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DIFFERENCES AMONG PROGENY FLEECES IN PROCESSING PERFORMANCE

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SUMMARY
Is it worthwhile processing progeny fleeces in sire evaluation studies? The operations of the 1999 NZ Corriedale sire evaluation scheme included the processing of batches of fleeces from the progeny of eight sires into worsted knitted panels to determine differences in processing and product performance. The procedure of randomly selecting eight fleeces from the main line to process small representative batches had some problems. There was a range in hauteur (average fibre length in top) of 13 mm among the tops made from the different batches of progeny fleeces. Rams' progeny that differed by over 5 mm in actual hauteur were predicted from midside measurements to have the same hauteur. This suggests prediction equations could be improved for mid micron wools.
Keywords: Central test sire evaluation, New Zealand, Corriedale, processing.

INTRODUCTION
The operations of the Corriedale sire evaluation schemes have been described by Cottle (1999). The 1999 scheme expanded the testing of sires' progeny to include the processing of a representative sample of their fleeces by scouring, carding, combing, spinning and knitting panels. Evaluation of the performance of these fleeces is being undertaken by a series of objective measurements, both in processing and in the knitted panel's performance. Corporate knitwear was considered to be one of the main uses for mid-micron wool. Therefore, it was of interest to the stud breeders to establish if there were any major differences between the sires' progeny in the performance of their wool during the processing route to knitwear panels.

The measured raw wool characteristics of fibre diameter (FD), coefficient of variation of fibre diameter (CVD), length and strength should explain most, but not all, of the processing differences. For example, the bulk of the wool should improve carding yields but reduce combing yields, spinning performance and yarn evenness (Carnaby and Elliott 1980; Lamb *et al.* 1996). Thus, it was of interest to compare actual with predicted processing performance to determine the added information resulting from processing batches of fleeces.

MATERIALS AND METHODS
The Corriedale scheme is run at West Melton on the Canterbury Plains. Eleven rams were naturally mated in 1999 for 3 weeks to 100 ewes each, while semen from Clifton WG728-96 was used to inseminate 100 ewes. Link sires to the 1998 scheme were Strathblane 235-93, Eudunda 348-95 and Wilfield 214-96. The fleeces from the progeny of four rams were not processed due to financial constraints. The best eight sires for wool production, based on a wool selection index calculated using midside wool measurements, had progeny fleeces processed.

The fleeces were shorn randomly in sire group order. The fleeces were classed into lines by a professional wool classer and the first eight fleeces from the main line for each sire were collected for subsequent processing at WRONZ. Scouring of each batch of eight fleeces, blending, carding, preparer gilling, combing, finishing gilling, roving, spinning, yarn folding, knitting and a range of performance testing were done in the WRONZ processing plant. Scoured wools were sampled and tested with an OFDA100 and colour and bulk also measured. Scoured wools were put through a length after carding (LAC) line, after which average fibre length (hauteur) and its distribution were measured on an almeter and carding wastes were determined.

To predict top parameters from midside samples, the CSIRO FLCSpec program (Hansford *et al.* 1996) required position of break (POB) values. The standard midside testing did not include this test. Constant breakage levels of 28% tip, 55% middle and 17% base were assumed for all fleece batches, based on auction lot data for mid-micron wool sold in spring. As all progeny were run under similar environments it is likely their POB were similar. Varying POB from 100% tip to 100% middle or 100% base had a maximum effect on predicted hauteur of -4 mm.

Worsted singles yarn were spun to a nominal 55 tex with 315 turns per metre (tpm) twist. The folding twist (170 tpm) was made to balance the singles twist in a 2 ply yarn, suitable for machine knitting. Similar measurements of length were made on processed tops and combing yield determined by weighing the top and noils. Spun yarns were measured for strength (force and extension at break). Test panels were knitted in single jersey to a standard cover factor and tested for abrasion resistance, pilling performance and bagging. T-tests, F tests and correlations were calculated on Excel spreadsheets.

