



Understanding Fleece Judging

Revision of notes that were first used as the basis for a Seminar organised by the Waikato Branch of the Black and Coloured Sheep Breeders' Association of New Zealand (BCSBANZ) on 2 March 1991. Original and revised notes prepared by Roland Sumner, retired scientist researching aspects of wool production and previously a wool judge for the BCSBANZ. Revision undertaken January 2017.

Why do we need to judge fleeces?

Wool as shorn from sheep is essentially valueless until it is converted into a useable product such as yarn, a felt or other product. As fleeces are a natural product no two fleeces are the same, despite their being combined together to make a particular product. Fleece judging is a systematic evaluation of the main attributes that affect a group of fleeces as to their suitability to be converted to a particular product. The 'winner' of a fleece competition is the fleece with the fewest 'faults' and as such it is the fleece best suited to produce the product that it is being judged to produce. In most fleece competitions this is a spun yarn.

Broadly speaking, white wool is the principal raw product for the commercial wool industry and pigmented (coloured) wool is the principal raw product for the handcraft wool industry. Both the commercial and handcraft industries use the same basic methods to convert fleece wool to a range of end-products. Owing to the size of the amount of wool in a commercial processing batch, commercial plants are limited in the adjustments they can make to their machinery during processing. Handcraft people, on the other hand, tend to work with single fleeces, or often parts of a fleece, and can adjust aspects of their procedures to the small amount of wool they are processing. Consequently while white and pigmented fleeces are both judged according to similar broad principals, different emphasis is placed on some characteristics when judging wool for commercial use or fleeces for handcraft use.

Until the relatively recent advent of objective measure procedures for some wool attributes, our descriptions of each attribute were all subjective. Being subjective, the relative ranking of each attribute can differ between judges and between exhibitors and judges. Even today there are still some characteristics that are assessed in fleece judging competitions that cannot be measured objectively. When objective measurements of characteristics that can be measured objectively are not available, judges must again revert to subjective assessment based on their wool handling experience.

In New Zealand the wool industry, in association with the Royal Agricultural Society of New Zealand (RASNZ) and the Black and Coloured Sheep Breeders' Association of New Zealand (BCSBANZ) have developed a set of judging criteria for their respective fleece competitions to provide a standardisation of judging standards throughout the country. The judging criteria are outlined on a 'fleece judging' card on which is recorded a numerical evaluation for each of the assessed or measured attributes.

Fleece judging cards

Fleeces submitted to fleece judging competitions under the auspices of either the RASNZ or the BCSBANZ should be displayed following completion of the competition, along with a 'completed' judging card. It is the responsibility of the steward managing the event that the 'total' points awarded have been checked and are correct. The cards enable the exhibitor to see a documented record of how the placings in the competition were achieved. A copy of the Wool Judging Card for fleece competitions run under the auspices of the

RASNZ is shown in Figure 1, and a Wool Judging Card for fleece competitions run under the auspices of the BCSBANZ is shown in Figure 2.

Figure 1: Fleece judging card approved for use in fleece competitions run under the auspices of the Royal Agricultural Society of New Zealand (RASNZ). Suitable for 'commercial' white fleeces.



POINTS AWARDED		MAXIMUM POINTS	POINTS AWARDED	OPTIMUM FLEECE CHARACTERISTICS
<div>  <div> The Royal Agricultural Society of N.Z. Inc. WOOL JUDGING CARD </div> </div>				
<div> <div>CLASS..... BREED..... EXHIBITOR.....</div> <div>A & P ASSN</div> </div>				
1. CLEAN FLEECE WEIGHT		35	.....	Points allocated on a clean scoured basis based on a washing yield.
2. COLOUR		10	.....	Penalty is in proportion to the degree of unscourable colour.
3. SOUNDNESS		10	.....	Any penalty is in proportion to the degree of tenderness or break.
4. STAPLE LENGTH			.....
(A) Optimum		10	.....	The optimum should be desired length for fibre diameter. Short and/or overgrown fleeces incur penalty.
(B) Eveness		5	.....	Over entire fleece with particular emphasis on adequacy of skirting.
5. CRIMP		10	.....	The optimum should be even and well defined crimp throughout the staple and fleece and characteristic of the breed.
6. STAPLE FORMATION		10	.....	The optimum should be typical of the breed, clearly defined, with even fibre length within the staple.
7. HANDLE & LUSTRE/BRIGHTNESS		5	.....	The optimum handle and brightness or lustre should be characteristic of the breed.
8. FREEDOM FROM FAULT		5	.....	Freedom from hair, kemp, pigmentation, skirts, vegetable matter, unevenness of fibre diameter, or any other faults detrimental to the breed or processing.
TOTAL		100	.....
<div> GREASY WEIGHT.....kg YIELD% </div>				
<div> CLEAN FLEECE WEIGHT.....kg MEAN FIBRE DIAMETER .....MICRONS </div>				

Figure 2: Fleece judging card approved for use in fleece competitions run under the auspices of the Black and Coloured Sheep Breeders' Association of New Zealand (BCSBANZ). Suitable for handcraft fleeces.

