A NEW APPROACH TO MANAGING WOOL PRODUCTION - 'MEASURE AS YOU GROW'

C.M. OLDHAM, S.G. GHERARDI, B PAGANONI and M. YELLAND

Wool Program, Department of Agriculture, Locked bag No.4 Bentley Delivery Centre, WA 6983

SUMMARY
This paper reports the results for three separate experiments used to explore aspects of a new field technique designed to estimate the monthly change in the fibre diameter (FD) and staple length (SL) of flocks; a new tool that would allow woolproducers to adopt a 'measure as you grow' (MYG) approach to managing wool quality. The new technique uses single staples cut on the skin using curved surgical scissors from immediately above the right hipbone of a random sample of sheep each month. The average FD of pooled 2mm snippets cut from the base of each staple is plotted against average SL. The first two experiments established the LSD (95% confidence limits) in FD and SL with increasing number of sheep sampled. In addition, it was established that between sheep variance in SL had the greatest influence on estimated SL. There was no influence of either the person cutting the staple or the person measuring the SL when a standard method was used. The SL of staples cut from above the left hipbone were not significantly different from the right hipbone but the hip staples were 1.5mm shorter than midside staples ($P<0.005$). In the third experiment, a single staple cut from immediately above the right hipbone of a random sample of 20 sheep each month was used to plot an MYG FD profile for each of 16 commercial flocks. The last sampling for the MYG FD profile was taken within 30 days of shearing. The seasonal variation in FD along the MYG profile was similar to that along hip or midside staples taken from a random sample of 50 sheep at shearing and measured using an OFDA2000. The length weighted mean FD of the MYG FD corrected for the difference in FD between the hip and the midside sites was a reasonable estimate of the flock mean FD (17.3µ ± 0.30 *v* 17.8µ ± 0.36; mean ± sem for MYG FD and 50 minicored midside samples, respectively). The mean FD of the hip staples was greater than the midside staples but the magnitude of the difference was variable between age groups on the same farm and between the same age and genotype run on different farms. The cost of the MYG service in a commercial wool testing laboratory is $5.50 per flock per month and it was concluded that it could provide an effective management tool for monitoring the effects of changes in grazing pressure on the FD of the wool grown.

Keywords: wool, sheep, management, staple length, fibre diameter, fibre diameter profile

INTRODUCTION

Peterson *et al.* (2000) reported that staple strength (SS) of young Merino sheep was significantly increased by restricting feed intake on green feed after the break of season compared to sheep grazed at the district average stocking rate. Restricting feed intake after the break of season increased the SS because it reduced the rapid increase in FD associated with the onset of the new season green pasture; i.e. 'flattened' the annual FD profile. Thus, restricting intake in winter/spring also resulted in a reduced mean FD and the strategy proved very economical since both the quality (FD and SS) and quantity (kg/ha) of wool grown increased simultaneously.

Traditionally, woolproducers have attempted to use measured or estimated changes in liveweight and/or condition score to indirectly manage wool quality (Gherardi and Oldham 1998). However, both Peterson *et al.* (2000) and Oldham (2000) reported a poor correlation between liveweight change and SS in flocks under paddock conditions. Alternatively, new technology such as the OFDA2000 (Peterson and Gherardi 2001) could be used to directly monitor changes in the FD profile of a sample of sheep within the flock. With this approach single staples are spread on a stage and optically scanned in 5mm steps. For a sample of 20 sheep this approach will give estimates mean (± sem) of the FD (± 0.15µ), the FD at any point along the staple (± 0.35µ) and the staple length (SL; ± 1mm). However, the current commercial OFDA2000 service is in the order of $1.20 per staple measured so it was decided to research an alternative less expensive approach. The site above the hipbone was chosen for speed, accuracy of sampling and convenience. It was hypothesised that manual measurement of SL from single staples cut from this site combined with pooled cuts of 2mm snippets from the base of each staple would provide estimates of flock FD and SL, and over time, estimates of change in flock

FD and SL that would be of similar accuracy to existing technology. Further, it was hypothesised that the sum of the length corrected mean FD would provide a reasonable guide to the flock average FD before shearing.

