

# Alpaca Fiber

## What We Know

## What We Need to Know

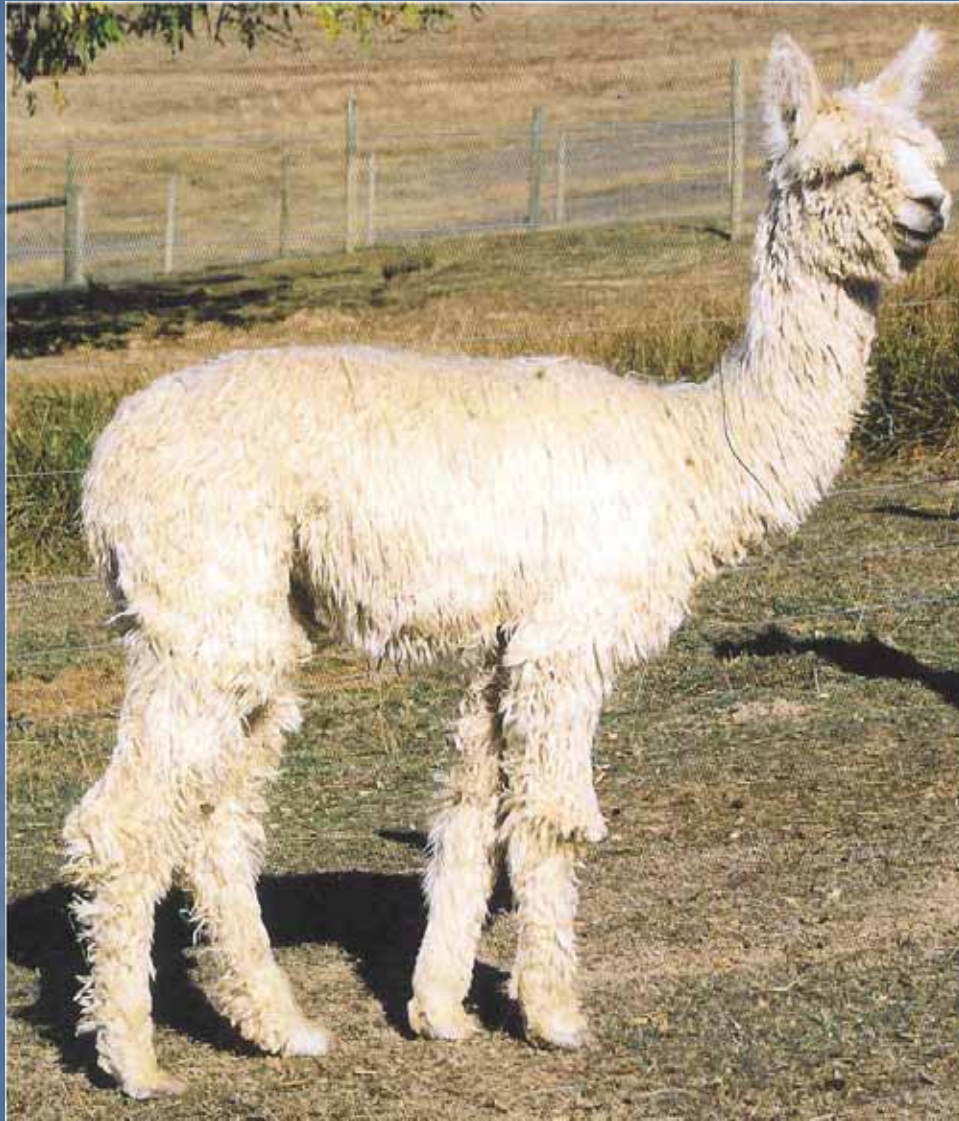


# The Huacaya

Huacaya fiber has loft and is well suited for knitted and crocheted products as well as woven applications.

Huacaya fiber has brightness and crimp.





## THE SURI

Suri fiber is smooth and heavy. Because of its lack of loft, suri is best used in lighter weight woven applications.

Suri has a very smooth scale structure which gives it its luster.

