

**Feed Gaps and Fibre Variations.**  
**The development of along staple diameter  
measurement as a diagnostic tool for improved  
grazing management**

**2004**

**Second Year Results**

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***Report on the 8x5 Project  
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The development of along staple diameter measurement as a  
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**SUMMARY**

This report details the results of the second year of the project. The 2003 report can be found on the 8x5 web site at <http://www.8x5.com.au/FDprofile.htm> Like the previous year this, 2004 report is written to allow the producers involved to compare their results with others.

In 2004, one hundred and fifty individually identified mobs, (55 ewe, 56 wether and 39 weaner mobs) were sampled compared with ninety one mobs, (40 ewe, 33 wether and 18 weaners) in 2003.

The biggest difference in seasonal effects was the rainfall in January and February 2004. The total for the 2 months in 2003 and 2004 was 44 and 199 mm in Swansea, 12 and 201 in Bothwell and 9 and 115 in Ross, three Bureau of Meteorology recording sites within the wool growing area.

Overall, the 2004 weaner wool was 4.5 N/ktex stronger with a lower range in maximum and minimum micron and over 30% of the mobs had a strength of 40 N/ktex or stronger compared with 11% in 2003.

Wethers were on average only 2 N/ktex stronger than 2003 and were similar in wool characters other than the position of break. In 2004 the break was closer to shearing time and over 25% of the mobs had a minimum micron position which would have been in the jaws of the ATLAS machine, resulting usually in a different position of break at a higher staple strength.

Ewes had an average staple strength of 40.1 N/ktex, an increase of 3.7 on 2003. The within mob micron range was lower than the previous year with a range of 3.1 micron compared with 3.8 in 2003

The difference between ewes, and wethers and weaners was the difference in profiles in the 2 years. Unlike the wethers and weaners, in ewes there was a reduction in micron in many mobs in late summer.

One of the problems in wool measurement is the lack of a relatively easy and quick method of estimating staple strength. Having over 1600 individual ewe and wether and 1100 weaner OFDA data and measures of staple strengths allowed a number of comparisons of strength against OFDA measurements to be made. On an individual sheep basis there were no OFDA measurements which could explain much of the staple strength variability, while on a mob basis only the total coefficient of variation of fibre diameter ( $CV_D$ ) and across fibre  $CV_D$  from the OFDA data were well related to staple strength and even then could explain no more than 30% of the variation in staple strength. This is consistent with Western Australian data.

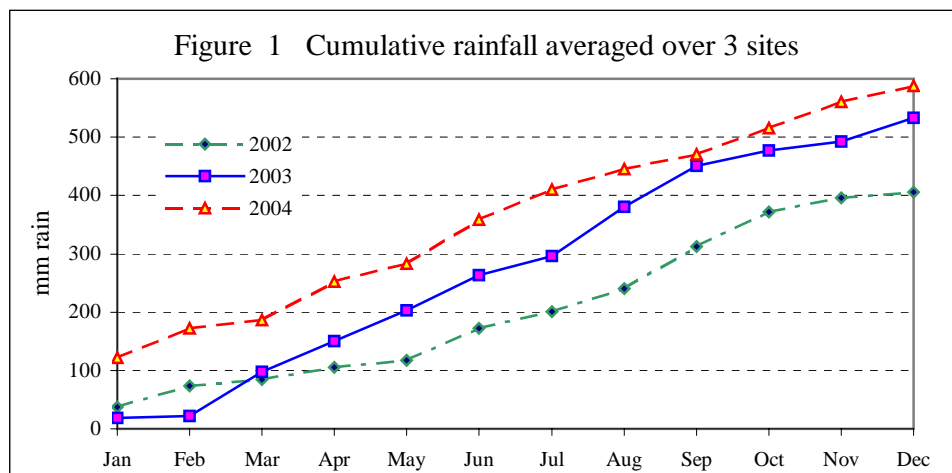
The data from 2003 and 2004 were also used to investigate the relationship between individual sheep or mob staple strengths in consecutive years. With this preliminary data, in neither case was there a significant relationship, ie individuals or mobs which had high staple strength in 2003 did not necessarily have the same in the subsequent year.

## BACKGROUND

Staple strength and fibre diameter are two of the major factors in determining wool price as fibre diameter broadly determines the use for the wool and strength affects processing properties. Among other properties of wool which may lead to discounts are staple length, variation in fibre diameter ( $CV_D$ ) and curvature.

Fibre diameter during the year is based primarily on the sheep's nutrition and health. In the Tasmanian fine wool growing area, much of the feed is provided by annual grasses. Low summer rain has a more significant effect on their productivity than it does on perennial pastures. Therefore to allow comparison between years, the monthly rainfall figures from 3 stations in the wool growing area, Ross, Bothwell and Swansea are shown in Table 1 (Bureau of Meteorology Jan. 2002 – Dec. 2004)<sup>1</sup> and summarised as cumulative annual averaged rainfall in Figure 1 and can be compared with the long term averages in Table 2

	Ross			Bothwell			Swansea		
	2002	2003	2004	2002	2003	2004	2002	2003	2004
Jan	49	9	81	27.2	9.2	107	35	37	177
Feb	40	0	34.4	20.8	3	93.6	47.8	7.4	22.4
March	6	5	11.4	19.2	73.2	18.4	8.2	148.2	15
April	20	0	47.4	3.2	55.8	43.2	39.2	101.4	104.9
May	11	0	20.4	13.4	34.4	51.6	11.8	123.7	19.7
June	51	66	102	74.4	49.4	68	40.2	66.3	59
July	40	45	56.8	38	44.2	72	8.4	9.6	24.2
Aug	39	76	11.4	42.4	81.4	75	34.6	95.6	18.6
Sept	76	69	23.8	91	106.6	39	49.4	35.4	14.6
Oct	66	19	44.6	50.8	31.4	37.4	63.6	27.8	51.7
Nov	31	6	37.2	24.2	6	42	17	35.8	56.2
Dec	11	36	21.6	9.4	41	33.2	9.8	43	27.2
<b>Total</b>	<b>440</b>	<b>331</b>	<b>492</b>	<b>414</b>	<b>535.6</b>	<b>680.4</b>	<b>365</b>	<b>731.2</b>	<b>590.5</b>



<sup>1</sup> Bureau of Meteorology (2002 – 2004) Monthly Weather Review – Tasmania. Commonwealth of Australia.

Table 2 Long term rainfall averages at 3 sites in the wool growing area			
	Ross	Bothwell	Swansea
Jan	59.2	38.7	50.4
Feb	40.9	38.3	41.8
March	32	38.1	50.8
April	38.7	48.8	52.2
May	32.2	42.5	47.6
June	34.9	43.3	58
July	41.6	45.4	48.5
Aug	45.8	47	44.3
Sept	51	45.3	40.7
Oct	46.8	55.1	53.5
Nov	44.8	51.5	51.6
Dec	40.4	51.3	61
<b>Average</b>	<b>508.3</b>	<b>545.3</b>	<b>600.4</b>

Staple strength is more difficult to measure than fibre diameter as it is determined by a number of wool characteristics: the actual force needed to break the staple, staple length and the number of fibres in the sample tested. The formula for calculating staple strength is:-

In some markets there is a discount for wool with a staple longer than 85 mm, particularly in fine wools (17 micron).

$\text{Staple Strength} = \frac{\text{Force}}{\text{Linear Density}}$ $\text{Linear Density} = \frac{\text{Sample clean wool wt.}}{\text{Staple length}}$
---

Variation in fibre diameter ( $CV_D$ ) is an estimate of the variability across and along wool fibres in a staple, with more uniform staples having a lower  $CV_D$ . It is calculated from fibre measurements in OFDA, Laserscan and related equipment. There is premium for low  $CV_D$ , but usually it is more evident in superfine wool with high staple strength.

Curvature is closely related to crimp frequency, with low crimp frequency corresponding to low curvature. There is sometimes a premium for high crimp frequency and therefore high curvature in superfine wool.

## THE PROJECT

### METHODOLOGY

For each mob, at shearing, midside samples are taken from 30 individuals at random on the skirting table and stored in individually identified bags. This technique was chosen to minimise the interference to normal shearing practices. The samples are analysed with an OFDA 2000 at Roberts Ltd. and length, strength and yield measured by the Aust. Wool Testing Authority, Melbourne laboratories (AWTA). Length and strength are measured on individual staples, but a single yield is measured from each mob of sheep. The OFDA SP2 files and direct ATLAS outputs are provided by the companies and are used to compare data from individual sheep. SP2 files are the raw data files from the OFDA 2000, and contain all the individual sheep measurements.

On the basis of published literature wool profile data are corrected for variation in growth rate assuming the rate of wool fibre growth is directly proportional to diameter and are adjusted to fit the time between shearing dates using a program developed by Dr P Johnson, TIAR.

The date of the point of break (POB) is calculated from the weight of wool in the two ends broken by the ATLAS machine at AWTA during strength measurement. Approximate point of break is calculated for each sheep and the results averaged and presented to show a time of break one standard deviation each side of the mean date for the mob. The weight of the tip is divided by the total weight of the staple (tip plus base) and converted from the AWTA data to an approximate number of days since shearing. The date is approximate as it is assumed that the wool has grown evenly throughout the year and there is no correction for variations in growth rate. The Standard deviation, rather than an actual date, is presented to give an estimate of the variation in the individual sheep date of break. One standard deviation each side of the average date includes 68% of the of the individual results. POB is usually presented in AWTA reports as the percentage of tip, middle or base breaks.

Results are reported to growers on an averaged mob basis, although in several instances producers request individual data.

In 2003, 40 ewe, 33 wether and 18 weaner mobs from 36 properties were sampled. This increased to 55 ewe, 56 wether and 39 weaner mobs from 46 properties in 2004.

The data collected for individual animals are

- Staple length
- Staple strength
- Average micron
- Micron range for each staple
- Maximum and minimum micron
- Overall coefficient of variation ( $CV_D$ )
- Along and across staple  $CV_D$ .
- Overall Standard deviation (SD)
- Along and across staple SD

The data calculated are

- Approximate date of break
- Standard deviation of the date of break in a mob

An advantage of this project is that graphing the profile allows the actual minimum point to be estimated whether it is held within the jaws of the ATLAS machine or not. As AWTA testing can only measure points of break more than 12 mm from the staple tip and base, there are cases where the actual minimum and therefore probable point of break at the tip or base of the staple would be masked.

A typical grower report is shown in Appendix 1

## RESULTS

### Key Findings

- There were differences in profiles between 2003 and 2004.
- Fifty percent of weaner wool was over length 85 mm and could be subject to price discounts
- The primary weaner break was in summer, but the minimum fibre diameter was in winter with 6 mobs having the minimum within the normal ATLAS jaw grip length.
- The date of break in wethers was close to the base of the staple and on average occurred only 71 days prior to shearing.
- Many ewe mobs in 2004 had profiles with a late summer – early autumn drop in the micron profile as a result of some of the sampled group having the minimum micron at that time, while the rest of the group had a winter minimum.

### TRIAL RESULTS

In the results the property number is consistent throughout. In some cases, several mobs from the same property were sampled. These were either different age groups or managed differently.

The staple strength results from 2004 are summarised in Table 3, with a comparison of the percentages in each class from 2003 and 2004 in Table 4.

The usually accepted differentiation between sound and tender wool is around 32 N/ktex, but currently there is commercial demand for wool of more than 40 N/ktex, and discounts in value occur for weaker wool than this, at least in the finer lines.

In 2004, 31% of weaners and over 50% of ewe and wether mobs tested had staple strengths above 40 N/ktex, and 77% of weaners, 88% of wethers and 96 % of ewes above 32N/ktex, the minimum for sound wool.

