Softness Attributes of Australian Cashmere

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Introduction

Cashmere is a luxury fibre regarded as being softer and more comfortable than other apparel fibres.

Cashmere is rare. Total cashmere production represents less than 0.01% of the textile market.

Processed cashmere is expensive. Specialised skills and equipment are required for processing cashmere.

For such an expensive textile raw material, surprisingly little objective information has been published on measurable attributes of cashmere in the form used by spinners.

This article discusses new information about the softness and other quality attributes of Australian cashmere. Comparisons are made between Australian cashmere and cashmere from traditional sources of supply.

Objective quality attributes of cashmere

The major quality attributes of raw cashmere fleece include: fibre diameter, freedom from fine medullated fibres, fibre length, fibre colour and freedom from contamination (vegetable fault, man made fibres).

Each of these quality attributes affects the speed of processing, processing yield, yarn and fabric quality. Most of these attributes are, or can be, objectively measured. There is little published information about many of the objective properties of Australian cashmere compared to the properties of traditional cashmere.

Softness

In the textbook on Textile Fibres von Bergen (1954) states "From time immemorial cashmere has been regarded as one of nature's choicest products for its softness affords the wearer an extravagance of comfort and its superb soft texture brings to the garment all that may be desired in real elegance and distinction". This is still the view of cashmere.

Softness, as it relates to textiles, means that a product yields to pressure or is easily deformed. The "handle" of a textile product is frequently equated with the softness of the textile.
While cashmere is regarded as one of the softest textile fibres, until recently there has been no reliable objective information on the measurement of softness in cashmere. This article provides new objective information on the softness of cashmere.

Softness is a different property to prickle discomfort. Prickle discomfort can be evaluated using easily obtained measurements of fibre diameter distribution. This topic is discussed elsewhere in relation to cashmere (McGregor 1997). As a general rule, prickle discomfort is not an issue with Australian cashmere. Prickle discomfort can be reduced by lowering of the spinning fineness and the coefficient of variation of mean fibre diameter in Australian cashmere in order to produce finer processing fibre that will provide more comfortable handling textiles.

Research approach

Samples

Samples from more than 140 lots of commercially dehaired cashmere and cashmere tops were obtained from manufacturers in Europe, Iran, China, Australia and other countries. Fibre classed as Cashgora by cashmere marketing agencies in Australia, New Zealand and the USA has been grouped together. Core samples taken from bales of raw cashmere prepared for sale by the Australian Cashmere Marketing Corporation (ACMC) were obtained.

Cashmere samples from a range of nutrition experiments and from samples collected from goats in various Asian countries were also studied.

Procedures

Mean fibre diameter (MFD) and diameter distribution (coefficient of variation (CV(D), % of fibres coarser than 30 \( \mu \)m), fibre curvature (degrees/mm), the diameter and incidence of medullated or hair fibres (white samples only), fibre length (Hauteur, mm), fibre colour, resistance to compression (Rc, kPa) and fibre bundle tenacity and extension were determined.

During statistical analysis it became apparent that the properties of cashmere from Australia, New Zealand and the USA had similar properties. In some analyses cashmere from these countries was analysed together as cashmere from new origins of production.

Affect of origin and processor

There were large affects of origin of the cashmere and of processor on the properties of dehaired cashmere.

The effect of processor includes:

- the differences due to fibre processed as a result of selection or purchase decisions; and
- differences in processing between dehairing companies.

Dehairing processor's varied significantly in their ability to remove guard hairs.

Implication
As the length of dehaired cashmere affects the price of cashmere, it is in the interests of those aiming to produce cashmere with the highest length to determine which dehairing processors can maximise the length of the final dehaired cashmere.

**Fibre diameter attributes**

The mean fibre diameter of dehaired cashmere samples ranged from 13.6 to 19.2 µm and that of cashgora samples from 17.8 to 22.7 µm (Figure 1).

Chinese dehaired cashmere samples were finer than dehaired cashmere from other origins. Cashmere from Australia was finer than that from Iran.

The mean CV(D) of the dehaired cashmere samples was 22.0 (1.63) % with little range in the median between Origins.

As the mean fibre diameter of dehaired cashmere increased, the content of fibres coarser than 30 µm increased and the incidence of medullated fibres (hair fibres) increased.

In white dehaired cashmere the median values for the medullated fibre were: medullated fibre diameter 32.3 µm; incidence of medullated fibres by weight 0.25%.

**Fibre curvature**

![Graph showing distribution of mean fibre diameter (MFD), fibre curvature and resistance to compression (Rc) attributes of dehaired cashmere from different origins and cashgora, after adjustment for processor effect. See legend for origin.]

**Definition**
Fibre curvature is a primary measure of the frequency of the crimp of the fibres within a fleece. The "inherent" curvature is the shape to which a fibre naturally returns after the removal of any temporary forces that are placed on the fibre while it is growing. Fibre curvature is a fundamental property of a wool fibre, the fibre crimp. Until this research was completed there was no report available on the fibre curvature of commercially dehaired cashmere.

Findings

The mean fibre curvature of dehaired cashmere was 61 degrees/mm with a range from 44 to 80 degrees/mm (Figure 1). This compared to Merino wool that ranged from 70 to 140 degrees/mm.

After adjustment for dehairing processor effect, cashmere from new origins had significantly lower fibre curvature than cashmere from Iran, East and Western Asia (Figure 1).

Cashgora samples had the lowest mean fibre curvature of 36 degrees/mm with a range from 24 to 46 degrees/mm.

Following adjustment for the effect of dehairing processor there was no overlap in the range of fibre curvature between cashgora and cashmere (Figure 1).

