

Wool Grading

by
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Certain qualities such as fineness, length, color and appearance determine the end use and value of wool. Fineness—the fiber diameter, or grade, and its distribution—is one of the most important of these quality factors. Fineness largely determines whether the wool is used in a suit, sweater, blanket or in a pair of socks.

Grade

In general, grade refers to the average diameter or thickness of the fibers. Three systems of wool grading are commonly used in the United States: American or Blood system; the English or Spinning Count system; and the Micron system. All three systems are measures of average fiber diameter and can be related to each other (Table 1). In actual practice, they are used interchangeably.

The American or Blood System

The American system of grading wool was developed in the early 1800s when the native coarse-wooled sheep were being bred to fine-wooled Merino rams imported from Spain. It assumes that the offspring of the cross would have fleeces which were intermediate in fineness between the two parents. The wool grade is defined as the percentage of Merino blood carried by the sheep that typically would produce a particular fineness of wool. The grade or fiber diameter came to be expressed as fine, $\frac{1}{2}$ -blood, $\frac{3}{8}$ -blood, $\frac{1}{4}$ -blood, low $\frac{1}{4}$ -blood, common and

braided (Figure 1). Today, these terms are not as exact as the trade would prefer, and the spread within a grade is too broad to suit the purposes of wool processors.

The English or Spinning Count System

The English system of grading wool provides narrower ranges and a more exact nomenclature than the American system. It uses a measurement called the “spinning count” and is based on the number of “hanks” of yarn which could be spun from one pound of clean wool on the equipment available at the time the system was developed. As wool becomes finer, more hanks or yards of yarn can be spun from a pound of clean wool and the spinning count becomes larger. In theory, one pound of clean 62s spinning count wool could produce 62 hanks or 104,160 feet of yarn. (A hank of yarn is 560 yards in length.) Although wool is seldom spun to its maximum count, there is a limit to the number of fibers which will hold together in yarn. The English or Spinning Count system of grading wool provides a numerical designation of fineness. English or Spinning Count grades of wool commonly used in the United States today are: 80s, 70s, 64s, 62s, 60s, 58s, 56s, 54s, 50s, 48s, 46s, 44s, 40s, and 36s (Figure 2).

The Micron System

Increased emphasis on an exact and highly descriptive method of describing wool grade has produced a measuring system in which indi-

Table 1. Relationship Between the American, English and Micron Systems of Grading Wool				
Type of Wool	American or Blood Grade	English or Spinning Count Grade	Micron (range in avg. fiber diameter)	Variability Limit for Standard Deviation Maximum (microns)
Fine	Fine	Finer than 80s	Under 17.70	3.59
Fine	Fine	80s	17.7019.14	4.09
Fine	Fine	70s	19.1520.59	4.59
Fine	Fine	64s	20.6022.04	5.19
Medium	1/2 Blood	62s	22.0523.49	5.89
Medium	1/2 Blood	60s	23.5024.94	6.49
Medium	3/8 Blood	58s	24.9526.39	7.09
Medium	3/8 Blood	56s	26.4027.84	7.59
Medium	1/4 Blood	54s	27.8529.29	8.19
Medium	1/4 Blood	50s	29.3030.99	8.69
Coarse	Low 1/4 Blood	48s	31.0032.69	9.09
Coarse	Low 1/4 Blood	46s	32.7034.39	9.59
Coarse	Common	44s	34.4036.19	10.09
Very Coarse	Braid	40s	36.2038.09	10.69
Very Coarse	Braid	36s	38.1040.20	11.19
Very Coarse	Braid	Coarser than 36s	Over 40.20	

vidual fibers are accurately measured. The unit of measure is the micron, which is one millionth of a meter or 1/25,000 of an inch. Fineness is expressed as the mean fiber diameter. Eventually, this system will become the standard for describing wool in the United States.

Distribution of Grade or Fiber Diameter

The use and value of a fleece or lot of wool is affected almost as much by the distribution of the individual fiber diameters as the average fiber di-

ameter or grade. The more uniform the individual fibers are in diameter, the more valuable.

An average fiber diameter or grade implies nothing about its distribution within a given quantity of wool. For instance, a lot of wool may contain 50 percent of its fibers at 35 microns and the other 50 percent at 15 microns and still have the same average fiber diameter—25 microns—as a lot of wool with only 1 percent of its fibers at these extremes. A measure of the amount of variation in fiber diameter within a given lot or

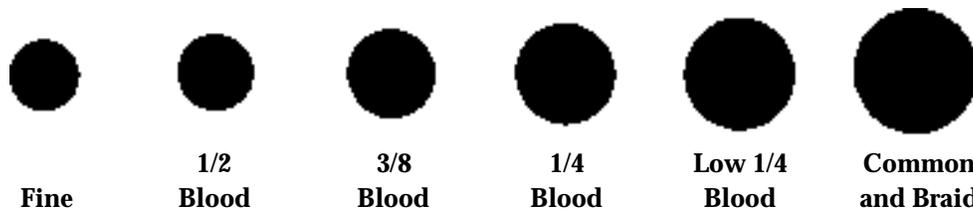


Figure 1. Relative diameters of the American Wool Grades (x 500 magnification).



