Proceedings 5th World Rabbit Congress, 25-30 July 1992, Corvallis – USA, 1623-1628

EVALUATION OF THE QUALITY OF ANGORA RABBIT WOOL

Dr. W. Schlolaut

Neu-Ulrichstein, 6313 Homberg/Ohm 1, Germany

Summary

Various quality parameters for Angora rabbit wool are examined with regard to their technological importance and the degree to which they can be rationalized. The current practice of pricing wool on the basis of length grades cannot be standardized and is considerably marred by subjective errors. Moreover, the great variation in hair length in the fleece deprives it of an objective foundation. For example, according to the current grading scheme, the German Industrial Standard (DIN) requires that grade I contain only hairs that are 6 cm or more. Actually, however, only 65.8% of hairs are over 6 cm long, with the proportion of those between 6.0-6.5 cm ranging from 39.0-80.3%. Since an objective determination of average hair length is too labor-intensive, it is suggested that grading be based on the proportion of hair in a sample which corresponds to the given norm. The proportion of coarse hair is measured both numerically and by weight. The latter method can lead to a substantial number of subjective errors, however. Therefore, it is suggested that the numerical proportion be used as the sole criterion.

Introduction

Considering a world trade volume for Angora rabbit wool of more than 10,000 tons per year, it is surprising that quality - as the foundation for price formation - is still evaluated subjectively, i.e. according to unverifiable market estimates. Although grading standards in different countries are all based on wool length (Table 1), concrete data are generally missing on how these subjective classifications can be objectively checked or which classification criteria are involved (e.g. average hair length, minimal and maximal tolerance values, etc.). Where such data do exist, such as the Chinese standard given in Table 1, the German DIN 60 407, or the requirements of a German processor for a coarse-hair content of at least 70% for Angora rabbit wool, given norms do not correspond to the actual situation.

The problem with hair length as the basis for wool grading is that the fleece of Angora rabbits contains a greater variety of lengths than does that of sheep. This is partly because the various hair types present in the fleece grow at different rates, with wool hairs growing more slowly than coarse-wool and coarse hairs (see Figure 1). An additional problem relates to shearing, which harvests hair of different ages and correspondingly different lengths. In the German Angora rabbit population, the growth phase for hair is longer than the usual 13 week shearing interval. Therefore, one hair may be cut several times. The length of

long hair (i.e. that has never been shorn) also depends upon whether the hair follicle is activated at the beginning or end of the shearing interval. Therefore, within a random fleece sample with an average length of 7.5 cm, hair lengths may fluctuate between 0.8 cm and 14.8 cm.

Table 1. Grading of Angora rabbit wool in different countries.

Grade	Hair Length in Microns			
	Germany	People's Republic of China	France	
Super	-	-	62	-
I	60	56	50	60 1a coarse 1b wooly
II	30-59	46	37	30-59
III	30	36	25	30 no Angora rabbit wool
IV	-	25		
Felted clean	i s s o r t e d			not sorted
Felted dirty	i s s o r t e d			not sorted

Lack of objectivity in evaluating the quality of Angora rabbit wool has resulted in quality requirements of the wool market or the textile industry that are determined to a considerable extent by demand, and not by objective (i.e. verifiable) criteria. For example, according to DIN, grade I wool should be over 6 cm long. In the 5 station trials in the Federal Republic of Germany (i.e. among animals of a single population) the proportion of hairs over 6 cm long in this grade varied between 65-89%.

However, the problem of evaluating Angora rabbit wool quality is not only one of objectively assessing length. It is also questionable whether longer hair should be given a higher classification ("grade I" = "super", etc.). Such grading is a carryover from the time when Angora rabbit wool was used exclusively for the production of outer wear. During the past two decades, however, refinements in yarn production have increased the demand for shorter wool (about 3-4 cm), since long hair is unsuitable for fine yarns.

Measures for the Objectification of Quality Evaluations

To remedy the present situation, the following requirements are proposed:

Grading should be based on objectively justified, i.e. verifiable, criteria;
If it is carried out on a subjective basis, a high degree of exactness must be ensured;
Only the technical requirements of the various processing methods should be considered.

