

MAKING SENSE OF WOOL PART I

Based on The Columbia Sheep Breed Standards of Excellence 2018 Revision



Produced by Columbia Sheep Breeders Association

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GOALS

- TO CLARIFY FLEECE-RELATED TERMS USED IN COLUMBIA SHEEP BREED STANDARDS OF EXCELLENCE
- TO BUILD UNDERSTANDING OF THESE TERMS FOR BEGINNING AND EXPERIENCED SHEEP BREEDERS
- TO EMPHASIZE THE ECONOMIC IMPORTANCE OF COLUMBIA SHEEP WOOL STANDARDS

Table of Contents

- Wool Blindness
- Inadequate Wool or Hair
- Wool Fiber Diameter/Grade
- Staple Length

- Fleece Uniformity
- Fleece Density
- Coloration
- Fleece Impurities







WOOL BLINDNESS

INADEQUATE WOOL OR HAIR ON FACE AND EARS

WOOL BLINDNESS

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Wool Growth Completely Obscures Sheep's Vision



FACE WOOL SCORES



FACE SCORE 1



FACE SCORE 2



FACE SCORE 3



FACE SCORE 4

Face Wool Score 2 Vision Impaired in Full Fleece



FACE WOOL IMPACTS LAMB NUMBERS AND WEIGHTS

Open-faced ewes wean 11.3 percent more lambs and 11.1 more pounds of lamb per ewe bred than their wooly faced flock-mates





FACE WOOL IMPACTS

SNOW BLINDNESS





FACE WOOL IMPACTS Can lead to eye irritation and infections when matted with burrs, seeds, and hay



FACE WOOL IMPACTS

NEED FOR "FACING" TO REMOVE EXCESS FACE WOOL



ECONOMIC IMPORTANCE of FACE WOOL



LIABILITIES

- Fewer Lambs
- Lighter Lambs
- Snow Blindness
 - **Eye Irritation**
- **Eye Infections**
- Panic
- Need for Facing



Columbia Sheep Breed Standards Identify Wool Blindness as a Disqualification for Registration

Wool Blind Sheep Should NOT Be Registered



Portrait Gallery Committee Favorites













FACE WOOL WOOL/HAIR

Should Protect Face & Ears From Sunburn



Columbia Sheep Breed Standards Identify Inadequate Hair or Wool on Face and Ears As a Disqualification for Registration

Sheep with Inadequate Hair or Wool on Face and Ears Should NOT Be Registered



Face Cover is 56% Heritable

1946 Study: Heritability of Face Covering and Neck Folds in Range Rambouillet Lambs as Evaluated by Scoring

See End Notes on Heritability



BODY

- WOOL GRADE/FIBER DIAMETER
- STAPLE LENGTH
- FLEECE UNIFORMITY
- FLEECE DENSITY
- COLORATION
- FLEECE IMPURITIES





STAPLE

Cluster or Lock Of Wool Fibers Within a Fleece

WOOL FIBER DIAMETER OR GRADE

Expressed as Microns (1 micron = 1/1,000,000 meter) or Spin Count

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Wool Sample Micron Analysis

Montana State University MT Wool Lab Optical Fiber Diameter Analyser (OFDA) 2000



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Machine Scan Measures:

- Coarsest Fiber Diameter
- Finest Fiber Diameter
- Average Fiber Diameter
- Other Data



Wool Sample Site



Wool Sampling Protocols

- Approximately 2" X 2"
- Cut with Scissors or clippers
- As close to skin as possible

See End Notes for Wool Lab Contact Information



Spin Count System is Based on Maximum Spinning Capacity of 1 Pound of Clean Wool



Clarification of Spin Count System

- 1 lb of Wool of Grade 50 Can Be Spun into 50 Hanks of Yarn X 560 ft./Hank = 28,000 Yd. of Yarn (Nearly 16 miles)
- 1 lb. of Wool of Grade 62 Can Be Spun into 62 Hanks of Yarn X 560 ft./Hank = 34,720 Yd. of Yarn (Almost 20 Miles)

