

Alpaca Fiber: What We Know and What We Need to Know

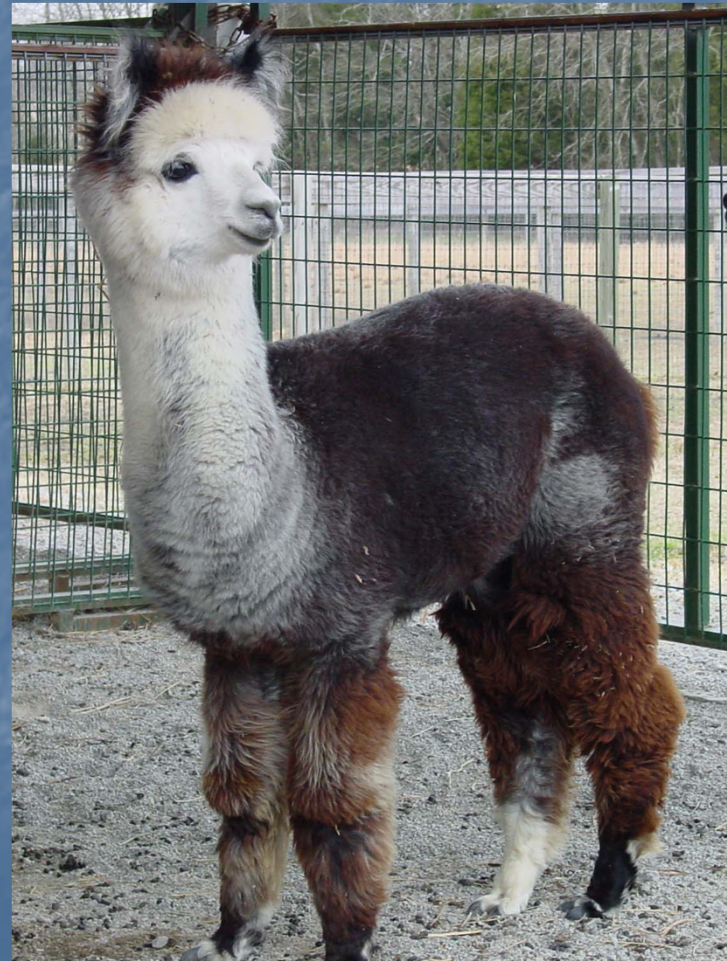
2015 AOA Fiber Conference, Denver Colorado
Presented by Ruth Fuqua, AOA Fiber Committee



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 16 official natural colors with 100s of shade variations

Official Natural Colors:

White

Beige

Fawn – light, medium, dark

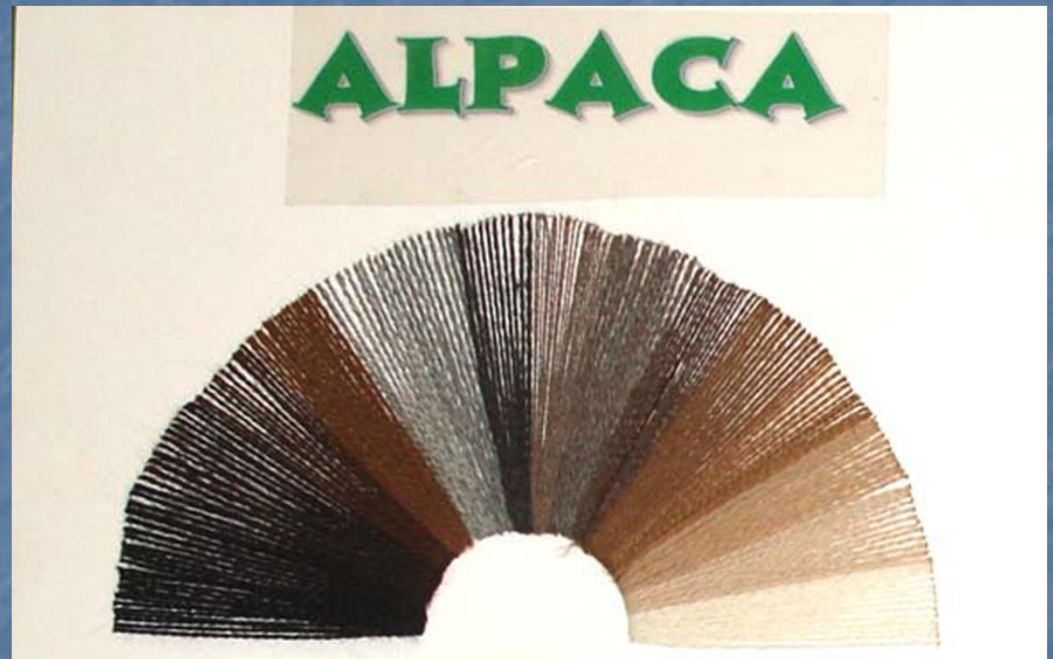
Brown – light, medium, dark

Bay Black

True Black

Silver Grey – light, medium, dark

Rose Grey – light, medium, dark



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
- *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

