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Editorial

The quantity of fibre sent for analysis has increased sharply during 1999 as the national breeding programmes for cashmere, mohair and fine wool have taken up the OFDA technology. The project has supported the analysis using OFDA equipment in France, Portugal, Germany and the UK, of some 7000 samples.

This rise in the use of objective fibre testing has also been matched by greater collaborationn between national breeding organisations, who have been taking advantage of the opportunities within the EFFN for technical exchange. Twenty participants took part in the visits this year. Both the Danish and French mohair associations visited Bradford to meet first-hand some of the major buyers of mohair in Europe, and to learn directly from them the importance of different fibre traits in the production process and their measurement. One of the founders of Scottish cashmere, Angus Russel, went with OFDA expert, Hilary Redden, to advise the Norwegian cashmere/dairy goat project on selection parameters for combined milk and meat. These exchanges help greatly to improve the level of contact between the national breeding schemes. It is this collaboration which will be essential in the coming years to support small developing enterprises to establish niche markets in the competitive world of luxury textiles.

The EFFN has established for the first time a set of common protocols for collection of genetic data, and a standardised database format for storage and sharing of information. This standardisation has been a significant step forward, not only for the improvement of genetic research, but it will also enhance the confidence with which fibre grades can be presented on the market. There is enthusiasm within the wool sector for a "virtual" electronic system for marketing European speciality wools. The widespread adoption of OFDA is one step in that direction.

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Inside this volume:

Recent advances in Danish mohair breeding

Annette Holmenlund

The Danish Goat Herd Book has 126 mohair breeders with 1,041 breeding goats which produce 1,500 kids each year. We have about 3,500 live animals in the genetic database, and we produce about 15 tons of mohair each year.

Fibre evaluations before EFFN and now.
Previous to the introduction of the EFFN. testing used the system developed by Dr. Palle Rasmussen at The Danish Institute of Agricultural Sciences. It was developed from mink-skin technology and made by cross section. This demanded considerable manual work to fix and prepare the samples. 4-500 fibres were tested in each sample.

The results of the tests showed medullated fibres, kemp and fibre diameter. Usually we tested about 70 bucks and very few does each year. The cost was twice as much as the price of the OFDA tests, and the Danish Institute of Agricultural Sciences could not even cover the wages for the work. The Danish mohair test was a research tool, and was not ready to be used on a wider scale.

The Danish Angora Breeders Association participated in the EFFN and used the OFDA measurement on 170 samples taken in 1998 and on 320 tests in 1999. The aim was to test all the bucks and young goats at the 3rd. shearing i.e. from 14-18 months of age.

That gave results which could be used in our well-developed genetic database. Because of the EFFN-network the Danish Angora Goat Association could offer free mohair test for all the does and bucks being evaluated. This caused in 1999 a great interest in mohair evaluations and we took mohair samples from about 200 animals. This will give the Danish Mohair breeders the opportunity to enhance more rapidly the selection for fibre quality traits.

Comparison of OFDA with qualitative tests.
A test was made by the fleece graders who wrote down their subjective results in a linear scoring scaled from1 to 6.

The measurement of diameter with the OFDA was in close agreement with the subjective scores. However, there were differences between measurements of kemp and medullation, which are imporant breeding traits. There was, however, a correlation between OFDA measurements and subjective evaluation results of 60%-70%. It was concluded that this level was sufficient for us to rely on the results from the OFDA fibre tests.

Common database with the French breeders.
The OFDA measurements were measured by the Macaulay Land Use Research Institue in Scotland and we are greatful to Hilary Redden for her help in explaining the results. The UK is now in the process of establishing a genetic database for Angora goats, and they will have a structure in the future by which we could use their results. The French Angora Goat Association has, however, a database and they present their results in ways very understandable to the breeders.

In summer 1999, 7 French mohair breeders visited the National Angora goat show in Denmark and we discussed very constructively how we could establish a common breeding database.

At the EFFN meeting in Portugal the Danish breeders decided to adopt a comon evaluation system of mohair tests with France, aiming to make readable results which could be easily understood by goat farmers.

The French textile Institute collaborated with Daniell Allain and the Danish mohair breeders to translate the French mohair tests into Danish.
The results has just arrived and the translation and presentation is very satisfying.

Now it will be very easy to put the data in our database and to exchange data with the French Angora Goat Association. Table 1 explains the differences and agreements between French and Danish systems.

Table 1. The similarities and differences between fleece evaluation systems used in France and Denmark

Criteria	Denmark	France	Agreements
Type, body conformation	6 different criteria, 3 are included in the selection index, weighted by only 2%	No information written. The breeder will get advice if a goat has severe defects.	The evaluation will still include type in Denmark, The French breeders maybe will find advice sufficient.
Length	No objective measurement. We look at the uniformity at 3-4 sites.	Measurement on shoulder	We wil try to use same method and measure cm, date at measurement, date at shearing.
Kemp	Only 1 value over the whole goat, on a scale 1 - 6	5 measurements at 5 different points. Each measurement counts from1-5	We hope that OFDA will make a better correlation between objective and visual kemp content.
Lustre	We look at lustre and think that the trait is important to the end product.	None	The French breeders will be introduced to this criteria.
Style	Danish system looks at Style and Character as 2 traits	French look at the form of the staples and has 7 different forms of staples	French breeders tintend to simplify their method, but question the heritability of the 2 traits.
Cover	Yes, Scale 1-6	Yes, between 1 to 9	use the scale 1-6
Synthetic index	a) evaluation results : 60 % for mohair traits 40% for body traits b) final S- indices 28% on mohair prod.uction 50% on mohair quality 13% on mothering raits 6% on viability 2% on body traits (from linear evaluation)	Elementary index, but no synthetic index	Will establish common basis for synthetic index

Conclusions of the agreements

1) It will be possible to establish common rules for collecting and storing data.
2) The data can be used in estimation of genetic parameters.
3) The data can be used when exchanging animals to make advances in the breeding programmes.
4) The data can be used in calculation of synthetic index

Collaboration with British Angora Goat Society

In summer 1999, 6 judges and the advisor of the Danish Angora goat Association visited the British Angora Goat Society at the mohair show in Stafford.

The best goats had a very fine quality, but the breeding programme does not yet have an operational database. Because of this, it is not possible to calculate breeding values, and it is thus necessary to record many generations to know if a good mohair goat has a high genetic value or if its good traits have arisen by chance.

The National Department of Cattle Husbandry of The Danish Agricultural Advisory Centre will offer the British Angora Goat Association an internet solution to participate in the Danish breeding database. This will give considerable information about the production results of the British Angora goats. We hope that it could be a reasonable beginning of a common breeding programme for the European Angora Goats.

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A genetic reserve of German Fine wool Merinos of Saxon Origin

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High quality fine wool is a special product from dry, hot regions in the world. Because of its good properties in respect to storage ability and suitability for transportation there is much prospect of producing acceptable world market goods especially in subtropical countries. Main regions for fine wool production are Australasia, southern Africa, South America, East Asia and the Near East as well as South-east Europe. However, fine wool production from Merinos in the original breeding centre in South-west Europe is of limited significance today.

Fine wool production is related to the Merino sheep, originating from Spain. The Fine Wool Merino type has an uniform fleece character with continuously growing fibres of similar diameter and medulla. The Fine Wool Merino belongs to the smaller body size type, which on account of its lower nutrient demand can survive better in hot climates and under unfavourable pasture conditions. Breeding activities in central Germany from the 19th century onwards contributed very much to improvements in wool fineness, resulting in a superior breeding type, which had a significant influence in former times on finest wool yield of Merino stock in nearly all fine wool producing countries.

