). Les bases physiologiques et anatomiques des fibres concernées sont tout aussi diverses d'une espèce à l'autre; or elles en conditionnent en grande partie les technologies de récolte. Et alors que la production des laines et poils est assurée au long de la vie de l'animal, la production de cuir et peau ne peut être obtenue qu'après abattage. Il était utile de rappeler que la peau, objet de tant de transformations et de traitements avant son usage sous forme d'objets et de vêtements, joue d'abord une fonction de protection de l'animal vivant contre les agressions de son environnement: le cuir en garde la trace.

Nous mettons ici en avant l'exigence de la qualité pour indiquer la différence fondamentale avec des productions qui doivent être assurées en masse, notamment celles qui correspondent aux besoins alimentaires essentiels pour l'homme. Le créneau exploré par ce Symposium est celui de produits motivé par une recherche du confort, ou de la qualité de la vie par un souci de l'esthétisme, et qui peuvent constituer des objets d'art et l'expression culturelle d'une société. Economiquement les quantités acceptables par le marché sont limitées et ceci d'autant plus si ces productions sont concurrencées en consommation de masse par des substituts industriels.

Par l'utilisation du terme de 'co-produits' (ou 'produits liés') plutôt que celui de 'sous-produits', nous voulons exprimer une réalité biologique: la même action d'élever les animaux aboutit simultanément à une gamme de diverses natures, à l'origine de diverses filières de transformation et de commercialisation. Sur le plan économique deux situations peuvent être envisagées au sein desquelles le concept de qualité est impliqué différemment:

- soit le lait, soit la viande, constituent l'objectif principal de l'activité d'élevage, alors que les autres productions ne représentent qu'une faible part du produit économique brut. Le principe à suivre est dans cette situation que les conditions d'exploitation du produit principal ne dégradent pas la qualité du (ou des) co-produit(s) économiquement secondaire(s), ceux-ci peuvant être à l'origine d'une filière à haute valeur ajoutée. Par exemple l'amélioration génétique des ovins pour les quantités produites de lait et de viande peut avoir pour conséquence la disparition des races locales dont les toisons sont adaptées à la fabrication artisanale de tapis (cas des croisements de brebis de race locale par des béliers Frisons). De même les conditions d'abattage agissent directement sur l'intégrité et la bonne conservation de la peau des animaux et sont donc déterminantes pour la qualité ultérieure des cuirs. Il faut remarquer à ce propos que le fait d'assurer de bonnes conditions sanitaires au troupeau pour sa production principale garanti la bonne part la qualité du co-produit secondaire contre les atteintes de certains parasites ou contre les effets négatifs d'affections telles que les abcès.
- soit l'un des co-produits, non lait et non viande, apporte un bénéfice significatif aux éleveurs. Il est alors essentiel que l'amélioration de la conduite des troupeaux, qui peut évidemment concerner une amélioration quantitative des performances, intègre des objectifs d' amélioration des paramètres exprimant les qualités qui justifient la valeur économique du produit. Tel est le cas des fibres telles que le mohair et le cachemire pour les chèvres, et l' angora pour les lapins.

Les processus technologiques gérés par les operateurs économiques

Il faut avoir bien identifié les critères de qualité à recherche sur les productions animales pour aboutir aux produits transformés recherchés. Pour y parvenir l'écoute réciproque des spécialistes des animaux et des spécialistes de la transformation de leurs productions en produits à haute valeur ajoutée apparaît une condition incontournable. Ces critères doivent avoir en effet une signification technologique pour les différents professionnels impliqués dans la chaîne de production-transformation: éleveurs, artisans, industriels. En fait il s'agit de construire le dialogue et les relations entre les opérateurs économiques. Ce dialogue doit reposer sur la connaissance des systèmes technologiques qu'ils pilotent res- pectivement:

- les éleveurs pilotent un système technologique de transformation de produits végétaux en produits animaux;
- de même, les industriels du cuir, du fil ou des tapis pilotent des systèmes technologiques de transformation d'une matière première animale en produits destinés aux consommateurs.