Explanation

Figure 2. The relationship between cashmere production of Australian cashmere goats and cashmere fibre curvature. Data points are for different nutrition treatments.

Why would cashmere from Australia have a lower fibre curvature? In Australian goats, cashmere fibre curvature was dependent on nutrition. Better fed goats grew more cashmere that was longer and had lower fibre curvature compared with poorly fed goats that grew less cashmere that was shorter and had higher fibre curvature (Figure 2). In both Australian and Chinese cashmere, finer cashmere and shorter cashmere had higher fibre curvature than coarser cashmere.

The results indicate that during a growing season only a certain number of crimps are produced. Thus if goats are poorly fed, the cashmere will be finer and more crimped.

Resistance to compression

Definition
Resistance to compression is the force required to compress a mass of fibre to a given volume. Reducing resistance to compression results in softer handle. In Merino wools, typical values range from 8 to 13 kPa.

Findings

The resistance to compression of the dehaired cashmere overlapped substantially between origin of cashmere. Iranian cashmere showed the highest median value and the largest variation (Figure 1).

Cashmere from Australia and other new origins had the lowest resistance to compression values recorded for cashmere.

Cashgora had significantly lower resistance to compression compared to new origin cashmere.

Increasing fibre curvature was strongly correlated with increasing resistance to compression.

Implications

It is possible to differentiate the cashmere produced in different regions of the world on the basis of the fibre attributes of the cashmere (Figure 1). By plotting any two of mean fibre diameter, fibre curvature and resistance to compression, cashmere from different producing regions segregate into distinct groupings.

It was possible to segregate cashgora from cashmere even though the finest cashgora has a similar fibre diameter to that of Iranian cashmere, as cashgora had a fibre curvature of less than 45 deg./mm and cashmere had fibre curvatures greater than 45 deg./mm.

As lower resistance to compression is related to softness of handle, then cashmere from Australia and other new origins of production has softer handle than cashmere from traditional origins of production.

Fibre length

![Box plots of the fibre length of dehaired cashmere from different origins and dehaired cashgora showing the median, upper and lower quartiles with outliers.](image)

Findings

The length of dehaired cashmere from new origins was up to 20% longer than that of cashmere from traditional origins (Figure 3).

As the mean fibre diameter of dehaired cashmere increased there was a correlated increase in the length of dehaired cashmere.
Implications

This data indicates that dehaired cashmere from Australia is longer and finer than cashmere from the origins traditionally used for worsted processing.

Bundle tenacy and extension

Importance

The bundle strength of tops is rated as the third most important fibre property after mean fibre diameter and fibre length, in terms of its importance with respect to yarn strength and the speed of processing operations.

In the dehairing of cashmere, repeated mechanical action results in fibre breakage. As a consequence, most dehaired cashmere is only of sufficient length to be spun on the woollen system. Higher tenacity and more extensible fibres result in less fibre breakage and the potential use of the fibre in the worsted spinning system.

Findings

The data show that cashmere from Australia and cashgora have superior bundle tenacity and bundle extension (Figure 4) than cashmere from Iran, Western Asia and China.

Colour

The variation of lightness and yellowness of white cashmere was large and of commercial significance for dyers (Figure 5).

The range in lightness of white samples between origins was similar. The within origin range in lightness and yellowness of "white" commercial lots was of commercial significance.
Natural contaminants

Commercial bales of Australian cashmere have relatively low levels of natural extraneous matter compared with traditional supplies from China. The composition of typical raw commercial main line Australian cashmere can be summarised as: guard hair 44.3%, cashmere 28.5%, moisture 17%, suint 4.2%, grease 3.0%, soil 2%, vegetable matter 0.9%, other impurities < 0.1% with negligible levels of skin debris.

The measurements of soil and grease content provide evidence that commercial Australian cashmere has low level of naturally occurring extraneous matter compared with the cashmere from the best producing regions in China. A survey of Chinese cashmere showed grease to range from 3.1 to 6.8% and average 4.9%, and soil content ranged from 0.7 to 10.6 and average 6.1%. Raw Chinese cashmere also consists of an average of 8.9% skin debris. The content of wax and suint in Australian cashmere is only half or less than that reported for Merino wool.

Conclusions

Attributes of Australian cashmere

Research studies indicate that cashmere from Australia has many properties equal or superior to that found for cashmere from traditional origins of production including:

- mean fibre diameter and fibre diameter variability;
- length after dehairing;
- softness;
- bundle tenacity and extension;
- colour of white cashmere; and
- has less grease, soil and skin pieces.

These superior attributes place Australian cashmere in the premium position for worsted yarn production.

Low fibre curvature, a problem or an asset?
One attribute where Australian cashmere is significantly different from traditional cashmere is its lower fibre curvature. As lower fibre curvature (crimp) can be easily observed by a trained fibre merchant, it may be a major factor contributing to the assertion by some observers that Australian cashmere is inferior to cashmere from traditional sources of supply.

This study has demonstrated that lower fibre crimp is not a liability but rather is a significant physical parameter that gives Australian cashmere a softer handle compared with traditional cashmere. Lower cashmere fibre crimp is related to improved nutritional management of Australian goats and should be seen as a significant attribute.

Further research is in progress to determine the relationship between cashmere fibre curvature and production of cashmere.

Towards a better definition of cashgora

There are numerous definitions of "cashgora" dating back to 1972. In Australia, strict fibre preparation standards over the past 15 years have reinforced perceived differences between cashmere and cashgora.

The findings reported here show that the fibre characteristics of cashgora are distinct from those of cashmere produced in Australia and other countries. The differences in objectively measured fibre curvature need to be incorporated into clearer definitions of cashmere and cashgora.

References


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