COMPARISON OF THE 'MEASURE AS YOU GROW' TECHNIQUE FOR MEASURING FIBRE DIAMETER PROFILES BETWEEN TWO LABORATORIES AND TWO SAMPLE SITES

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SUMMARY

Fibre diameter (FD) was measured on 2 mm snippets of wool from the base of staples and compared between 2 laboratories and 2 sample sites for 6 flocks. The base snippets were taken at regular intervals during the year, and the FD was plotted against staple length to produce a FD profile. There was a mean bias of 0.4 μm between laboratories in estimating the mean FD of the profile. The hip-bone sample site was 0.96 μm broader than the mid-side, although this differed significantly between flocks. The staple length estimates between both laboratories were strongly correlated (r^2 = 0.99). There was no difference in the precision of estimating FD profile between the sample sites. The confidence limit of a mean FD estimate at a point along the staple profile was ± 0.54 μm within a sample site. The 'measure as you grow' technique for estimating FD profile parameters appears precise enough to be used as a guide to growers. However, other alternatives need to be investigated which provide a more accurate and precise estimate of the FD profile.

Keywords: staple profile, fibre diameter, OFDA2000, fibre measurement

INTRODUCTION

In Western Australia, 40 wool producers have monitored the monthly change in fibre diameter (FD) in at least 1 of their flocks (House *et al.* 2002; Oldham *et al.* 2002). The technique used is called "measure as you grow', and involves measuring the FD of 2 mm snippets taken from the base of a staple every month or longer interval. Producers have nominated a target FD, staple length (SL), staple strength (SS) and liveweight that they want their flock to achieve 12 months in advance. By monitoring monthly changes in FD, a FD profile is progressively generated. The shape of this profile and, consequently, the properties of the wool, are manipulated using various forms of grazing management. For example, many of these growers have increased stocking rates in late winter to counter the rapid increase in FD that normally occurs with abundant green feed. The result is finer, and generally stronger, wool at the expense of lower fleece weight, less staple length and lower liveweight.

In response to determining the effects of FD profile changes on other wool properties, the Western Australian Department of Agriculture has developed a software package called the Profile Calculator™. The software estimates the mean FD, clean fleece weight, hauteur and price of a fleece using information from a complete FD profile. The Profile Calculator is primarily used to predict changes in wool quality as a result of modifying the shape of the FD profile.

This paper builds on the paper of Oldham *et al.* (2002) by comparing the 'measure as you grow' technique between 2 laboratories and 2 sample sites. The differences between laboratories and sample sites were also quantified by inputting the FD profiles into the Profile Calculator.

METHOD

A total of 6 separate flocks were used in this experiment. Twenty sheep were randomly selected at each sampling time from each flock. Sheep were sampled up to 7 times throughout the year until shearing. Six staples were removed from the hip-bone and mid-side of each fleece using curved surgical scissors close to the skin.

Snippet measurements

Three staples were sent to Australian Fibre Testing (AFT) in York, Western Australia, and 3 staples were retained for measurement by the Department of Agriculture WA (DofA) for each sampling period. The length of each staple was measured using a plastic ruler, and a 2 mm snippet was then guillotined from the base of each staple and pooled as 1 sample for measurement using either the

Laserscan or OFDA100. For the first sampling time (after roughly 6 months of wool growth), the staple was divided into 3 equidistant sections and a 2 mm snippet was taken at the tip, 1/3, 2/3 of the way along, and at the base of each staple. The mean FD of each of the snippet sections was determined by Laserscan or OFDA100. After the first sampling period, only the base 2 mm snippet of each staple was measured by Laserscan or OFDA100.

Profile Calculator™

The information for each complete FD profile (as at the last sample period) was entered into the Profile Calculator and mean FD, clean fleece weight, hauteur and fleece value were calculated from each profile (Figure 1). Clean fleece weight was estimated using a relationship between fleece weight and FD established in previous grazing trials (Peterson *et al.* 2000). Hauteur was calculated using the algorithm developed by Peterson and Oldham (2002). The results were compared between laboratories and sample sites by ANOVA, using Genstat.