The German Merino gene pool was founded by limited importation of Merino stock from Spain about 240 years ago to the central German provinces of Saxony and Brandenburg - a temperate climate with moderate precipitation ranging from 400 to 800 mm per year. The live weight of a sheep was from 25 to 30 kg. The animals grew extremely fine carding wool with a low clean weight of about 25 %. The whole breeding process was characterised by a continuous recurrent use of Spanish Merino importation, whereby strains of different genetic makeup were selected for further breeding. German superfine wool Saxon Merinos were exported to many countries in the world.

At the beginning of the 20th century the one-sided emphasis on wool production grew more and more unprofitable. By using French mutton Merino types (Précoce Merino) and British Leicester types the former combing wool sheep was converted to a mutton wool and finally to the German Mutton Merino sheep. A special breeding strategy for more humid conditions had been recently performed in eastern Germany by crossing Merino Land Sheep with American Merino mutton breeds and with Russian longwool types.

Because of the self-supporting economic system in the former GDR finewool production from dual-purpose Merino sheep was widespread. After German reunification a decade ago, the number of sheep in eastern Germany has drastically reduced. Thus the major part of the fine wool merino gene pool was lost. Additionally, the breeding goal of the few remaining flocks was adapted to the changing economic conditions. The selection for wool was mostly replaced by cross-breeding programmes with meat-oriented breeds.

To preserve and develop a gene pool of fine wool merinos, a group of 33 elite ewes was transferred from Brandenburg near Berlin to Baden-Württemberg in June 1999. The ewes have been selected from one of the last traditional flocks of Fine Wool Merinos at Grabow on the basis of pedigree information, traditional wool-quality grading and laboratory analysis of fibre quality. At the same time, wool samples were collected from this stock in order to analyse wool characteristics and to evaluate genetic parameters for fineness and especially the important trait of uniformity. Additionally attempts to purchase some of the last remnants of frozen semen of eastern-German elite bucks succeeded at the end of 1999. It will be used from the breeding season of the year 2000 onward. Thus it will be possible to develop the nucleus flock without having to import genetic material of different background from overseas for the next generations.

The nucleus breeding flock of the Fine Wool Merino sheep has been established on the Hohenheim University Experimental Farm "Oberer Lindenhof". The development of fibre characteristics is monitored in comparison to a group of Merino land sheep of similar age and sex structure, using the OFDA-methodology in our laboratories in Hohenheim. Additionally the reproductive traits as well as growth and carcass traits of the lambs are regularly recorded.

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http://www.mluri.sari.ac.uk/~mi573/

Our site on the World Wide Web provides:

· Information about the project's activities and the partners involved

· Details and reports of the workshops held

· Details of the published newsletters

· Details of latest developments on the ***What's new?*** page

Mating Decisions in the Alpaca Fibre Industry: An Approach from the Perspective of the Biological School to Genetic Selection

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Mating decisions are one of the cornerstones to the future of the alpaca industry. An informed mating decision is a necessary condition to ensure superior progeny.

A practical system of evaluation is required for the alpaca breeder to assess the strengths and weaknesses of the body conformation and fleece characteristics of each animal. This will allow a proper grading of females, and a proper selection of sires, which will ensure a sound basis for the development of an elite fibre for the manufacturing, fashion and cottage industries.

Selection of sires, based solely on show results cannot be the mainstream sire selection method, considering that show judging patterns do not answer to any particular school of animal selection but to subjective perceptions of superiority from individual judges.

On the other hand, the development of a method of practical selection of animals to be used on-farm, and in the showring, that may be linked to objective evaluation of performance is a challenging perspective that deserves to be explored.

The aim of this article is to encourage the implementation of a methodology for an integrated subjective phenotypic evaluation of alpacas that may be correlated with objective assessment from performance recording.

This article discusses the meaning and implications of selective mating, and an integrated method of assessment for alpacas based on body conformation and structural fleece characteristics. A classification and description of "alpaca types" and their fleece characteristics is proposed for evaluation using a scoring table. Selective mating criteria are recommended for use by alpaca breeders.

Selective Mating: Definition & Implications

The concept of *"selective mating"* implies the selective use of a superior sire over a female whose structural fleece characteristics and body conformation have previously been identified. This will result in the correction of deficiencies / weaknesses and the enhancement of strengths in the progeny (i.e. improved performance in relation to the dam). Successive generations of animals under such a scheme will demonstrate "added" value in biological and consequent economic terms.

Following a classification from Charry et al (1999), there are basically two schools for defining selection criteria of stud animals. The first is the traditional *quantitative school* that supports Estimated Breeding Values (EBVs) as its best selection tool. This school does not offer guidelines for evaluation of the structural fleece characteristics on the animal's body. The second school, herein called the *qualitative school*, is based on the identification of biological markers that are an indication of high quality heavy fleeces. The only evidence reported in the literature about this school is the emerging *Soft Rolling Skin (SRS®)* theory (Watts 1992; Charry 1998a,b; Ferguson & Watts 1999; Watts 1996 & Watts & Ferguson 1999,a,b). This paper will partially refer to some of the components of this approach. However, this does not imply that the authors, nor the institutions they represent, have specific interest in S*RS*® trade mark..

Watts (1992, 1996) argues that elite fibre production combined with high fleece weight can better be achieved through the development of secondary fibre follicles in the animal's skin in an additive manner. Further selection components refer to identifiable characteristics in the fleece surface and the fleece structure of the animal These characteristics appear in the skin of the animal in a progressive and sequential manner, with the terminal stage bringing up two new concepts: *deep and bold crimp* of the fibres, and *the fibre bundle* as the basic unit of fleece structure, as *typical biological indicators of the quality of the fleece, and the genetic merit of the animal to fleece production*. It is important to highlight that there may be a different perception from the manufacturer's perspective about these specific fleece characteristics (Knox 1999). The remaining biological markers which appear previously to the above-mentioned markers are, increase in handle &/or softness of the fleece, lack of guard hair and lustre. All of these markers are external indicators of an animal with a high follicular density in the follicular groups of the skin (Watts & Ferguson 1999b).

The follicle group is the basic unit of skin structure. It is comprised of 3 primary follicles and from 17 to 45 secondary follicles as per early results of the *University of Sydney - AAA, Performance Recording Program (AAA-US, PRP) Research Project* (A.A. Charry, 1999, pers. com.).

Whether these biological markers of elite fleece production are correlated with follicular density in alpacas is currently a matter being evaluated. Initial results from AAA-US, PRP are providing evidences to support this (A.A. Charry, 1999, pers. com.).

Evidence of heritability of follicle density for Merino wool is given by Purvis & Swan (1997) as +0.46 (i.e. 46%, a high value in genetic terms) with a genetic correlation between follicular density and fibre diameter of -0.68 and between follicular density and fleece weight of +0.13. The former indicates the advantage of having more follicles in the skin of the animal to improve fineness; and the latter indicates that in spite of having fibres of lighter weight there is still a marginal increase in total fleece weight. These values confirm the worthiness of selection processes, for elite fibre production, based on increasing follicular density in the skin of the animal. The relative low correlation value between follicular density and fleece weight (+0.13) is understandable and justified in technical terms. When more follicles are added to the skin structure they decrease in their diameter as a consequence of crowding, and competition for space and nutrients, which results in a lower weight of the individual fibres. The new fibres are lighter, and the correlation method cannot identify this factor. If a positive correlation between follicular density and fleece weight continues to exist, as it does (+0.13), then this is a clear indication that the increased follicular density not only compensates for the lesser weight of the new fibres but, furthermore, contributes to increase fleece weight. Thus the final weighted value of this effect implies that in technical terms an upward adjustment of the nominal correlation value needs to be done.

A major implication of selective mating deals with the design of systematic and complementary methods for a twofold evaluation of structural fleece characteristics on individual animals, and lifetime comparative production performance of parents and progeny (Charry 1998a, 1998b).