Strength Range N/ktex	AWEX Description	AWEX ID	Number of Mobs		
			Weaners	Wethers	Ewes
> 40	Sound		12	30	28
32 - 40	Sound	-	18	19	25
25 - 31	Part tender	W1	9	7	2
18 - 24	Tender	W2			
1 - 17	Very tender	W3			
	Total no. of mobs		39	56	55

Strength Range N/ktex	AWEX Description	AWEX ID	Percentage					
			Weaners		Wethers		Ewes	
			2004	2003	2004	2003	2004	2003
> 40	Sound		<b>31%</b>	11%	<b>54%</b>	39%	<b>51%</b>	30%
32 - 40	Sound		<b>46%</b>	28%	<b>34%</b>	31%	<b>45%</b>	55%
25 - 31	Part tender	W1	<b>23%</b>	61%	<b>12%</b>	30%	<b>4%</b>	15%
18 - 24	Tender	W2						
1 - 17	Very tender	W3						
Total number of mobs			<b>39</b>	18	<b>56</b>	33	<b>55</b>	40

#### Statistical note

A simple statistical comparison ( $\chi^2$ ) of the numbers of mobs in each staple strength class in 2003 and 2004 showed a significant difference with more mobs having greater strength in 2004 in the ewes ( $\chi^2=6.38$ ) and weaners, ( $\chi^2=8.04$ ), but not the wethers ( $\chi^2=4.39$ ).

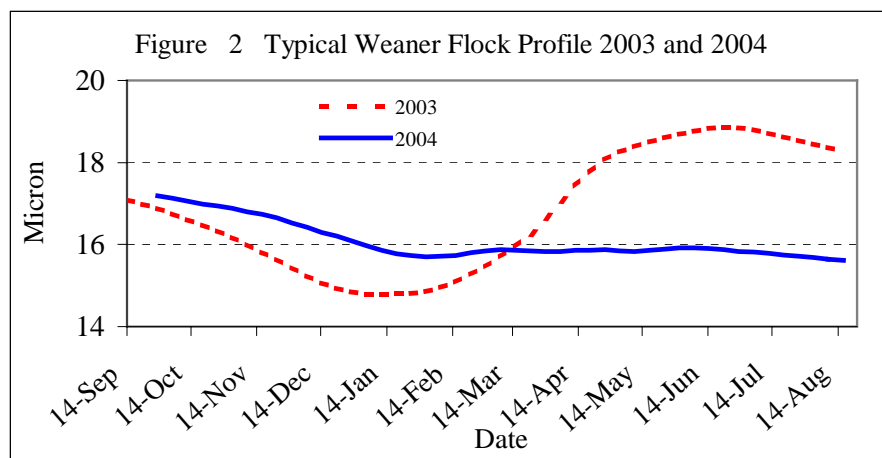
### Weaner Results

Weaners are referred to in this document as being sheep up to their first full shearing, they may or may not have been shorn as lambs. Dates in the weaner data are less precise than older sheep because unless they had the lamb tip removed the birth date was averaged over the time lambs were being born.

The individual property weaner data is shown in Table 5 with selected data graphed in Figures 3 – 7. These figures provide information on the distribution of a number of features of wool production and quality. Figure 8, an average of the 2003 – 2004 monthly rainfall from Table 1 is included to allow comparison of rainfall with the wool character figures.

- Weaner shearing was predominantly in July - November.
- Sixty percent of the wool break was in January – March, with 30% in April - July
- The wool was long enough not to attract a discount for under length, with all mobs averaging over 70 mm. Over 50% of the mobs had an average length greater than 85 mm and were therefore at the risk of having a discount applied.
- The average fibre diameter was 17.3 microns, with a range between mobs of 15.7 to 20.3, compared with an average of 17.7 microns in 2003.
- Within mobs, the average variation in micron (micron range) was 2.7 microns, with the smallest variation being 2.0 and the greatest 3.6 micron. This was a reduction on the average of 3.9 microns in 2003.
- Staple strength averaged 36.4 N/ktex and varied between 24.5 and 48.1 N/ktex. (see Tables 2 and 3 for the distribution of staple strength). In 2003 the average was 31.9 N/ktex.
- 39 weaner mobs from 32 properties were involved

Profiles from weaners from different properties were more varied than wethers or ewes, but the trend was towards the 2003 and 2004 profiles represented in Figure 2. These graphs are not from the same group of sheep, but represent lambs born on the same property in 2002 (Shorn 2003) and 2003 (shorn 2004) and show the lower micron range which occurred in 2004. The graphs indicate that in 2004, the minimum point in the staple was close to the shearing date, rather than the autumn point of 2003. This would have resulted in some mobs having the minimum point of the staple in the jaws of the ATLAS machine and therefore a higher strength as the staple would have broken at the next weakest point.



In 2004 there were more than twice the number of mobs involved in 2003. The major differences were in staple strength which was higher in 2004 and the variation in diameter along the fibre which was lower. This is reflected in a lower overall micron range, ie the difference between the maximum and minimum fibre diameters during the year, and the along staple coefficient of variation ( $CV_D$ ). The difference was around 30% for both figures which is not surprising as they measure similar wool properties, ie the variation in micron along the fibres during the year. The across staple  $CV_D$  was similar between the 2 years. This lower variation could have been partly due to the better summer rain in 2004 (see Table 1 and Figures 1 and 8) providing more feed at this time.

In this report the minimum point on the staple is calculated from the average of the individual sheep minima, and so will differ from the minimum shown on the graph sent to growers which was the average of the individual sheep micron calculated each week. The average of the individual minima can be used to indicate some change in the shape of the wool profile, and from Table 5 it is evident that the minimum overall was later than in 2003, being in May rather than February. Over 40% of the weaner mobs had a minimum point in June – August and 7 mobs would have had the minimum point in the jaws of the ATLAS machine, resulting usually in a different position of break at a higher staple strength. Overall, the calculated position of break was similar in 2003 and 2004.

Table 5 Summary of weaner staple data

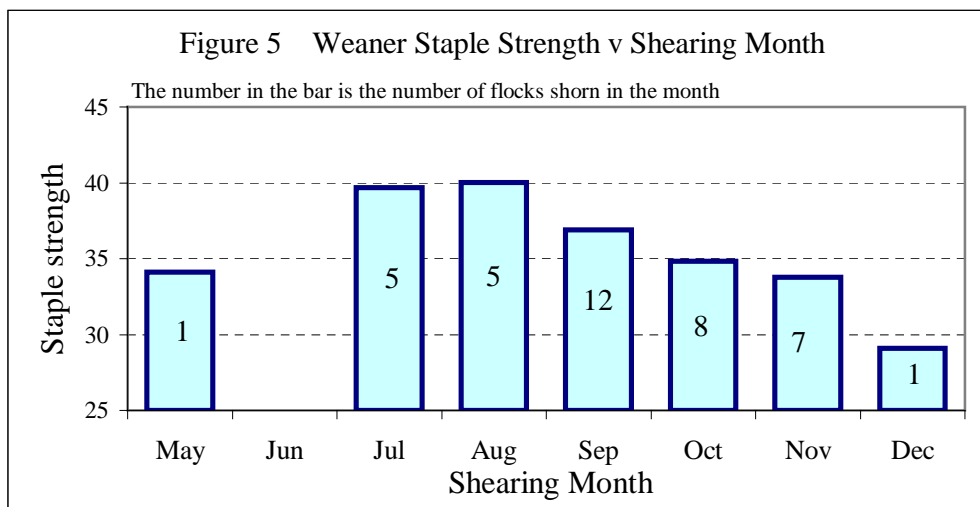
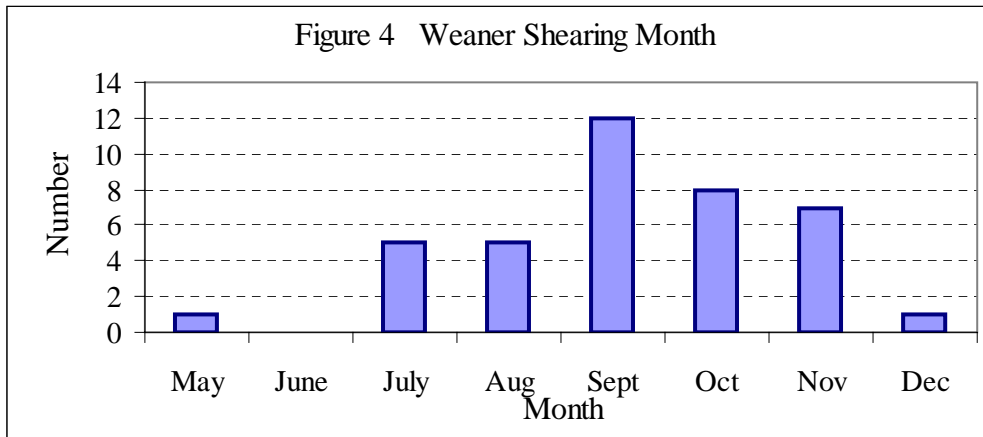
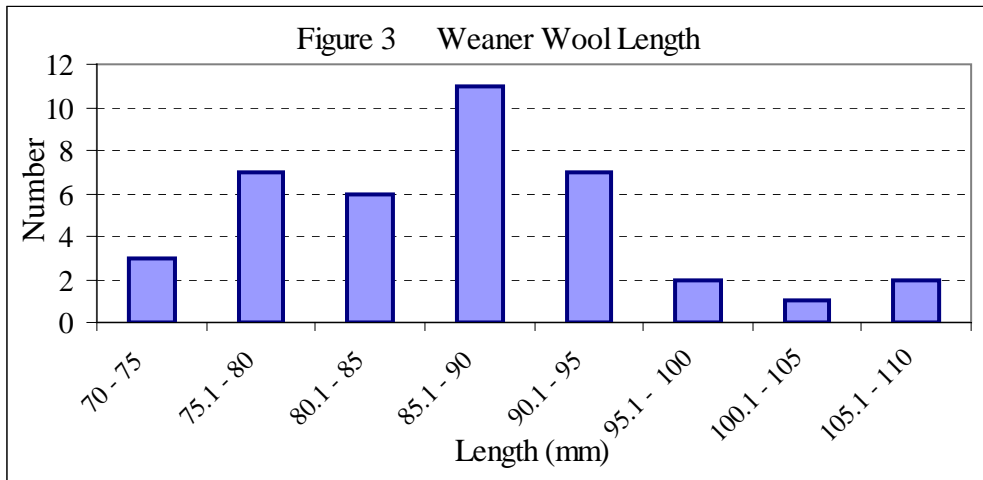
Property No.	Length (mm)	Staple Strength N/ktex	CV <sub>D</sub> *	Av micron	Along Staple CV <sub>D</sub> *	Across Staple CV <sub>D</sub> *	Micron Range	Minimum Date	SD#	Along Staple SD#	Across Staple SD#	Date Of Break	Shearing date
44	90.5	24.5	18.6	18.2	4.6	20.8	2.7	16-Feb-04	3.4	0.8	3.8	20-Apr-04	4-Oct-04
4	86.2	27.7	18.6	17.5	4.2	21.2	2.3	7-May-04	3.2	0.7	3.7	08-Jun-04	22-Nov-04
47	80.0	28.4	19.3	17.0	5.5	21.5	3.0	20-May-04	3.3	0.9	3.6	08-Jun-04	8-Nov-04
18d	79.1	29.0	18.2	16.1	4.9	20.5	2.4	20-May-04	2.9	0.8	3.3	03-Mar-04	4-Oct-04
37	95.3	29.1	18.1	15.8	4.6	19.6	2.2	30-Jul-04	2.8	0.7	3.1	01-Jul-04	10-Dec-04
2a	80.4	29.4	18.7	16.2	5.8	20.3	2.8	6-Jan-04	3.0	0.9	3.3	11-Mar-04	13-Aug-04
34	106.4	29.5	18.1	18.3	4.5	21.2	2.7	15-Apr-04	3.3	0.8	3.8	22-Jan-04	4-Nov-04
2b	75.7	29.6	18.2	15.9	5.1	20.1	2.5	22-Feb-04	2.9	0.8	3.2	23-Feb-04	7-Sep-04
28	93.6	30.3	18.5	16.6	5.1	21.5	2.7	8-Jul-04	3.0	0.8	3.5	14-Mar-04	23-Aug-04
1	93.5	31.1	17.7	16.9	4.5	19.1	2.5	22-Mar-04	3.0	0.8	3.2	22-Dec-03	31-May-04
6	91.0	31.6	19.7	17.2	6.0	21.3	3.2	7-Jul-04	3.4	1.0	3.6	10-Mar-04	2-Sep-04
46	84.1	31.7	17.7	17.1	4.8	21.1	2.6	10-Mar-04	3.0	0.8	3.6	24-Jan-04	9-Aug-04
11	81.2	33.5	19.3	20.3	4.2	21.5	2.7	17-Mar-04	3.9	0.8	4.3	14-Mar-04	30-Sep-04
42	90.0	34.4	17.7	19.1	4.1	19.7	2.4	11-Mar-04	3.3	0.8	3.7	06-Apr-04	24-Nov-04
39	85.6	34.5	18.3	18.3	6.0	19.1	3.6	26-Jan-04	3.4	1.1	3.5	23-Dec-03	21-Jul-04
7	94.0	34.8	18.3	17.7	4.0	21.6	2.2	14-Feb-04	3.2	0.7	3.8	20-Jan-04	20-Oct-04
12b	81.0	35.0	18.7	15.9	7.0	19.7	3.2	11-Aug-04	3.0	1.1	3.1	19-Jun-04	30-Sep-04
10	88.4	35.4	18.3	17.6	5.2	20.1	2.9	6-Jul-04	3.2	0.9	3.5	10-Jul-04	30-Sep-04
33	96.9	36.1	18.4	17.4	4.8	19.8	2.7	9-May-04	3.2	0.8	3.4	19-Mar-04	20-Oct-04
9	72.4	36.4	17.7	15.7	4.6	20.9	2.0	15-Jul-04	2.7	0.7	3.2	24-Jun-04	30-Jul-04
18c	85.9	36.6	18.3	16.3	6.0	20.0	2.9	10-May-04	3.0	1.0	3.3	22-Feb-04	16-Sep-04
18b	93.8	36.7	18.6	16.6	5.2	20.2	2.7	7-May-04	3.1	0.9	3.3	24-Feb-04	30-Sep-04
18e	82.5	37.1	17.8	15.9	4.6	19.8	2.2	28-Mar-04	2.8	0.7	3.1	11-Mar-04	1-Nov-04
16	106.6	38.3	18.3	17.9	5.4	19.8	3.1	7-Jul-04	3.2	1.0	3.5	10-Mar-04	13-Aug-04
20	78.4	39.1	18.5	18.6	5.1	19.8	2.9	31-Jan-04	3.4	0.9	3.7	22-Jan-04	6-Sep-04

