CSIRO

Finewool Newsletter

Issue 11

September 1998

Editorial - Ian Purvis

I am writing this having just been out to Parkes to talk to a group of farmers about developments in research that are focused on fine and superfine wool sheep. Such an occasion is always valuable for the feedback I receive from growers, and also because it causes me to reflect on the real value of the research we are conducting.

The Fine Wool Project has been a major undertaking for CSIRO, IWS/The Woolmark Company (on behalf of woolgrowers), the Cooperative Research Centre for Premium Quality Wool and the collaborating stud breeders. We have also developed important collaborative projects with NSW Agriculture at Condobolin and Agriculture WA at Katanning. A large amount of time and money has been invested by these organisations in this project.

So, after 8 years, what is there to show for this investment? Consider the outcomes and their implications in the table below:

The staff in the Fine Wool Project are very aware of the investment that CSIRO and the industry have made. Our aim is to continue to focus on providing high quality and unbiased information to Fine Wool breeders and their clients, and to address issues of importance as they arise.

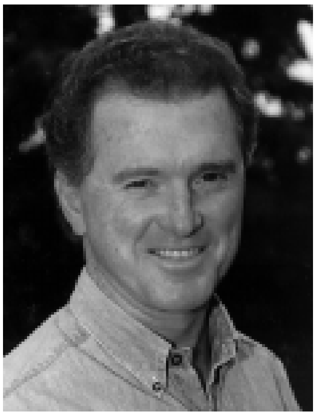
In this newsletter, among a host of good reading, you will find there is an excellent article by Barry Harrowfield from CSIRO Wool Technology. Barry has a long history of high quality research and, perhaps more importantly, of creating products and processes that have improved the efficiency of processing of Merino wool. Michael Lollback from NSW Agriculture presents an article containing the latest results of the New England wether trial and this makes interesting reading for those growers running a critical eye over the genetic makeup of their flocks.

To follow on from the last issue where I presented results on crimp frequency and Peter Lamb from CSIRO Wool Technology talked about the processing implications of different crimp frequencies, in this issue I talk about staple length.

We trust you will find this edition profitable reading.

Outcomes	Implication/Value
• Estimates of between bloodline and within flock genetic differences for a wide range of wool quality and production characters.	• Allows the development of customised selection indices for fine wool breeders and is the basis for developing reliable predictions of how a particular breeding program will change a flock over 10-20 years.
• Performance of fine wool flocks in different environments	• Gives woolgrowers and breeders objective information about the consequences of changing bloodlines and utilising ram sources from fine and superfine wool strains.
• Processing Performance: relating raw wool characteristics to processing efficiency and product value at the genetic level	• Ensures that breeders have the information necessary to predict the consequences of their selection decisions, for their downstream clients.
• Economic values: developing economic values for wool quality and production traits.	• Ensures that breeders have the necessary information to focus on the traits of economic importance with the emphasis they and their clients desire.
• Software package	• Breeders need confidence in the consequences of their breeding programs, not only for traits that are directly important, but also for traits they wish to maintain.

Evaluating Bloodline Performance



Michael Lollback
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The choice of a ram source is a critical decision for commercial Merino breeders as it will have a major influence on the flocks' performance. This is clearly demonstrated in the table below, the final results of the Walcha wether trial which commenced in 1995 and ended after the third shearing in July 1997.

The results demonstrate the range in performance between many of the bloodlines used in the New England area. Average wool returns per head per year ranged from $23.22 to $38.98 while the carcass values varied from $18.52 to $23.16 reflecting a range in average team liveweight of 48.6 kgs to 60.8 kgs.

The returns from wool were largely determined by fibre diameter and fleece weight and to some extent by style grade although the bulk of wool from this trial was a best topmakers type. Price premiums for finer wool continue to have a significant influence on returns.

Data generated from wether trials are increasingly being sought by breeders who want to identify the best ram source or who are setting up a Merino breeding enterprise and want to get a good start by using ewes from productive bloodlines. Property owners who run wether enterprises are also keen to source wethers from productive bloodlines.

It can be difficult for flock ram buyers to accurately assess the merits of the different bloodline/studs that are available, as it is important that any assessment of bloodlines is independent of the effects of management. Wether trials overcome this problem by comparing a random sample of wethers from a range of bloodlines under identical management conditions.

Care should also be exercised not to judge bloodlines on the results of only one trial. As the average team size for the majority of wether trials is about ten, the accuracy of the results will be greater if the bloodline has been involved in more than one trial.

Another important factor to consider is the recent development in stud breeding programs. Because wether trial teams represent a particular age group, the results do not reflect recent changes in the stud's breeding program.