Figure 2. Relative diameters of some of the English or Spinning Count wool grades (x 500 magnification).

fleece has been added as a quality factor to more accurately describe the wool being evaluated.

Standard Deviation

The measure most commonly used to describe the distribution of measurements about an average is the standard deviation. The average fiber diameter plus or minus the standard deviation will encompass roughly two-thirds of all the individual fiber diameters. The more variable the wool is, the larger the standard deviation and the lower the quality. The ASTM (formerly the American Society for Testing Materials) has set up standards for the fiber diameter and variability of the various grades of wool (Table 1). This standard is based on the average fiber diameter of a sample and the actual distribution of fibers within that fineness range. It prescribes a certain distributional requirement—a maximum allowable standard deviation—to meet standard specifications and makes allowances for distributional differences of given grades. If a lot or sample of wool fails to meet the distributional characteristics of that grade, i.e. has a larger standard deviation than that allowed for that grade, the wool is lowered to the next spinning count grade. In short, variation is expressed in terms of the standard deviation and wools with greater variability than allowable for a particular grade are automatically placed in the next lower grade.

Coefficient of Variation

Another useful concept in describing the uniformity of fiber diameter within a given quantity of wool is the coefficient of variability. It expresses the variation as a percentage of the average and is usually used when one wishes to compare the variances between two or more lots of wool with differing average diameters. A standard, based on the coefficient of variability, has been derived in recent years for field work with wool. This standard is shown in Table 3.

Coefficient of Variation	Standard of Uniformity
Less than 21.0%	Excellent
21.0% to 27.0%	Average
Over 27.0%	Poor

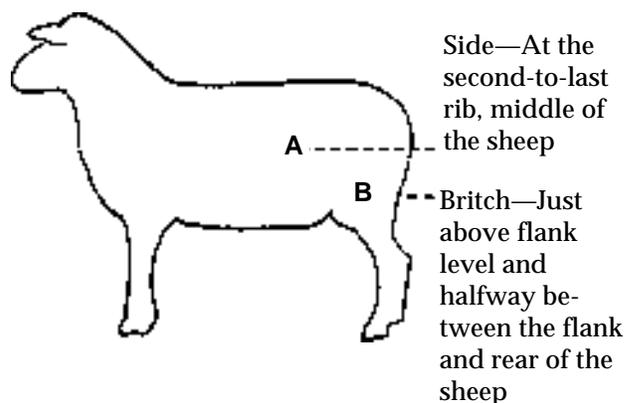


Figure 3, Parts of the sheep from which to take samples for Micron testing

The Micron Test

Although an experienced wool grader can usually estimate wool grade fairly accurately, there are exceptions. Even the most experienced wool graders will be wrong some of the time. Sooner or later most wool will be micron tested, either by the producer, the buyer or at the textile mill. A micron test may not always tell the producer what he wants to hear, but it will tell the true story.

Taking the Sample

The normal method of obtaining a sample for micron testing is taking a core test sample. In fact, the cores drawn for clean yield or shrinkage determination are adequate and can also be used to estimate fineness and variability of a lot of wool. For selection purposes, micron tests can be run on samples taken from individual sheep. The most economic way is to cut two square inches of wool from the area marked "A" in Figure 3. Remember, this measurement will not indicate the amount of fiber diameter variation between the individual's side and britch, the area marked "B" in Figure 3.

The degree of this variation, however, is very important. It should be assessed visually. In some situations producers may also want to have a britch sample micron tested. Micron testing both a side and a britch sample should provide a general overall picture of the fleece grade.

Laboratory Analysis

Once a representative sample has been taken it should be packaged and sent to a wool testing laboratory where the average fiber diameter, the standard deviation and/or coefficient of variation can be determined. Assistance in insuring that a representative sample is taken and names and

addresses of laboratories where this analysis is performed, can be obtained from the State Extension Sheep Specialist, Rodney Kott, 994-3414, or the Montana Wool Laboratory, 994-2100.

One more point

Micron testing a lot of wool that is extremely variable will be of little value since the standard deviation will be so large that the test results will be almost impossible to interpret. Wool pools, in particular, will usually fit this category since they often are a collection point for many different types of wool.

Conclusions

The importance of grade or fiber diameter and its distribution within a given lot or fleece of wool in the textile industry cannot be over-emphasized. Research has shown fiber diameter to be the most significant feature determining the physical characteristics of the finished fabric. Manufacturing properties, such as spinning limits, yarn regularity and softness of the finished garment, are directly dependent upon fiber diameter.