The first part of this process (i.e. fleece scoring) is implemented through the evaluation of the external markers that are supposedly correlated to fibre quality and high fleece production. In practical terms, this will provide the opportunity for the identification of weaknesses and strengths in each animal; and an appropriate sire selection to correct or improve weaknesses and/or strengths in females.

This type of exercise is the first step in SRS® Merino flocks (J.E. Watts, 1998, pers. com) and SRS® Angora flocks (Cowen 1998) where defined methods for fleece scoring and body type are used. Visual selection is practised at the initial stages of the selection process and/or in "only commercial" herds. However, stud herds require a lifetime production performance recording for breeding and selection processes (Watts & Ferguson, 1999b, p. 19). However, methods and institutional support for objective specification, measuring and evaluation of performance recording of SRS® animals are not known to be available to the breeders.

J.E. Watts (1998, pers. com.) argues that, by using SRS® methods, the level of secondary follicle development may be accurately reflected in the nature of the fleece surface and the fleece structure of the animal. More specifically, there are fibre properties, namely softness of handle, deep and bold crimp, lustre and bundling that are positively correlated with follicular density (i.e. resulting in higher fleece weight), and allow the alpaca breeder to systematically identify and rank animals with a much greater level of assurance of the breeding outcome than has previously been possible.

Therefore, if follicular density is demonstrated to be a cornerstone in the production of superior fleeces, it may also be said that the phenotypic characteristics, or *biological markers*, associated with an increased number of secondary follicles can also be considered a critical factor in the overall process of genetic improvement of alpaca fibre (Charry, 1998 & J.E. Watts, pers. com. 1998).

For the particular case of stud alpacas (i.e. huacaya type as the main reference for this proposal) the structural characteristics of the fleece considered to be worthy of evaluation and scoring are those proposed by Charry (1998a,b), Knox (1999), Ferguson & Watts (1999), Watts (1992, 1996) and Watts & Ferguson (1999a,b) as follows:

(a) Softness of Handle (i.e. Handle, Softness, Fineness)

Softness of handle is expressed as softness, handle or fineness of the fleece. Softness of handle is maximised as the fleece becomes finer, more evenly sized, cylindrically shaped, smoother surfaced and bolder crimped.

Fibre diameter test results are an objective evidence of fineness of the fibres and must be used for fleece scoring purposes. When fibre diameter values are not available a visual and tactile assessment of fineness needs to be done.

Another element that contributes to the softness of the fleece is the absence of guard hair. Knox (1999) argues that the influence of guard hair on the commercial value of fleece becomes critical only when the primary fibres that constitute the guard hair are beyond 30 microns diameter.

(b) Density

Density is the product of the number of follicles in a follicle group (i.e. the follicle group contains 3 primary follicles and many more secondary follicles). However, follicular density by itself does not reflect heavy weight if the animal does not have the ability to grow fleece rapidly, as reflected in fibre length (Ferguson & Watts 1999a). Results from AAA-US, PRP (A.A. Charry, 1999, pers. com.) indicate that a meaningful number of sires with acceptable follicle density values in the follicular groups are not as desirable as expected when 365-day fleece weight is accounted for, comparatively to other sires. This is an indication of a differential factor of *"speed of fibre growing"* present in the genetics of the animals.

Reference to sheep research shows that increased follicle density decreases fibre diameter (Carter 1943, 1968; Moore, Jackson & Lax 1989; Watts 1996; Purvis 1997). In consequence, fleece weight of individual fibres decreases, affecting the correlation between follicular density and fleece weight. In spite of the lower positive correlation values between follicular density and fleece weight, found by Purvis & Swan (1997) the technical explanation of this phenomenon, as outlined before, justifies an adjusted up-weighting of this correlation to a more real dimension in order to better value the genetic merit of follicular density. What remains then is the selection of sires for *fast growing fleece* to compensate the lower weight of the fibres as a consequence of the increased follicular density and improved fineness.

Secondary to primary (S/P) follicular ratios are considered objective evidence of the magnitude of the fleece density, and should be used, where possible, for fleece-scoring purposes. When S/P follicular ratios are not available visual and tactile assessment of density needs to be made.

(c) Crimp character and crimp distribution

Crimp is the waving of the fibre within the structure of the bundle. A desirable crimp should be bold and deep. Boldness of crimp (as opposed to fine crimp) means the distance between the peaks of each crimp wave. Deep crimp indicates that the concavity of the crimp is high. Watts & Ferguson (1999a,b) clearly explain why this is a faster growing fibre. In consideration to this, it may be said that *deep and bold crimps are the biological consequence and evidence of fast-growing fibres*. For the fleece fibres to be collectively deep crimped, high fibre alignment is essential.

Similar to bundling distribution, it is desirable to have an evenly crimped animal throughout the whole body (i.e. saddle, neck, rump and legs). A hands-on crimp evaluation includes not only the character of the crimp but also the crimp distribution.

Diagram 1 is a reference display for crimp character and bundling character for the types of alpacas proposed in this paper.

(d) Lustre

Lustre is a natural reflection of the high alignment of the fibres in the fleece. Evenly sized, cylindrical fibres are able to strongly reflect the light. It is expressed by the intensity of light reflection from the fleece. It depends, for its maximum expression, on the fleece fibres being highly aligned, cylindrical in shape and smooth surfaced. High levels of secondary follicle development deliver this type of light reflection from the fibres (Watts & Ferguson 1999b).

(e) Bundling character and bundling distribution:

Bundling is the organised alignment of fibres that grow closely packed from each follicular group in the skin. High number and close packing of secondary follicles in the follicular group of the skin forces the high alignment of alpaca fibres. As a result, the *bundle should be considered, not a commercial characteristic of the fleece but, mainly a biological consequence of fibre organisation in superior fleece-producing animals.* A specific number of fibres will stick together in a parallel and organised array, not thicker than a match stick, highly aligned and free of fibre entanglement. As per this definition, the bundles are clearly differentiated from locks and/or staples.

Depending upon the stage of evolution of the alpaca the bundles will be located in different parts of the animal's fleece. This location must be evaluated in a hands-on fleece scoring on animals.

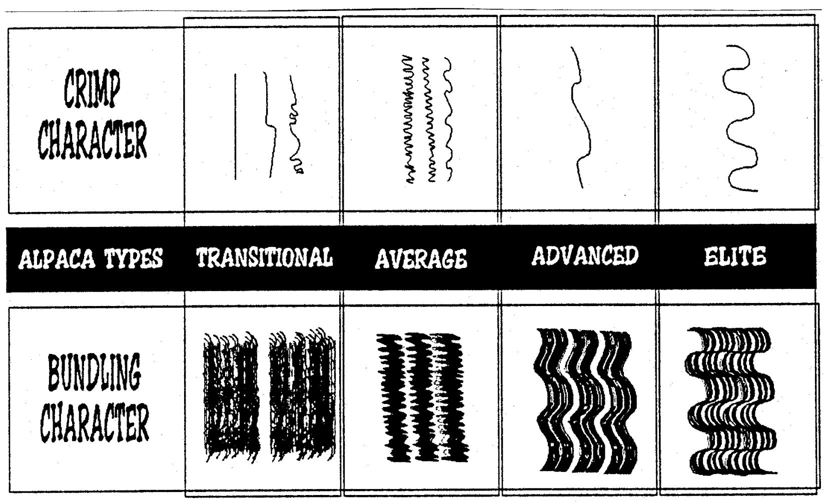

Figure 1. Crimp and bundling character for types of alpacas

Types of Alpacas in the Australian Herd

Four broad types of alpacas are proposed as the reference point for the objectives of this paper, as follows:

TRANSITIONAL ALPACA

A transitional alpaca usually displays none of the biological markers, or structural fleece characteristics, in a consistent manner. The fleece structure is the one typical of thick staples or entangled fibres without defined organisation. Fibres are harsh and dry, usually testing strong, and beyond 30 microns, though some lineages may present lower micron counts. Crinkle of the fibres (or elementary crimp) is a typical characteristic of this type of alpaca.