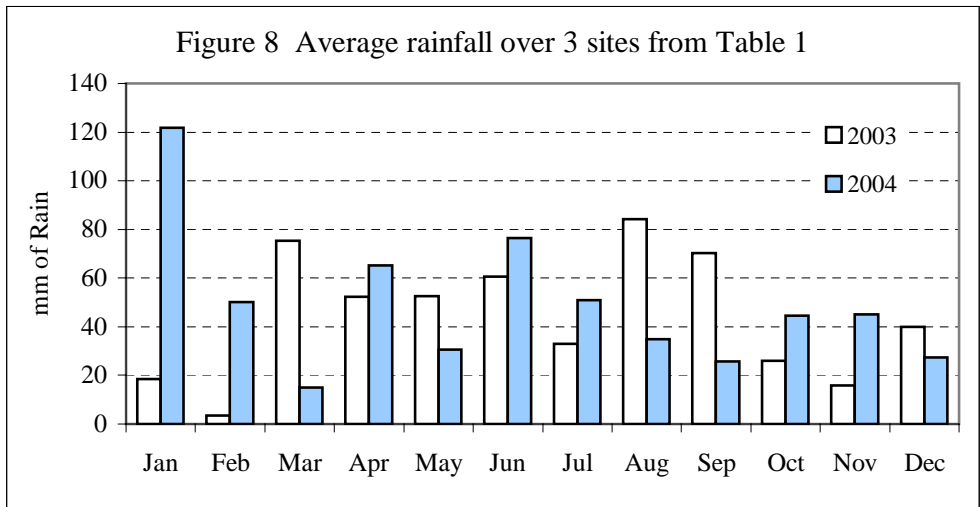
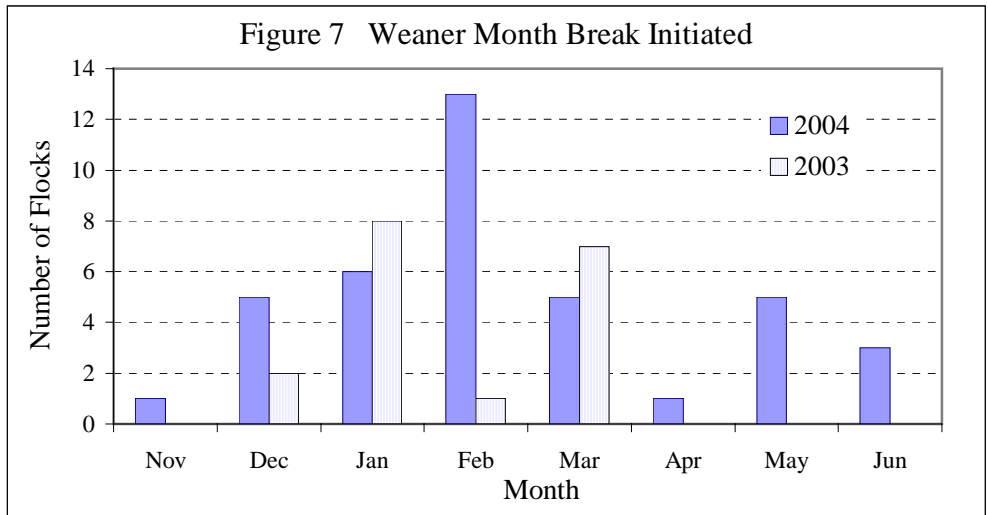
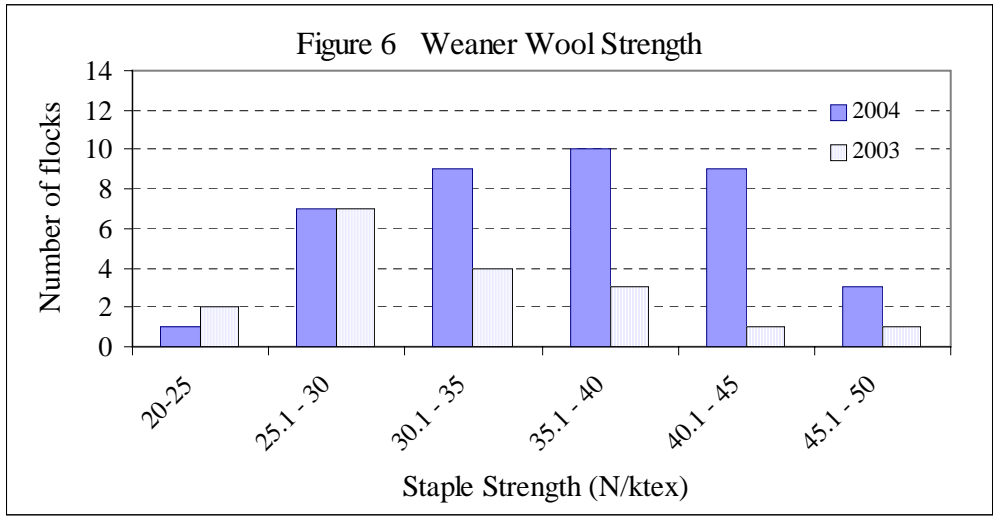
Property No.	Length (mm)	Staple Strength N/ktex	CV <sub>D</sub> #	Av micron	Along Staple CV <sub>D</sub>	Across Staple CV <sub>D</sub>	Micron Range	Minimum Date	SD	Along Staple SD	Across Staple SD	Date Of Break	Shearing date
18a	86.0	39.2	17.6	16.0	4.2	20.2	2.1	12-Jun-04	2.8	0.7	3.2	23-Mar-04	21-Sep-04
38a	101.6	39.7	17.1	19.0	4.0	18.9	2.3	17-Mar-04	3.2	0.7	3.6	22-Nov-03	1-Sep-04
41	85.2	40.1	18.4	16.3	6.5	19.9	3.2	11-Jul-04	3.1	1.1	3.3	27-Mar-04	16-Jul-04
27	83.4	40.1	18.7	17.4	5.0	20.7	2.7	15-Mar-04	3.2	0.9	3.6	31-Jan-04	27-Jul-04
12a	91.9	40.3	18.4	16.8	6.5	19.9	3.2	22-Jul-04	3.1	1.1	3.3	14-Apr-04	24-Sep-04
30	78.0	41.1	17.8	17.7	4.0	20.9	2.2	10-Jun-04	3.1	0.7	3.6	10-May-04	15-Oct-04
25	87.6	41.2	19.1	17.3	6.8	20.8	3.4	4-Jun-04	3.3	1.2	3.6	28-Feb-04	3-Nov-04
21	72.6	44.1	17.7	18.5	4.4	19.5	2.5	14-May-04	3.2	0.8	3.6	02-Mar-04	20-Sep-04
23	85.1	44.2	18.5	17.6	4.2	21.0	2.4	23-Jun-04	3.2	0.7	3.7	31-Jan-04	30-Jul-04
38b	76.0	44.4	17.7	16.6	4.9	19.6	2.4	25-Jul-04	2.9	0.8	3.2	24-May-04	24-Aug-04
8	87.2	44.5	16.2	17.7	4.3	18.2	2.2	14-Jul-04	2.8	0.7	3.2	29-May-04	4-Oct-04
40	86.1	46.3	17.4	17.4	4.9	18.8	2.7	9-Jul-04	3.0	0.9	3.2	21-Jan-04	3-Nov-04
32	71.0	47.2	17.0	17.0	4.0	18.3	2.0	1-May-04	2.9	0.7	3.1	20-Jan-04	5-Oct-04
36	78.0	48.1	18.2	17.7	5.4	19.3	3.0	2-Jun-04	3.2	0.9	3.4	24-Jan-04	6-Oct-04
<b>Average</b>	<b>86.2</b>	<b>36.4</b>	<b>18.2</b>	<b>17.3</b>	<b>5.0</b>	<b>20.2</b>	<b>2.7</b>	<b>May-04<sup>^</sup></b>	<b>3.1</b>	<b>0.9</b>	<b>3.5</b>	<b>March-04<sup>^</sup></b>	
2003 Average	82.5	31.9	18.8	17.7	7.0	19.7	3.9	Feb-04				Feb 04	

\*The coefficient of variation of fibre diameter (CV<sub>D</sub>) has 2 components contributed by the variation between fibre diameters (CV<sub>D</sub> across staple) and the variation in diameter along the fibres (CV<sub>D</sub> along staple).

# Standard Deviation (SD), another measure of the staple variability has similar components. In both, a higher value indicates more variation in the fibres.

<sup>^</sup> These averages are presented to provide a comparison between years.





## Wether Results

The primary aim of running wethers is for wool production, so their management should be aimed at producing the maximum amount of good quality wool. This is the only class of sheep which, once mature, can be managed almost exclusively for wool production.

The wether data are shown in Table 6 and Figures 10 – 13, Figures 10 and 12 only have results from mature sheep, 3 years and older, to remove any effect of low staple strength due to animals which are still growing. Figure 8, the 2003 / 04 average monthly rainfall is included for comparison.

- Staple strength ranged from 25.0 to 51.2 N/ktex, with a mean of 39.5 (see Table 1 for staple strength distribution). This compares with a mean of 37.6 N/ktex in 2003, although there were less mobs in 2003.
- Average micron was 18.6, with a range of 16.4 to 22.3, almost identical to the 2003 mean and range.
- Within mobs the mean micron range was 3.7, with a range of 2.3 to 5.2, again similar to the 2003 results.
- Shearing was predominantly in September and October.
- In the mobs where different age groups were tested, staple strength consistently increased with age.
- Fifty six mobs from 36 properties were involved.
- On average, the minimum micron occurred 71 days before shearing, and in 15 of the mobs the minimum point would have been held in the jaws of the ATLAS machine so the staple would have broken at the next weakest point, resulting in an increase in staple strength.
- Despite the difference in profile shapes, both the micron range and the along staple CV<sub>D</sub> were similar between the two years. Indicating the overall variability was similar.
- Figure 9 shows profiles from 3 year old wethers from the same property in 2003 and 2004. Although all properties were different in profile, these graphs represent the pattern of the majority in both years. In 2003, the minimum point and the position of break were similar and averaged over all the properties both were in April (Table 6). 2004 however, the average position of break was in June but the minimum micron date was in July. Like the weaner mobs, some of the minimum staple diameters would have been in the ATLAS jaws.

