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A comparison of the OFDA2000 with conventional mid-side testing of mohair

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Abstract

The portable fibre-testing instrument OFDA2000 has applications in the mohair industry for both fibre classing and animal selection. A comparison was completed between single-staple mid-side testing using an OFDA2000 and conventional laboratory mid-side testing using an OFDA100. Mid-side mohair samples (n=504) were collected from two consecutive shearings of a mixed sex group of Angora kids at 6 and 12 months of age. The samples were at the fine end (average 20.9 μm) of the mean fibre diameter range of mohair. There was a bias between the estimates of mean fibre diameter at both shearings. The other traits studied also had biases between measurement methods. The regression analyses results of mean fibre diameter from the two test methods accounted for 91% and 88% of the variance for first and second shearings, respectively. Regression analyses between test methods for standard deviation, coefficient of variation of fibre diameter and fibre curvature accounted for less variance than the regressions of mean fibre diameter results. The results indicate OFDA2000 is suitable for estimation of mean fibre diameter of greasy kid mohair staples and is therefore useful for both mohair classing and Angora selection.

Keywords: Fibre diameter, correlation, bias, portable fibre-testing
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Introduction

The OFDA2000 is a portable fibre-testing device developed to measure the properties of greasy fibres for both animal selection and fibre classing (Brims *et al*., 1999) and is widely used in the Australian wool industry. Further information regarding the OFDA2000 can be obtained from the manufacturers website (www.ofda.com). The OFDA2000 and similar portable testing devices have advantages over conventional laboratory based testing in being able to provide real-time data allowing timely management decisions. The mean fibre diameter (MFD) results from the OFDA2000 are closely correlated to conventional mid-side testing across a wide range of fibre diameters in wool (Behrendt *et al*., 2002). The technology has potential uses in the mohair industry for fibre classing prior to sale and for animal selection and breeding. Although there have been several studies completed testing the OFDA2000 measuring wool samples there is little published data on the performance of the instrument when used in mohair. This study presents a comparison of the OFDA2000 and the conventional laboratory based Optical Fibre Diameter Analyser 100 (OFDA100) when used to measure mean fibre diameter (MFD), standard deviation of fibre diameter (SD) co-efficient of variation of fibre diameter (CVD) and fibre curvature (FC) of kid mohair.

Materials and Methods

This study used mohair mid-side samples from Angora goats that were grazed at Horsham (36º43'00"S, 142º14'30"E) in north-western Victoria, Australia. The mid-side samples were collected prior to shearing at 6 and 12 months of age. Samples (n=504) consisted of 259 and 245 samples from the first and second shearings respectively. A grease correction factor (GCF) is used by the OFDA2000 to account for grease (wax and suint) on the outside of the fibre, and as the level of grease is proportional to MFD, a GCF slope is used to determine a GCF for each sample. A mohair specific GCF slope was calculated prior to this study utilising 151 mohair samples (average 28.3 μm; range 18.8 to 40.2 μm), from three flocks. A staple was randomly removed from each sample and a portion of this staple was tested on an OFDA2000 in a greasy state with the GCF set to zero. The remaining part of each staple was scoured in a sonicator for 1 minute in a solution of 20% isopropanol in industrial grade hexane. After allowing the sample to dry in fan-forced air it was measured on an OFDA2000 with the GCF set to zero. A regression analysis was then completed between clean and greasy MFD results to calculate the GCF slope of 1.06. For each shearing a staple was removed from each of 20 randomly selected mid-side samples. A portion of each staple was measured on the OFDA2000 in a greasy state and again in a scoured state following the method previously described. The difference between the greasy and clean results was then utilised to calculate a GCF (GCF 0.4 μm and 1.0 μm for first and second shearings respectively). A randomly selected staple from each mid-side sample was then measured on an OFDA2000 that was operated using the calculated GCF and a wool calibration with the calculated mohair specific GCF slope.

The mid-side samples were mini-cored, washed with sonication in a series of detergent solutions at 60 ºC, dried and conditioned for 24 hours and measured utilising an OFDA100 calibrated using mohair top supplied by the CSIR, Port Elizabeth, South Africa, and following the IWTO-47-98 standard.

Regression was used to determine the relationship between the test methods at each shearing for MFD, SD, CVD and FC and a paired T-test was used to determine any bias that existed using GenStat 5.42 (GenStat Committee 2000).

Results and Discussion

The samples used were at the fine end of the MFD range for mohair (Table 1), finer than would normally be expected for Angora kids at that age (Snyman, 2002). The MFD results from the two test methods were closely aligned (Figure 1) and the regression models (Table 2) accounted for 91% and 88% of the variance at the first and second shearings respectively, which compared favourably to that reported for wool (Behrendt *et al*., 2002). Compared to the OFDA100, the OFDA2000 under-estimated ($P < 0.001$) MFD by 0.3 μm at the first shearing and over-estimated ($P < 0.001$) MFD by 0.4 μm at the second shearing (Table 1). These biases are likely to be related to GCF calculation used with OFDA2000. The appropriate GCF will vary for each sample depending on the level of wax and suint of that sample. Using an average GCF for all samples across a shearing with varied genotypes, will lead to some errors.