If a commercial breeder is in the process of considering a change of bloodline, wether trial results can be a very helpful starting point. Consultation with the stud master to review recent developments would be an essential second step. Even when the decision has been made to purchase rams from a new ram source it can be beneficial to evaluate the results of the change by assessing a significant number of progeny from the new ram source. To ensure that this evaluation process is accurate, there are a few guidelines which need to be followed.

Firstly, a reasonable number of rams from the new bloodline need to be used, eg. 5-7. These rams and a similar number of rams from the original bloodline should then be joined to groups of randomly allocated ewes from the same age group. Ideally the ewes should be run in the same mob prior to joining and during pregnancy and lambed in separate mobs in lambing paddocks with similar feed quantity and quality.

After lamb marking when the progeny of each ram source group are identified, all ewes and their progeny should be run together. After weaning, the two progeny groups should be run together until their first shearing. Prior to shearing all progeny should be classed and assessed for the traits that are included in the owners breeding objective.

It is also a good idea to give each animal a grade, eg. 'top', 'flock' or 'cull'. A 'top' animal will meet all the standards for your breeding objective, 'flock' will meet most of the standards while 'cull' is below the minimum standard.

It is relatively easy to collect fleece weight and fibre diameter data at shearing and combined with the pre-shearing visual assessment data you will have an accurate basis for evaluating the new bloodline.

Team No.	Team Owner	Bloodline	Avg FD (μ) 1997	Avg Fl.Wt (kg) 1997	Avg Live Wt.(kg) 1997	Trial Rank	Avg Trial Return $	Carcase Value $	Total Avg Return $
1	A. Burgess	Ruby Hills	19.3	5.54	56.2	8	32.49	21.41	53.90
2	M. Fenwicke	WRBG	20.2	5.14	57.2	17	27.44	21.79	49.23
3	J. McLaren	Nerstane	20.6	6.04	58.2	5	32.85	22.17	55.02
4	C. Laurie	Boree	21.5	6.64	58.2	13	30.03	22.17	52.20
5	E. Barnet	Miramoona	19.8	5.54	54.3	21	26.18	20.69	46.87
6	Nivison Family	Mirani	18.4	5.14	52.8	1	38.98	20.12	59.10
7	D. Cameron	WRBG	19.9	5.12	53.8	15	29.05	20.50	49.55
8	B. Miller	Nerstane	20.6	5.74	56.4	19	26.97	21.49	48.46
9	R. Fulloon	Cressbrook	20.1	5.74	60.8	2	32.78	23.16	55.94
10	G. Nivison	Yalgoo	19.1	5.34	53.5	3	35.42	20.38	55.80
11	L. Blanch	Westvale	19.2	5.03	48.6	20	29.79	18.52	48.31
12	R. MacLean	Saumarez	21.9	6.14	56.5	18	27.49	21.52	49.01
13	J. Wood	Nerstane	21.7	6.04	56.5	14	28.61	21.52	50.13
14	J. Maher	Gostwyck	18.6	5.14	55.6	7	32.78	21.18	53.96
15	J. Hayter	Petali	20.0	4.73	53.2	24	23.92	20.27	44.19
16	J. Harris	Abbington	22.3	6.14	54.3	23	24.89	20.69	45.58
17	L. Fletcher	Coomooloo	19.5	5.64	54.4	6	33.64	20.72	54.36
18	M. Endacott	Merrindee	19.0	4.33	49.4	25	25.23	18.82	44.05
19	A. Wood	Bungulla	21.5	6.35	52.8	16	29.28	20.12	49.40
20	I. Sutherland	Deargee	18.7	5.14	55.0	11	31.77	20.96	52.73
21	A. Van Eyk	Shalimar	18.7	5.24	59.6	4	32.77	22.71	55.48
22	G. Fletcher	Auchen Dhu	19.7	5.24	58.8	9	31.16	22.40	53.56
23	D. Rainger	Wanganella	23.4	6.04	53.4	26	23.22	20.34	43.56
24	R. King	WRBG	20.2	5.24	54.7	12	29.37	20.84	50.21
25	D. Fletcher	Auchen Dhu	20.2	5.14	54.3	22	25.47	20.68	46.15
26	J. Hayter	Nerstane	19.8	5.44	56.0	10	31.56	21.34	52.90
		Averages	**20.2**	**5.5kgs**	**55.2kgs**		**29.74**	**21.02**	**50.76**