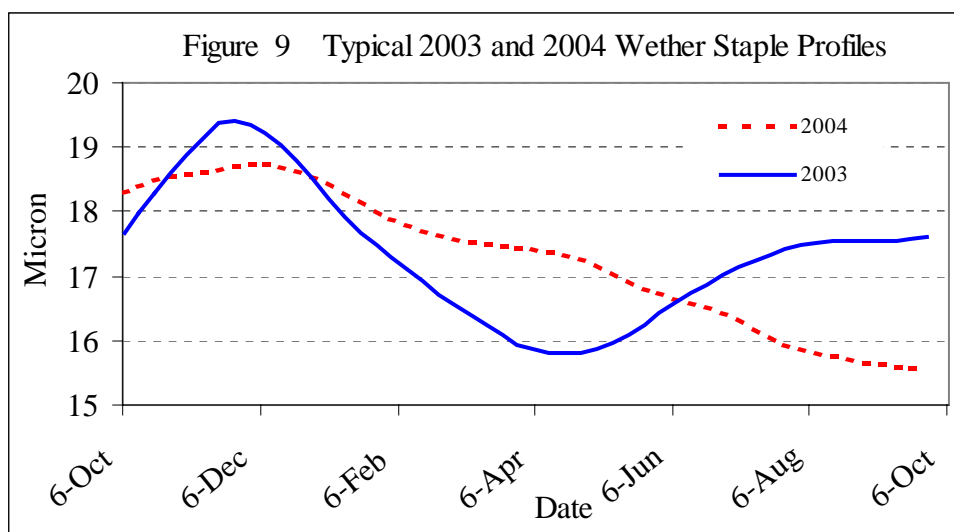


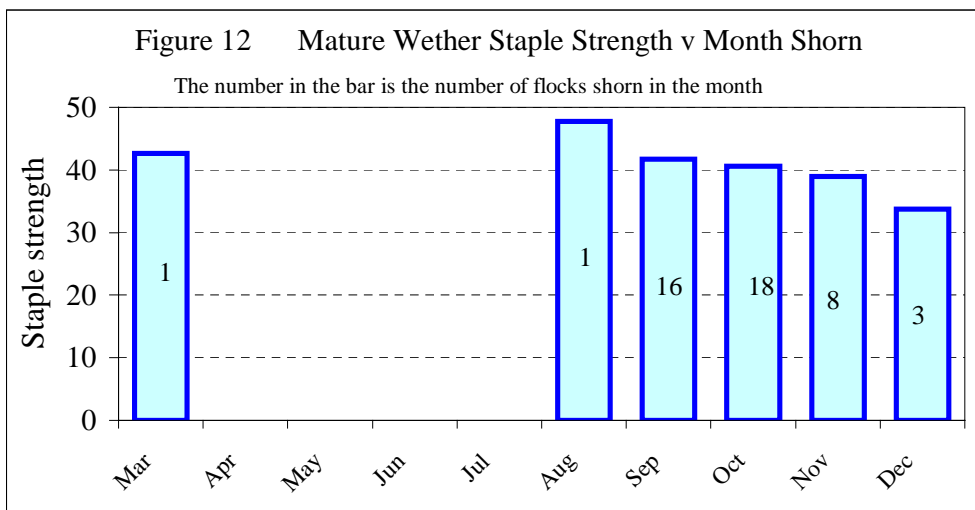
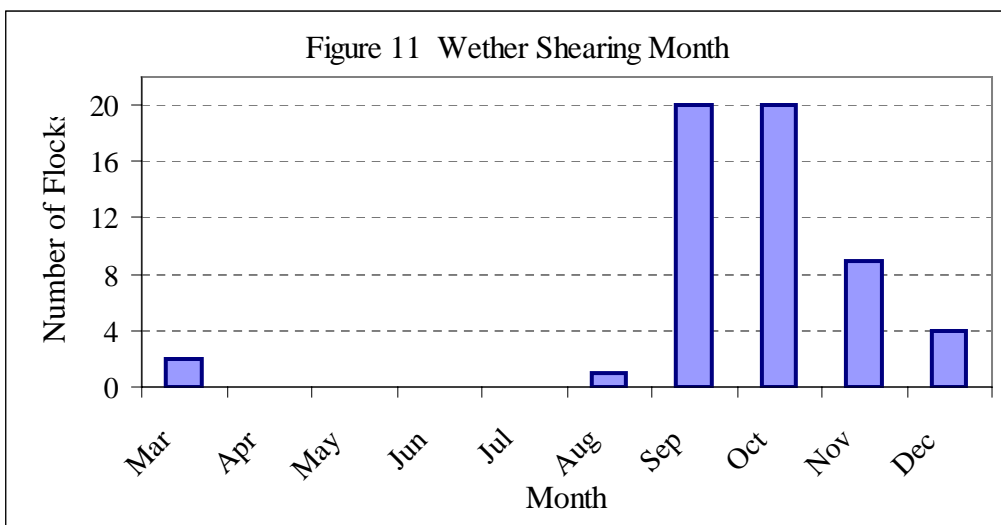
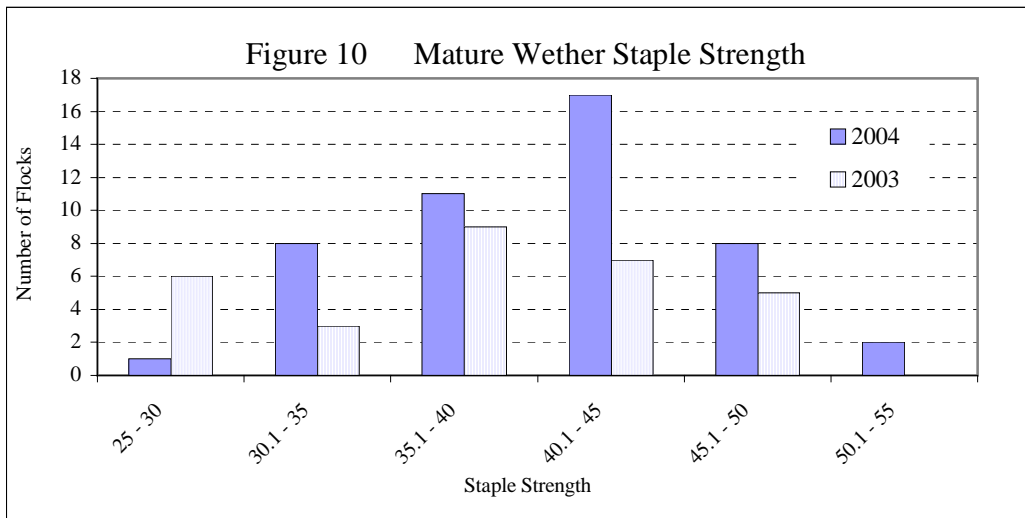
Table 6 Summary of wether staple data

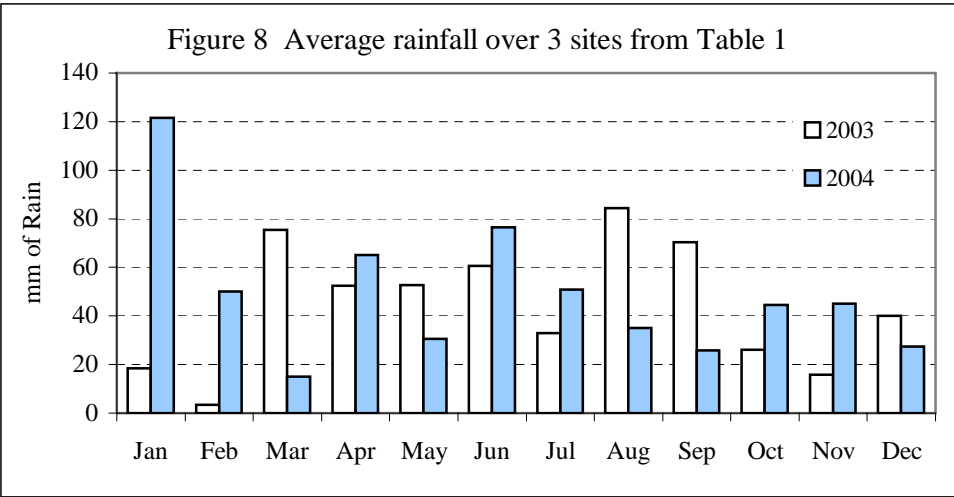
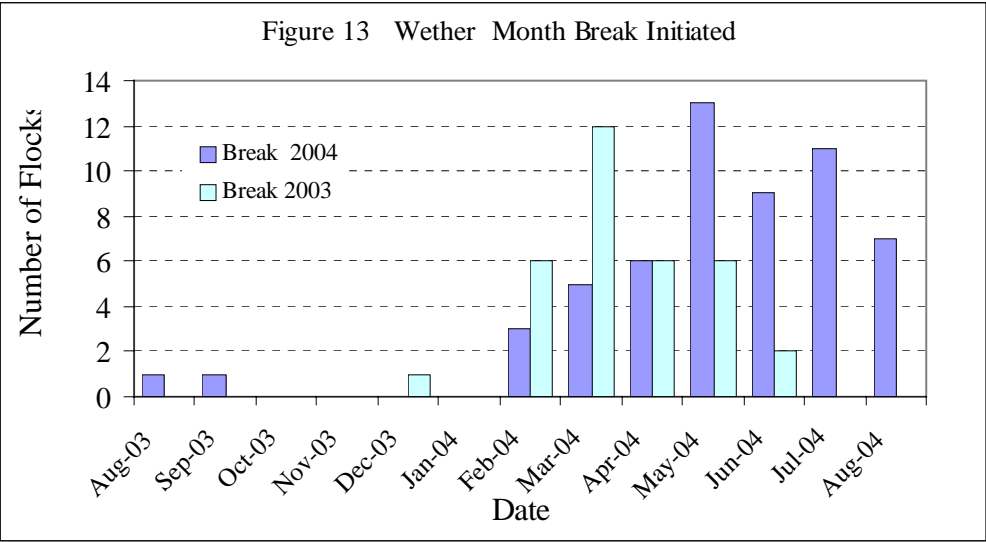
Property No.	Length (mm)	Staple Strength N/ktex	CV <sub>D</sub>	Av micron	Along Staple CV <sub>D</sub>	Across Staple CV <sub>D</sub>	Micron Range	Minimum Date	SD	Along Staple SD	Across Staple SD	Date Of Break	Shearing
39a	113.3	25.0	18.8	18.2	5.7	20.1	3.4	22-Aug-04	3.4	1.0	3.7	28-Jul-04	29-Oct-04
20a	92.1	27.2	19.2	18.2	6.6	20.4	3.7	20-Aug-04	3.5	1.2	3.7	2-Sep-04	8-Dec-04
12a	95.5	28.7	20.0	16.4	9.9	19.9	4.8	10-Aug-04	3.3	1.6	3.3	26-Aug-04	17-Nov-04
20b	102.8	28.9	18.0	18.7	5.1	19.7	3.0	22-Feb-04	3.4	0.9	3.7	9-Apr-04	3-Dec-04
1a	104.2	29.9	18.7	17.2	5.4	19.8	2.9	28-Apr-04	3.2	0.9	3.4	16-Apr-04	22-Sep-04
15a	99.5	30.8	16.7	17.7	5.1	17.5	3.0	11-Jun-03	2.9	0.9	3.1	24-Aug-03	26-Mar-04
4	109.0	30.9	17.5	19.8	4.6	19.2	3.1	25-Jun-04	3.4	0.9	3.8	21-Jun-04	25-Oct-04
19	85.7	31.6	18.9	18.5	6.8	20.4	3.9	1-Sep-04	3.5	1.3	3.7	9-Jul-04	6-Oct-04
38a	97.1	32.0	18.4	17.3	7.0	19.6	3.6	27-Jun-04	3.1	1.2	3.3	30-May-04	13-Sep-04
16	101.8	32.5	18.1	19.1	5.0	19.7	3.0	7-Aug-04	3.4	0.9	3.7	15-May-04	19-Oct-04
13a	93.0	32.7	20.5	17.7	9.2	21.2	4.9	2-Oct-04	3.6	1.6	3.7	4-Sep-04	20-Nov-04
8	96.5	33.4	18.6	18.1	8.5	18.9	4.5	11-Sep-04	3.4	1.5	3.4	13-Sep-04	28-Nov-04
39b	89.3	33.7	18.4	19.0	6.1	19.4	3.5	7-Sep-04	3.5	1.1	3.6	4-Aug-04	27-Oct-04
13b	75.6	34.7	19.9	16.7	9.4	19.9	4.5	20-Oct-04	3.3	1.6	3.3	18-Sep-04	20-Nov-04
32a	84.5	35.2	18.4	17.0	6.6	19.1	3.3	29-Jun-04	3.1	1.1	3.2	25-Apr-04	30-Sep-04
20c	102.3	35.3	17.7	19.2	3.8	19.5	2.3	16-Aug-04	3.4	0.7	3.7	13-Jul-04	3-Dec-04
30	100.4	35.5	18.1	19.4	6.7	19.4	4.1	12-Sep-04	3.5	1.3	3.7	4-Jul-04	20-Oct-04
46	94.4	37.8	18.6	18.9	8.6	19.1	4.7	13-Jul-04	3.5	1.6	3.6	27-May-04	6-Sep-04
33a	96.6	37.8	19.4	18.3	9.1	19.6	5.2	23-Aug-04	3.5	1.7	3.6	15-Jul-04	21-Sep-04
33b	96.4	37.9	19.0	19.1	8.6	19.3	4.8	28-Jun-04	3.6	1.6	3.7	24-Jun-04	17-Sep-04
18a	96.5	38.0	19.6	17.7	8.3	20.2	4.4	11-Aug-04	3.4	1.5	3.6	22-Jun-04	7-Sep-04
29	99.8	38.1	17.7	19.1	5.7	19.9	3.4	27-Aug-04	3.4	1.1	3.8	17-Aug-04	7-Nov-04
6	100.9	38.5	19.0	19.1	7.8	19.8	4.8	29-Jul-04	3.6	1.5	3.7	31-May-04	27-Oct-04
25a	92.2	38.6	19.1	17.5	8.0	19.6	4.3	7-Sep-04	3.3	1.4	3.4	25-Jun-04	30-Sep-04
37	82.9	38.8	17.6	18.2	5.6	18.4	3.0	9-Oct-04	3.2	1.0	3.3	20-Sep-04	14-Dec-04