# Alpaca fleece comes in 18 official natural colors with 100s of shade variations

Official Natural Colors:

White

Beige

Fawn – light, medium, dark

Brown – light, medium, dark

Bay Black

True Black

Silver Grey – light, medium, dark

Rose Grey – light, medium, dark

Indeterminate Dark

Indeterminate Light



# Micron Relationships to End Uses

- 18-20 – underwear, high fashion fabric, suiting
- 20-23 – fine to medium knit-wear, men's suiting, lightweight worsteds, hand knitting yarn
- 23-26 – woven outerwear, machine and hand knitting yarns
- 24-29 – socks, fine felting, and heavy woven outerwear
- 30+ interior textiles, carpets, and industrial felting

# AOBA Fiber Characteristics Study 2009-2012

- Three Phase Study
- Managed and coordinated by AOBA Fiber Committee
- Validation of Fiber Characteristics Claims
- Utilization of College and University Testing/Use of Standard Methods
- Literature Search for Research Papers

# Goals of the Study

- To validate claims made about alpaca fiber using scientific data
- Intrinsic Values of Alpaca Fiber
- Characteristic Values of Alpaca Fiber as compared to other fibers

# Phase One

## Literature Review

- Locating studies performed on alpaca fiber worldwide
- Locating studies and values for wool, cotton, silk and synthetic fibers
- Establishing values and charts for comparison purposes



# Pertinent Alpaca Studies

- Wang, X.; Wang, L.; and Liu, X. The Quality and Processing Performance of Alpaca Fibers, Rural Industries Research and Development Corporation Australia, (rirdc). (2003) available for download or ordering at [www.rdc.infoservices.com.au](http://www.rdc.infoservices.com.au)
- *A comprehensive report of several studies on the processing of alpaca as compared to wool in commercial scouring and processing mills in Australia.*

# Wang et al Studies - Conclusions

- Alpacas Are Dirty
- Alpaca fiber can be cleaned at lower temperatures than wool
- Alpaca fiber has the same softness comfort as wool at higher micron levels.
- Alpaca must be processed slower than wool, but has better yield.

# Wang et al Studies

- Alpaca has less pilling than wool
- Alpaca is fuzzier and sheds more than wool
- The twist factors for alpaca yarns should be different than wool
- Alpaca has lower resistance to compression than wool.

# Wang et al Studies

- Alpaca fiber may be bleached and dyed
- Alpaca dehairing is not cost effective
  - Approximately 30% loss at dehairing
  - Only 50% of the guard hair present was removed

# Pertinent Alpaca Studies

- McColl, A.; Lupton, C.; and Stobart, B..  
Fiber Characteristics of US Huacaya Alpaca, *Alpacas Magazine*, Summer 2004, pp 186-196. (2004)
  - *A study of microns, length and tensile strength of raw alpaca fiber with regional, color and age comparisons*
- *Conclusions: there are differences*

# Pertinent Alpaca Studies

- Tillman, A. and Tillman, C.; Surface Scanning Electron Microscopy of Suri Alpaca Fiber and Other Members of the Camel Family. *Alpacas Magazine*, Spring 2006, pp 158 – 171. (2006)
  - *A comparison of scale structure of suri alpaca and huacaya, llama and wool*
- Conclusion: There are differences

# Handle Claims



- Scale structure
  - Smoother scale = better handle
- Uniformity of micron
  - Products created with a very uniform micron will produce a more pleasing handle than their micron size indicates

Photo from National Geographic ca 1990

# Phase One

- Three parameters identified
  - Flammability
  - Thermal Conductivity (insulating factors)
  - Moisture Retention (wicking, absorption, desorption)
- Intrinsic Properties of Alpaca Fiber
  - Using roving processed under controlled conditions
  - Huacaya, suri, and variable colors and alpaca ages



# Phase One Testing Plan

- Utilization of Gaston College Textile Technology Center, Belmont, NC
- Summer/Fall 2009
- Using 15 lbs of roving/felt
- Moisture Regain %
- Gaston College Staff and
- Summer intern from NCSU



# Phase One Testing 2010

- Continuation of Testing
  - Utilizing woven, knitted, felted fabric
  - Flammability
  - Moisture Management
  - Thermal Conductivity
- Beginning of comfort values claim establishment
- Comparisons to other fibers from literature

# Test Methods



- Moisture Regain
- Absorbency
- Wicking
- Abrasion/Pilling
- Thermal conductivity
- Flammability