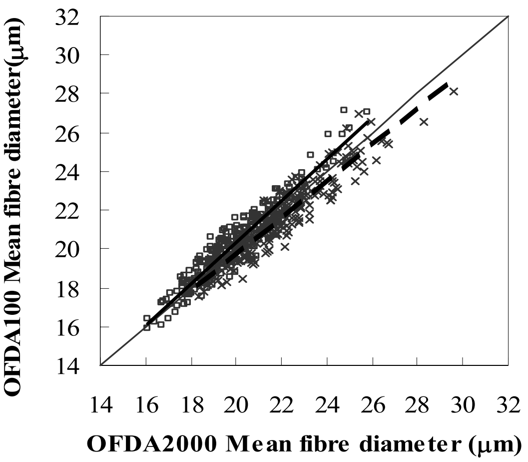

Figure 1 The relationship between OFDA100 and OFDA2000 for mean fibre diameter for first (□) and second (×) shearings, including regression lines for first (▬▬) and second (▬ ▬) shearings

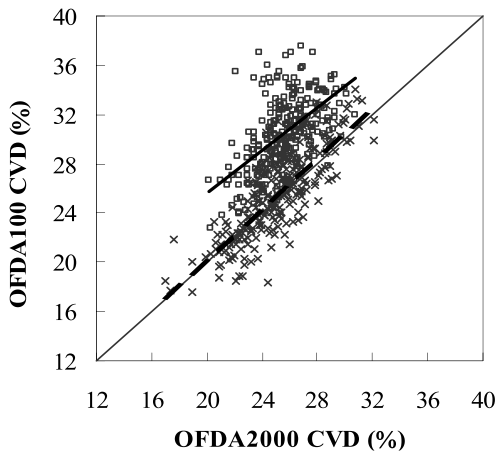

Figure 2 The relationship between OFDA100 and OFDA2000 for coefficient of variation of diameter for first (□) and second (×) shearings, including regression lines for first (▬▬) and second (▬ ▬) shearings

The regression between test-methods for SD, CVD and FC accounted for less of the variation. For SD and CVD, this is again consistent with that found for wool (Behrendt *et al*., 2002), and would be associated with differences between methods and number of fibres measured. The regressions between test methods for SD accounted for 70% of the variance at the second shearing compared to 56% of the variance at the first shearing. SD results measured by OFDA2000 were 1.1 μm lower ($P < 0.001$) than those from the OFDA100 for the first shearing and did not differ ($P > 0.05$) at the second shearing.

The regressions of CVD results from the two test methods accounted for 32% and 68% of the variance for first and second shearings respectively. The OFDA2000 under-estimated CVD at the first ($P < 0.01$) and second ($P < 0.001$) shearings (Table 1). The first shearing CVD results were higher and more variable than those for the second shearing (Figure 2), due to the presence of coarser birth coat fibre in the first fleece. At both shearings the OFDA2000 was operated with a distribution-trimming algorithm switched on, which trims measurements more than 4 standard deviations above the sample mean (Baxter, 2001). This may have

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affected the CVD results at the first shearing and would have lowered the CVD of some highly variable samples, this may explain the difference in regression results between shearings.

The regressions between test methods for FC accounted for 32% and 56% of the variance for first and second shearings respectively. These low results are likely to be associated with the very low curvature of mohair and the method of sample preparation used on the OFDA2000.

Table 1 Mean (± s.e.) of results from OFDA2000 single-staple mid-side testing and OFDA100 conventional mid-side testing for measured traits at the first (1st) and second (2nd) shearings

Test Method	Mean fibre diameter (µm)		Standard deviation (µm)		Coefficient of variation (%)		Fibre Curvature (°/mm)	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
OFDA2000	19.9 (0.11)	21.9 (0.12)	5.1 (0.04)	5.5 (0.04)	25.6 (0.12)	25.1 (0.17)	16.1 (0.12)	18.8 (0.19)
OFDA100	20.2 (0.12)	21.5 (0.12)	6.2 (0.05)	5.5 (0.05)	30.5 (0.18)	25.4 (0.22)	19.0 (0.19)	17.9 (0.21)
Significance	***	***	***	ns	**	***	***	***

***values differ ($P < 0.001$); **values differ ($P < 0.01$); ns values do not differ ($P > 0.05$)

Table 2 Intercept (± s.e.), slope (± s.e.), percentage of variance accounted for (% var. acc.) and residual standard deviation (r.s.d.) from regression analysis of OFDA100 *versus* OFDA2000 for mean fibre diameter (MFD), standard deviation of fibre diameter (s.d.), coefficient of variation of fibre diameter (CVD) and fibre curvature (FC) for first and second shearing results

	First Shearing				Second Shearing			
	MFD µm	s.d. µm	CVD %	FC °/mm	MFD µm	s.d. µm	CVD %	FC °/mm
Intercept	-1.08(0.42)	1.66(0.25)	8.71(1.96)	4.86(1.29)	0.61 (0.50)	-0.37(0.24)	-0.80(1.16)	2.35(0.88)
Slope	1.07(0.02)	0.88(0.05)	0.85 (0.08)	0.88 (0.08)	0.95 (0.02)	1.06(0.04)	1.05(0.05)	0.82(0.05)
% var. acc.*	91	56	32	32	88	70	68	56
r.s.d.	0.57	0.48	2.43	2.49	0.67	0.44	1.95	2.19

* Adjusted R^2

Our work shows that MFD results from single-staple OFDA2000 testing are similar to laboratory-based mid-side testing when used in mohair. Compared to MFD less variation is accounted for by regression analyses between test methods for SD, CVD and FC, reflecting the reduced precision when testing for these traits. Results from regression analyses completed in this study suggest there may be level dependent biases for some traits and further work is required to better define the grease correction factor and distribution trimming algorithm used for OFDA2000 measurement of mohair to reduce these biases. This study did not attempt to estimate the precision of the OFDA2000 when used to test mohair and repeatability between shearings for the two methods and future work will investigate these areas.

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