The follicular density of a transitional alpaca is less than 18 follicles per follicular group, and the S/P follicle ratio is around 5:1 (AAA-US, PRP Research Project – A.A.Charry 1999, pers. com.). The presence of guard hair along the overall parts of the body is a major characteristic of this type of animal. It affects the handle of the fleece in a significant manner. The apron and legs of this type of alpaca have evidence of guard hair and no presence of secondary follicles is detected therein.

In the scoring system proposed in this article, a transitional alpaca is one whose overall score of fleece characteristics is between 0.00 and 6 points.

AVERAGE ALPACA

An average alpaca is an animal that displays a fleece that is attractive to the eye. This type of alpaca is characterised by the demonstration of one or more of the desirable fleece characteristics at basic levels of development. Generally fine-crimped fibres with some degree of bundling appear in the fleece structure of this animal, which are an indication of light-cutting fleece weights (J.E.Watts 1999, pers. com.). Guard hair starts to disappear at least in the more valuable parts of the animal's fleece. Alpacas with fibre diameters between 25 and 30 microns should be ranked as average. The total follicular group density is up to 33 follicles, and the S/P follicle ratio is up to 10:1 (AAA-US, PRP Research Project, A.A.Charry 1999, pers. com.).

In the scoring system proposed in this article an average alpaca is one whose overall score of the fleece characteristics is between 6.1 and 12 points.

ADVANCED ALPACA

An advanced alpaca displays most of the characteristics typical of the high quality fleece package. However one or several of the characteristics do not offer the desired level of development. Fibre bundles are not well defined or are still considered thick; crimp is intermediate between the extremely fine crimp of the average alpaca and the deep and bold crimp of the elite alpaca. The softness of handle of the fibre may be affected by the presence of undesirable erratic guard hair in valuable parts of the fleece. Crimp and bundling characters start being evident in non-traditional areas of the body of the alpaca. Overall, the fleece exhibits an excellent quality and has an attractive weight.

The fineness of the fleece of an advanced alpaca should not be greater than 25 microns. The follicular counting per follicular group of an advanced alpaca, at this stage, is up to 48 follicles, and the S/P follicle ratio should be up to 15:1 (AAA-US, PRP Research Project, A.A.Charry 1999, pers. com.)

In the scoring system proposed by this paper, an advanced alpaca is one whose overall score of the structural fleece characteristics is between 12.1 and 18 points.

ELITE ALPACA

An elite alpaca displays all of the characteristics or *biological markers* of a high quality and heavy weight fleece. The structure of the fleece is unique in softness of handle. Its fibre diameter should be below 20 microns. The elite alpaca lacks guard hair (i.e. primary fibres beyond 30 microns diameter). Bold and deep crimp comes out of the skin in organised shining bundles of well-aligned fibres. The up-to-date elite alpaca has a follicular density beyond 48 follicles per follicular group, with leading animals of the AAA-US, PRP reporting values up to 78 secondary follicles and 5 primary follicles per square mm of skin. The S/P follicle ratio of an elite alpaca must be at least 15:1 at this point in time (AAA-US, PRP - A.A. Charry, 1999, pers. com.).

Selective mating and performance recording will facilitate the identification of elite sires that surpass these parameters of skin performance, and contribute over time to the improvement of the national genetic pool.

In the scoring system proposed in this article, an elite alpaca is one whose overall score of the structural fleece characteristics is between 18.1 and 24 points.

The Fleece Scoring Table

Table 1 contains a detailed description of score distribution for the structural fleece characteristics in the different types of alpacas. It also contains a typology of body conformation of the animal.

The score range for the overall marking of structural fleece characteristics is between

Table 1: Fleece & Conformation Type Scoring Criteria for Alpacas

FLEECE RANKING CATEGORIES / CHARACTERISTICS IN EVALUATION	SOFTNESS OF HANDLE			DENSITY		CRIMP	LUSTRE	BUNDLING	MAXIMUM SCORE PER TYPE	SCORE RANGE
	FINENESS SCORE	FIBRE DIAMETRE (mic)	ABSENCE OF GUARD HAIR	SCORE	SECOND/PRIMARY FOLLICLE RATIO					
TRANSITIONAL	<= 1	>= 30	<= 1	<= 1	<= 5:1	<= 1	<= 1	<= 1	6	0.00 to 6 points
AVERAGE	<= 2	>= 25	<= 2	<= 2	<= 10:1	<= 2	<= 2	<= 2	12	6.1 to 12 points
ADVANCED	<= 3	>= 20	<= 3	<= 3	<= 15:1	<= 3	<= 3	<= 3	18	12.1 to 18 points
ELITE	<= 4	< 20	<= 4	<= 4	>= 15:1	<= 4	<= 4	<= 4	24	18.1 to 24 points

BODY CONFORMATION: TYPE 01: TOP FRAME TYPE 02: MEDIUM FRAME TYPE 03: LOW FRAME

<= MEANS: "LESS THAN OR EQUAL TO" - GREY COLUMNS INDICATE VALUES OF REFERENCE

0.00 to 16 points. The distribution of values for each of the types and characteristics is as follows:

Softness of Handle

A total score of up to eight points has been allocated to this characteristic, distributed in two traits, *fineness* defined by fibre diameter (microns) and *absence of guard hair* (visual and tactile observation of fibres beyond 30 microns) with the following distribution between alpaca types for each of the two characteristics herein in evaluation,

Transitional fleeces:	0.0 to 1 points; (> 30 microns)
Average fleeces:	1.1 to 2 points; (> 25 microns)
Advanced fleeces:	2.1 to 3 points; (> 20 microns)
Elite fleeces:	3.1 to 4 points. (< 20 microns)

Density

A total score of up to four points has been allocated to this characteristic, with the following distribution between alpaca types:

Transitional fleeces:	0.0 to 1 points; (< 5:1 S/P follicle ratio)
Average fleeces:	1.1 to 2 points; (<10:1 S/P follicle ratio)
Advanced fleeces:	2.1 to 3 points; (<15:1 S/P follicle ratio)
Elite fleeces:	3.1 to 4 points. (>15:1 S/P follicle ratio)

Crimp Character and Crimp Distribution

A total score of up to four points has been allocated to this characteristic, with the following distribution between alpaca types:

Transitional fleeces:	0.0 to 1 points;
Average fleeces:	1.1 to 2 points;
Advanced fleeces:	2.1 to 3 points;
Elite fleeces:	3.1 to 4 points.

Lustre

A total score of four points has been allocated to this characteristic, with the following distribution between alpaca types:

Transitional fleeces:	0.0 to 1 points;
Average fleeces:	1.1 to 2 points;
Advanced fleeces:	2.1 to 3 points;
Elite fleeces:	3.1 to 4 points.

Bundling Character & Bundling Distribution

A total score of up to four points has been allocated to this characteristic, with the following distribution between alpaca types:

Transitional fleeces:	0.0 to 1 points;
Average fleeces:	1.1 to 2 points;
Advanced fleeces:	2.1 to 3 points;
Elite fleeces:	3.1 to 4 points.

The Body Type Score

Body type defines the conformation of the animal as per three alternatives. The TYPE 01 is a well-framed animal that does not requires further improvement in its body conformation. This conformation TYPE 01 has been named as "TOP FRAME". The TYPE 02 is an average-framed animal, generally of medium size, but not as impressive in its standing as the type 01. This conformation TYPE 02 has been named as "MEDIUM FRAME". The TYPE 03 defines an animal with weaknesses in its body structure, not having the conformation of the previous types. This body conformation has been named as TYPE 03: "LOW FRAME".