Property No.	Length (mm)	Staple Strength N/ktex	CV <sub>D</sub>	Av micron	Along Staple CV <sub>D</sub>	Across Staple CV <sub>D</sub>	Micron Range	Minimum Date	SD	Along Staple SD	Across Staple SD	Date of Break	Shearing
45a	97.4	39.6	17.3	18.9	5.0	18.9	3.0	1-Jul-04	3.2	0.9	3.5	20-Apr-04	18-Oct-04
31	77.6	40.2	18.5	17.2	7.4	19.1	3.9	30-Aug-04	3.2	1.3	3.2	2-Jul-04	3-Oct-04
11a	108.1	40.6	17.5	21.3	4.9	18.7	3.5	12-Jul-04	3.7	1.0	4.0	26-May-04	6-Oct-04
9b	87.3	40.6	19.1	17.0	7.3	20.2	3.7	10-Sep-04	3.2	1.2	3.4	20-Aug-04	2-Nov-04
38b	100.1	40.9	17.2	20.2	5.1	18.7	3.3	20-Mar-04	3.5	1.0	3.8	12-Mar-04	13-Sep-04
12b	81.8	41.0	19.3	16.6	9.3	19.9	4.3	22-Sep-04	3.2	1.5	3.3	2-Sep-04	15-Nov-04
42	100.9	41.3	18.9	19.4	6.4	19.9	3.8	30-Jul-04	3.6	1.2	3.8	11-Jul-04	18-Oct-04
33c	99.9	41.6	18.9	17.6	6.8	20.5	4.0	16-Aug-04	3.3	1.2	3.6	24-May-04	30-Sep-04
1b	96.4	41.9	18.0	18.1	5.2	19.4	3.0	17-Aug-04	3.2	0.9	3.5	10-Jun-04	22-Sep-04
7	91.4	42.1	18.0	18.4	5.7	19.7	3.4	21-Aug-04	3.3	1.0	3.6	28-Jul-04	25-Oct-04
25b	87.4	42.4	18.4	19.5	7.0	19.3	4.2	23-Sep-04	3.5	1.4	3.7	5-Aug-04	30-Sep-04
18b	98.5	42.5	18.6	18.8	6.8	20.0	4.0	26-Jun-04	3.5	1.3	3.7	16-May-04	14-Sep-04
41	86.4	42.6	18.1	18.2	6.9	18.9	4.0	8-Sep-04	3.3	1.3	3.4	26-Jul-04	4-Oct-04
15b	93.8	42.6	16.2	19.6	3.9	17.3	2.5	10-Sep-03	3.2	0.8	3.4	9-Oct-03	26-Mar-04
2	87.0	43.6	16.8	17.4	4.6	18.4	2.4	22-Aug-04	2.9	0.8	3.2	28-Jul-04	27-Oct-04
21	83.1	43.8	19.2	19.4	7.9	19.4	4.8	14-Jul-04	3.7	1.5	3.7	8-May-04	1-Sep-04
45b	95.9	44.3	17.6	19.8	5.0	19.6	3.3	30-Jul-04	3.5	1.0	3.9	24-May-04	18-Oct-04
43a	83.4	44.4	17.0	18.9	4.6	19.0	2.7	21-Jun-04	3.2	0.9	3.6	15-Apr-04	9-Sep-04
9a	91.8	44.7	17.6	16.6	6.3	19.4	3.2	2-Oct-04	2.9	1.0	3.2	24-Jul-04	4-Nov-04
11b	107.0	44.9	17.8	22.3	6.2	18.6	4.6	14-Aug-04	3.9	1.4	4.1	16-Jun-04	6-Oct-04
26	98.7	45.3	17.4	22.0	4.9	18.6	3.5	7-Sep-04	3.8	1.1	4.1	24-Jul-04	29-Oct-04
44	105.3	45.6	17.6	19.0	4.8	19.0	3.1	23-Jul-04	3.3	0.9	3.6	26-May-04	18-Oct-04
32b	85.1	45.7	18.8	17.9	7.6	19.3	4.0	8-Jul-04	3.3	1.4	3.4	27-May-04	30-Sep-04
9c	87.6	46.3	18.3	18.2	6.5	19.5	3.7	9-Oct-04	3.3	1.2	3.5	13-Aug-04	1-Nov-04
14	90.0	47.7	17.1	17.4	5.2	18.4	2.8	2-Jul-04	3.0	0.9	3.2	10-May-04	27-Aug-04
43b	105.1	47.9	16.7	21.6	4.1	18.8	2.9	12-May-04	3.6	0.9	4.0	31-Mar-04	9-Sep-04
40a	95.1	48.1	18.3	20.6	5.8	19.9	4.0	18-Jul-04	3.7	1.2	4.0	4-Mar-04	2-Sep-04

Property No.	Length (mm)	Staple Strength N/ktex	CV <sub>D</sub>	Av micron	Along Staple CV <sub>D</sub>	Across Staple CV <sub>D</sub>	Micron Range	Minimum Date	SD	Along Staple SD	Across Staple SD	Date Of Break	Shearing
5	88.1	48.5	16.6	18.5	4.7	19.8	2.7	9-Jun-04	3.0	0.9	3.6	8-Jun-04	20-Oct-04
40b	93.6	48.8	17.4	19.7	5.6	19.1	3.8	19-Jul-04	3.4	1.1	3.7	23-Feb-04	2-Sep-04
36	94.5	50.6	18.2	19.0	5.8	18.8	3.7	1-Aug-04	3.4	1.1	3.5	19-May-04	25-Oct-04
1c	83.3	51.2	17.1	18.6	5.0	18.6	2.9	2-Jul-04	3.2	0.9	3.4	29-May-04	22-Sep-04
<b>Average</b>	<b>94.4</b>	<b>39.5</b>	<b>18.2</b>	<b>18.6</b>	<b>6.3</b>	<b>19.4</b>	<b>3.7</b>	<b>Jul-04<sup>^</sup></b>	<b>3.4</b>	<b>1.2</b>	<b>3.6</b>	<b>June-04<sup>^</sup></b>	
2003 Average	92.3	37.6	17.5	18.6	6.4	18.5	3.8	April 03				April 03	

<sup>^</sup> These averages are presented to provide a comparison between years.





## Ewe Results

Ewes have to be managed for both a lamb and wool production and the needs of the animal for conception, pregnancy and lactation must be put above those for wool production. This can result in different staple profiles in ewes, particularly when compared with wethers.

The ewe results are presented in Table 7, and Figures 15 - 18. Figures 15 and 17 only have results from mature sheep, 3 years and older, to remove any effect of low staple strength due to animals which are still growing. Figure 8, the 2003 / 04 average monthly rainfall is included for comparison.

- Staple strength averaged 40.1 N/ktex with a range from 28.1 to 59.9, compared with the 2003 average of 36.4.
- Forty seven percentage (22 of 47) of mature ewe mobs had a staple strength above 40 N/ktex
- The average micron was slightly higher than the previous year, at 19.7 micron with a range of 16.8 to 24.4 compared with 19.3 in 2003.
- Shearing time was spread through the year with a predominance in late winter, while the minimum micron and date of break averaged over all the mobs were in late summer.
- Within mobs the mean micron range was 3.1, lower than the 3.8 of 2003 and the variation between mobs was 2.1 – 4.7 micron. This was reflected in a lower along staple CV<sub>D</sub> which is not surprising as the two measure essentially the same thing.
- Figure 14 is typical of mature ewe profiles, these were different groups of sheep, both being 3 year olds in the relevant year.
- The ewe profiles were generally different from wethers and weaners in that during both 2003 and 2004 there was a late summer or autumn drop in micron in both years in most of the ewe mobs. In Figure 14, for example, although the 2004 micron was at a minimum in September, ten of the ewes had the minimum in Jan – March resulting in the late summer drop in micron.