RESULTS AND DISCUSSION

The average midside wool test results for all fleeces from the progeny of each sire and the eight fleeces selected for processing are given in Table 1.

Table 1. Corriedale average midside test results from 12 month old female progeny

Ram Name	No. progeny	FD (μm)		CVD (%)		Fibre curvature (º/mm)		Staple length (mm)		Staple strength (N/ktex)	
		Fleeces processed (FP)	All fleeces	FP	All fleeces	FP	All fleeces	FP	All fleeces	FP	All fleeces
Ballindalloch JK 493/97	19	29.3	28.2	21.5	21.1	56.9	60.3	96.1	89.6	23.0	23.4
Clifton 728/96	12	28.2	27.3	22.2	20.9	66.9	70.2	85.6	85.3	28.4	29.8
Glenovis A7/97	36	28.8	27.9	22.1	21.5	63.1	64.3	92.0	88.0	23.2	26.2
Glenrock 387/96	16	27.2	27.0	21.0	21.3	62.6	65.4	86.4	86.6	28.4	27.0
Lemington Downs 17/95	38	26.8	27.3	22.0^{+}	22.6	63.8	62.5	92.8	89.9	28.0	25.9
Lockerbie 502/96	26	29.3	29.1	23.0^{+}	22.9	58.7	59.6	100.4	96.7	29.0	24.8
Wilfield 214/96	23	28.6	28.6	21.5	21.4	62.3	59.4	94.6	95.6	22.8	23.3
Wilfield 43/93	50	27.0	27.2	21.4	20.1	59.4^{+}	63.4	92.1	88.4	27.0^{+}	26.1
Average	31	28.2	27.8	21.8	21.5	61.7	63.1	92.5	90.0	26.2	25.8

$^{+}$ Processed fleeces variance significantly different from all fleece variance at the 90% level (F test).

The mean midside results from the randomly selected eight fleeces from the main line were not significantly different from the midside results from all fleeces from each sire for all traits. However, F tests comparing the variance ratios showed some significantly different distributions were created. For example, the midside test results of the eight fleeces processed from Wilfield 43/93's progeny had a variance of 25 $(N/ktex)^2$ compared to a variance of 50 $(N/ktex)^2$ for all the midsides. The variance of staple strength may affect processing perfomance.

The test results for fleeces after being scoured, carded and gilled are given in Tables 2 and 3.

Table 2. Test results from scoured fleece samples

	OFDA				Colour			
Ram Name	FD (μm)	FDCV (%)	Curvature (°/mm)	Med (%)	Y	Y-Z	VM (%)	Bulk (cm^3/g)
Ballindalloch 493/97	27.7	22.0	70.8	1.1	65.6	-0.3	0.01	25
Clifton 728/96	26.3	21.1	79.4	1.0	65.8	-0.5	0.01	26
Glenovis 7/97	27.5	22.3	70.7	0.9	66.0	-0.3	0.04	26
Glenrock 387/96	27.5	22.0	72.6	0.7	66.7	-0.1	0.01	26
Lemington Downs 17/95	27.1	22.7	70.3	0.9	65.6	-0.8	0.04	26
Lockerbie 502/96	28.8	22.3	64.3	1.0	66.1	-0.3	0.11	26
Wilfield 214/96	28.5	22.8	75.2	1.2	66.1	-0.6	0.06	27
Wilfield 43/93	27.2	19.5	72.3	0.4	66.1	-0.4	0.01	26
Average	27.6	21.8	72.0	0.9	66.0	-0.4	0.0	26
Minimum value	26.3	19.5	64.3	0.4	65.6	-0.8	0.01	25
Maximum value	28.8	22.8	79.4	1.2	66.7	-0.1	0.11	27

The differences between test results on scoured fleece samples and average midside values were not significant for fibre diameter (-0.6 μm, P=0.21), FDCV (0.02%, P=0.97) or medullation (-0.01%, P=0.94) but were significant for curvature (10.2 °/mm, P<0.001). The increase in curvature of the scoured wool may be attributed to the scouring treatment relaxing the fibres. We speculate that the constrained staple structure while growing prevents full curvature developing. The bulks of the scoured wool samples from different sires' progeny were similar (25-27 cm^3/g), despite fibre diameter values ranging from 26.3 – 28.8 μm and fibre curvature ranging from 64.3 – 79.4 °/mm.