Selective Mating Criteria

The selective mating criteria for body conformation are flexible enough to move between top-framed and medium-framed sires, providing the latter have advanced to elite characteristics in their fleece structure. As a rule of thumb, when breeding females with body conformation of the type 03, deficiently framed, need to be mated, sires of body conformation type 01 should ideally be used. However, sires of types 02 with excellent fleece score continue to be an option. Sires with body conformation type 03 should not be used.

The selective mating criteria for structural fleece characteristics are as follows:

(a) Transitional female alpacas should be mated to a sire that exhibits elite characteristics - *and elite Standardised Deviation Ranking (SDR) values* - in the overall structural components of the fleece and body type conformation.

Commercial herds might consider the possibility of using less valued sires over their transitional females.

(b) Average female alpacas might be mated to sires of the same characteristics as those used for transitional alpacas. Alternatively, depending on the breeding objectives of the breeder, a sire with *elite performance* is the most desirable.

(c) Advanced female alpacas should be mated to *elite sires* that compensate for the deficiencies of the females in order to ensure a superior progeny.

(d) Elite female alpacas should be mated only to *elite sires* (in body conformation and structural fleece characteristics) of better score than themselves with the objective of optimising the body size and overall fleece characteristics of the progeny.

Conclusions

(a) Mating decisions have to be associated with specific targets of genetic improvement. The use of elite sires over scored females for characteristics of economic importance is the best and only way to ensure the improvement of the quality of the Australian alpaca herd.

(b) The outcome of scoring breeding females is the identification of strengths, and weaknesses, which can be improved in future progeny through the use of elite sires.

(c) Selective mating is the key component for organised mating programs at the herd level. It implies an integrated evaluation (i.e. subjective and performance recording) of stud alpacas in the relevant characteristics that constitute the genetic and economic targets of the breeder.

(d) The external markers that are sequential indicators of high quality fleece-producing animals are softness of handle, and absence of guard hair (i.e. primary fibres greater than 30 microns). Thereafter, deep and bold crimp, lustre and bundling should be used together to indicate high follicular density in the follicular groups of the skin of an alpaca.

(e) Fibre length is becoming an important external indicator in the production of heavy cutting fleeces. However, considering that there are not parameters of reference, at this stage, to evaluate *fast-growing fibre alpacas*, outside the shearing time, deep and bold crimps may be indirect indicators of this characteristic.

(f) Stud animals cannot be evaluated in a fair manner at different ages. This is particularly important in sires where some of the external markers of high quality fleece diminish with ageing. Reference ages of one year (1YO) and two years (2YO) are proposed for fleece scoring and performance recording purposes.

(g) The scoring of stud alpacas according to the guidelines set out in this article, although being a subjective exercise, increases the probability of production of superior animals. The characteristics being evaluated are those that are a consequence of increased follicular density in the skin of the animal.

(h) Four types of alpacas are proposed for evaluation purposes: Transitional, Average, Advanced and Elite. Breeders should attempt an overall classification of their female herd, without being concerned about the final ranking of individual females. What matters is the breeding objective and the method for choosing sires for selective mating.

(i) The scoring table encompasses a value-range between 0.00 and 16.00 points strategically distributed between fleece characteristics of economic importance (i.e. softness of handle, density, deep and bold crimp character, crimp distribution, lustre and bundling and bundling distribution).

(j) An elite sire can certainly be identified as such when performance recorded results are made available and SDR values in the characteristics of economic importance are calculated as proposed by Charry, Lawrie & Johnson (1997) and Charry (1997), through an official Performance Recording Program (PRP). The SDR values of sires for fleece characteristics within the classification types of this paper are: TRANSITIONAL, SDR values below than -1; AVERAGE, SDR values between -1 and +1; ADVANCED, SDR values between +1 and +2; and ELITE, SDR values above +2. The SDR values rank the genetic merit of sires as per a normal distribution herd-based comparative performance, rather than individual isolated merit.

(k) The showring may definitely contribute to the identification of superior elite sires. However, it implies the definition of a systematic method of animal evaluation that adequately reflects the biological standards of animal performance. The judges will have to judge the animals using a *hands-on scoring process* of individual animals, and allocation of championship awards to those animals with the highest scores. The use of computers at shows to average scores coming from more than one judge per show, and showing the results in public screens, will surely help to ensure the fairness of the process.

(l) It remains a challenge to determine the correlation between visual fleece characteristics and genetic performance. If this can be achieved, it will provide the opportunity to convert the showring and the on-farm evaluation of animals into valuable tools for functional selection of elite alpacas

(m) If the characteristics subjectively evaluated on the body and fleece structure of the animal can be systematically quantified, there is an opportunity for the alpaca industry to be the first animal industry to integrate in a consistent manner subjective evaluation (i.e. on-farm scoring and show judging) with objective evaluation (performance recording and SDR values) in the genetic selection of stud alpacas.

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Finnish angora wool turned into successful products

Arja Simola & Asko Maki-Tanila

In Finland, there has been a pilot project running between 1997 and 1999 to increase the volume and quality of production of small-scale producers with angora rabbits. There is a need for genetic improvement of animals, the development of angora processing and specialised courses. These elements now serve as a basis for a quality control system to cover the entire production chain. The objectives of the project were:

1) development of nutrition, husbandry and selection of angora rabbits;
2) an entrepreneur network covering production, processing and marketing;
3) an educational programme.

The results were, in the order of the project targets, the following:

1) The selection programme was designed to improve the production and reproduction traits. For this purpose, a unique ID number was given to all individuals. A database for pedigree recording and production was set up. A feed containing high amounts of methionine and fibre was development to meet the special nutritional require-ments of angora rabbits. In the recom-mendations for good husbandry, there was a strong emphasis on animal welfare.

2) The network was formed by 8 processors/entre-preneurs at Jokioinen and nearby towns together with a spinning mill at Mikkeli. A range of training options was offered to producers. The spinning process was scrutinised with expertise from the Tampere University of Technology.

3) Basic courses were designed by the project co-ordinator and given at Tammela of the Forssa Unit of Hiime Polytechnic. They covered angora rabbit production, angora processing and economics. The further education concentrated on processing, entrepreneur legislation and quality control. Teaching was carried out by persons from the collaborating organisations.

The project was conducted from 1 May '97 until 31 Dec '99. It was co-ordinated locally by the Council of Jokioinen. The project leader was Ms Arja Simola, an angora entrepreneur. The total budget was 165,000 Euro. The funding from the Employment and Economy Development Centre was 110,000 Euro, of which 55,000 Euro was contributed by the EU. The other sources of funding were the project participants and the Council of Jokioinen town and Agricultural Research Centre, MTT.

The project was assisted by international co-operation with the support of the European Fine Fibre Network. The most intensive exchange programme was with a French group of Angora breeders. The project appeared several times in media, including newspapers, radio and TV.

Classification and selection criteria for Finnish angora fibre

In Finland, angora products have in the past been mostly been practical clothes like sweaters, socks and warm underwear. Therefore the quality requirements for Finnish angora fibre are for good strength and stretchiness . It is important to achieve good durability for the products in use.

Classification of Finnish angora

Class 1:	adult animal, clean, not felted, length of downs > 6 cm, from the back and sides of the animal
Class 2:	adult animal, clean, not felted, from the belly and the chest of the animal
Class 3	adult animal, clean, not felted, length <3 cm,
Class 4:	baby, from the first harvest, not felted, clean
Class 5:	teen, from the second harvest, not felted, clean
Class 6:	felted, clean, adult or young animal
Class 7:	dirty

Finnish angora fibre measurement results

Measurements of Finnish angora fibre have been made at the Tampere University of Technology (TTKK), using the vibroscope method and OFDA method (in France).