Mais il faut être également attentif au contenu des interventions des industriels du cuir qui révèle l'intérêt que prend de plus en plus le débat sur le respect de l'environnement, en termes de procédés technologiques de traitement, et de localisation des entreprises (on aurait pu illustrer dans les mêmes termes les problèmes de l'industrie de la laine).

La plupart des rapports présentés motivent un appel à tout un ensemble de travaux de recherches à l'interface entre les exigences technologiques de ces systèmes différents mais articulés ou articulables:

- s'agissant de systèmes économiques divers et mal connus, il apparaît d'abord indispensable de réaliser un effort systématique de descriptions minutieuses de filières articulant systèmes d'élevage et systèmes artisanaux ou industriels. L'intérêt de telles études est bien mis en évidence par les travaux préparés spécialement en Algérie et au Maroc pour ce Symposium;

- la définition des objectifs de qualité de la matière première animale doit faire aussi l'objet de recherches. Celles-ci doivent impliquer les opérateurs économiques intervenant aux différents maillons de la chaîne. Elles doivent tout particulièrement intégrer le savoir-faire et les exigences technologiques des artisans et industriels assurant le traitement et les transformations en produits finis;
- les critères de qualité eux-mêmes doivent faire l'objet, autant que possible, de la mise en oeuvre de mesures objectives. Les travaux présentés au cours de ce Symposium révèlent la nouvelle modernité de ces opérations sur la base des nouvelles tech- nologies de la robotique, de l'informatique et de l'analyse d'image.

Plusieurs rapports et plusieurs témoignages ont montré aussi le rôle déterminant que joue dans la stratégie des industriels (du cuir comme du textile), l'accès au marché international pour leur approvisionnement en produits d'une qualité choisie. Une meilleure articulation locale entre systèmes d'élevage et systèmes artisanaux ou industriels correspond à une autre logique de gestion des entreprises. Il faut analyser cette question soigneusement pour rendre possible et acceptable une stratégie visant à sauvegarder une économie d'élevage sur la base des ressources génétiques nationales et de produits spécifiés. Ceci signifie en effet la mise en place de relations interprofessionnelles, et probablement de systèmes de redistribution des profits qui matérialisent l'intéressement réciproque, les uns aux conditions d'obtention de la matière première, les autres à la valorisation du produit fini.

L'organisation des suites du symposium

Il s'agit maintenant de transformer en collaboration l'écoute réciproque réalisée durant 3 jours entre 'hommes de métier'. Trois objectifs s'imposent:

- pour les peaux et les cuirs, mettre en rapport leurs caractéristiques avec celles du matériel animal (races, types de toison, etc.) et avec les conditions d'élevage, notamment le régime alimentaire. Le CIHEAM, à l'initiative de l'Institut Agronomique Méditerranéen de Zaragoza, propose d'apporter son concours à l'organisation d'un séminaire de travail pouvant réunir ensemble spécialistes de l'élevage et spécialistes du cuir durant une à deux semaines. La Turquie et l'Université de Cukurova qui ont si bien accueilli le présent Symposium pourraient en être le lieu de réalisation;
- pour les laines et les tapis, définir les spécificités des laines destinées à la fabrication artisanale des tapis, notamment tester dans des situations régionales bien identifiées l'hypothèse de la liaison 'race × tapis × localité'. Les travaux conduits dans ce sens dès les prochains mois devraient être présentés lors du Symposium méditerranéen qui se tiendra au Portugal en 1993 sur le thème des relations entre activités touristiques et activités d'élevage;
- pour les chèvres mohair et cashemire, entreprendre un programme concerté d'inventaire et d'évaluation du patrimoine génétique, dans le cadre d'une collaboration internationale ayant pour objectif la mise en évidence des spécificités et de la diversité des écotypes dans les pays d'origine, tant sur le plan des caractéristiques zootechniques (format, prolificité, production laitière) que des caractéristiques des fibres.

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