CASHMERE, MOHAIR & WOOL
FIBER STRUCTURE & BLENDING OPTIONS

Presented by Wini Labrecque
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CASHMERE
Photo courtesy June Cashmere

MOHAIR
Photo courtesy of Woolshed1

WOOL
Photo from Wikipedia
PROPERTIES OF FIBER

• Fiber Diameter (micron)
• Scale Height/Frequency/Pattern
• Medullation/Kemp/Guard Hair
• Staple Length/Style
• Natural Impurities
• Yield
• Color
Micron or Micron Count (um)

- A micron is 1/25,400 of an inch and human hair averages 30 um
- Micron counts are used as a technical description of diameter for all fibers
- The lower the count, the finer the diameter of the fiber
- Average Fiber Diameter is documented as AFD
CASHMERE FIBER DIAMETERS

• Down fibers should have AFD of less than 18 microns with no down fiber above 28 microns. Down fibers are typically non-medullated showing little to no hollow core in electron microscopy.

• Outer Guard Hair is coarser and longer. Typically has an AFD of greater than 50 microns. This lends itself to processing through a fiber separator effectively as these stronger micron fibers are heavier and drop out easier in processing. These primary fibers are medullated (having a hollow core) which leads to stiffness in the fiber.
MOHAIR FIBER DIAMETERS

- Fiber AFD is typically evaluated and labeled on fineness according to Mohair Council of America
  Kid – Fine 20-30 micron
  Yearling – medium 30-34 micron
  Adult – Strong 34 – 39 micron
  subgrades exist within each category (superfine, fine, good)

- Kemp and Heterotype Hair Fiber are coarser, primary fibers
  Kemp is typically shorter in length with AFD of greater than 50 microns.
  Heterotype hair can vary in micron but is stronger in micron than the finer existing secondaries
• Sheep are known by breed in part because of the wool they produce. Their wool should meet standards that have been documented over many years.

• Wool diameters range from fine wools in the low micron ranges of 12 – 18 all the way to coarse wools ranging in micron over 40-50.

• Some sheep are double coated with strong differences in micron in the 2 coats.
SCALE HEIGHT

Cashmere scale height rarely exceed 0.5 um

Mohair scale height averages around 0.4 um

Wool scale height rarely falls below 0.5 um
Usually height falls into the range of 0.6 to 1.1 um

Scale height affects the reflectivity of light and contributes to the brightness or lustre of the fiber.
SCALE FREQUENCY & PATTERN

Photo courtesy of National Geographic May 1988

CASHMERE  MOHAIR  MERINO WOOL
MEDULLATION/KEMP/
GUARD HAIR
KEMP AND GUARD HAIR

• A medullated fiber is an animal fiber that in its original state includes a medulla. A medulla in mammalian hair fibers is the more or less continuous cellular marrow inside the cortical layer in most medium and coarse fibers.

• By definition (ASTM), a kemp fiber is a medullated fiber in which the diameter of the medulla is 60% or more of the diameter of the fiber.

• Kemp is a term used to describe coarser fibers present within the coat. They are usually straight and oval in cross section, have a relatively large medulla, are usually the most visible fibers in the fleece and don’t accept dye well.

• Guard Hair is actually the protective coarse fiber covering a downy undercoat of a two coated animal. It is a term used across animal species when describing stronger micron fibers (usually over 30 micron) present originating from a primary follicle.
• Staple length is the measured length of a fiber from tip to base

• Fibers commonly referred to as down type fibers are usually very short and have very unstructured bundling – usually coming from a double coated animal

• Style refers to the crimp or curvature appearing in the downy undercoat
NATURAL IMPURITIES

Impurities lower the value the fleece -

- Tender fleece
- Lacking uniformity throughout fleece
- Color contaminations
- Staining from urine, soil or vegetable matter
- Grease, dirt, dust, sweat
- Felting
The yield is usually expressed in grams, ounces, pounds or kilograms.

Actual yield is the total clean, dehaired, dry uniform fiber free from all impurities produced annually.

**CASHMERE** – 20 – 45% of actual harvested fiber  3.5 – 6 oz down

**MOHAIR** – 60 – 80% of actual harvest  2 – 25 lbs dependent on kid/doe/buck

**SHEEP WOOL** – 50 – 100% of harvest, up to 25 lbs dependent on cleanliness/breed
Fiber color as a marketable characteristic can be an important criteria in placing value and price.

White fiber is the most desirable color in all species of fiber producing animals due to its ability to be dyed any color.