Finesse using the Vibroscope method is fibre mass in proportion to fibre length. The Vibroscope method can be used in measuring the finesse, strength and stretchiness of one fibre. Finesse = dtex , dtex = 0.1 milligram / metre

Results of Finnish angora fibre, vibroscope method

strength (cN/dtex)	finesse (dtex) stretchiness
Coarse(in Winter)	12.5-15.3
15.5 - 16.7	43.0 - 48.5
(in Summer)	7.0-9.5
15.5 - 16.7	43.1 - 46.7
Down (in Winter and in Summer)	2.1-2.7
12.3 - 15.9	37.0 - 39.1

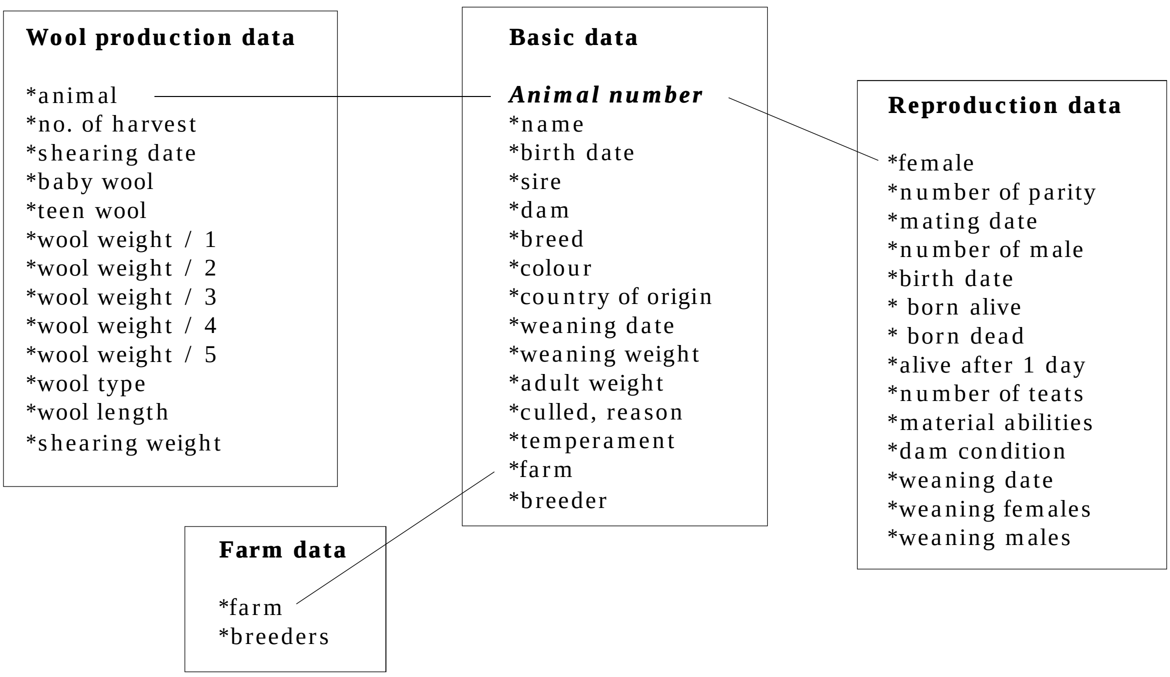
Results of Finnish angora fibre; vibroscope and OFDA method

Finesse	Vibroscope (dtex)	OFDA (micron)
Sample 1:	14.0 (in Winter)	14.8
Sample 2:	14.1	15.4
Sample 3:	14.3	16.1
Sample 4:	13.2	14.7

Organization of angora rabbit genetic selection

In Finland there is no dedicated research farm for angora rabbits. Therefore during the project Mrs Arja Simola's commercial farm was used for the research. The breeders participating in the project collected data for MTT (Agricultural Research Centre of Finland) according to agreed protocols. An Angora rabbit database has been established at MTT using Microsoft Access 97, following a standardised structure agreed within the European Fine Fibre Network.

Database structure



Within a single database, file data is divided into tables: basic data, farm data, wool production data, and reproduction data. The primary key in the database is animal identification number. By this number it is possible to form relationships between the tables. The database is a source of basic information such as group information and simple summary statistics, and is also a research resource, for example for BLUP evaluations. The Angora rabbit database will provide many important opportunities for developing Finnish angora production in the coming years.

Development of Finnish angora production in the future

A new organisation, FinnAngora, was founded during the project. This organisation continue the development of Finnish angora production that began during the project. FinnAngora maintains the angora database and Agricultural Research Centre of Finland is responsible for genetic control.

SHEEP BREEDS IN ITALY : STATISTICSPROPOSALS FOR IMPROVING MARKETING

Dr. Leo Gallico (Agenzia Lane dʼItalia)

Italy produces modest quantities of wool (Table 1), while consuming in spinning operations some 157 million kg of scoured wool, the majority of which is imported. This article aims to illustrate the situation of domestically produced Italian wool and presents some proposals of the Agenzia Lane dʼItalia to improve the realisation of its value in the marketplace.

Sheep breeds in Italy

Sheep have been bred in Italy for at least 3,000 years. The ancient Romans appreciated sheep, and considered them as objects of value. Indeed, the Latin word "pecunia" derives from "pecus" (cattle, particularly sheep). Figure 1 indicates the development of sheep breeding from the Unification of Italy to 1990. In 1996 the population stood at just under 11 million.

Table 1. Wool production statistics for Italy in relation to Europe and the rest of the world

1996/7	Sheep population	Production of Greasy Wool	Scoured Wool (kg)
World	1,007 million	2,616 million	1,474 million
Europe	120 million	251 million	134 million
Italy	11 million	12 million	5 million

Table 2. Further information about sheep breeding in Italy

Number of farms with at least 10 sheep	76,759
Total area used (ha)	3,136,381
Number of sheep in 1996	10,920,000
Average size of farms	40.9 ha
Average flock size	142.4 ewes
Sheep/hectare	3.5

* There are also about 100,000 family-run farms with less than 400,000 sheep in total.

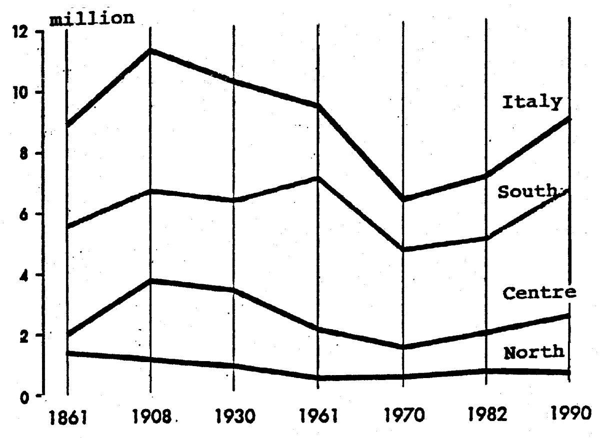


Figure 1. Variations in the Italian sheep population from 1861 to 1990.
Sources: SVIMEZ for the years 1861,1908,1930 and 1961 and ISTAT (agricultural census) for the others.

Fig 1. Sopravissana ram

Table 3
The distribution of the breeds officially recognised in the Genealogical Book, as well as the two new breeds being created, Merinized Italian and Valle del Belice.