		BLACK & COLOURED SHEEP BREEDERS ASSOCIATION OF N.Z. INC.	
		..... SHOW	
		at..... on	
		Class	
Catalogue No		Exhibitor	
	Maximum points	Points awarded	
1. EVENNESS of:			Variation and degree of intensity of pigmentation shall not be considered a fault.
Quality over fleece	10	.....
Staple length over fleece	10	.....
2. SOUNDNESS	10	.....	Commensurate with handcraft requirement. Penalty in proportion to degree of tenderness or break.
3. CRIMP	10	.....	Even and well defined throughout the staple and fleece and characteristic of breed type.
4. STAPLE FORMATION	10	.....	Typical of breed type, clearly defined and even.
5. STAPLE LENGTH	5	.....	Commensurate with handcraft requirement. Short or overgrown fleeces incur penalty.
6. HANDLE	10	.....	Characteristic of breed type and commensurate with handcraft requirements.
7. FREEDOM FROM FAULT	10	.....	Freedom from kemp, vegetable matter, mud, skirts or any other hereditary or acquired faults.
8. CLEAN FLEECE WEIGHT	25	.....	Points allocated on clean fleece weight.
	100		
Greasy fleece weight (kg)		Estimated mean fibre diameter.....microns	
Clean fleece weight (kg)		Yield (%).....	
Steward		(Revised 1999)	

Wool growth

Individual fleeces differ in their overall appearance and feel. Through their experience working with wool, wool judges have developed an appreciation of the inherent range of the characteristics that are important in converting a greasy fleece into different end-products, within different breeds of sheep. To enable exhibitors to understand why judges have ranked fleeces in a particular order it is important that they appreciate some of the basic aspects of wool growth to explain the underlying reason for variations within and between individual fleeces.

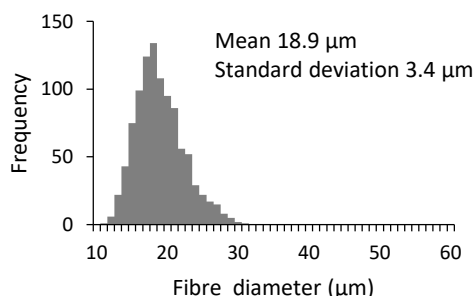
Wool is an inert fibre composed largely of protein. It has a natural seasonal growth cycle that is responsive to light, nutrition, pregnancy and lactation. The growth cycle in Fine (Merino) wool type sheep is less seasonal than that in Coarse (British long-wool) wool type sheep, in which fleeces can grow two to three times faster during the summer than during the winter. In growing faster the fibres are also coarser and the crimps (natural wave) along the staple are larger. Wool, like human hair, changes with age being finest in young sheep.

Fibre diameter and its related characteristics, is the attribute most strongly related to the type of product that can be produced from the fleece or commercial lot of wool. A greater length of yarn with a softer handle results from spinning finer wool than from spinning coarser wool.

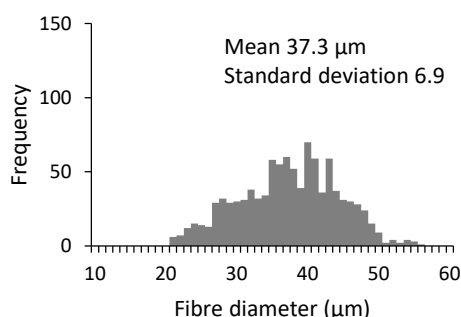
The diameter of fibres in an individual fleece varies throughout the fleece and along individual fibres. Figure 3 shows the variation in the fibre diameter of snippets of individual fibres within a sample of wool taken from the mid-side region of a Merino (Fine wool) fleece (a) and a Romney (Coarse wool) fleece (b). These graphs clearly show the wide spread in fibre diameter within a sample taken from one site of a sheep's body. Thus although a particular fleece is classified as having a specific diameter each fleece contains fine and coarse fibres such that the quoted fibre diameter value is a mean (or average) fibre diameter. The standard deviation is a measure of the degree of 'spread' of fibre diameters within the sample. Mean fibre diameter also varies over the body with wool on the neck being the finest and wool on the britch (outside of the hind legs) being the coarsest. While changes of a micron or two in fine (Merino) fleeces have a significant effect on machine spinning performance this degree of variability is of lesser significance in coarse (Romney) fleeces. A particularly wide spread of fibre diameter within a sample can indicate that the sheep may have experienced a period of poor nutrition while the fleece is growing. A period of undernutrition, particularly during the winter, can cause a greater than normal reduction in fibre diameter along the fibre resulting in a reduction in the tensile strength of the staple. Such a weakness is associated with a weaker yarn.