The following possibilities currently exist for achieving these objectives:

Hair length

Grading based on average hair length. The most exact calculation of average hair length is performed with the Zweigle "pile stretcher". By this method, 1 g of Angora rabbit wool is subdivided by length into fractions, varying in length by 4 or 5 mm each. The proportion of weight of the various fractions is then used to calculate average hair length. The distribution of lengths within a wool sample determines its evenness, as shown in the "pile diagram" (Figure 2). The disadvantage of this method is the time required, which amounts to about 2.5 hours. This process is, therefore, not appropriate for the routine checking of subjective quality assessments.

Proportional weight of hairs conforming to a particular grade. Since the determination of average hair length is so laborious, it is suggested that the criterion should be the proportional weight of hairs which corresponds to a particular grade norm. For wool of the present "grade I" category, for example, this would require that at least 50% of the hairs in a random sample be longer than 6 cm. This could then be verified in less than 10 minutes, merely by using the pile stretcher.

Proportion of coarse hair

Hairs having several medullae are characterized as coarse hairs, whereas wool hairs possess only one (single medullation), if at all. An intermediate form, the so-called "coarse-wool" hair, is sometimes distinguished (Figure 1). Differentiating hair types into wool hairs with one medulla and coarse hairs with several facilitates the determination of their numerical proportions. This is done by means of a lanameter or an electronic image analyzer.

The importance of the proportion of coarse hair depends on the final product. For outer wear, a higher coarse-hair proportion is desired to achieve a structured, fleecy effect. A greater difference in length between coarse and wool hair enhances this effect. In contrast, a lower proportion of coarse hair is desired for producing underwear, fine yarn, and cloth. The relatively thick coarse hairs reduce the comfort of underwear (skin irritation). Coarse hairs do not bind as well in fine yarns, which reduces the tenacity of the thread. In cloth manufacture, coarse hair differs from wool hair in light refraction and reaction to dyes, causing undesirable textured effects.

The following two methods are currently in use for determining the coarse-hair content:

Determining the numerical proportion of hairs with multiple medullation. The lanameter or electronic image analyzer is used to count the number of hairs having single and multiple medullae. A random sample consists of at least 300 hairs. This takes about 3-4 hours with a lanameter and 30-40 minutes using an image analyzer.

Proportional weight of hair with multiple medullation. This system is practiced in France and consists of pulling out and weighing the coarse hairs protruding from the wool. Weight is given as percentage of total weight of the sample. Since the diameter of coarse hairs is several times that of wool hairs, the proportion of total weight is larger than their proportion of the numerical count (Table 2). This difference in measuring methods has often caused an overestimation of the proportion of coarse hair in French animals. Another practical problem with this method is that coarse hairs can be grasped only if they are substantially longer than the wool hairs. While this is the case with French Angora rabbits, it does not apply for German animals. For these reasons, this does not seem to be a suitable system of determining the proportion of coarse hair. One must also take into consideration that errors in measurement increase with higher yields. Therefore, numerical determination is recommended as the standard method.

Table 2. Influence of measuring method on coarse hair proportion of the French and German Angora rabbit.

Method	French	German
Weight-proportion %	7.22	2.96
Number-proportion %	2.46	1.82

Since plucking the wool leaves the tips of coarse hair intact, this characteristic also shows which wool collection method was used. The French recommend, for example, that at least 60% of coarse hairs should exhibit intact tips.