The average staple length results from sires' progeny ranged from 85–100 mm and staple strength from 23-29 N/ktex, while the LAC hauteur ranged from 70.6–78.4 mm and top hauteur ranged from 84.4-97.3 mm. The actual top hauteur was over 20 mm longer than the predicted hauteur, which may be attributed to the high ratch setting used in combing and the wool not being typical of Australian Merino wools that were used to create the FLCSpec prediction equations. It is difficult to account for differences in settings and performance of pilot and commercial processing plants.

Actual top hauteur correlates well with H^P (0.74) and LAC hauteur (0.68) but poorly with H^a (0.20). The midside results of the eight processed fleeces and all of the progeny fleeces were similar and therefore, as expected, H^P and H^a were moderately correlated (0.66). These results therefore raise the

question of whether the hauteur of top made from all the progeny fleeces would have ranked the rams differently to top made from eight selected fleeces on H^a rankings. The only way to answer this question would have been to process all the fleeces, which is expensive.

Table 3. Length (H- hauteur (mm), CVH – coefficient of variation of hauteur (%)), card waste and noilage (%) from the top, LAC line and predicted from FLCSpec

Sire	H (top)	H (LAC)	H^p	H^a	CVH (top)	CVH (LAC)	CVH^p	CVH^a	Noil (top)	Waste (LAC)	$Noil^p$	$Noil^a$
Ballindalloch JK 493/97	95.4	78.4	70	68	26.3	49.0	48	46	-	5.4	1.7	2.1
Clifton 728/96	84.4	70.6	68	69	28.2	44.6	51	49	3.7	4.4	2	2.3
Glenovis A7/97	90.3	78.4	68	69	27.5	40.9	44	45	3.2	2.2	2	2.2
Glenrock 387/96	90.4	75.6	70	70	25.4	44.6	48	46	3.6	2.3	2.4	2.5
Lemington Downs 17/95	92.5	72.9	74	71	28.6	53.0	48	47	4.3	1.9	2.4	2.3
Lockerbie 502/96	97.3	77.1	74	71	30.5	52.3	46	47	4.7	3.1	1.7	1.8
Wilfield 214/96	96.0	76.6	73	70	26.0	47.7	50	48	3.7	3.2	2.2	2.3
Wilfield 43/93	90.1	71.7	70	71	27.6	50.1	48	50	3.3	2.3	1.9	1.8
Average	92.1	75.2	71	70	27.5	47.8	48	47	3.8	3.1	2.0	2.2

^{p} - predicted from FLCSpec using midside results from only processed fleeces
^{a} - predicted from FLCSpec using midside results from all fleeces

The FLCSpec predictions are for fibre length in the top, whereas the LAC results are for wools which have not been combed. The LAC hauteur results are expected to be shorter than top hauteur, as the LAC card is more severe than a typical worsted card and combing removes short fibres as noil. However, the FLCSpec hauteur predictions (H^p) were significantly shorter than LAC hauteur ($P<0.05$) and the correlation between these results was only low ($r=0.11$). The FLCSpec predictions were poor for some sire's progeny, eg. Glenovis A7/97 and Clifton 728/96 were predicted to have the same top length but their progeny actual hauteur differed by 5.9 mm. Noil predictions look poor, eg. Lockerbie 502/96 had the highest actual noilage but was predicted to have the lowest level. When the knitted panel results are available the added value of processing batches of progeny fleeces for sire evaluation will be better understood.

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