RESET
Interreg Europe

European Good Practices in Eco-creativity, natural fibres, short value chains

Romanian Angora Mohair Fibres: from acclimatized Angora goats to final textile products

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National Research & Development Institute for Textiles & Leather

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Development Fund

INCDTP is a center of excellence in RDI in the field of textile-clothing, leather-footwear-rubber goods

- develops RDI activities having a fundamental and applicative character
- small and short series micro production
- consultancy & technical assistance services by 2 accredited laboratories
- editing & publishing of technical reviews, books, ISI-rated magazine
- standardization activity
- professional training activities

The research fields of interest for our institute

- Advanced products and technologies for textiles-clothing and leather-footwear- rubber consumer goods
- Functionalities for high performance materials
- Increase of flexibility and efficiency in the development of the products and materials through design
- Ultralights aircrafts, parachutes, paragliders, autonomous platforms
- Invasive and non-invasive medical devices with biomedical and bio-functional characteristics specific to the clinical use in medicine, health
- Clean technologies for textile and leather field and environment protection
- Conservation and protection of cultural heritage
- Support instruments for developing RDI capacity

Background for the implementation of the GP

- **"Returning to Nature"** is a growing **tendency in the textile industry.**

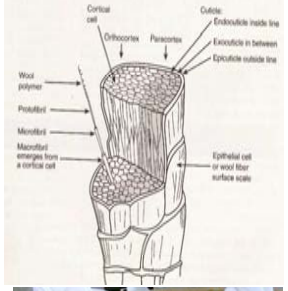
- **Chemical fibers** had known spectacular, even fascinating developments over time**, trying to imitate nature** in all its specific aspects.

- **Despite this expansion** of the production and processing of chemical fibers with extremely diversified and sophisticated characteristics**, the specific properties of natural fibers** and **especially those of animal hairs** could not be equalized.

- The use of these **precious raw materials**, the so-called **noble fibers** or "**luxury hair fibers**" overcame **the barriers of "luxury"** products, becoming a **characteristic of the textile product market** in the last years.

- The **noble animal fibres** present **specific characteristics:** *soft, fluffy, handle, bulky, superior thermal isolation, breathable characteristic, air and humidity permeability,* that **give** to the **products** containing such fibres:
  - an **increased degree of comfort** in wearing;
  - possibility of **adjusting to different environmental temperatures**, **maintaining the thermal equilibrium** of the body.

- **From the consumer perspective:** their requests and exigencies go beyond **the level of quality textile products,** reaching a superior one: **natural fiber products**, with a **high added value**, that bring "**services" to the consumer**, such as: *comfort, easy care, functionality, "anti" properties*: anti-soiling, anti-felting, anti-moths, odour control.



Background for the implementation of the GP

Aim of the Good Practice:

- **to develop the natural animal fibers production** and **especially noble animal fibers** starting **with the acclimatization process of animals-** Angora goats, their **breeding** and **multiplication;**
- to elaborate the **comparative study of the main characteristics** of Romanian Angora mohair type of fibers, and
- **to establish the manufacturing process of mohair /wool fibers blends and/or wool type chemical fibers**, for obtaining **woven fabrics with superior aesthetical and comfort characteristics.**

Stakeholders involved:

- **The National Research& Development Institute for Textiles and Leather**
- **The Research & Development Institute for Sheep and Goats Breeding -** Palas, Constanta
- **FERM-PROD ltd** Scarlatesti, Braila county, *zootechnical farm*
- **SC STOFE Buhusi SA**

a wool processing integrated company:spinning, woven, finishing mill

Detailed content and working of the Good Practice

- In Romania, **Angora goats were brought** under the form of **donations**, in order to reinvigorate Romanian livestock farms.

- **INCDTP initiated in collaboration** with the **FERM PROD ltd** company from Braila county (area favorable in terms of environmental conditions and climate) an **acclimatization project in Romania of a nucleus of Angora goats**.

The Good Practice presents aspects regarding:

- **the acclimatization process of animals**, their breeding and multiplication;
- **the comparative study of the main characteristics** of Romanian Angora mohair type of fibers: physical-mechanical, chemical, electronic microscopy;
- aspects regarding **the processing of mohair /wool fibers blends and/or wool type chemical fibers,** for obtaining woven fabrics with superior aesthetical and comfort characteristics.