Note: The Higher the Number, the Finer the Wool

INFORMAL ESTIMATES OF FIBER DIAMETER



First Sample 22.7 Microns Second Sample 25.2 Microns Third Sample 29.0 Microns





Chart 1. COMPARISON OF COLUMBIA WOOL FIBER BY SPIN COUNT AND MICRONS

| Spin Count | Fiber Diameter | |
|------------|----------------|--|
| (Hanks) | (Microns) | |
| 60-62 | 22.05-24.94 | |
| 56-58 | 24.95-27.84 | |
| 50-54 | 27.85-30.99 | |



FIBER DIAMETER INFLUENCED BY GENETICS AND FOLLOWING STRESS FACTORS:

- NUTRITION
- **PREGNANCY**
- LACTATION
- AGE
- PARASITISM
- STRESS HORMONES

ECONOMIC IMPORTANCE OF FIBER DIAMETER

| | Micron | End Product | |
|-----------------------------------|---------------|-------------------------|--|
| | Range | | |
| FIBER DIAMETER IS | 16 10 | Fine worsted and | |
| <section-header></section-header> | 10-13 | intimate wear | |
| | 19 - 23 | Apparel, outerwear, | |
| | | quilt-batting, felts | |
| | 23 - 28 | Sweaters, light | |
| | | upholstery, coatings, | |
| | | comforters | |
| | n o 27 | Upholstery, tapestries, | |
| | 20-52 | some carpets | |
| | 32 - 38+ | Carpets, industrial use | |



Columbia Sheep Breed Standards Identify Fiber Diameters < 22.05 Microns Or > 30.99 Microns as Disqualifications For Registration

Sheep With Fleece Grades Outside This Range Should NOT Be Registered



Wool Fiber Diameter is 41-57% Heritable

Multi-year Study (Published 2002): Estimates of Genetic Parameters and Genetic Change for Reproduction, Weight, and Wool Characteristics of Columbia Sheep 2004 Study: A review of genetic parameter estimates for wool, growth, meat and reproduction traits in sheep

See End Notes on Heritability



Staple Length

Distance from Base to Tip of Unstretched Wool Fibers





Staple Length Often Correlated with Fiber Diameter

(The Longer the Staple the Coarser the Fibers)



Chart 3. COLUMBIA BREED STANDARDS FOR FIBER DIAMETER & STAPLE LENGTH

| Spin | Fiber | Minimum | |
|---------|-------------|---------------|--|
| Count | Diameter | Staple Length | |
| (Hanks) | (Microns) | (Inches) | |
| 60-62 | 22.05-24.94 | 3.25 | |
| 56-58 | 24.95-27.84 | 3.50 | |
| 50-54 | 27.85-30.99 | 4.00 | |

Chart 4. TEXTILE INDUSTRY PROCESSING REQUIREMENTS

| Fiber Diameters by Spin Count and Micron | | Manufacturing Standards for Staple Length | |
|---|-------------|--|-----------------------------------|
| Spin Count | Micron | Worsted | Woolen |
| 60-62 | 22.05—24.94 | $3\frac{1}{4}$ " & Longer | < $2\frac{1}{4}$ - 3" |
| 56-58 | 24.95—27.84 | $3\frac{1}{2}$ " & Longer | < $2\frac{1}{2} - 3\frac{1}{2}''$ |
| 50-54 | 27.85—30.99 | $3\frac{1}{2}$ ¹ & Longer | < $2\frac{1}{2} - 3\frac{1}{2}''$ |





Worsted System Noble Comb & Detail









Worsted System
Combed WoolWoolen System
Carded Wool


WOOLEN: Loosely Twisted Yarn, Air-Filled Loft for Warmth & Insulation WORSTED: Tightly Twisted Yarn; Dense & Hard-Surfaced for High Fashion Drape & Style