# The Fiber Samples

Color/type	microns
H - Grey	24
H-White	19
H-Rose Grey	22
H-Black	30
H-Brown	28
H-Fawn	24

Color/type	microns
S- White	34
S- Fawn	20
S-Black	26
W - Shetland	25 est
W- Merino	18 est
C/H - White	20/28

# Moisture Results

- Moisture Regain %
  - Indicates a part of the “comfort”
  - Higher % equals warmth/resistance to static
  - Standard test in the textile industry
  - Published data readily available for all fibers

# Moisture Regain %

Alpaca*	8.0
Wool	16
Silk	9
Cotton	8
Polyester	0.3
Nylon	4
Rayon	11

Soy silk	8
Milk silk	5.5
Bamboo	13
Tencel	10
Corn silk	0.5
Cashmere	16
Linen	12

\* From AOBA test results at Gaston College

# Moisture Regain Conclusions

- Alpaca compares to cotton and silk
- Alpaca has a lower moisture regain than wool
- Explains why alpaca usually feels lighter and less “sticky” than wool under use conditions
- Paper published Alpacas Magazine 2012

# Flammability

- Flame resistance
- Class I fiber by FTC/CPSC methods
  - 16 CFR Part 1610 Standards for Flammability of Clothing Textiles
- Flammability, vertical test
- Marginally flame retardant, char 15 in, after flame 70 sec, after glow 0 sec
  - FTMS 191A 5903, Vertical Flammability Test



# Absorbency

- A reflection of the absorbency of the fabric in resistance to wetting
- Drop test AATCC 79-1995, Absorbency of Bleached Textiles
- Spray test AATCC 22-2005, Water Repellency Spray Test

# Drop Test Results

Color/type	Time
H - Grey	0/60 min
H-White	0/60 min
H-Rose Grey	0/60 min
H-Black	0/60 min
H-Brown	0/60 min
H-Fawn	0/60 min

Color/type	Time
S- White	0/60 min
S- Fawn	0/60 min
S-Black	0/60 min
W - Shetland	0/60 min
W- Merino	0/60 min
C/H - White	4/30 min

# Spray Test Results

Color/type	Spray Pattern
H - Grey	70
H-White	70
H-Rose Grey	70
S-White	70
W-Shetland	80
W-Merino	70
C/H White	50
Cotton Sock	0

# Wicking

- A reflection of the absorption in wicking moisture away from the skin
- Vertical wicking test
  - British Standard 2424

# Wicking Results

Sample	2 min	5 min	10 min	20 min	30 min	1 hr	12 hr
H White	0 mm	0 mm	3 mm	5 mm	7 mm	9 mm	25 mm
S White	0 mm	0 mm	0 mm	3 mm	3 mm	5 mm	15 mm
H Black	0 mm	0 mm	0 mm	3 mm	5 mm	9 mm	20 mm
S Fawn	0 mm	0 mm	3 mm	5 mm	5 mm	7 mm	18 mm
H Grey	0 mm	0 mm	3 mm	3 mm	5 mm	7 mm	18 mm
W Shetland	0 mm	0 mm	0 mm	0 mm	0 mm	3 mm	7 mm
H Grey sock	14 mm	35 mm	75mm	121mm			
Cotton sock	45 mm	114 mm	165 mm	170+ mm			

# Absorbency Conclusions

- Alpaca is resistant to absorbency
- Alpaca is similar to wool in absorbency
- Alpaca can wick away moisture when knitted appropriately for use

# Thermal Conductivity

- ASTM F1868, Thermal and Evaporative Resistance of Clothing Materials
- Measured in three values
  - Clo values, the heat comfort/insulation value
    - 1 = men's suit
  - Permeability, the heat retention value
    - 1 = totally permeable (air)
  - Total Heat Loss, reflective of the amount of metabolic heat generation that can be exerted without comfort loss

# Thermal Conductivity TAFS

Type	Weight Oz/sq yd	Thickness mm	Clo Value	Permeability	Total Heat Loss
Suri woven	10.06	1.30	0.867	0.618	417.354
Huacaya woven	14.69	1.94	0.903	0.603	388.288

Preliminary conclusions:

Clo value, comfort for indoor wear

Permeability, the fabric will “breathe” and not create sweating

Total Heat loss, one could theoretically dig trenches without the need for cooling.