Sheep breeds registered in Herd Book	**Total number of sheep**
BREEDS KEPT FOR THEIR MILK	
ALTAMURANA	500
COMISANA	750,000
DELLS LANGHE	27,000
LECCESE	180,000
MASSESE	180,000
PINZIRITA	207,000
SARDA	4,700,000
44.6% of total national population	
VALLE DEL BELICE	60 000
TOTAL 58% of total national population	6,104,500
BREEDS KEPT FOR THEIR MEAT:	
APPENNINICA	190,000
BARBARESCA	43,000
BERGAMASCA	50,000
BIELLESE	40,000
FABRIANESE	25,000
LATICAUDA	50,000
TOTAL 3.8% of total national population	398,000
BREEDS WITH DUAL FUNCTION (Derived from Merinos)	
GENTILE DI PUGLIA	5,000
SOPRAVISSANA	4,000
MERINIZZATA ITALIANA	600,000
TOTAL 5.8% of total national population	609,000
Total ewes in herd book 67.5% of total national population	7,111,500
OTHER POPULATIONS 32.5% of total national population	3,419,500
TOTAL SHEEP POPULATION	10,531,000
NORTH	5.7%
CENTRE	24.7%
SOUTH	25.8%
ISLANDS	43.8%

Table 4 Further information on Italian wool breeds and production levels

BREED	POPULATION	AREAS	WOOL PRODUCTION RAMS	EWES	USES OF WOOL
ALTAMURANA	8,000	Basilicata	3	2	Mattresses, carpets
APPENNINICA	190,000	Appenines	2.5	1.5	Mattresses
BARBARESCA	43,000	Sicily	6.5	3.1	Ordinary fabrics
BERGAMASCA	60,000	Lombardy. Em., Romagna Marche, Abruzz., Umbria	5	4.1	Mattresses, stuffing, carpets
BIELLESE	56,000	Piedmont and area	3.5	3	Mattresses, stuffing, carpets
COMISANA	700,000	Sicily, Veneto, E, Rome. Lazio, Abruz. Molise, Calabria	3 .	1.3	Mattresses,
DELLE LANGHE	27,000	Piedmont. Liguria. E. Rom-, Lazio, Abruz., Basilicata	3	2.5	Mattresses
FABRIANESE	25,000	.March, Abruz. Friuli	4	2.5	Mattresses, , carpets, ordinary yams
GENTILE DI PUGLIA	365,000	Puglia, Abruz., Molise, Basilicata, Calabria	6	3.5	Yarns for hand knitting and knitwear
LATICAUDA	50,000	Campania	3	1.8	Mattresses and d carpets
LECCESE	184,000	Puglia	3.2	2.1	Mattresses and carpets
MASSESE	185,000	Tuscany, Liguria, Emilia Lazio, Marche	2.2	1.5	Mattresses, carpets and yarns
SARDA	4,755,000	Italia	2.5	1	Mattresses and carpets
SOPRAVISS.	340,000	Umbria, Lazio, Tuscany,Abruz, Molise, Puglia	6.5	4.5	Yarns for hand knitting and knitwear
OTHER BREEDS	4,462,000				
TOTAL	11 450 000				

From Table 5, overleaf, it is clear that only 2 breeds (Gentile di Puglia and Sopravissana, which will form the merinized Italian breed currently being created) have a good fineness, and can be used in knitwear because of their resilience. All the other wools are used almost exclusively for mattresses and carpets. However, some tests have revealed other possibilities, and a systematic research project is necessary to find a good use for Italian wools.

The majority of farms are run as the full-time activity of the farmers, the breeding stations with paid employees account for only 2.1% of farms.

Producer's Associations

Breeder's organisations with technical character:

A.I.A. (Associatione Italiana Allevatori) is interested in the genetic improvement of all breeds (cows, horses, sheep...). It is a private organisation funded by the Agriculture Ministry. A section of it ASSONAPA (Associazione Nazionale Pastorizia) is dedicated to sheep and goats. The territorial structures of the A.I.A. are: A.R.A. (Associaz. Regionali Allevatori) and A.P.A. (Associaz. Provinciali Allevatori); they are also associated to the ASSONAPA if they have sheep and goats. There_ are also National Unions of-Producers-with an economic nature:

UNAPOC (Unione Nazionale Associazioni Produttori Ovicaprini). A member of the Farmers' Union (Confederazione Nazionale Coltivatori Diretti) and also represents the CONFAGRICOLTURA.

UIAPROC (Unione Italiana Associazioni Produttori Ovicaprini). This is a member of the CIA (Confederazione Italiana Agricoltori). Finally, COPA and COGECA are the economic and trade union representatives of the producers. They operate at a European level with functions of consultancy and proposal (not executive). Every proposal is passed to them for their opinion. The Brussels Commission also consults COPA and COGECA.

Collection Structures

Wool is collected by dealers The Agricultural Consortiums can be a point of support, andthe

Table 5 provides a summary of the data of the major research project carried out by L'Istituto Rivetti of Biella, part of the National Research Council, on the wool produced by the breeds enrolled in the genealogical books.

Table 5. Physical/Chemical properties of Italian Wool

	SARDA	COMISANA	MASSESE	LANGHE
Fibre diameter (μ)	33.5	37	41.3	29.3
Length				
H mm	27.5	25.8	26.6	27.4
B mm	48.9	38	35.5	37.7
Resistance to compression				
kPa	9.6	6.9	6.1	5.8
loss % *	41.1	13.2	17.9	16.9
Single fibre strength				
cN	57.5	39.9	14.2	33.2
elongation %	64.8	66.4	57.1	57.5
White degree (W)	62.4	59.7	**	60.3
Cystine/cysteine %	11.9	11.5	10.7	10.9
Alkaline solubility %	14.7	13.6	11.3	10.4
Felting capacity ***	3	3	3	3

	BARB.	LATICAUDA	BERGAMASCA	BIELLESE	FABRIAN.
Fibre diameter (μ)	33.4	37.5	38	33	32
Length					
H mm	29.6	29.9	29.9	28.5	26.6
B mm	41.2	36.6	42.6	39	35.1
Resistance to compression					
kPa	8	11.1	7.8	5.5	10.2
loss % *	17	21.9	12.1	23.7	11.8
Single fibre strength					
cN	35.2	17.2	20.8	20.9	12.6
elongation $	57.3	56.1	53.4	45.7	49.2
White degree W	54.2	81	56.4	64.6	71.5
Cystine/cysteine %	10.9	9.7	10.1	10.2	9.7
Alkaline solubility %	11.3	7.7	16.5	14.3	11.5
Felting capacity ***	3	2	3	2	2

	APPENN.	LECCESE	ALTAMURANA	GENTILE P.	SOPRAVISS.
Fibre diameter (μ)	28.2	36.8	38.7	21	20.2
Length					
H mm	27.7	31	29.2	25.9	24.1
B mm	36.8	52.3	43.3	30.4	28.5
Resistance to compression					
kPa	9.8	8.1	8.5	14.5	13.6
loss % *	13.7	22	27.2	13.8	3
Single fibre strength					
cN	10.3	60.4	38.5	9.8	12.1
elongation $	51	65.9	61.1	54	56.4
White degree W	68.3	67.3	70.8	58	65.7
Cystine/cysteine $	10.4	10.3	11.6	12	11.4
Alkaline solubility $	12.3	9.6	9.1	14.4	10.5
Felting capacity ***	2	3	2	1	1

* loss of resistance to compression after 10 cycles of compression and decompressions ** dark fibre (natural pigment); *** 1=weak, 2=average, 3=strong

producers' associations can organise collective contracts. In Sardinia there are about 10 collection points which deal with selection, scouring and initial processing; they then sell the wool directly.

Classification and selection
In the 10 combing mills there are experts in this task.

Export
Mainly to UK and Belgium.

Selling system
There is no statutory organisation in Italy to sell wool.

Processing.
In Italy there are many industrial plants capable of performing all stages of the processing - scouring, carding, combing, spinning, weaving, knitting, dyeing and finishing. These plants use only a small quantity of wool from Italy or Europe. They work almost exclusively with wool from the Southern Hemisphere.