Cashmere – white, grays, browns

Mohair – white, tan, red, gray, black

Wool – dependent upon breed – all colors
CASHMERE

- Down Fiber Diameter – 12.5 - 19 micron
- Guard Hair Diameter - 20 micron and up
- Staple Length – 1.25 – 3 in
- Average Yield – 3.5 – 5.6 oz
- Scale Properties –
  Height 0.4um
  Frequency 6-8/100um
  Regular waved mosaic, Smooth, distant margins

Photo – Wini Labrecque

Microscopic photo – Wini L
MOHAIR

Fiber Diameter –
  kid - 20 - 30 micron
  yearling - 30 – 34 micron
  adult - 34 - 39 micron

Kemp Diameter - >50 micron

• Staple Length – 6 – 12 in
• Average Yield – 1.5 – 5 lbs

• Scale Properties –
  high frequency – 6-10um
  Low height 0.4 or less
  Kemp and Heterotype hairs are medullated
SHEEP WOOL

• Fiber Diameter –
  – 12.5 - 22 micron fine breeds
  all the way to 40+ breed dependent
• Staple Length  – 2.5 – 8 in
• Average Yield  – 2 - 20 lb
• Scale Properties –
  height 1 – 1.1
  frequency >9/100um

CSIRO photo

Milligans Gander Hill Farm photo

Csiro photo
Natural Fibers For Blending

- Angora Rabbit
- Bison
- Yak
- Silk
- Quiviut
- Camel
- Paco-Vicuna
- Alpaca (both huacaya and suri)
BLENDING POSSIBILITIES

Man Manufactured & Synthetic Fibers For Blending

• Lyocell/Tencel
• Bamboo/Rayon Bamboo
• Soy Silk
• Ingeo (Corn Protein)
• Milk
• SeaCell
• Rose Fiber
• Nylon
• Mylar (Angelina)
• Firestar
<table>
<thead>
<tr>
<th>BREED</th>
<th>FIBER DIAMETER (micron)</th>
<th>STAPLE LENGTH (inches)</th>
<th>AVERAGE YIELD</th>
<th>SCALE HEIGHT (microns)</th>
<th>SCALE FREQUENCY (microns)</th>
</tr>
</thead>
<tbody>
<tr>
<td>YAK</td>
<td>12 – 14</td>
<td>18 - 20</td>
<td>3.5 oz</td>
<td>0.4 or less</td>
<td>&gt;9/100</td>
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<tr>
<td>QIVIUT (MUSK OX)</td>
<td>12.5 - 22</td>
<td>3/4 - 2</td>
<td>2 lb</td>
<td>0.4</td>
<td>&gt;9/100</td>
</tr>
<tr>
<td>BISON</td>
<td>12 - 29</td>
<td>1/2 - 3</td>
<td>under study</td>
<td>under study</td>
<td>under study</td>
</tr>
<tr>
<td>CAMEL</td>
<td>16 - 20</td>
<td>0.5 - 2.5</td>
<td>7.7 – 15.4 lb</td>
<td>0.4</td>
<td>6-8/100</td>
</tr>
<tr>
<td>CASHMERE</td>
<td>12.5-18.5</td>
<td>1.25-3</td>
<td>3.5 – 5.6 oz</td>
<td>0.4</td>
<td>6-8/100</td>
</tr>
<tr>
<td>GUANACO</td>
<td>14 - 16</td>
<td>20 - 25</td>
<td>10.5 – 28 oz</td>
<td>0.4</td>
<td>&gt;9/100</td>
</tr>
<tr>
<td>LLAMA</td>
<td>19 - 38</td>
<td>4 - 8</td>
<td>4.4 - 11 lb</td>
<td>0.4</td>
<td>&lt;9/100</td>
</tr>
<tr>
<td>VICUNA</td>
<td>12 - 14</td>
<td>1</td>
<td>1.5 lb</td>
<td>unavailable</td>
<td>unavailable</td>
</tr>
<tr>
<td>MOHAIR</td>
<td>17 - 40</td>
<td>6 - 12</td>
<td>1.5 – 5 lb</td>
<td>0.6</td>
<td>6-8/100</td>
</tr>
<tr>
<td>MERINO SHEEP</td>
<td>13-22</td>
<td>2 - 5</td>
<td>14 - 25 lb</td>
<td>1-1.1</td>
<td>9-11/100</td>
</tr>
<tr>
<td>OPOSSUM</td>
<td>18 - 22</td>
<td>1/2 - 1</td>
<td>Unknown</td>
<td>very deep</td>
<td>unavailable</td>
</tr>
<tr>
<td>HUACAYA</td>
<td>18-28</td>
<td>4 - 8</td>
<td>3 – 12 lb</td>
<td>0.4</td>
<td>&gt; 9/100</td>
</tr>
<tr>
<td>SURI</td>
<td>18 - 36</td>
<td>6 - 10</td>
<td>3 – 4 lb</td>
<td>0.4</td>
<td>6.5/100</td>
</tr>
<tr>
<td>ANGORA RABBIT</td>
<td>10 - 16</td>
<td>3 - 7</td>
<td>1.8 – 2.6</td>
<td>rounded, smooth</td>
<td>10.6/100</td>
</tr>
</tbody>
</table>
REFERENCES

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THANK YOU!!!!