ECONOMIC IMPORTANCE OF STAPLE LENGTH

Staple Length is One Determinant of End Use and End Use Impacts Value

Staple Length Adds to Fleece Weight More Than Any Other Wool Characteristic and Price per pound X Fleece Weight = Wool Income



Columbia Sheep Breed Standards Identify Staple Length Shorter Than Standard for Wool Grade (See Chart 3) as a Disqualification for Registration

Sheep with Shorter than Standard Staple Should NOT Be Registered



Staple Length is 48-55% Heritable

2004 Study: A review of genetic parameter estimates for wool, growth, meat and reproduction traits in sheep Multi-year Study Published 2002: Estimates of Genetic Parameters and Genetic Change for Reproduction, Weight, and Wool Characteristics of Columbia Sheep

See End Notes on Heritability



Britch Wool Often Coarser & Longer



Should Vary By No More Than 2 Spin Counts

(2.89-3.14 Microns Depending on Grade)

Change or "Break" from Body Wool to Britch Wool Should Be Low on Britch



Lab Evaluation of Fleece Uniformity

Wool Lab Samples

- Shoulder
- Side
- Britch



Informal Evaluation of Staple Length Uniformity

Part Fleece to Examine Shoulder, Side, & Britch











Informal Evaluation Of Fiber Diameter Uniformity

Count Number of Crimps (Zigzags)/Inch on Staple Samples



Chart 5. Micron : Spin Count : Crimps/Inch Comparison

| Fiber Diameter | | | | | | |
|-------------------|------|------|------|------|------|------|
| (Microns) | 31.0 | 29.0 | 27.6 | 25.2 | 23.8 | 22.7 |
| Spin Count | 50 | 54 | 56 | 58 | 60 | 62 |
| Crimps/In. (CPI) | 7 | 10 | 11 | 14 | 16 | 18 |
| Staple Samples | | | | | | |



BELLY WOOL SCORES





SCORE 2



SCORE 3



BELLY WOOL

- Short, Kinky, and Often Weak
- Belongs Only on Underside as in SCORE 1 on Chart

SCORE 4



BELLY WOOL OUT OF PLACE



NOTE BELLY WOOL CAN BE CONCEALED BY CLOSE TRIMMING FOR SHOW FITTING

Belly Wool Encroachment



ECONOMIC IMPORTANCE OF FLEECE UNIFORMITY

FLEECE WITH UNACCEPTABLE VARIABILITY MUST BE SORTED PRIOR TO PROCESSING BY COMMERCIAL PROCESSORS and HAND SPINNERS and SORTING ADDS EXPENSE

UNIFORM FLEECES SPIN INTO UNIFORM YARN





Columbia Sheep Breed Standards Identify Unacceptable Variation in a Fleece As Disqualification for Registration

Sheep with Fleece Grade Variation That Exceeds Two Spin Counts Should NOT Be Registered



Variation in Fiber Diameter Between Side Wool and Britch Wool is 46% Heritable

Study Published 1992: Estimation of genetic parameters for wool fiber diameter measures

See End Notes on Heritability



FLEECE DENSITY

Compactness of Fleece Determined by # of Wool Fibers/Unit Area of Skin





FIBER NUMBERS

- Determined Before Birth
- Influenced by Prenatal
 Nutrition
- Most Dense on Sides and Shoulders
- Diminishes with Age

ESTIMATING FLEECE DENSITY INFORMALLY COMPARE PENETRATION OF CONTAMINATION



Fleeces from Two Different Sheep Raised Together

Note Deeper Penetration of Dirt in Looser Fleece on Left

ESTIMATING FLEECE DENSITY ON SHEARING FLOOR







Dense Fleece Holding Together As Unit During Shearing



ECONOMIC IMPORTANCE OF FLEECE DENSITY

DENSE FLEECES RESIST CONTAMINATION AND YIELD CLEANER WOOL MORE VALUABLE TO MILLS AND HAND SPINNERS

FLEECE WEIGHT DETERMINED BY FLEECE DENSITY AND STAPLE LENGTH and

Fleece Weight X Price Per Pound = Wool Check





Columbia Sheep Breed Standards Identify a Loose Fleece, Lacking Density, as Disqualification for Registration

Sheep with Fleeces Lacking Density Should NOT Be Registered

NOTE: Although Columbia Breed Standards of Excellence do not quantify *Fleece Density*, they specify that Columbia ewes should shear a fleece of at least 12 pounds. This requirement addresses Fleece Density indirectly.