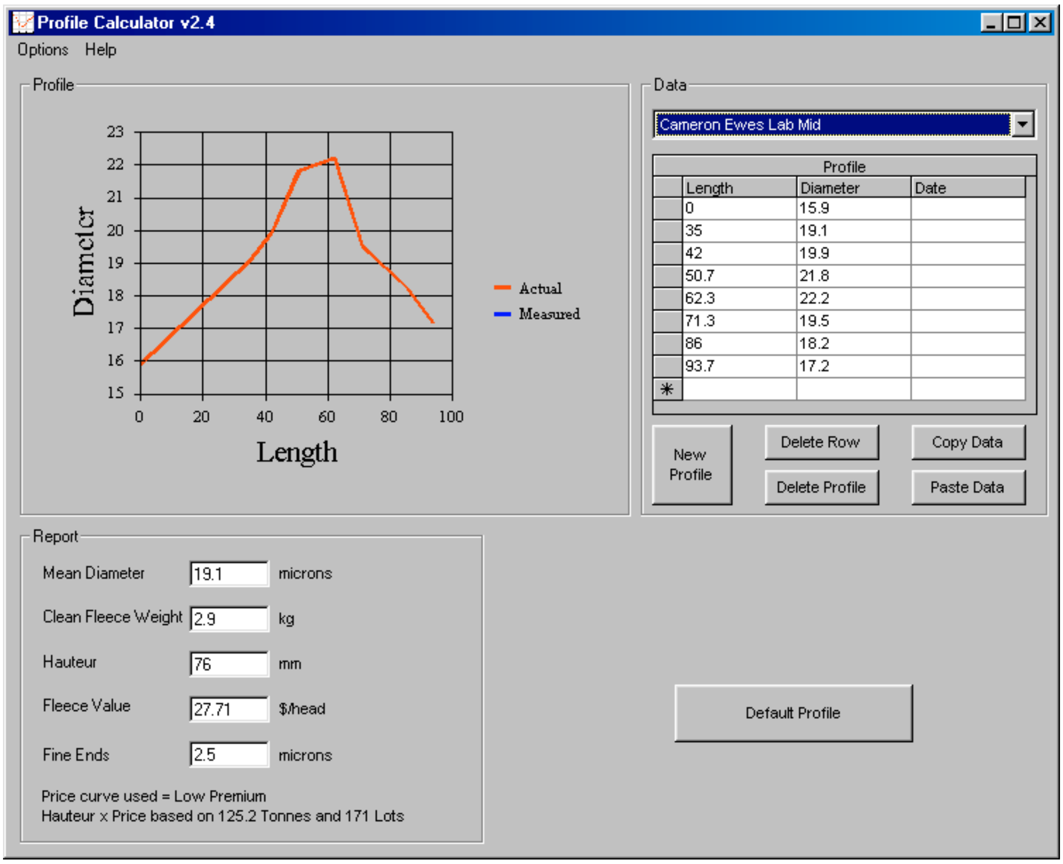

Figure 1. The front page of the Profile Calculator (v. 2.4).

RESULTS

There was generally good agreement on FD profiles measured between both laboratories (Figure 2). The mean variance of a 2 mm snippet measurement was 0.076 µm. This equates to a 95% confidence limit of ± 0.54 µm for any point along the diameter profile. The variance between staple replicates on a 2 mm snippet measurement was 0.096, 0.081, 0.063, 0.065 for AFT mid-side, AFT hip, DofA mid-side and DofA hip, respectively. Averaged over all flocks, the mid-side was 0.96 µm finer (variance = 0.20 µm) than those from the hip-bone (P<0.05). There was no significant (P>0.05) difference in precision of estimates of FD and staple length between sample sites. There was very good agreement (r^2 = 0.99) between DofA and AFT estimates of staple length, although DofA estimates tended to be shorter than AFT as staple length increased (Figure 3). The mean difference between AFT and DofA for the same sample point along the profile was 0.40 µm (s.e. = 0.10 µm) for hip-bone and 0.49 µm (s.e. = 0.08 µm) for mid-side samples (Table 1). These differences were significantly different to zero (P=0.05). There was no significant (P>0.05) effect of flock on these differences. When entered into the Profile Calculator, the AFT profiles were on average 0.44 µm broader than DofA profiles although this was not significant at P = 0.05 due to the low number of profiles pairs compared (n=10).

