A COMPARISON OF FLEECE TESTING METHODS FOR THE ESTABLISHMENT OF A RAM BREEDING NUCLEUS IN A WOOL FLOCK AND FOR CLIP PREPARATION

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SUMMARY
A mobile OFDA2000 device was compared to conventional mid-side fleece testing in helping to establish a ram breeding nucleus, from a base of 840 fine-wool ewe hoggets. Together with tests on 693 wether hoggets the results were also used to help establish lines of wool for sale. The Pearson correlation coefficient between the two fleece testing methods was 0.86. The Spearman rank correlation coefficients between estimated breeding values (EBVs) for mean fibre diameter (MFD) and for selection indices using determinations from the two fleece testing methods were 0.84 and 0.86 respectively. In conclusion, similar genetic selection differentials were achieved by selecting the top 200 animals based on either OFDA2000 or conventional mid-side test information. Further, both OFDA2000 and conventional mid-side fleece testing closely predicted core testing results from lines of wool created from use of MFD tests of individual fleeces, with the correlation coefficients between results from either methods and core tests for MFD both being 0.99.
Keywords: Fleece testing, ram breeding nucleus, clip preparation, OFDA2000.

INTRODUCTION
With the recent advent of mobile fleece testing instruments, there has been widespread interest in using these devices on-farm, particularly for clip preparation purposes. Little information is currently available in the published literature comparing these devices with conventional testing methods.

This study compared the use of an OFDA2000 device (Brims *et al.* 1999) and conventional mid-side testing for establishing a ram-breeding nucleus and for establishing lines of wool for sale. The work is part of a larger study on in-shed and on-farm testing of wool, including the evaluation of the OFDA2000 device (Behrendt *et al.* 2001).

MATERIALS AND METHODS
A flock of 1,533 Merino hoggets, born in September 1999 and depastured at a commercial property near Nareen in South-West Victoria was utilised in the study. The flock is of Merinotech (Victoria) blood, with an average fibre diameter (excluding lambs wool) of 19.1 to 19.2µm for the last 3 years. Since weaning, ewes and wethers have been grazed together in one flock and were shorn as lambs in late February 2000. No pedigree information was available.

In October 2000, the hogget sheep were individually identified with eartags and their wool sampled from the mid-side. The mid-side samples were sub-sampled, with a staple removed at random (and retained for testing), and the remainder sent to a commercial Rampower accredited fleece testing laboratory (hereafter known as the commercial laboratory), for determination of mean fibre diameter (MFD) and washing yield, using conventional mid-side testing methodology. The sub-samples were tested for MFD with an OFDA2000 device, based on determinations from single staples (Behrendt *et al.* 2001), in a fleece testing laboratory setting.

Selection indices incorporating clean fleece weight (CFW) data and MFD results (those from the commercial laboratory and from the use of OFDA2000) were calculated using PEST (Groenveld 1990), with the data being corrected for the effect of sex. A selection index based on a 12% premium for MFD (where a 1 µm decrease is associated with a 12% increase in the clean wool price) were derived using estimated breeding values (EBVs) for CFW and MFD. These index values were then used to aid in screening of the flock to create a ram-breeding nucleus and to help identify culls. Economic weights were obtained from Rampower (Atkins 1997).

MFD results from the commercial laboratory and wool prices prevailing in early December 2000 were utilised in the preparation of lines of wool for sale. Optimal lines of wool were predicted with the software package 'Virtual Wool Classer' (Semple and Atkins 2000), which provided MFD cutoff points for classing of fleeces at shearing in December 2000. Greasy fleece weights (including bellies) and classer comments were recorded at shearing. Although the MFD results formed the main basis for classing of wool, whole fleeces judged as tender or heavily coloured or with dermatophilosis (lumpy-wool dermatitis) were removed to secondary lines.

The two methods for testing MFD were compared by the following means (i) using a Pearson correlation coefficient between phenotypic measurements (ii) using Spearman rank correlation coefficients to compare ranking of the top and bottom animals on EBVs for MFD and on selection index values and, iii) their ability to predict core-test results for sale lines prepared with the aid of fleece testing results (using Pearson correlation coefficients).

RESULTS AND DISCUSSION

Fleece testing results. The results of fleece testing by the two methods are shown in Table 1.

Table 1. Summary statistics for MFD from fleece testing of ewe and wether hoggets using a commercial laboratory and OFDA2000 (n=1,469)

Parameter	Mid-sides tested at a commercial laboratory (µm)	Sub-samples of mid-sides tested by OFDA 2000 (µm)
MFD	18.47	18.54
Standard Deviation of MFD	1.47	1.41
Lowest Value of MFD	14.65	14.44
Highest Value of MFD	24.52	23.72
Pearson correlation coefficient between methods	0.86	

The two methods gave similar results in terms of the overall mean and the range of values, although the standard deviation of MFD for the commercial laboratory was slightly higher than that from using the OFDA2000. The Pearson correlation coefficient of 0.86 between fleece testing methods is comparable to the figure of 0.84 from another related study (M. Ferguson, pers. comm.) but lower than a figure of 0.94, estimated from wether trial data (Behrendt *et al.* 2001).