# Abrasion and Pilling

- Related to the structure of the fabric
- Indicates wear and tear and aesthetics
- Specs are described for upholstery use
- Minimum upholstery value >15000 abrasion
- No pilling 5, excessive pilling 1

# Abrasion/Pilling

## The Alpaca Blanket Project

- Abrasion
  - 15,000 cycles – good resistance
- Pilling
  - Value of 3, good pilling resistance

# Craft Felting Study



- Study for publishing to the craft industry
- Compares huacaya and suri to wool

# Pertinent Alpaca Studies

- Liu, X, and Wang, X.; A Comparative Study on the Felting Propensity of Animal Fibers, Textile Research Journal, (77) 957. (2007)
  - *A study of the felting of wool vs alpaca fibers in a commercial scouring setting*

*Conclusion: Alpaca has a higher propensity to felt during scouring.*

# Felting Method

- 3 layers perpendicular, about 2 oz fiber
- 15 X 24 rectangle wetted
  - 600 ml water, 10 ml detergent
- Prefelt
- 50 throws to full felt

# Time to Prefelt

Fiber Type	Prefelt time (min)
Huacaya	15
Suri	45
Merino	10
Shetland	15
Huacaya/cotton	25

# Shrinkage Results

Color/type	% Shrink	
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	L	W
H - Grey	22.6	33.3
H-White	20.8	30.0
H-Rose Grey	18.2	21.6
H-Black	16.7	26.7
H-Brown	16.7	26.7
H-Fawn	16.6	20.8

Color/type	% shrink	
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	L	W
S- White	16.6	33.3
S- Fawn	12.5	33.0
S-Black	12.5	36.7
W - Shetland	29.2	13.3
W- Merino	34.5	14.5
C/H - White	14.5	24.5

# Felting Properties

## ■ Conclusions

- Alpaca felts differently than wool
- Huacaya felts as easily as wool
- Suri is more resistant to felting for the craft industry
- Shrinkage is less than wool widthwise, more than wool lengthwise



Where Do We Go From Here?

Continuation of Testing

# Fleece Characteristics Claims Made

- Is unusually strong and resilient – stronger than wool
- Strength does not diminish as it becomes finer
- More thermal capacity in its fiber than almost any other animal
- Contains microscopic air pockets creating lightweight garments with high insulation values

# Fleece Characteristics Claims

- 26 micron alpaca feels like 16 micron wool
- Considered to be hypoallergenic
  - lack of lanolin
  - unique scale structure and low micron diameter
  - low prickle factor

# The Fiber Fairy



Is It All True???

More Validation Needed!



## 2015-2018 Strategic Plan Target Goal Four

### **Increase demand for alpaca fleece and fleece products throughout North America**

*Explanation: This strategy addresses the desire to see an increase in demand for North American alpaca fleece and fleece related products, including options for getting fleece from farm to market.*

Strategy 4.1 — Sponsor studies about alpaca fleece to get the science and comparison data to backup statements on strength, weight, warmth, etc., then utilize that information in national marketing efforts

# Phase Two

## Comparisons to Other Fibers

- “Stronger than Wool”
- Softer than Cashmere
- Alpaca 26 micron feels like wool 16 micron
- Combination of Consumer/Laboratory Evaluations

# Phase Two

- Continuation of Testing
  - Utilizing woven, knitted, felted fabric
- Beginning of comfort values testing
- Consumer perception and attitudes toward alpaca fiber, comparisons to other fibers
- Utilizing various colleges and universities
- Engineering, Consumer Sciences

# Phase Two

## Other Attributes

- Utilization of test values for raw fiber:
  - Micron ranges
  - Curvature values
  - Tensile strength ranges
- Survey of % fiber by age, color, type
- Statistical analysis of data



# Phase Two

## Hypoallergenic Claims

- The most costly
- Nearly a medical claim
- Development of testing protocol
- Sensitivity to fibers
- Comparison to other allergens
- Dander? Lanolin? Prickle?

# Phase Three



- Exploration of other attributes for:
- Functional Fabrics
- Technical Fabrics
- Blending for Optimization
- Color Studies