Fleece Density is 46% Heritable

Study Published 1984: Heritability estimates of wool follicle traits in sheep skin

See End Notes on Heritability



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REFERS TO ANY COLORED WOOL FIBERS WITHIN THE FLEECE

Economic Importance of Coloration

- COLORED FLEECES CAN BE MARKETED TO HAND-SPINNERS
- WOOL WITH COLORED FIBERS IS DISCOUNTED BY COMMERCIAL WOOL BUYERS
- WHITE WOOL FIBERS ABSORB DYE PREDICTABLY; COLORED FIBERS DO NOT
- 2-3 COLORED FIBERS/SQ. YD. FABRIC CALLS FOR REJECTION
- NATURAL COLORED AND SPOTTED SHEEP SHOULD BE SEPARATED AND SHORN AFTER WHITE SHEEP TO AVOID COLORED FIBER CONTAMINATION OF WHITE FLEECES FROM SHEARING FLOOR



Columbia Sheep Breed Standards Identify Colored Wool as a Disqualification for Registration

Sheep With Colored Wool Should NOT* Be Registered

* In 2019 CSBA Members Voted to Incorporate Colored Sheep Into the Columbia Sheep Registry. The Disqualification for Colored Wool Continues to Apply to Those Sheep that Represent Traditional Breed Standards and are Not Registered as Natural Colored



Colored Wool Fibers are 35% Heritable

Study Published 2016: Genetic parameters of objectionable fibers and of their associations with fleece traits in Corriedale sheep

See End Notes on Heritability



IMPURITIES

POSSESS AIR-FILLED CORE OR MEDULLA WITHIN FIBER

- HAIR
- KEMP

MEDULLATED HAIR AKA: Gare, Med-Fiber, Heterotype Fiber

Medullated Hair Fiber

Note: Lack of Crimp & Greater Fiber Diameter Compared to Finer Wool Fibers

Wool Fibers

UNDESIRABLE HAIR







KEMP

- Medulla <u>></u> 60% of Fiber
 Diameter
- Short & Coarse
- Brittle
- Often Chalky White
- Shed Seasonally
- Often Lies Loose in Fleece

Black and White of Above Photo Clarifies Kemp Fiber

Kemp/Wool/Face Hair Comparison





Economic Importance of Fleece Impurities

- Inconsistent Dyeing Properties
- Contribute to Prickle Factor
- Reduce Value and Appearance of Finer Fabrics and Garments

Kemp: Disqualification or Requirement?

Required in Some Sheep Breeds

- Sheep Bred for Production of Carpet Wool
- Sheep that Provide Wool for Harris Tweeds



Columbia Sheep Breed Standards Identify Fleece Impurities as a Disqualification for Registration

Sheep with Medullated Fibers in Fleece— Hair or Kemp—Should NOT be Registered

- Sheep w/Fleece Grade < 28 Microns Less Likely to have Medullated Fibers.
- Impurities Should be Distinguished From Hair Belonging on Face and Legs and from Halo Hair on Lambs



Halo Hair on Newborn



Medullated Fibers are 37% Heritable Kemp Fibers Are 63% Heritable

Study Published 2016: Genetic parameters of objectionable fibers and of their associations with fleece traits in Corriedale sheep

See End Notes on Heritability



SUMMARY OF WOOL-RELATED DISQUALIFICATIONS

- Wool Blindness
- Inadequate Face Cover
- Fleece Deviations
 - Fiber Grade
 - Staple Length
 - Unevenness
 - Lack of Density
 - Coloration* See Previous Qualification
 - Impurities