Detailed content and working of the Good Practice

Regarding the acclimatization process:

Animals **have adapted easily to the new living conditions** at FERM-PROD ltd

The **acclimatization process is completed**:

- ✓ **quantity of mohair**: **4-6 kg fiber** per animal;
- ✓ **most animals** are now the **4th-5th-6th generation;**
- ✓ goats that **produce two kids** are in percentage of **50-60%.**

Romanian Angora goats

At present, there are carried out **actions** for **purchasing pure Angora males** from Turkey, in order **to preserve** the **specific characteristics** of the breed.

Detailed content and working of the Good Practice

Comparative study of the main characteristics of Romanian Angora mohair fibres

The main physical - mechanical characteristics for Romanian mohair fibers
(2004 and 2010)

as compared with Romanian wool fibers

Physical – mechanical characteristics

		Mohair Fibres 2004	Mohair Fibres 2010		
Characteristics		Mohair fibres Young Angora goat	Mohair fibres Kids Angora goat Age 6 months	Mohair fibres Young Angora goat Age 1 year	Romanian wool sort 29P
Diameter	µm	30,3	23,4	30,2	30,1
	CV%	26,9	34,3	23,9	31,9
Comfort Factor	%	-	84,6	51,1	50,2
Individual length	mm	100,2	148,66	152,24	100,7
	CV%	56,6	46,83	34,58	50,0
Breaking Force	cN	32,67	19,6	18,81	10,8
	CV%	46,8	45,63	19,21	51,1
Elongation at break	%	50,58	38,6	41,11	39,1
	CV%	11,7	14,81	10,0	23,1
Number of Crimps/cm		0,700	0,700	0,714	5,3
Friction coefficient fiber/fiber	static	0,217	0,320	0,334	0,424
	dynamic	0,192	0,281	0,310	0,390
Friction coefficient fiber/metal	static	0,260	0,371	0,327	0,318
	dynamic	0,224	0,353	0,300	0,295

Physical – mechanical characteristics of the Romanian mohair fibers

- **Mean diameter** is found around **30 µm**, for the **fibers coming from adult goats**, value comparable with the one corresponding to the semi-fine wools, sort 29P (21); **no modifications are noticed** as far as samples in the 2010 production are concerned, as compared to the 2003 production;

- **Mean length** of the **mohair fibers** shows a higher value (140 mm), in comparison with fibers in the 2003 production (100.2 mm);

- **Staple fibers content** has **high values in case of mohair** against wool, as this is generally a characteristic specific to goats (Angora, Cashmere) and camelids (camels, alpaca), being formed out of the fibers layer next to the animals skin (ca. 14% of total fleece);

- **Friction coefficient values** prove **a sensible increase in case of 2010 production** fibers, against the 2003 ones, process that can be explained by possible changes of the scales, which, due to acclimatization, thickened and became more prominent

Physical – mechanical characteristics of the Romanian mohair fibers

- **Number of wrinkles** for the **mohair fibers is 0.7 wrinkles/cm**, with 86% lower against the one corresponding to wool fibers (5.3 wrinkles/cm); these aspects **are due to differences existing between the two types of fibers** at the level of **cuticle cells** and are worth being considered when designing the fibrous blends and, further, when managing the technological processing stages;

- **Luster** is **influenced by the cuticle cells characteristics**, which determine **an increase** of the even reflecting component to the decrease of the diffuse reflecting one, thus leading to **a more intense luster** gained, as compared to wool;

- **Whiteness degree** determined by the Elrepho method amounts to **37.90 for the mohair**, which highlights **a white color with a soft yellowish tint favoring the fibers luster**.

- The **variation coefficient** of all characteristics **is high** (this is a specific characteristics of animal hairs);

- The **friction coefficients, fiber/fiber and fiber/metal** have **low values**. This aspect determine **the lowest adherence of the mohair fibers**.