MATERIALS AND METHODS

Exploration of sampling issues

Experiment1 (Fibre diameter) In each of 4 commercial flocks of young Merino sheep, staples were cut from the midside (approximately 20cm from the backbone over the last rib) of 40 tagged individuals selected at random. All flocks consisted of approximately 14 month-old mixed sex sheep, with average liveweight between 38 and 44kg and average SL varying between 85 and 95mm (approximately 11 months wool growth). Two flocks were of medium non-Peppin blood run in separate paddocks on the same farm and the remaining two flocks were of Peppin blood also run as separate flocks on a second farm. The staples were removed on the skin with curved surgical scissors and rolled in soft toilet paper. In the laboratory the base 2mm was cut from each staple and the mean FD was measured on an OFDA100 (a minimum of 2000 fibres were measured). The variance in FD between staples within flocks was used to estimate the least significant difference (LSD; 95% confidence level) in FD with increasing number of sheep sampled.

Experiment 2 (Staple length) In a commercial flock of 14 month-old Merino wethers with average SL at the midside of 81mm, four operators (woolproducers) cut a staple from immediately above the right hip bone of the same group of 93 individual tagged sheep. One operator also cut a staple from above the left hipbone and the right midside of the same group of sheep. In this case the staples were collected into individually labeled envelopes. In the laboratory, SL of each staple was measured independently by three operators. The SL was measured by hand using a clear plastic ruler. The wool staple was roughly straightened by hand and pressed flat using the weight of the ruler but not stretched. The staple was measured from the tip to the base to the nearest millimetre; from the point at the tip and the base where a majority of the staple fibres are aligned. Note wispy fibres at the tip and base do not contribute to the SL measurement. The variance in SL within the flock was used to estimate the LSD (95% confidence level) in SL with increasing number of sheep sampled. Differences in SL between sampling site (midside, right and left hip), staple cutter and staple measurer were examined using ANOVA (Genstat).

The relationship between flock performance estimated using the 'measure as you grow' FD profile compared with standard laboratory tests conducted on midside samples after shearing

Experiment 3 (MYG FD profile in commercial flocks) In our studies we use a standard laboratory test for FD (minicore and OFDA100) on 25g midside samples of greasy wool taken from 50 randomly selected sheep to estimate the unbiased (unclassed) performance of the flock for the year for skirted fleece wool (CM Oldham pers. com.). In this experiment the mean FD from 16 Commercial flocks of Merino sheep was compared with the mean FD predicted from their flock's MYG FD profile (AD Peterson pers. com.). In Peterson's system the length corrected mean FD of the MYG FD profile is corrected for the mean difference in FD between a hip staple taken at shearing measured on the OFDA2000 and the mean FD of the standard midside samples taken from the same 50 sheep. The sheep had 8 to 14 months of wool growth and were shorn between August 2001 to February 2002. In these flocks the last sampling of the MYG hip staples was conducted within 30 days of shearing (range 29 to 2 days). In Western Australia at the time of writing, Australian Fibre Testing of York, is providing this service commercially to approximately 50 woolproducers at $5.50 per flock; i.e. $5.50 per set of 20 staples.

RESULTS

Experiment 1 The LSD in FD varied from around 1.8μ for 5 sheep to 0.6μ for 40 sheep and was similar among the 4 flocks sampled (Figure 1).

Experiment 2 The LSD in SL varied from around 8mm for 10 sheep to 1.0mm for 90 sheep and were similar among the 3 sites sampled (Figure 2). The SL of single staples cut from above the right hipbone of 93 young Merino sheep was highly variable (range 57 to 100 mm). However, the measured SL was independent of the person who cut or who measured the staples. The mean SL of staples cut above the left hipbone (79.0mm) was not different from those cut above the right hipbone (78.1mm; P

= 0.08). However, the mean SL of the staples cut from the midside was longer than those cut from the hipbones (80.9mm *v* 78.6mm, respectively; P=0.005).

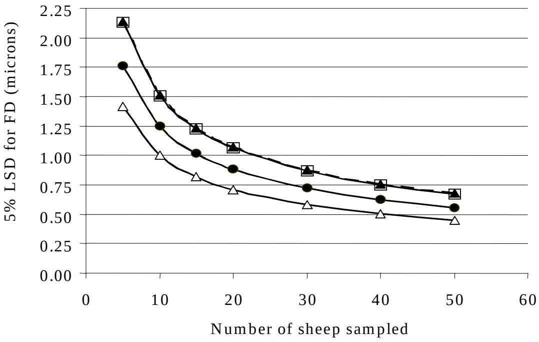

Figure 1. The effect of sample size on the least significant difference FD; from 2 mm snippets cut from the base of single midside staples from 40 young Merino sheep; Flocks 1 (▲) and 2 ( ) were medium non-Peppins and Flocks 3 (ρ) and 4(●) were Peppin blood