Figure 3: Fibre diameter profile of 1,000 fibres within a Merino fleece (a) and a Romney fleece (b).

(a) Merino fleece



(b) Romney fleece



coarse wool to other uses

- Unshorn, or woolly, hogget fleeces have a brittle tip to the staple which may break off during processing

Deciding on the class in which to enter a show fleece

To enable fleeces to be compared on a 'level playing field' they must be grouped according to their suitability for similar end-uses. This grouping is normally achieved through the 'show' classes which are based on the age of the sheep which grew the fleece, and its breed. The breed in turn related to its mean fibre diameter.

- Fleeces of young sheep are finer and softer than the fleeces of older sheep
- Fine wool is better suited to clothing use and

If a judge considers that a fleece has been entered into the 'wrong' class it is normal practice for the judge to have the right to transfer the fleece to what he/she considers the correct class.

How fine is the fleece?

Since early times the fineness of wool has been recognised as the most important characteristic affecting processing performance, that is the length of yarn that can be spun from a parcel of loose fibres. As a consequence several descriptive systems were developed in different parts of the world to assess this attribute. In recent years these subjectively assessed descriptive systems have been replaced with an objective measurement of fibre diameter for wool traded internationally. These measurements are derived using scientific instruments operated according to strict sampling and measurement procedures. Extensive research has shown a relationship between mean fibre diameter, the size of the fibre crimp (waves along the fibre) and the degree of softness of the loose wool. Fine wool has a smaller crimp size and a softer handle than coarse wool. With experience wool handlers gain an appreciation of these relationships and can ascribe an 'assessed' mean fibre diameter to small lots of wool, such as an individual fleece. It must be emphasised that this value is 'assessed' not 'measured'. The associated relationships between mean fibre diameter, crimp size and handle are not strong. Consequently, with nature inherently being variable, the measured mean fibre diameter of small lots of wool, such as an individual fleece, may be 'out of line' with respect to its apparent crimp size and handle. This is of no consequence in large commercial parcels of wool where these anomalies are 'diluted out', but is of major importance to individual fleeces in handcraft use where the associated characteristics are more important to the end-product than the measured mean fibre diameter.

Other characteristics associated with mean fibre diameter include staple length and grease content (also called washing yield) with coarse wool being longer and containing less grease than fine wool.

How much clean wool is there in the fleece?

With fleeces varying in the amount of grease (consists of wax and suint (sweat)) and dirt that they contain, which has no commercial value, it is important that the 'useable' amount of wool in a fleece is evaluated on the basis of an assessment of the amount of clean wool in the fleece, not the weight of the presented greasy fleece. Clean wool is what is left after the 'grease' has been removed from the fleece by washing. A subjective assessment of the amount of clean wool in a particular fleece is always a bone of contention between exhibitors and judges!

Bellies and skirtings (dirty edge pieces around the edge of the fleece) MUST be removed from a fleece before judging as they are unsuitable for the 'primary end-use' of the fleece wool. On economic grounds the more wool which is suitable for use in the primary end-use of the fleece, the better the returns to the wool grower. This is of particular relevance to white fleeces in RASNZ fleece competitions (Figure 1) where 35% of the points are allocated for fleece weight whereas in the case of judging handcraft fleeces in BCSBANZ fleece competitions (Figure 2) only 25% of the points are allocated for fleece weight. In the case of handcraft wools more emphasis is placed on the 'feel' of the fleece.

The level of skirting (removal of dirty edge pieces from around the edge of the fleece) is a delicate balancing act for the exhibitor. If not enough 'second grade' wool is removed from the fleece the exhibitor may gain more points for 'fleece weight' but will be penalised if the 'faulty' wool is found by the judge. If too much 'second grade' wool is removed the reverse will apply. It is virtually impossible to recover points lost from a low fleece weight through improved points for 'freedom from fault'.