Regarding the study of the structural properties of the Romanian mohair fibers

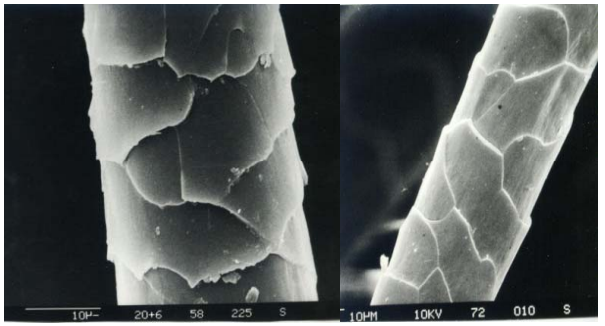
The **mohair** (keratin fibre) **is characterized** from the **morphological** point of view by the existence of **three distinctive cellular layers**: **cortical** layer, **cuticle** layer and **medulla.** Medulla is specific for **coarse fibres**, with **diameter over 35-38 μm.**

It can observe:

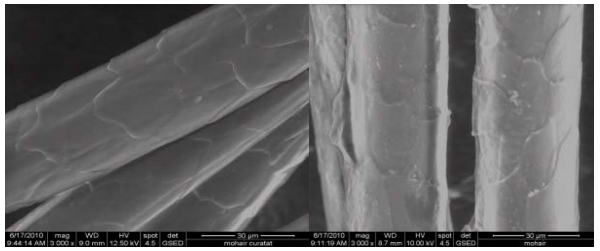
- the existence of **some fine denticulate cuticle cells**, **with sharp peaks** and with **smaller thickness** (scale height) in comparison with wool fibre scales;
- the **longitudinal surface aspect** of the **mohair fibres** is **more uniform** as compared with wool fibres; there are not significant differences between analyzed fibres (2010 as compare with 2003);
- the **specific surface scale appearance** is one of the factors that **determine the high natural luster degree** and the **improved tinctorial properties** of mohair fibers.

The **analyses of electronic microscopy** has emphasized for the **mohair fibres** a **cortical structure** formed of **orthocells** and **para heterotype cells** (cells of transition from ortho to para).

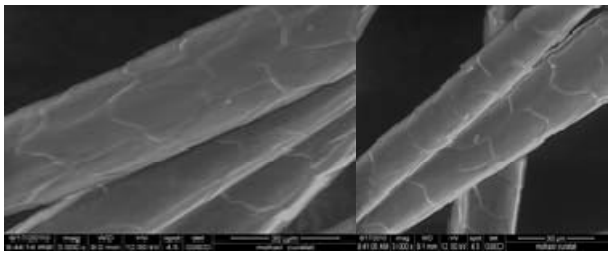
The aspect of the longitudinal surface



a) wool fibres **b) *2003 mohair fibres***



2010 raw mohair fibres



2010 washed mohair fibres

Regarding the study of the structural properties of the Romanian mohair fibers

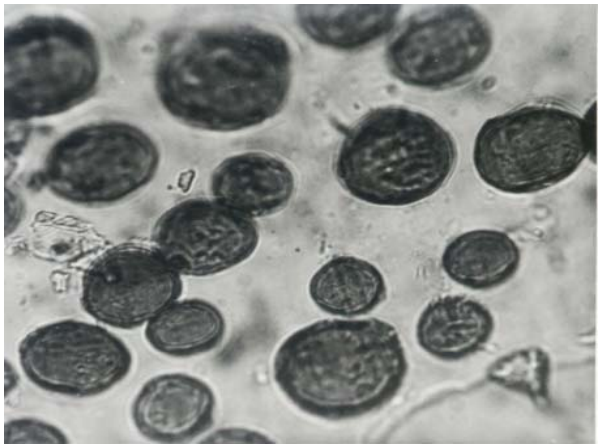
- The undertaken researches have emphasized **a close connection** between **the cortical structure** and **crimping of the fibres**

- The **mohair fibres** have a **reduced number of crimps** (0,7/cm) and a **monotype distribution** (ortho-cortical cell and of transition ortho →para)

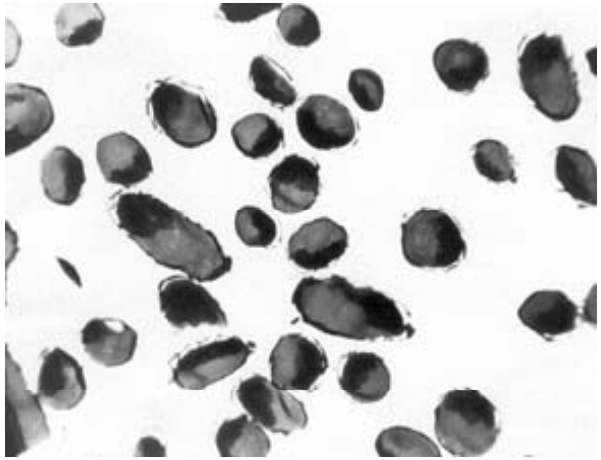
- For the emphasizing of the **cortical structure** a coloration specific to the paracortical cells (silver nitrate 2,5 %) has been effected in the investigation laboratories in the institute;

- In **the section** it can observe that there **are not clear differences of colour inside the cortex** as it is in the case of fine wools, that proves the character of ortho- paracortical transition of the cells.