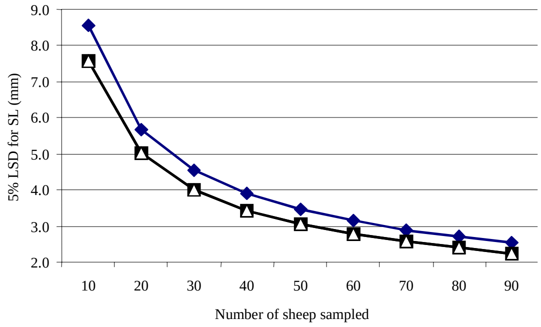

Figure 2. The effect of sample size on the least significant difference in SL; from staples cut from above the midside (◆) , right hipbone (ρ) or left hipbone (■) of the same flock of 93 Merino

Experiment 3 - The mean FD of the hip staples was greater than the midside staples (mean = 0.8µ sem = 0.12µ; range = 1.6 - 0.1µ). However, the magnitude of the difference was variable between age groups on the same farm (0.9 v 0.1µ; 14 month-old and 26 month-old, respectively) and between the same age and genotype run on different farms (0.4, 0.7, 0.9, 0.2 and 0.5µ; for 5 different flocks of 14 month-old Merino ewes).

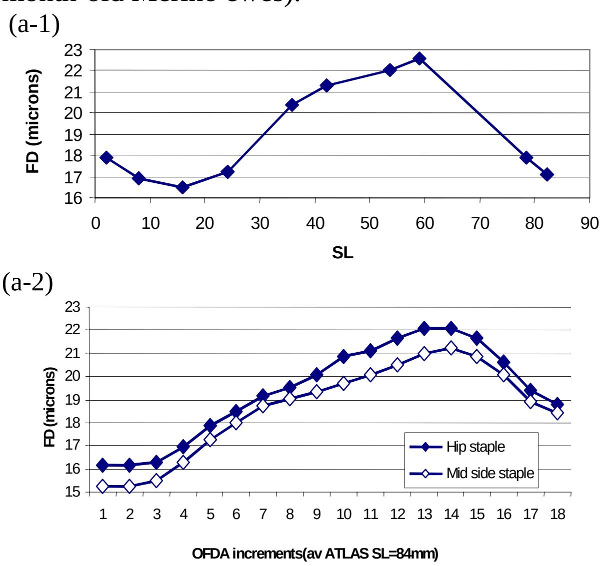

Figure 3. The MYG FD profile for 14 month-old ewes shorn in February (a-1) and OFDA2000 FD profiles for hip and midside staples (a-2) - hip to mid correction = 0.7 microns

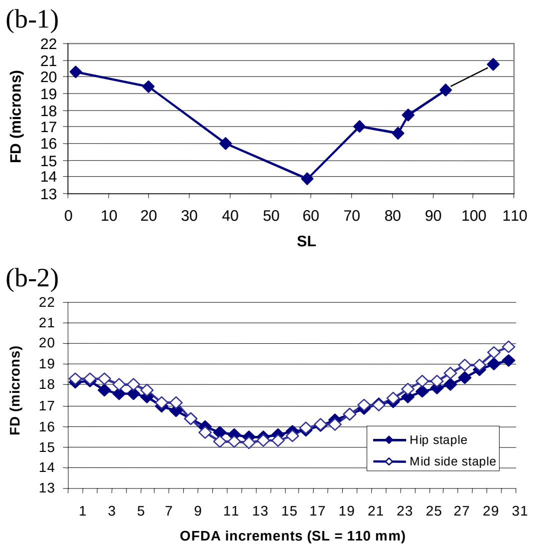

Figure 4. The MYG FD profile for 14 month-old ewes shorn in October with lamb tip (b-1) and OFDA2000 FD profiles for hip and midside staples (b-2) - hip to mid correction = 0.1 microns

The two typical examples shown in figures 3 & 4 demonstrate that seasonal change in FD in the MYG profile is similar to the OFDA2000 profile for the hip and changes in hip staples measured by the OFDA2000 also accurately reflect changes in the midside staples. The Flock FD estimated from the 50 midside samples taken at shearing was not different from the estimate using the Australian Wool Testing Authority test certificates for the main fleece line produced from the flocks (17.8 ± 0.36µ *v* 17.7 ± 0.20µ, respectively). The estimate of flock FD calculated from the MYG FD profile for the flocks, corrected for the difference in FD between the hip and midside sites, was not different from our standard estimate of the mean Flock FD (Table 1).