Screening to create a ram-breeding nucleus. The Spearman rank correlation coefficients between fleece testing methods for EBVs for MFD and that for selection index values were 0.84 and 0.86, respectively (n=1,469, $p<0.001$). These correlations are similar to the Pearson correlation coefficient of 0.86 between the phenotypic MFD data derived from the two testing methods. This is not surprising, as the variance-covariance matrices used in estimating EBVs for MFD and selection indices for the two fleece testing methods were identical.

To further examine the influence of fleece testing method on the results of ranking elite animals, we compared the number of animals that appear in the top 200 for both methods and on the genetic selection differentials if these animals were selected (Table 2). When ranked on EBVs for MFD and on selection index value, 132 animals (66%) and 121 animals (61%), respectively, were in the top 200 for both conventional mid-side testing and OFDA2000 testing.

Table 2. Genetic selection differentials for EBVs for CFW (%) and MFD and a selection index value (using a 12% MFD premium) when the top 200 animals are selected on index

Fleece testing Method	Genetic Selection Differentials		
	EBV for CFW (%)	EBV for MFD (μm)	12% Index
Midside	+2.40	-0.58	104.98
OFDA2000	+2.59	-0.55	104.91

Comparing the two fleece testing methods, there is little difference in the genetic selection differentials achieved, even though only 61% of the animals are common between the two selected groups. Further work is required to determine if general comparisons between commercial fleece testing laboratories would give similar results.

Larger 95% confidence limits for MFD have been reported for comparisons across laboratories in round trials rather than in the one laboratory (Morgan 1990; Cottle *et al.* 1996), suggesting that fleece testing samples to be internally compared should all be tested at the same laboratory. In practice, users of fleece testing services have been advised not to mix results from different methods or laboratory sources and our results support that policy.

To examine the influence of fleece testing method on the results of ranking low performing animals, the number of animals that appear in the bottom 200 for both methods was compared. For ranking on EBV for MFD and on selection index value, 139 animals (70%) and 129 animals (65%) respectively, rank in the bottom 200 on data based on both conventional mid-side testing and OFDA2000 testing. These proportions are similar to the comparison made for ranking of elite animals (the top 200).

Creation of wool sale lots using fleece testing information. The results of creating lines of wool for sale largely based on individual fleece tests of MFD can be seen in Table 3.

Table 3. Weights of wool and weighted MFD averages based on individual fleece tests, core test information for MFD and staple strength (SS), and clean prices paid for sale lines

Sale Line	Potential Weight of Fleeces in Main Lines (kg)	Weight of Unskirted Fleece Classed into Lines (kg)	Total Weight Skirted Wool (kg)	Commer-cial Lab. MFD (μm)	OFDA 2000 MFD (μm)	Core Test MFD (μm)	SS (N/ktex)	Mid Breaks (%)	Clean Price Paid on 16/01/01 (c/kg)
14.6-17.2μm	866.9	397.6	302	16.6	16.9	16.8	26	70	2044
17.3-18.0μm	850.6	564.8	381	17.6	17.9	18.1	35	49	1906
18.1-18.8μm	1069.0	662.3	531	18.4	18.5	18.4	41	59	1785
18.9-19.6μm	894.0	593.3	447	19.2	19.1	19	41	43	1334
>19.6μm	1024.2	798.2	575	20.6	20.3	20	36	35	837
Tender	-	451.5	388	18.2	18.2	18.1	22	72	1283
Colour	-	1237.0	908	18.1	18.3	18.1	28	62	1237

Removal of wool to secondary lines reduced the potential weight of the main fleece lines by 44%, with skirting removing a further 15.1%. For the 7 sale lines of wool, the Pearson correlation coefficient for MFD between either of the two fleece testing methods and core-testing is 0.99, and is 1.00 between conventional mid-side testing and OFDA2000 testing ($p<0.001$). There was also close agreement of mean values estimated with both fleece testing methods and with core test results for MFD, with the OFDA2000 results marginally better at predicting the core test results. However, both fleece testing methods predicted core testing results for MFD to within 0.2-0.3μm for most lines.

Although not the key focus of this paper, the prices paid for the wool are of interest. The price of the finest line (with fleeces between 14.6μm and 17.2μm) was heavily reduced because of low SS and a high percentage of mid-breaks when compared to the other main lines. This may have resulted from the impact of an unfavourable phenotypic correlation between MFD and SS when classing out the finest fleeces. This possible effect, together with the loss of fleece wool to secondary lines, the level of price premiums available and other factors all need consideration before using fleece testing information for preparing lines of wool for sale.

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