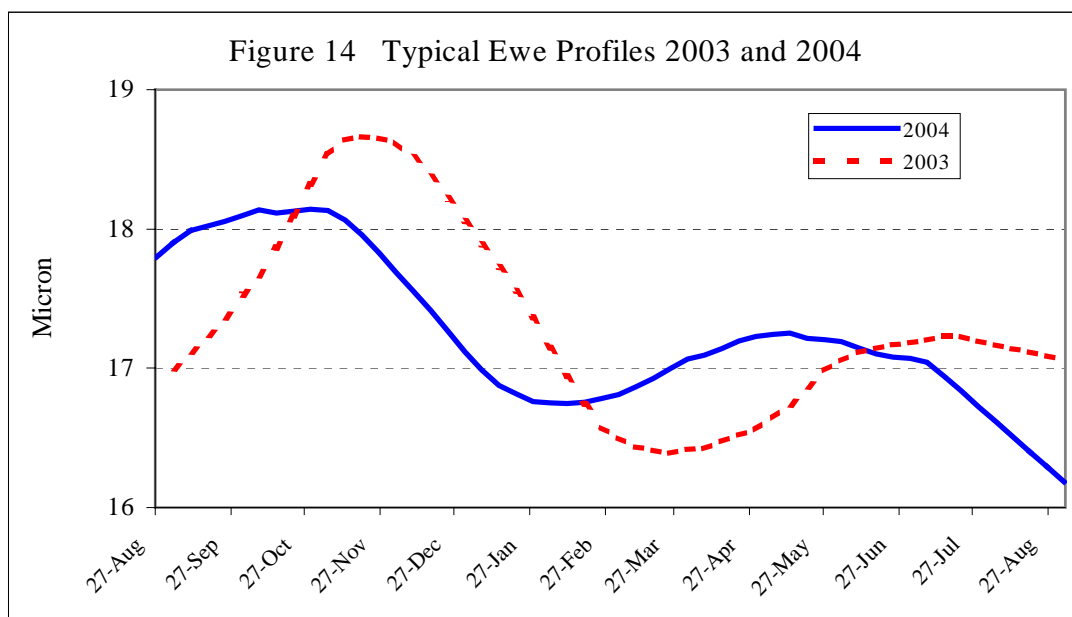


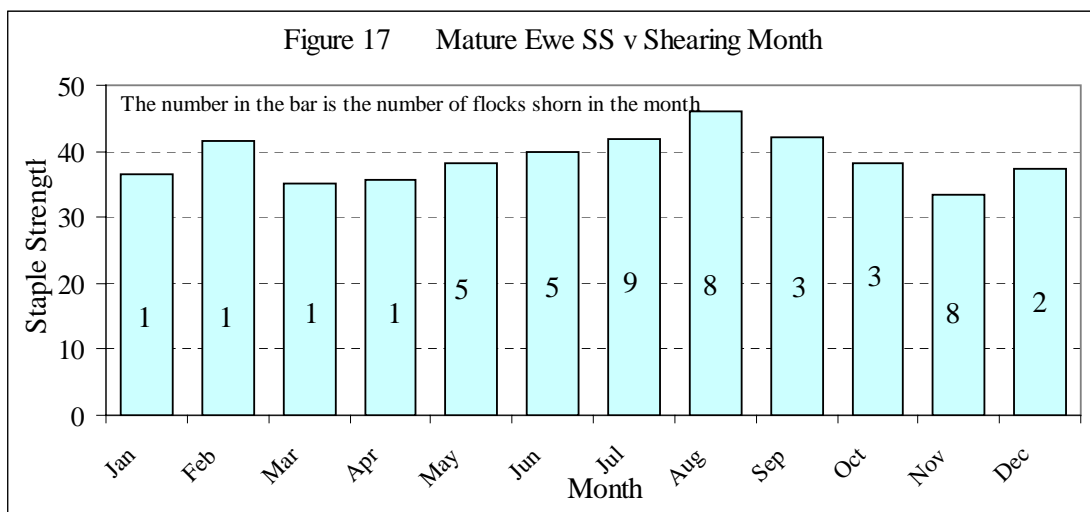
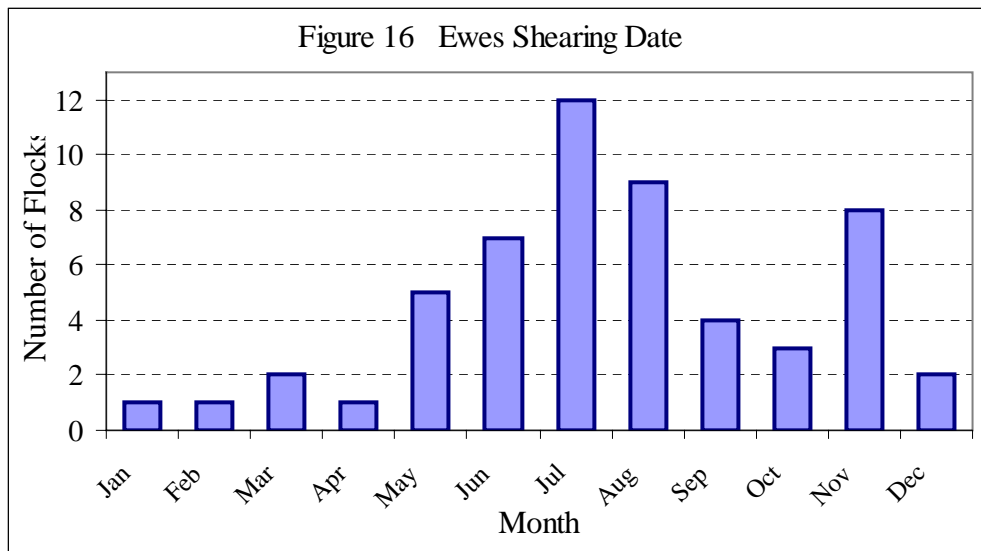
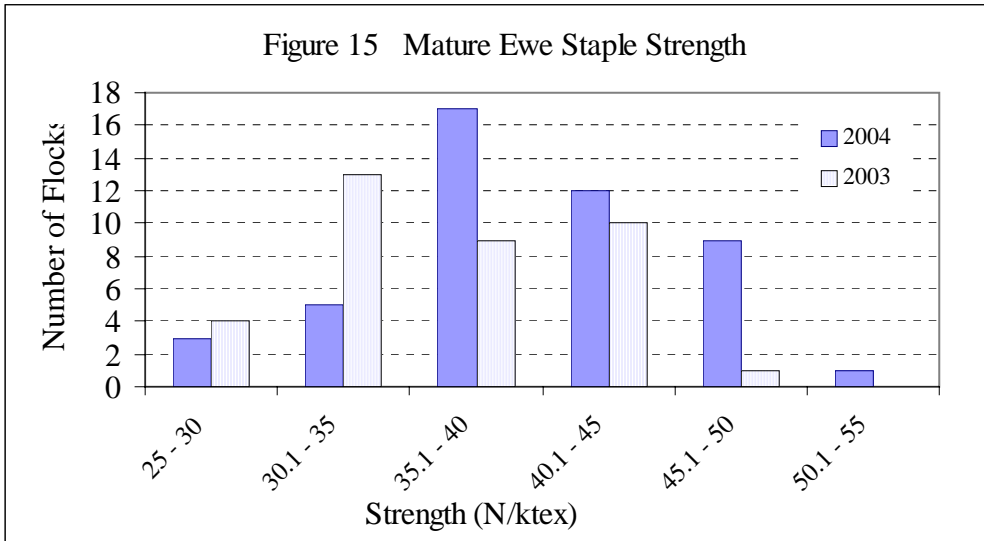
Table 7 Summary of ewe staple data

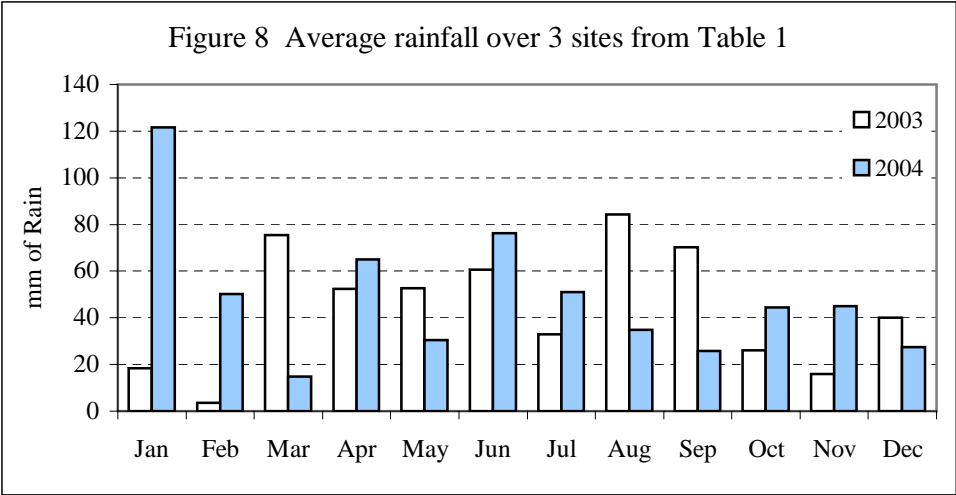
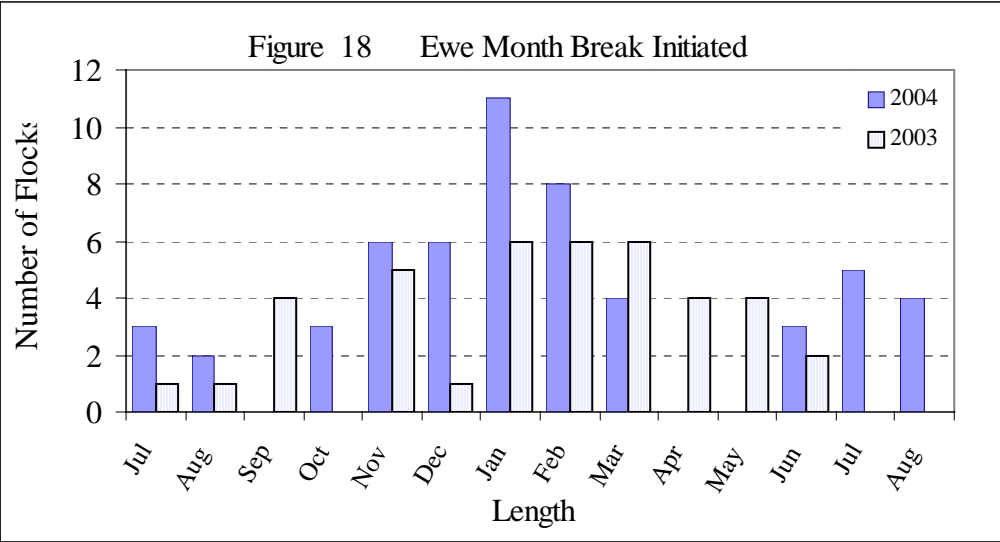
Property No.	Length (mm)	Staple Strength N/ktex	CV <sub>D</sub>	Av micron	Along Staple CV <sub>D</sub>	Across Staple CV <sub>D</sub>	Micron Range	Minimum Date	S D	Along Staple SD	Across Staple SD	Date Of Break	Shearing Date
22a	89.2	28.1	18.2	21.4	5.3	20.9	3.6	12-Jul-04	3.8	1.1	4.4	25-Aug-04	09-Nov-04
22d	98.0	29.2	18.4	20.4	5.1	20.3	3.3	12-Aug-04	3.7	1.0	4.1	3-Aug-04	12-Nov-04
42b	99.3	29.5	17.9	21.7	4.9	20.0	3.4	7-Aug-04	3.8	1.1	4.3	6-Sep-04	30-Nov-04
15a	95.3	31.0	17.0	17.4	5.2	17.8	2.9	8-Jul-03	3.0	0.9	3.1	20-Aug-03	26-Mar-04
32a	82.8	31.1	17.7	16.8	4.6	18.7	2.4	16-Jun-04	2.9	0.8	3.1	6-Mar-04	30-Sep-04
1e	102.0	32.4	17.4	17.8	4.2	19.0	2.4	23-Nov-03	3.1	0.8	3.3	9-Feb-04	27-Jul-04
32b	84.5	32.5	17.2	16.8	4.6	18.9	2.4	12-May-04	2.9	0.8	3.2	12-Mar-04	30-Sep-04
22b	93.8	33.0	19.6	19.2	5.4	21.4	3.4	17-Jul-04	3.7	1.0	4.1	28-Jul-04	16-Nov-04
22e	111.2	33.4	17.9	19.4	4.4	19.5	2.8	4-Aug-04	3.4	0.9	3.8	5-Jul-04	24-Nov-04
20a	103.0	34.9	16.9	20.9	5.4	18.1	3.7	7-Jan-04	3.5	1.1	3.7	1-Feb-04	21-Jun-04
15b	88.0	35.1	16.4	18.5	5.1	17.4	2.9	25-Jul-03	3.0	0.9	3.2	26-Aug-03	26-Mar-04
37	86.5	35.3	18.3	17.9	5.3	19.4	2.9	7-Oct-04	3.3	1.0	3.5	5-Sep-04	13-Dec-04
39b	105.0	35.7	17.0	21.1	4.8	18.0	3.3	5-Oct-03	3.6	1.0	3.8	14-Nov-03	31-May-04
31	82.3	35.8	16.3	17.3	4.6	17.6	2.5	15-Aug-03	2.8	0.8	3.0	27-Nov-03	08-Apr-04
42a	98.4	36.1	18.1	20.4	4.4	19.7	2.8	27-Jun-04	3.7	0.9	4.0	31-Jul-04	26-Nov-04
16	87.5	36.2	20.2	18.9	7.9	21.7	4.7	18-Aug-04	3.8	1.5	4.1	4-Aug-04	28-Oct-04
21	79.9	36.6	16.2	19.9	4.7	18.0	2.9	30-May-03	3.2	0.9	3.5	2-Aug-03	17-Jan-04
26	76.0	37.3	17.2	17.9	5.0	18.3	2.7	16-Oct-04	3.1	0.9	3.3	21-Jul-04	26-Oct-04
1d	99.7	37.5	16.6	18.0	3.6	18.1	2.1	26-Jan-04	3.0	0.6	3.2	10-Feb-04	27-Jul-04
6	108.2	37.9	16.9	21.0	5.6	18.2	4.0	21-Dec-03	3.5	1.2	3.8	6-Feb-04	05-May-04
9b	88.2	38.0	16.5	18.6	4.5	18.2	2.6	6-Feb-04	3.1	0.8	3.4	19-Feb-04	11-Jun-04
39a	104.2	38.2	16.8	22.0	4.1	18.5	3.0	28-Oct-03	3.7	0.9	4.0	22-Nov-03	31-May-04
33	111.1	39.0	16.4	20.6	4.7	17.7	3.1	25-Jan-04	3.4	1.0	3.6	23-Jan-04	25-May-04
1b	98.3	39.2	17.0	19.0	4.8	18.5	2.9	17-Feb-04	3.2	0.9	3.5	11-Feb-04	27-Jul-04
22c	96.2	39.3	17.6	19.4	4.1	19.6	2.5	9-May-04	3.4	0.8	3.8	30-Jun-04	10-Nov-04
8	93.9	39.7	17.2	19.4	5.9	18.1	3.4	15-Oct-04	3.3	1.1	3.5	9-Sep-04	18-Dec-04