When shorn, approximately 30% of a fine wool (Merino) fleece and 25% of a coarse wool (Romney) fleece is grease and dirt. Based on experience judges subjectively assess the proportion of clean wool in the fleece. This is referred to as washing yield, expressed as a percentage.

$$\text{Yield} = \text{Clean weight after washing} \div \text{Greasy weight before washing} \times 100$$

As with mean fibre diameter, commercial parcels of wool are traded with an objectively measured measurement of washing yield undertaken in a laboratory according to a strict testing protocol.

Table 1 gives some examples of typical washing yields for a range of wool types.

Table 1: Examples of a typical washing yield (%) for different wool types containing different amounts of grease and dirt.

Grease content	Fine wool (Merino (20µm))	Medium wool (Corriedale (27µm))	Coarse wool (Romney (37µm))
Heavy	63	65	71
Medium	68	70	76
Light	73	75	81

Short fleeces contain less grease and dirt than longer fleeces of the same type because a short fleece is more easily wetted to the skin than a longer fleece. As a result some of the grease and dirt is 'washed' out of a short fleece while it is growing on the sheep's back.

When the washing yield of a fleece is known, or assessed, fleece weight conversion charts can be used to convert a greasy fleece weight to a clean fleece weight. A fleece weight conversion chart is included as Chart 1 in http://www.colouredsheep.org.nz/files/conversion_charts.pdf

A more extensive chart covering a greater range of fleece weights and yields is available from the RASNZ. Alternatively the clean fleece weight can be calculated using a calculator as:-

$$\text{Clean fleece weight} = \text{Greasy fleece weight} \times \text{Washing yield} \div 100$$

Woolly or unshorn hoggets are expected to grow more wool than hoggets shorn as lambs. Mature sheep are expected to grow more wool in a year than young sheep.

Fleece weight points charts covering a wide range of fleece weights applicable to white fleece competitions administered by the RASNZ are available from the RASNZ. Fleece weight points charts applicable to handcraft fleece competitions administered by the BCSBANZ are included as Chart 2 in http://www.colouredsheep.org.nz/files/conversion_charts.pdf

It is important to note that the fleece weights listed in the RASNZ fleece weight points charts to receive the maximum 35 points within each class is higher than the fleece weights listed to receive the maximum 25 points within each class in the BCSBANZ fleece weight points charts. This is largely a breed effect with the RASNZ competitions focused on 'wool growing' breeds, that is breeds that have been intensively selected for increased fleece weight over many generations. Handcraft fleeces covered by the BCSBANZ fleece competitions tend to be derived from sheep, often a cross between two or more breeds, which have been selected for their tactile (handle and feel) properties rather than outright fleece weight. Many of the tactile characteristics important for handcraft fleeces are associated with lighter weight fleeces.

Examples of **INDICATIVE** threshold skirted greasy fleece weights for shorn hogget, woolly hogget and mature fleeces to obtain a the maximum 25 points for fleece weight in handcraft fleece competitions administered by the Black and Coloured Sheep Breeders' Association of New Zealand are given in Table 2.

Table 2: Indicative threshold skirted greasy fleece weight (kg) for shorn hogget, woolly hogget and mature fleeces to obtain the maximum 25 points for fleece weight in handcraft fleece competitions administered by the Black and Coloured Sheep Breeders' Association of New Zealand

Fleece class	Grease content	Fine wool (Merino (20µm))	Medium wool (Corriedale (27µm))	Coarse wool (Romney (37µm))
Shorn hogget	Heavy	2.5	3.2	3.8
	Medium	2.3	3.0	3.6
	Light	2.1	2.9	3.3
Woolly hogget	Heavy	3.0	3.7	4.3
	Medium	2.8	3.4	4.0
	Light	2.6	3.2	3.7
Mature	Heavy	3.9	4.2	4.8
	Medium	3.6	3.9	4.5
	Light	3.4	3.7	4.2

Fleece characteristics and faults

When judges are using wool judging cards they place considerable reliance on their experience as to the normal variation in a characteristic in the type of wool being judged. All fleece types are not treated equally for all characteristics. For example a woolly hogget should not be penalized for being 'tippy' as this is a normal characteristic of an unshorn fleece.

The following 'bulleted' points outline the relative significance of each of the various characteristics listed on the RASNZ and BCSBANZ fleece judging cards with a brief outline as why the emphasis placed on each characteristic may differ between the two cards.

- Colour

Colour in white wool describes the extent of unscourable discolouration in the fleece. This is important as it affects the potential of a fleece to be used in an undyed state or dyed to many colours, particularly pastel shades. Variation in the degree of intensity of pigmentation in handcraft fleeces should not be treated as a fault.