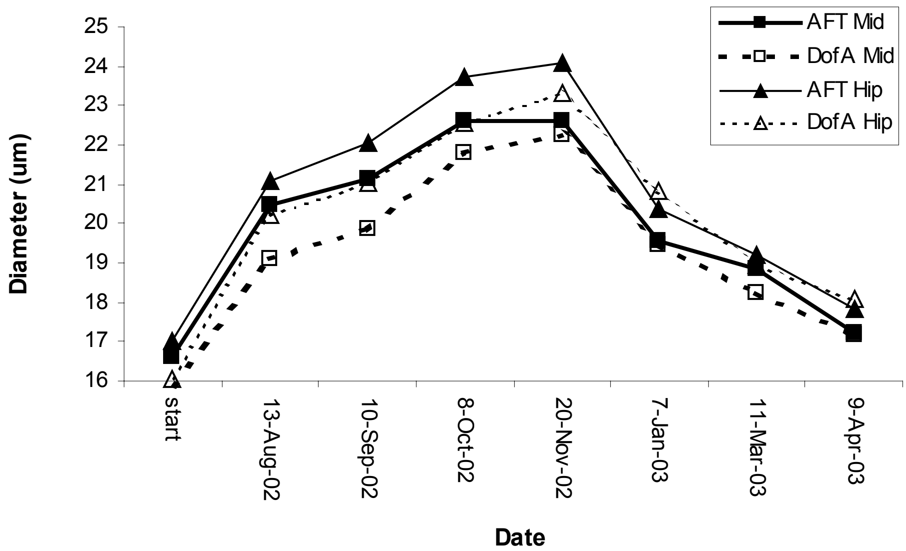

Figure 2. Mean profiles from 3 replicate staples taken from 1 flock and measured by Australian Fibre Testing (AFT) and the Department of Agriculture Western Australia (DofA) on either mid-side (Mid) or hip-bone (Hip).

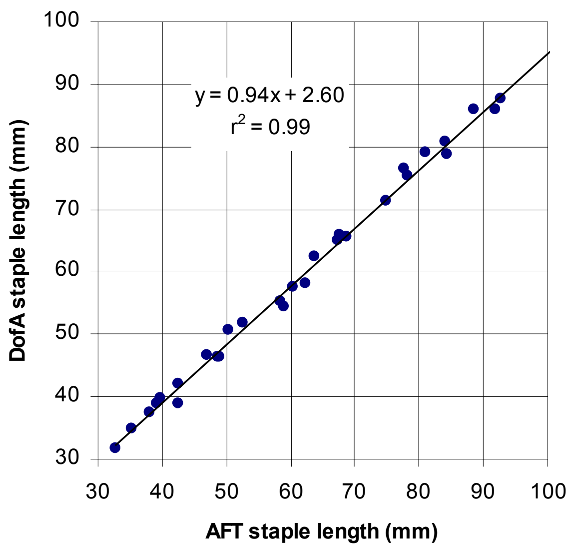

Figure 3. The relationship between Australian Fibre Testing (AFT) and Department of Agriculture Western Australia (DofA) estimates of staple length based on an average of 3 replicate staples from both mid-side and hip-bone sample sites.

Table 1. Estimates from the Profile Calculator of mean fibre diameter (MFD), clean fleece weight (CFW), hauteur and fleece value based on full profiles measured from staple 2 mm snippets by Australian Fibre Testing and the Department of Agriculture Western Australia on mid-side and hip-bone staples.

	Department of Agriculture Western Australia	Australian Fibre Testing	s.e.d
MFD (µm)	20.12	19.68	0.36
CFW (kg)[A]	3.02	2.79	0.10
Hauteur (mm)	73.2	69.7	2.24
Fleece value ($/head)	26.6	29.8	3.21
	Mid	Hip	
MFD (µm)[A]	19.47	20.33	0.32
CFW (kg)	2.83	2.98	0.11
Hauteur (mm)	70.9	72	2.37
Fleece value ($/head)	29.1	27.2	3.26

[A] Values in a row are significantly different (P<0.05)

DISCUSSION
In most applications, the 'measure as you grow' technique for measuring FD profile is sufficient to predict monthly changes in FD along the staple. However, there were cases where the mean FD of snippet sections differed significantly between the 2 laboratories. There tended to be a bias in estimates between the 2 laboratories (0.4 μm), which indicated that either the calibration of the instruments differed (Laserscan *v.* OFDA100) or that the different scouring techniques may have accounted for the bias. However, this difference was insignificant at P = 0.05 due to the low number of flocks compared (n=6).

Differences between mid-side and hip-bone were consistent with previous studies (Peterson and Gherardi 2001; Oldham *et al.* 2002) and a correction between hip-bone mean FD and fleece mean FD must be determined for each flock if staples from the hip-bone are to be used to accurately assess the mean FD of the fleece. The Profile Calculator incorporates an ability to enter a correction factor for FD between sample sites. This correction factor has been shown to differ significantly between flocks so that the correction factor must be calculated for each flock (Peterson and Gherardi 2001).

The 'measure as you grow' technique for estimating FD profile parameters appears precise enough to be used as a guide to growers. However, other alternatives need to be investigated which provide a more accurate and precise estimate of the FD profile. Some growers have indicated a preference to meet mean FD targets of within 0.3 μm of the sale-lot test, and the 'measure as you grow' technique lacks the precision to achieve this. The measurement of FD profile using the OFDA2000 may provide a more accurate and precise alternative to the 'measure as you grow' technique. Further work on the OFDA2000 that complements this work is now being carried out.

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