Felt

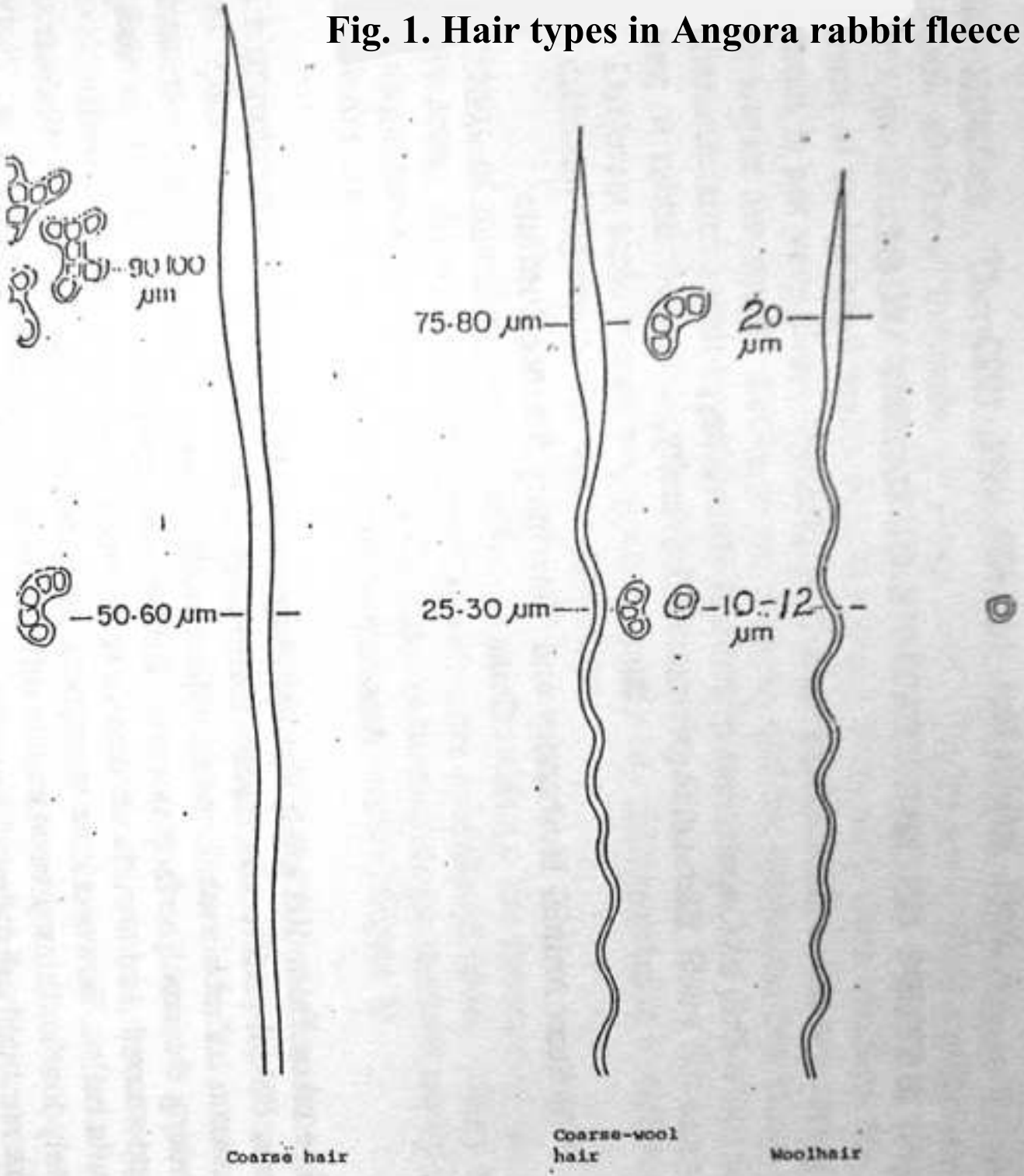
The proportion of felt in wool is not difficult to determine and has declined considerably since the beginning of station trials for Angora rabbits in Germany. This would indicate hereditary influences, although the cause of differences in felt formation is not known. Moreover, genotype-environment interactions exist as well, as may be seen by comparing the French and German Angora rabbit populations. For example, French animals had a felt

proportion of 10% if the wool had been harvested by shearing. Plucking reduced the felt to 4%. Although the 1.5% coarse hair proportion of the German population was 25% lower than the 2% for French animals, the felt proportion of German animals was only 1% (Table 3). If the felt proportion is to be used as a selection criterion, only the proportion of clean felt can be considered, of course.

Table 3. Influence of harvesting on hair yield and quality (French Angora).

Item	Plucked	Shorn
Hair yield, g	158.7	127.4
1st grade, %	69.5	61.2
Felt, %	4.4	10.2
Average hair length, cm	6.8	6.2
Coarse hair proportion (Accord. number), %	2.5	1.4