Aspect of the cross-section



mohair fibres



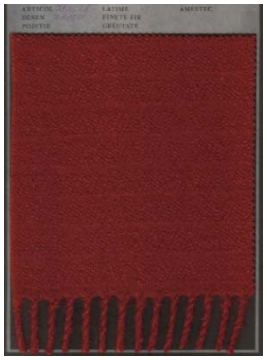
wool fibres

The Romanian mohair fibres processing technology

- To emphasize the behavior in **processing of mohair fibers**:

✓ there were accomplish **technologic experiments** of **processing mohair/wool fibre blends and/or wool type chemical fibers** in the **semi-worsted spinning** and

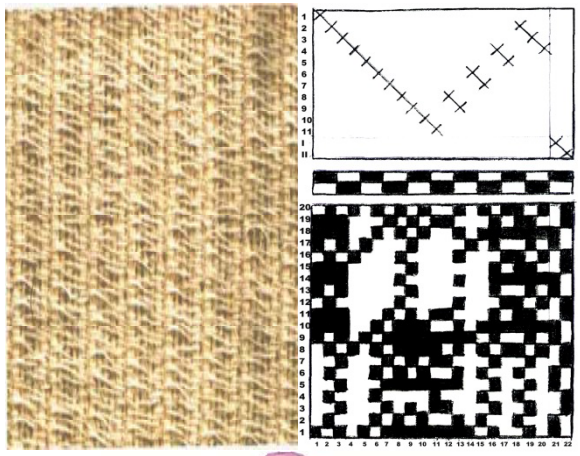
✓ there were created **variants of woven** fabrics, with **derived or combined armures**, with **weft effect**, meant for **indoor textiles and cold season clothing.**



- **The selection** of **the components** and **participation levels** in the **fibrous blending** has in view:

✓ **the improvement** of **some characteristics** of the **mohair fibers**: **adherence between fibers**, the **reduced values of the static and dynamic friction coefficient**;

✓ the **efficient utilization** of the **mohair specific properties.**



- Using **semi-worsted and worsted wool spinning** technological process, **yarns (10-24 Nm)** and **woven articles** were created.

- **Utilization fields** are: **garment articles** meant for the **cold season** (suits, jackets, light overcoats, overcoats) and **home textiles, blankets.**

Success factors of GP

- **the acclimatization process** of animals, their **breeding** and **multiplication;**
- the **study of the main characteristics** of **Romanian Angora mohair fibers**, in order **to emphasize their specific properties**;
- the **elaboration of adapted processing technologies**, of mohair/wool fibers blends and/or wool type chemical fibers, for obtaining **woven fabrics with superior aesthetical** and **comfort characteristics**;
- the **good example** for **young entrepreneur**, both **zootechnical farms** and **textile producers.**

Difficulties encountered and lessons learnt from the practice

- **the acclimatization process was not a very easy process**, it imposes **medical and biological observation**;
- the **manufacturing process** imposes **specific technological parameters**, **adapted to the fibres characteristics**, in order to rise the **efficiency of the process** and the **valorization of the high value characteristics of the mohair fibres**, from **comfort and aesthetical** point of view.

Remarks on the durability of the GP results and impacts

In comparison with the classic wool products, **the new Angora mohair containing products** are:

- "**hand knitted**" type structures, in natural shades;
- **lofty appearance**, **reduced mass**, increased bulkiness, with **natural luster**;
- **soft touch**, ability to **take** the **form of the body**, confirmed by **low values of the bending rigidity**;
- **high degree of comfort**, showed by the **medium and high values** of the **thermal insulation capacity**.

Good Practice value added at regional and transregional (EU) levels

- **Natural fibres** remain **the source of economic vibrancy** for millions of people including **small-scale processors** and **farmers.**
- **Angora goats are not only beautiful** to the eye, but **as fiber goats, they're valuable** to the touch and comfort.
- The **acclimatization process** of Angora goats, their **breeding and multiplication** could be **a source of employment** in **disadvantaged agricultural areas**.
- At regional and transregional levels, **the production of the Angora mohair fibres** could be a **new local/autochthonous base of valuable raw material**.

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Thank you!

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