- Evenness of fibre diameter and staple length over the fleece

Variation within a fleece is of little importance to commercial processors who use large volumes of wool and thoroughly blend it before processing. As a consequence evenness of staple length in white fleeces is assessed out of 5 points. In the case of handcraft fleeces where all, or part, of a single fleece is used at any one time, this variation is of the utmost importance. It is not normal practice that all handcraft fleeces are 'carded' (passed through a machine that aligns and blends the fibres) before processing as it tends to break the weaker fibres making for a weaker yarn when the fibres are spun. When spinning an uncarded handcraft fleece, the first handful withdrawn from the bag of fleece should be similar to the handfuls withdrawn later during the production process otherwise the yarn may have several irregularities. Hence evenness of fibre diameter over the fleece and evenness of staple length over the fleece are each assessed out of 10 points.

- Soundness

With the tensile strength of fibres in a staple of wool being related to the tensile strength of yarn spun from that wool, soundness, or tensile strength, of the fibres within a staple are assessed out of 10 points in both fleece judging cards, regardless of the end-use of the fleece. A loss of tensile strength within staples of wool is usually related to a marked variation in fibre diameter along the staple. Commercial carding and processing machines subject wool fibres to much greater stresses than a crafts person spinning straight from the fleece.

- Staple length

Staple length and yarn strength are interrelated. Commercial fleeces tend to be spun at high speed using large volumes of wool. It is therefore important that the resultant yarn be as strong as practicable. Yarn breakages are expensive to fix in a commercial environment. Hence staple length is allocated 15 points on the RASNZ fleece judging card. In the case of handcraft fleeces, handled in small volumes where the fleece can be selected to produce a specific end product, staple length is assessed out of 5 points on the BCSBANZ fleece judging card commensurate with a likely end-use dictated by other fibre characteristics.

- Crimp

Regardless of the type of the fleece an even crimp along the staple and throughout the fleece is indicative of a minimal variation in fibre diameter along the fibre and throughout the fleece. This attribute is assessed out of 10 on both fleece judging cards. Some breed types, such as Down breeds do not display a well defined crimp and should not be penalised for a lack of staple crimp. Instead their fleeces have a pronounced tight fibre crimp giving the fleece a very springy feel resulting in a 'stretchy' yarn that is well suited to some end-uses.

- Staple formation

Staple formation is a characteristic of an individual breed that is assessed out of 10 points on both fleece judging cards. Staples are expected to be clearly defined with a relatively even fibre length within the staple such that the end of the staple is not 'tippy' and weathered. Weathered tips can be brittle and may break off during processing.

- Handle

In the case of commercial fleeces this characteristic is assessed in association with lustre and brightness characteristic of the breed and is assessed out of 5 points on the RASNZ fleece judging card. Handcraft uses for wool are closely aligned with the handle or feel, of the wool. As such handle on the BCSBANZ fleece judging card is assessed out of 10 points and aligned with the likely handcraft use of the fleece with fine fleeces expected to be soft and coarser fleeces expected to have a harsher feel.

- Freedom from fault

This characteristic is an overall assessment of the fleece with respect to freedom from hair (medullated fibres) and/or kemp (shed medullated fibres); and either presence of dags (faecal matter adhering to the wool), short greasy skirtings (edges of the fleece), vegetable matter, mud or any other aspects that may be 'out of character' with the breed. Each of these 'faults' is detrimental to processing.

In the case of commercial white wool the presence of pigmentation is a serious fault as it cannot be 'overcome' with dying. Most handcraft fleeces, on the other hand, are pigmented to varying degrees. In handcraft fleeces the colour and depth of pigmentation imparts a natural colour shading to a product without it being dyed. If pigmented fleeces are yellow or exhibit water staining these faults are considered at this stage of the evaluation as the presence of yellow or water discolourations detract from the visual appearance of a pigmented fleece. Commercial fleeces are assessed out of 5 points on the RASNZ fleece judging card whereas handcraft fleeces are assessed out of 10 points on the BCSBANZ fleece judging card reflecting the greater seriousness of these aspects to a fleece being processed by hand.

Placings

Placings in each class at a fleece competition are based on the ranking of the numbers of points scored within that class while the Competition Champion and Reserve Champion fleeces are selected on the basis of the rankings of total points scored across all classes.

Concerns with the judging standards

The judging at many fleece competitions often takes place in advance of the fleeces being placed on display for the public to view. As a consequence the judge may not be available to discuss an exhibitor's concerns when the exhibitor is able to first view the judging cards relating to the fleeces in the competitions. If a serious error has been made the exhibitor should discuss the issue with the senior steward for the competition.