

VARIATION BETWEEN FLEECES IN YARN STRENGTH AND HANDLE CHARACTERISTICS

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Yarn strength is an important characteristic of a yarn. Drape describes the way a construction of yarn or fabric falls or takes shape on a human body. Drape is related to rigidity so that changes in drape can be engineered by changing the structure of the yarn or fabric (Frydrych *et al.* 2000). Although investigation of yarn properties assumes that the properties of the fibres are identical (Ghosh *et al.* 2005), recent studies by Schlink *et al.* (2006) suggest that differences in surface properties and fibre damage between individual fleeces may have both an environmental and a genetic component. The effects of these possible differences between fibres on yarn strength and drape characteristics between individual fleeces have not been investigated.

Fifty handspun yarn samples were randomly selected from 533 yarn samples used by Greeff *et al.* (2004). The fleeces had been measured for yield, fibre diameter (FD), coefficient of variation of FD (CVFD), staple length (SL), staple strength (SS), felt ball diameter (FBD), curvature (CURVE), standard deviation of curvature (sdCURVE) and yarn shrinkage. Ten-ply yarns were produced and set as described in Greeff *et al.* (2004). Yarn bending length (C), flexural rigidity (G) and bending modulus (BM) were calculated using a 50 mm yarn overhang instead of fabric overhang (Saville 1999). Yarn tex was used instead of fabric area or fabric thickness for the flexural rigidity and bending modulus calculations. Yarn peak breaking force was measured using Agritest (9.4 mm gauge length) to determine yarn strength (Strength) in N/ktex. Data were analysed using Minitab®.

Table 1. Mean fleece and yarn parameters and their standard deviations (sd), coefficients of variation (cv) and correlations of yarn traits (C, G, BM and strength) with yarn and raw wool traits

	Mean	sd	cv	Correlation with yarn traits of:			
				C	G	BM	Strength
FD (µm)	19.67	1.51	7.67	0.08	0.10	0.03	0.02
CVFD (%)	23.63	3.30	13.4	-0.16	-0.14	-0.10	-0.04
SL (mm)	106	8	7.82	0.23	0.28	0.12	-0.01
SS (N/ktex)	33.7	9.6	28.6	0.18	0.16	0.07	-0.10
FBD (mm)	24.3	0.7	3.04	0.01	0.09	-0.14	-0.29*
CURVE (°/mm)	88.2	8.9	10.0	-0.02	0.04	-0.04	-0.15
sdCURVE (°/mm)	66.4	5.8	8.67	0.05	0.07	0.08	-0.07
Yarn felt shrinkage (%)	61.5	6.9	11.2	-0.05	-0.20	0.16	-0.07
C (mm)	22.1	2.0	8.94	-	0.78*	0.66*	0.07
G (µN.m ²)	0.17	0.05	29.4	0.78*	-	0.11	-0.16
BM (N.m ² /(k0.274tex) ³)	55.6	27.2	49.0	0.66*	0.11	-	0.27
Strength (N/ktex)	32.3	10.3	31.8	0.07	-0.16	0.27	-

*P<0.05

Table 1 shows that the variation between fleeces for yarn flexural rigidity, bending modulus and strength is high but the lack of significant correlations between yarn and fleece measurements (except FBD) suggests that the physical parameters of raw wool currently measured do not have a significant role in determining the yarn strength and drape outcomes for individual fleeces. Thus, we propose that differences in yarn strength and drape are a function of the composition of the fibres produced by the individual sheep. The large coefficients of variation in measures of yarn drape and strength warrant the continuation of these measurements of yarn to determine if a proportion of the variation is genetically controlled. If so, it may offer an opportunity to improve processing and performance of wool in the hands of the consumer.

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