Property No.	Length (mm)	Staple Strength N/ktex	CV <sub>D</sub>	Av micron	Along Staple CV <sub>D</sub>	Across Staple CV <sub>D</sub>	Micron Range	Minimum Date	S D	Along Staple SD	Across Staple SD	Date Of Break	Shearing Date
44	89.2	39.8	18.3	22.0	5.6	19.7	3.8	28-Aug-04	4.0	1.2	4.3	14-Aug-04	19-Nov-04
23b	96.8	40.1	17.2	21.0	4.9	18.8	3.5	8-Nov-03	3.6	1.0	3.9	7-Nov-03	29-Jun-04
5	94.5	40.2	16.6	19.3	6.1	17.7	3.5	21-Feb-04	3.2	1.2	3.4	31-Mar-04	23-Jul-04
20b	111.6	40.8	16.9	20.8	4.0	18.3	2.9	25-Dec-03	3.5	0.8	3.8	16-Jan-04	21-Jun-04
29	99.5	40.8	15.9	21.6	4.9	17.5	3.5	22-Nov-03	3.4	1.1	3.8	4-Jan-04	15-May-04
4	100.0	41.0	17.5	21.3	5.6	19.7	3.9	8-Sep-04	3.7	1.2	4.2	5-Aug-04	27-Oct-04
1c	99.0	41.1	17.7	18.0	4.1	19.4	2.4	2-Feb-04	3.2	0.7	3.5	28-Jan-04	27-Jul-04
25a	80.2	41.2	16.8	18.7	4.8	18.0	2.9	2-Feb-04	3.1	0.9	3.3	9-Mar-04	20-Jul-04
28	98.6	41.2	17.8	19.4	5.7	19.2	3.4	23-May-04	3.4	1.1	3.7	24-Feb-04	09-Aug-04
30	103.2	41.5	16.1	21.3	4.3	17.6	3.4	15-Jun-03	3.4	0.9	3.7	11-Sep-03	23-Feb-04
9a	85.9	42.0	16.3	17.7	5.0	18.0	2.6	2-Mar-04	2.9	0.9	3.2	4-Mar-04	11-Jun-04
40b	105.1	42.5	16.1	20.3	4.8	17.3	3.2	13-Jan-04	3.3	1.0	3.5	13-Dec-03	16-Jul-04
38	102.4	42.7	16.8	20.0	5.7	18.3	3.5	6-May-04	3.3	1.1	3.6	31-Mar-04	30-Jul-04
27	92.7	43.3	18.1	19.0	5.3	19.1	3.3	24-Mar-04	3.4	1.0	3.6	19-Jan-04	09-Aug-04
23a	88.7	44.0	16.5	19.9	4.2	18.1	2.8	22-Oct-03	3.2	0.8	3.6	27-Nov-03	29-Jun-04
11b	109.1	44.5	16.0	22.7	3.8	17.6	2.9	24-Feb-04	3.6	0.9	4.0	10-Dec-03	02-Aug-04
46	101.9	44.6	15.8	19.8	4.9	17.5	3.1	31-Mar-04	3.1	1.0	3.4	13-Feb-04	06-Sep-04
14	101.1	45.1	15.4	18.6	3.9	16.9	2.2	1-Feb-04	2.8	0.7	3.1	11-Dec-03	16-Jun-04
1a	95.7	45.9	16.7	18.9	4.1	18.4	2.6	14-Dec-03	3.1	0.8	3.4	7-Jan-04	27-Jul-04
19	98.3	46.1	17.0	19.7	5.0	18.3	3.3	19-Apr-04	3.3	1.0	3.6	28-Feb-04	06-Aug-04
11c	111.6	46.2	16.8	23.2	4.2	18.2	3.5	9-Feb-04	3.9	1.0	4.2	15-Jan-04	02-Aug-04
2	86.4	46.3	17.8	19.6	7.2	18.9	4.2	27-Mar-04	3.4	1.4	3.7	13-Mar-04	03-Aug-04
41	80.2	46.3	17.3	18.9	4.0	18.8	2.4	3-Mar-04	3.2	0.8	3.5	26-Jan-04	09-Aug-04
12	82.3	46.8	16.1	17.9	4.1	17.0	2.3	11-Mar-04	2.9	0.7	3.0	27-Mar-04	28-Jul-04
11a	104.8	48.1	16.5	24.4	3.6	18.1	3.1	11-Jan-04	4.0	0.9	4.4	20-Nov-03	02-Aug-04
32c	85.9	49.3	16.5	18.8	4.1	18.2	2.4	26-Apr-04	3.1	0.8	3.4	19-Feb-04	30-Sep-04
25b	104.8	49.6	16.2	19.9	5.3	17.3	3.4	29-Dec-03	3.2	1.0	3.4	27-Feb-04	20-Jul-04

Property No.	Length (mm)	Staple Strength N/ktex	CV <sub>D</sub>	Av micron	Along Staple CV <sub>D</sub>	Across Staple CV <sub>D</sub>	Micron Range	Minimum Date	SD	Along Staple SD	Across Staple SD	Date Of Break	Shearing Date
36	93.6	53.1	17.7	19.3	5.5	18.5	3.4	12-May-04	3.4	1.0	3.5	29-Mar-04	23-Aug-04
40a	95.0	59.9	15.8	20.2	4.5	16.9	3.2	5-Nov-03	3.2	0.9	3.4	13-Jan-04	16-Jul-04
<b>Average</b>	<b>95.6</b>	<b>40.1</b>	<b>17.1</b>	<b>19.7</b>	<b>4.9</b>	<b>18.5</b>	<b>3.1</b>	<b>Feb-04<sup>^</sup></b>	<b>3.3</b>	<b>1.0</b>	<b>3.6</b>	<b>Feb-04<sup>^</sup></b>	
2003 Average	93.6	36.4	17.5	19.3	6.1	18.5	3.8	Mar-03				Feb-03	

<sup>^</sup> These averages are presented to provide a comparison between years.





## COMPARISON BETWEEN SOME WOOL CHARACTERISTICS

In the 2004 season full data were collected on over 1100 weaners from 39 mobs and 1600 ewes and wethers from 55 and 56 mobs respectively. Linear regression equations were used to compare how well staple strength could be predicted by the range of measurements made by the OFDA 2000 machine both using all the individual animal's data (Table 8) and the mob averages from the 30 individuals sampled from each mob (Table 9). In addition, to investigate the relationship between  $CV_D$  and staple strength within mobs, this comparison was calculated on the individual animals in 5 wether mobs over a range of average staple strengths (Table 10)

Linear regression is a statistical method used to calculate how one measurement can be used to predict another on the same object. If there is a close relationship, i.e. a change in the measured character gives a proportional response in the predicted one, the regression coefficient ( $r^2$ ) approaches 1, if there is no relationship at all then the regression coefficient is 0.

In the tables below the best predictors of staple strength were overall  $CV_D$  and across staple  $CV_D$  for mob results, but in the best case less than 30% of the variation in staple strength was accounted for. There was no significant relationship within wether mobs over the range of staple strengths. As an example the graph of staple strength against across fibre  $CV_D$  for the weaner mobs, ie the closest relationship (grey cell in Table 9), is shown in Figure 19. If there was a close relationship the points would lie close to the line.

**Table 8 Regression of Individual Animal Staple Strength V Other Characteristics**

	Weaners	Wethers	Ewes
Number of animals	1163	1670	1626
	$r^2$	$r^2$	$r^2$
$CV_D$	0.008	0.009	0.011
Along fibre $CV_D$	0.002	0.007	0.002
Across fibre $CV_D$	0.012	0.002	0.015
SD	0.002	0.000	0.000
Along fibre SD	0.001	0.003	0.000
Across fibre SD	0.005	0.003	0.002
Micron Range	0.001	0.001	0.000
Average Micron	0.001	0.015	0.006
Staple length	0.004	0.004	0.009

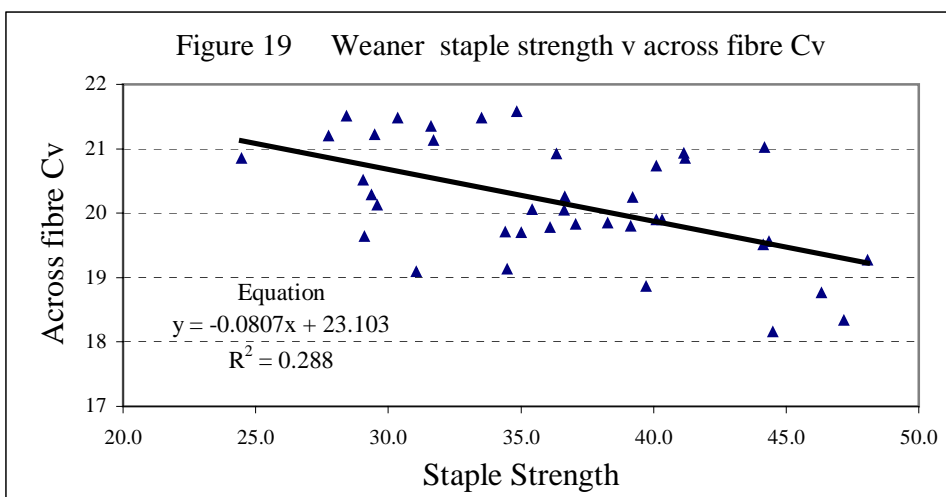
**Table 9 Regression of Mob Staple Strength v Other Characteristics**

	Weaners	Wethers	Ewes
Number of mobs	39	56	55
	$r^2$	$r^2$	$r^2$
CV <sub>D</sub>	<b>0.196</b>	<b>0.194</b>	<b>0.201</b>
Along fibre CV <sub>D</sub>	0.001	0.069	0.021
Across fibre CV <sub>D</sub>	<b>0.288</b>	<b>0.122</b>	<b>0.246</b>
SD	0.017	0.000	0.010
Along fibre SD	0.000	0.037	0.003
Across fibre SD	0.056	0.017	0.020
Micron Range	0.002	0.018	0.000
Average Micron	0.013	<b>0.105</b>	0.032
Staple length	0.077	<b>0.074</b>	0.006

The figures in bold type are statistically significant

**Table 10 Regression of Individual Staple Strength v CV<sub>D</sub> at a range of average mob staple strengths.**

Approximate mob Staple Strength	R <sup>2</sup> between Staple Strength and CV <sub>D</sub>
30	0.041
35	0.001
40	0.023
45	0.017
50	0.016