Table 1. The fibre diameter (FD) predicted from 'measure as you grow' FD profiles (MYG FD; corrected for the difference in FD between the hip and midside sites) compared with the standard estimate of flock

FD (Flock FD; minicores and OFDA100 on midside samples from a random N=50) for each of 16 commercial flocks of Merino sheep

	Flock performance	
	MYG FD (μ)	Flock FD (μ)
Mean	17.3	17.8
Range	19.9-16.2	20.8-16.5
Sem	0.30	0.36

DISCUSSION

Pragmatically, there is no doubt that sampling above the hipbone, is much quicker, easier and more accurate than sampling from the midside. The monthly change in FD in hip staples also accurately reflects changes in the midside staples. The average variation in FD from minimum to maximum along the FD profile of staples drawn from 370 sale lots sold at auction in Fremantle and shorn between September 1997 and September 1998 was 6.1 μ (C.M. Oldham pers. com.). Hence, we believe that if woolproducers sample 20 sheep per flock per month, they will be able to detect and react to, real changes in FD of ± 0.8μ and that is sufficient within their current grazing systems. Furthermore, the prediction method developed by AD Peterson for predicting mean FD of flocks from their MYG FD profile appears to offer promise as new management tool for wool producers. In the current analysis the MYG estimate of flock FD was calculated using the difference between the overall length weighted mean FD of the MYG FD profile and the mean FD of the midside sample from the same 50 sheep at shearing. However, the relationship appears more complex than reported by Young and Chapman (1958). Future experiments should explore the use of correction factors assessed between hip and midside staples sampled much early in the wool growing year and over years within the same genotype and with increasing age.

In Western Australia 53 woolproducers are currently monitoring the monthly change in FD in at least one flock of Merino sheep, as part of the Precision Wool Production project (see House *et al.* 2002). The woolproducers in this project nominate the target FD, SL and SS that they want the flock to achieve 12 months in advance and are developing new satellite based feed budgeting tools to allow them to meet their targets with the help of the Department of Agriculture, CSIRO and DOLA (Henry *et al.* 2002). As this project develops and control over the grazing systems improves it may be necessary to sample more sheep per flock and/or change over to a more accurate and precise system of measurement. With this in mind it is proposed to conduct a direct comparison of the MYG system with monthly measurement on the OFDA2000. In the latter case the FD profile of each new batch of staples creates the latest estimate of current FD at the new SL but also adds additional information for previous estimates of FD earlier in the profile. This increase in accuracy and precision may justify an increase in cost.

ACKNOWLEDGEMENTS

The technical assistance of Robyn Bradley, Robyn Pitman as well as Tricia and Lorraine Hewett of Australia Fibre Testing, York, WA is gratefully acknowledged, as is the enthusiastic cooperation of the woolproducers participating in experiment 3.

REFERENCES

GHERARDI, S.G. and OLDHAM, C.M. (1998). *Anim. Prod. Aust*. **22**, 193.
PETERSON A. and S.G. GHERARDI (2001) *Wool Tech. Sheep Breed*. **49**, 110.
HENRY, D., EDIRISINGHA, A., DONALD, G. and HILL, M. (2002). *Anim. Prod. Aust.* **24**, (these proceedings).
HOUSE, R., BILNEY, R., LADYMAN, D., OLDHAM, C. M. and YELLAND, M. (2002). *Anim. Prod. Aust.* **24**, (these proceedings).
OLDHAM, C.M. (2000). *Asian-Aust. J. Anim. Sci*. **23 (Vol A)**, 301.
PETERSON A and C OLDHAM (2000) *Proc. Int. Wool Tex. Res. Conf.* **10**, (in press), Germany.
PETERSON, A.D., GHERARDI, S.G. and ELLIS, M.R. (2000). *Asian-Aust. J. Anim. Sci.* **23 (Vol A)**, 469.
YOUNG, S.S.Y. and CHAPMAN, R.E. (1958). *Aust. J. Agric. Res.* **9**, 362.

Email: coldham@agric.wa.gov.au