Research
There are experts in the quality of wools in wool trading companies and in combing mills. Training courses for shearers have been organised by the Agenzia Lane d'Italia, by some APA's and by a seller of shearing machines. Genetic improvement is still an important aim but it is mainly targeted at the production of milk and meat. In Italy the only Institute which works on wool is the Istituto di Ricerche a Sperimentazione Laniera "O.Rivetti", part of the National Research Council (CNR), with premises in Biella in the "City of Textile Studies". This Institute has remarkable research potential. In Citta Studi there are also other institutes linked with wool: Texilia organises training courses for the wool industry; there is a secondary school which trains textile and chemical experts; the Polytechnic of Turin offers a course leading to a Diploma in Chemical Engineering; there is a public conditioning lab and the Woolmark Company (ex IWS). In Italy, there are other Industrial Institutes which concentrate on Textiles, but not specifically on wool. Sheep are studied in the Veterinary Faculties of the University, but only rarely for their wool. Studies are underway at the National Zootechnical Institute at Bella (PZ) on Cashmere and Mohair, while others are being done in the Marche on naturally coloured sheep and the use of their wool. L'INIPA (Istituto Nazionale Istruzione Professionale Agricola) has annual programmes for the training of trainers.

Comment
Compared with a modest production of wool, which needs aid if it is to continue to exist and improve, Italy has an important wool textile industry, which uses imported wool. The wool industry is renowned for its development and particularly for its quality, which is at the highest levels. Also the production of textile machinery is important and much appreciated throughout the world.

Proposals for improving marketing
The Agenzia Lane d'Italia was founded in 1988 by Ing. Giorgio Frignani, then President of the Chamber of Commerce of Vercelli, by Unioncamere and other Chambers of Commerce. The fundamental consideration was that in Italy there are about 11 million sheep which are kept for the production of milk and meat, which give a revenue, but these sheep also produce 12 million kilos of greasy wool (equal to 5 million kilos of scoured wool). For the farmer this wool is a cost, because the selling price is so low that it does not cover the cost of shearing, which is a physiological necessity of the animal. However, if the farmer, discouraged by the low price paid for the wool, attemps to get rid of it by burning it he pollutes the atmosphere. If he abandons it on the land, he pollutes the ground. So he has to try to use it as best he can, obtaining the best revenue. On the other hand, wool has been considered a source of wealth for thousands of years and it can become so again if the quality is improved and other uses found. The Agency proposes the following actions:

- "Good flock management"
- Training courses for shearers
- Establishment of wool collection and commercialisation centres
- Research into the best use, for the various types of wool.

Good flock management
This is essential because a healthy sheep produces good milk, meat and wool. Preventive measures must be taken against parasites and

illnesses. In Australia, the teeth of the sheep are filed so that they can graze better, their hooves are looked after to prevent them limping. Sheep with dark fibres should not be allowed to reproduce, so as not to spread the defect in the flock. The sheep must not be branded with tar or paint to identify their owner because these damage the fibres, but with the recommended dyes which last a season and can be easily eliminated during scouring without damaging fibres or machinery. These are small measures, which do not cost a lot but tend to improve the quality. Coloured or brown sheep should be shorn in a separate place otherwise they can ruin a lot of good wool. During the shearing, a preliminary selection can be made so as to improve quality.

Training courses for shearers
In all parts of the world shearing is done by teams of expert shearers using modern shearing equipment. They operate quickly and well, without injuring the animal which is not subjected to stress and continues to produce milk normally. These experts make appointments to come to the farms and they work two shearing seasons a year, one in the northern hemisphere and the other in the southern. It is a tiring but well-paid job. L'Agenzia Lane d'Italia organises courses lasting a few days for young people who wanted to learn this trade with the use of expert shearers and a company which produced shearing machines.

Establishment of wool collection and commercialisation centres
The average Italian flock contains 142 sheep and the average 150 kg of wool produced is paid a very low price because, on its own, it has no industrial use. In a collection centre wool from different producers but with similar characteristics, (e.g. fineness and length) can be collected into lots of 5-10,000 kg, which is a quantity that is of interest to the Industry. This is what happens in Great Britain, where the British Wool Marketing Board collects all the wool produced by farmers, pays for it according to quality and quantity, before creating lots which are auctioned off every 15 days at a remunerative price. This is what should be done also in Italy.

Research into better uses for single qualities of wool
Each quality of wool can have particular applications for which it is particularly suited. It is necessary to carry out systematic research to be able to use it in the best possible way and produce better revenue for the farmer. It would be even better if the breeders in a certain zone with sheep of a particular quality would form consortia to collect, scour, spin, weave or knit the wool to produce typical products which the breeders could sell directly, obtaining the maximum profit. The Italian Industrialist Carlo.Piacenza, President of the European Wool Goup, who is a fan of Italian wools, has experimented in this manner, obtaining excellent results with Sambucana wool (from the Stura Valley in Piedmont, near Cuneo) used to produce knitwear, plaids, bags etc. He provided the farmers with all the instructions of how to carry out the industrial operations in factories working on commission and selling the products directly. He saw that his teachings gave good results and the breeders of sambucana wool organised themselves to obtain the best products and the best profits for themselves.

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Many thanks to Mr. S.Carta, Dr. G.Credazzi, Dr. D'Ambrosio,

Appendix: Useful statistics on Italian wool production

Method of management

not main activity	10,441
main activity	
managed directly	63,183
with paid workers	1,620
other	1,515
	76,759 farms

Land used for sheep production

owned by breeder	1,547,930
rented	1,296,062
other	292,395
Total	3,136,378 hectares

Sheep farms

No of sheep	No of farms
10-19	14,003
20-49	17,182
50-99	12,029
100-299	23,567
300-499	6,223
500-999	3,201
>1,000	491
Total	76,759

Number of sheep farms

on the plain	18,121
in the hills	30,198
in the mountains	28,440
Total	76,759

The majority of the farms are owned by individuals, only 2.8% have institutional owners (co-operatives and building societies).

Transhumance: not very common (only 8%)

Age of the farmers: there are a lot of young breeders, principally in the bigger farms.

less than 34 years old	14.4%
35-55	42.2%
>55	43.4%

Equipment present in the farms

No of farms (total 76,759)	
Electricity	50,858
Phone	29,899
Byres	62,900
Mechanical milking	2,486
Refrigeration plant	5,935
Abattoir	204
Processing plant	6,845

Wool production and prices

Wool (ISTAT)	1994	1995
sellable quantity	12,900,000 kg	12,000,000 kg
price lire/kg	1,476	1,845
value in lire	19,040,000,000	22,140,000,000

Development of wool prices from 1984/5

1984	merinos	800-900 lire/kg
	coarse	400-500
1990	merinos	400
	coarse	200-300
1996	merinos	1,300-1,500
	course	1,000-1,100

(according to other sources the price of wool paid to the producer in the period 1995/6 varied between 800 and 1,000 lire/kg)

European Fine Fibre Network in Portugal

The fourth and final meeting of the EFFN was held in October 1999 at the Escola Superior Agraria in Castelo Branco, and capably hosted by Luis Pinto de Andrade and João Pedro Várzea.

The Faculty of Animal Production has been closely involved with a number of projects aiming to stimulate local production of quality textiles, both mohair and fine wool. As part of this effort they have established an OFDA-based fibre analysis laboratory, and have been active participants in the EFFN initiative to adopt standardised procedures for genetic parameter recording and data storage.

The meeting was staged over three days, and provided an opportunity to discuss the progress that has been made in establishing a collaborative approach to genetic improvement based on objective fibre measurements.

Future research needs were also addressed and in particular four specific ideas were discussed in detail for possible future research and development projects.

Full details of these and the rest of the presentations can be found in the workshop report.