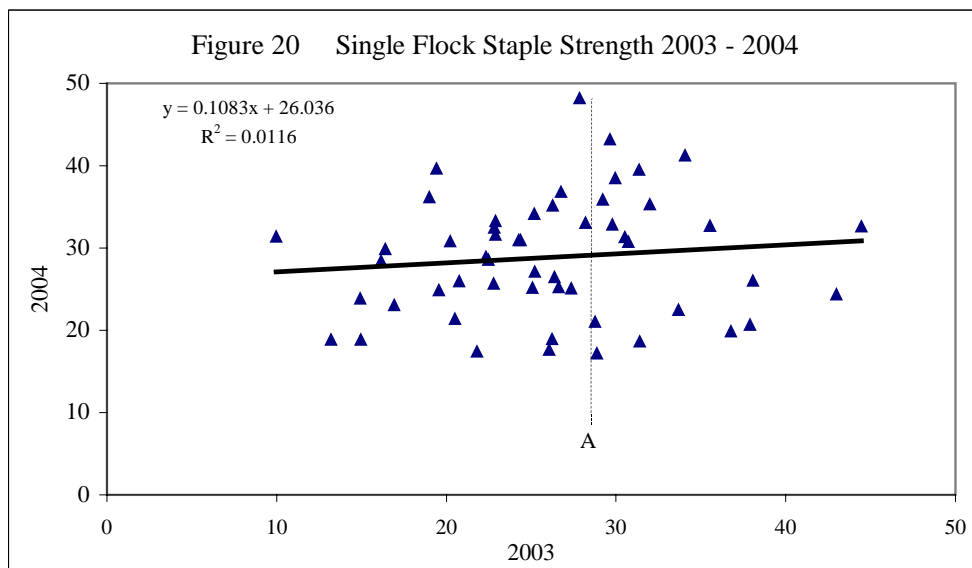
## COMPARISONS BETWEEN YEARS IN STAPLE STRENGTH

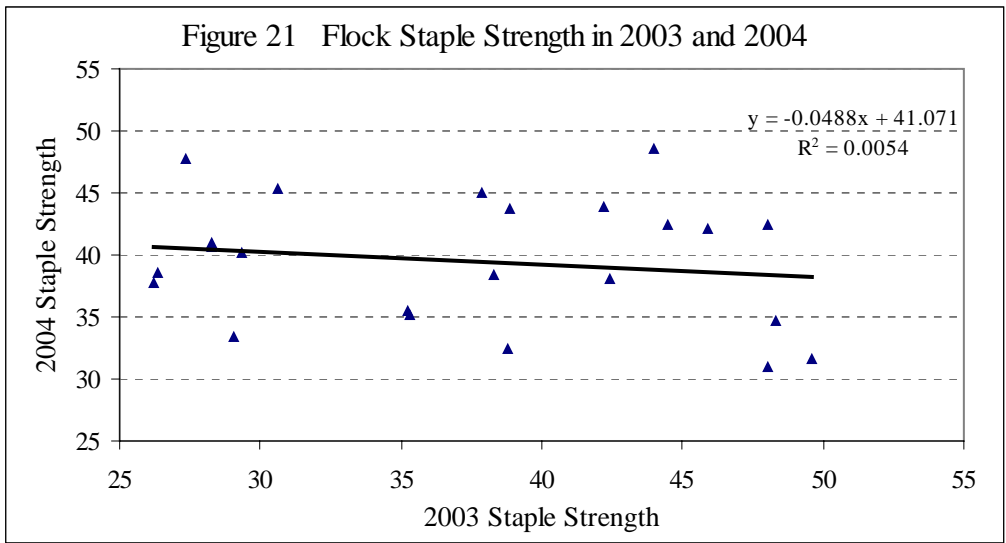
One group of individually tagged weaners were sampled at approximately 12 months of age in 2003 and were resampled 12 months later in 2004. There was little relationship between the staple strength of the individual sheep in the two years with a regression coefficient of only 0.01, or 1% of the variation being accounted for (Figure 20). Each triangle represents a sheep with its 2003 staple strength along the bottom axis and its 2004 strength on the left. An example of the variability can be seen by looking at the points along the vertical dotted line A. This line represents a staple strength of around 28 N/ktex in 2003. In 2004, the sheep near the line with staple strength of 27 – 28 had strengths ranging from about 17 to 48 N/ktex.

This is of course only one group of sheep in 2 years, but it is an area needing further investigation, as if this work can be repeated, the data indicate that it may not be possible to affect staple strength by selection of high strength sheep at the first shearing.

In addition, to test the idea that some properties consistently had high or low staple strength, wether mobs sampled in both 2003 and 2004 were compared in the situation where similar aged mobs were sampled on the same property. These were not the same sheep, rather the same age group eg 3 yr old wethers in each year. This of course could lead to significant errors but in general wethers of the same age had consistent management on a property in the short term.

Like the single mob, there was little relationship between years in staple strength of the mobs (Figure 21), with only 5.5% of the variation in 2004 being accounted for by previous staple strength. These data indicate that environment is the most important factor in determining staple strength in an individual sheep and mob and masks any of the small effects of the across fibre  $CV_D$  relationship shown in Table 9, at least in wethers.





## DISCUSSION

The differences in rainfall pattern between 2003 and 2004 with the big difference in January – February undoubtedly affected the staple profiles in the two years. In 2004, the late summer rain promoted growth of perennial pasture species and minimised the late summer feed restriction which occurred in 2003. The change in profile had an effect on staple strength because a number of wether and weaner mobs had the minimum point of the fibre near the base of the staple resulting in the weakest point occurring in the jaws of the ATLAS machine. The staple break would then have been at another, higher strength, point.

The increased summer pasture growth reflected to a limited extent the effects of pasture species which will grow under lower rainfall, producing green feed in normal summer conditions. There are a number of new pasture species currently under trial in DPIWE which are better adapted to Tasmanian summer conditions than currently used perennial pasture plants. These, with further work, could enable the development of pastures that provide greater continuity of feed supply throughout the growing season. In addition, high producing species like the newly released Arrotas Arrowleaf clover (see <http://www.8x5.com.au/documents/ArrowleafCloverfactsheet28012005.pdf>), could be used for supplementary feeding at critical times of the year

This trial, with the ability to measure all the profile, including the sections which would normally be held in the jaws of the ATLAS machine, gives an accurate assessment of the minimum point in the fibre. As this is usually near the position of break it is necessary to see the whole profile before making any decision in relation to change in shearing date to maximise staple strength. A decision based on ATLAS data could be faulty if the minimum point is at the tip or base of the staple as the break shown would be the next weakest point. If this is the case, a change in shearing date may reveal the the break normally held in the jaws of the ATLAS machine.

The two years of this trial have demonstrated that the minimum point of the fibre can change with environmental conditions, so more data is needed to be able to predict the point of break in average years.

In 2004, there were a number of ewe mobs which had a micron reduction in late summer - early autumn due to some of the group having a minimum micron and point of break at that time. Wether mobs from the same properties did not usually show the same feature. A contributing cause may have been the effect of ewes ingesting larval parasites from contaminated pastures. Barger and Southcott (1975)<sup>2</sup> found that resistant sheep exposed to a challenge with *Trichostrongylus colubriformis* larvae at levels usually found on pastures had 11% less wool growth than unchallenged controls without producing faecal eggs. Schlink *et al.*<sup>3</sup> have also shown that cortisol which is produced under stress conditions can reduce staple strength by increasing fibre shedding in sheep which are maintaining or losing weight, but not in those gaining weight. It may be that some sheep in a mob are suffering stress problems as a result of ingesting larval parasites.

Variation along the staple is the result of environmental, health and management practices during the year and is shown in changes in the annual staple profile. Both Coefficient of Variation (CV<sub>D</sub>) and Standard Deviation (SD) have components which measure the variability between fibres and along the fibres

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<sup>2</sup> Barger I. A., Southcott W. H. (1975) Trichostrongylosis and wool growth 3. The wool growth response of resistant grazing sheep to larval challenge. *Australian Journal of Experimental Agriculture and Animal Husbandry* **15**, 167-172.

<sup>3</sup> Schlink A. C., Wynn P. C., Lea B. J., Briegel A. J. R., Adams N. R. (2002) Effect of cortisol acetate on wool quality in sheep selected for divergent staple strength. *Australian Journal of Agricultural Research* **53**, 183-189.  
2004 Results 8x5 Wool Profile and Staple strength Project

In general terms, genetic selection for staple strength results in selection for more uniform diameter fibres and length as some follicles produce long broad fibres while others produce shorter thinner ones. Wool fibres are crimped and crossed over to combine into a staple with most fibres being longer than the staple length. When measuring staple strength short fibres break before long ones are under much tension, reducing the strength. Selection for more uniform diameter fibres should also result in more even fibre lengths and greater staple strength<sup>4</sup>, (Schlink 2000) although some research suggests that genetic gain in staple strength could be small and difficult to achieve.<sup>5</sup> (Hill and Ponzoni 1999)

In this trial, the staple strength and a number of staple characteristics were compared on individual sheep, mobs and sheep within mobs. The only consistent significant results were when the mob average staple strength was compared with either the total CV<sub>D</sub>, or the across fibre CV<sub>D</sub>. The CV<sub>D</sub> regression values of 0.19 for weaners, 0.19 for wethers and 0.20 for ewes are similar to the average for Western Australian spring shorn sheep of 0.22 ( $r = 0.47$ )<sup>6</sup> (Greeff 1999)

Staple strength can be affected by selection for other characteristics, for example, (Butcher *et al.* 1984)<sup>7</sup> showed that sheep with a higher potential for wool growth had a greater reduction in staple strength after opening rain than those with a lower potential. Later, (Friend and Robards 2005)<sup>8</sup> demonstrated that the staple strength of sheep selected for high fleece weight can be reduced significantly below that of lower producing sheep by a rapid change in nutrition. This was proposed to be largely due to the higher producing sheep producing wool with a greater along – fibre variation. These data indicate that sheep selected for increased clean fleece weight may need more careful management during and after periods of restricted feed.

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<sup>4</sup> Schlink A C (2000) in Managing Wool Production for Quality and Profit. Ed Adams, N R, Oldham, C M, Suiter R J and Wilson, G M CRC for Premium Wool Quality

<sup>5</sup> Hill J. A., Ponzoni R. (1999) Predicting genetic change in staple strength - How much gain can we expect? *Proceedings of the Association for animal Breeding and genetics* **13**, 456-449.

<sup>6</sup> Greeff J. C. (1999) Relationship between staple strength and coefficient of variation of fibre diameter within and between flocks. *Proceedings of the Association for animal Breeding and genetics* **13**, 54-57.

<sup>7</sup> Butcher G., Eady S., CSmith F. (1984) Preliminary observations on some factors which influence the tensile strength of wool. *Proceedings of the Australian Society of Animal Production* **15**, 125 - 128.

<sup>8</sup> Friend M. A., Robards G. E. (2005) Fibre diameter and staple strength of sheep selected for divergent clean fleece weight when subjected to an increase in intake or an increase in intake and diet change. *Australian Journal of Agricultural Research*. **56**, 195–201.

## FUTURE RESEARCH

These research opportunities have been developed from the current work and are not an exhaustive list of possibilities.

- Quantify the benefits of a high quality diet in late summer – autumn on weaner staple strength. This would involve weaner grazing trials on established areas of e.g. lucerne, the newly released cultivar of arrow leaf clover and irrigated pasture. Work could therefore begin in 2006.
- Examine the variation of wool staple strength between individual sheep from year to year. In the present trial measurements on one property showed that sheep with a high staple strength in one year did not necessarily have a high staple strength the next year. If this is a general case then selection of high staple strength sheep may not improve staple strength in later years.
- Continue the collection of staple strength and profile data to improve the robustness of the information. Staple profile is largely dependant on environmental factors and further data may allow these to be separated from changeable management practices.
- Commercialise the current profile analytical method, given the advantage that it has over other reporting processes in helping growers better understand what has happened to their sheep over the year. This program could be developed further to allow individual producers and OFDA operators to produce mob profiles between shearing dates if necessary.

## APPENDIX 1 TYPICAL GROWER REPORT LETTER

Dear

Attached are results from your ewe and wether wool samples.  
The data will be slightly different from wool test data because of the different sampling techniques.

The results consist of :-

- 1 A graph of the average of the profiles of the sheep you sampled.
- 2 The average plus lowest and highest micron sheep measured in the groups.
- 3 The average staple strength of the groups, and the range of staple strengths.
- 4 The approximate position of the break is shown on the graphs, the line represents the time in which approximately 70% of the breaks occurred. The shorter the line, the more likely the break was caused by a single event. In general, the wool break occurs at the minimum diameter or the point of maximum change in diameter of the fibre.

**It is important to remember that the data in this report are based on shorn wool. Any factor which affects wool profile or strength would not show up until at least 3 weeks later than the date it occurred. For example an event which occurred on the 1<sup>st</sup> of March would not be seen in the results until at least the 22<sup>nd</sup> of March. Similarly any feature on the graph actually started at least 3 weeks earlier.**

When you have had a chance to look at the data please contact me if you would like to discuss them.

Regards

Dr Mick Statham

Ph (03) 6336 5339

Fax (03) 6336 5399

Email [Mick.Statham@dpiwe.tas.gov.au](mailto:Mick.Statham@dpiwe.tas.gov.au)

	<b>Average Micron</b>	<b>Range</b>	<b>Staple Strength (N/Ktex)</b>	<b>SS Range</b>
<b>Ewes</b>	19.8	17.0 – 23.4	46.1	3.6 – 69.7
<b>Wethers</b>	18.5	15.0 – 22.6	31.6	22.7 – 48.6

The break in the wether wool was several weeks prior to shearing because the final 6 weeks wool would have been held in the jaws of the testing machine.

## PROFILES