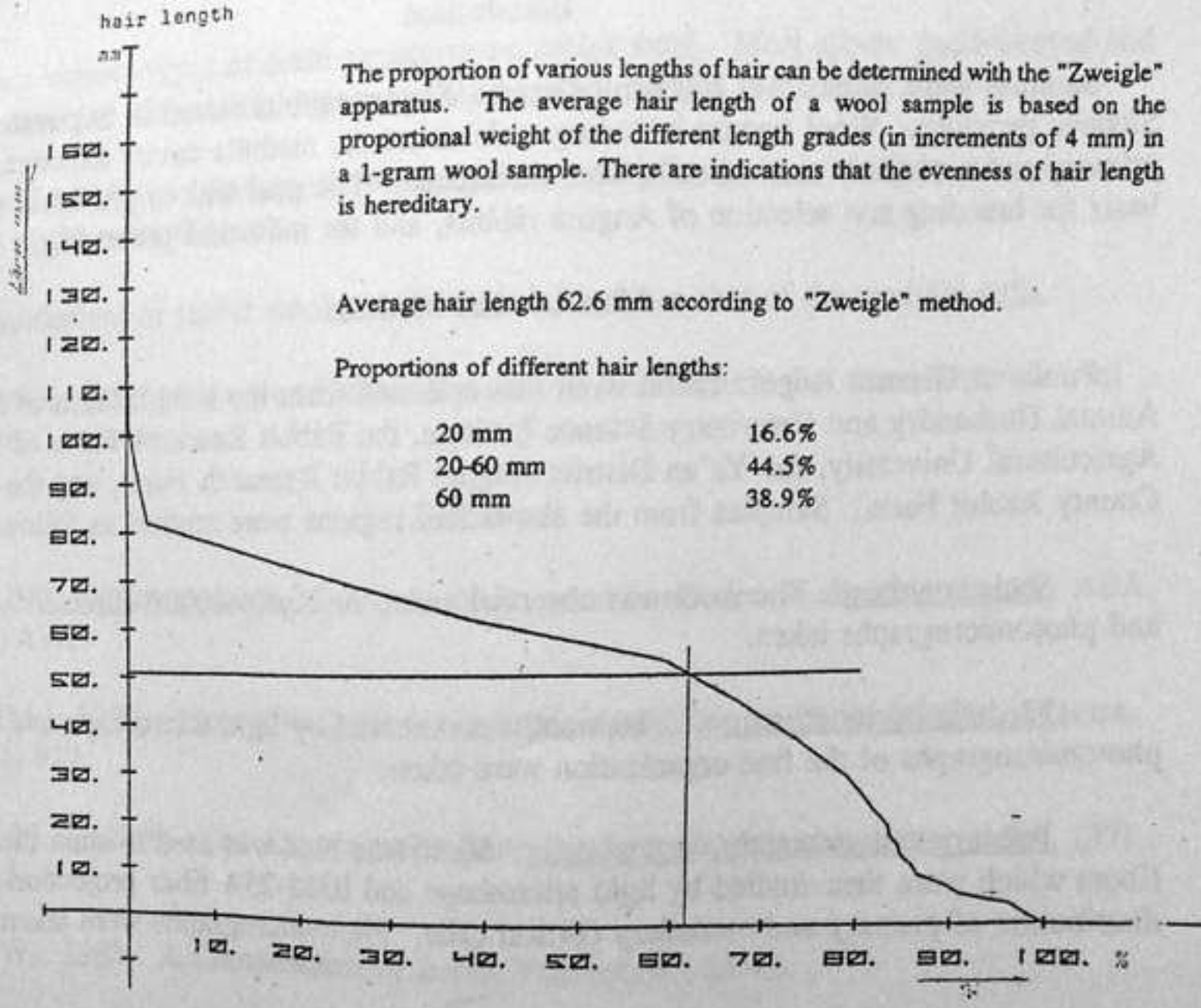
Fig. 1. Hair types in Angora rabbit fleece



Rougeot u. Thebault, 1985.

Medullae are seen in wool hairs only during the first phase of growth. They influence light refraction during dyeing, reduce tensile strength, and increase the ability to preserve body heat.

Fig. 2. Variation in hair length distribution in fleece of the Angora rabbit.



The proportion of various lengths of hair can be determined with the "Zweigle" apparatus. The average hair length of a wool sample is based on the proportional weight of the different length grades (in increments of 4 mm) in a 1-gram wool sample. There are indications that the evenness of hair length is hereditary.

Average hair length 62.6 mm according to "Zweigle" method.

Proportions of different hair lengths:

20 mm	16.6%
20-60 mm	44.5%
60 mm	38.9%