CSIRO Finewool teams perform well in WA wether trials

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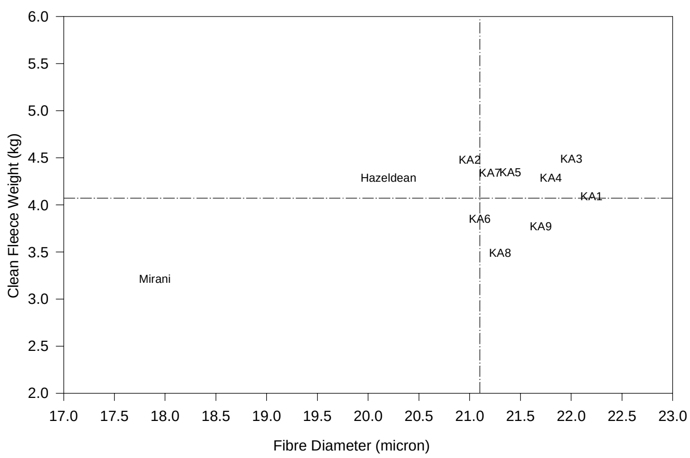
Agriculture WA, at the Great Southern Agricultural Resarch Institute, is working with woolgrowers involved in wether trials to link trials across the state. The trials that are currently linked are located at:

- Condingup (near Esperance)
- Esperance
- Katanning
- Mingenew
- Newdegate

Further interest was added to the Katanning and Condingup trials by the inclusion of teams from CSIRO's fine wool flocks to demonstrate the performance of fine wool animals in different environments in Western Australia. The Katanning wether trial included two teams (Mirani and Hazeldean) of weaners that had been born at the Great Southern Agricultural Research Institute (GSARI). The same two bloodlines were represented in the Condingup trial and were wether hoggets from Yalanbee Research Station.

KATANNING WETHER TRIAL 1997



The Mirani team had the lowest average fibre diameter and the lowest clean fleece weight but the highest average fleece value in the Katanning trial. There was a greater than $15.00/head difference between the highest and lowest average fleece values. The prices used for the trial were based on the premiums and discounts that applied to all wool sold at auction in the first quarter of the 1997/1998 wool selling season. A similar difference in price was found by the Condingup wether trial. They found a difference between the highest and lowest fleece values for green tag wethers of over $17.00/head.

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Results from the Eastern Wether Trial (Condingup) four tooth shearing

Team	Fibre Diameter (microns)	Clean Fleece Weight (kg)	Average Fleece Value ($)
Hazeldean	19.7	5.34	$49.53
Mirani	19.4	4.60	$44.35
Team 9	22.7	5.27	$40.77
Team 8	23.1	6.28	$40.22
Team 6	21.6	6.48	$40.08
Team 7	21.6	4.70	$35.79
Team 2	21.7	4.82	$35.62
Team 11	20.5	4.06	$35.19
Team 1	22.1	4.86	$33.91
Team 12	23.3	5.70	$33.75
Team 3	23.1	5.32	$33.35
Team 4	23.4	5.16	$31.55
Group Average	**21.9**	**5.22**	**$37.84**

Under the current wool market, differences in team performance may not be fully realised. However, the inclusion of the fine wool teams into WA wether trials has certainly added much interest and has proven that fine wool wethers can be competitive in a Mediterranean environment. Such is the level of interest that we are struggling to meet demand to include fine wool sheep in new trials.

Arding Farm Report

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Since last writing the Arding report we have had a very successful lambing in 1997. The ewes lambed during October and November and for the whole five weeks we enjoyed glorious Spring weather, with lush green feed, no blowflies and very few problems with predators such as foxes, dogs and crows.

The lambs thrived for the first couple of months, but the effects of marking and mulesing, and the abundance of feed (which had now dried off and was of considerable height) gave the lambs a slight set back and they didn't continue to bloom as well as they did at first. However, weaning weights were average or slightly better and they are now doing well at Chiswick and are due to be shorn in September.

During Summer and Autumn, Arding experienced very high temperatures, constant hot dry winds, and very little rain. The huge bulk of feed that was evident during the Summer months just simply disappeared, and we found ourselves in drought conditions. Due to the very dry conditions it was decided to postpone joining for two weeks and reduce the joining period to only four weeks.

In early March during the very hot and dry period we had contractors carrying out a routine hoof paring and foot inspection program. It was as a result of this that the big "F" was discovered. Of 3,000 adult sheep inspected, five were detected as having footrot. Diagnosis by laboratory culture

More report and pictures next page

Bodyweight changes of the Finewool Flock at Condobolin

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One question commonly asked with regard to the Finewool flock at Condobolin, relates to the value of the surplus sheep sold from the flock. The superfine and fine wool bloodlines are generally smaller than the medium bloodlines run in non-traditional fine wool areas and this is thought to impact on the value of the finer bloodline animals when they are sold.

A comparison of the body weights of the sheep in each micron group (Tables 1 & 2) indicates that there are only small differences between the superfine, fine and medium groups. A summary of the data for each year of measurement (Table 1) indicates that the largest difference between the three micron groups is 3.2 kg which occurred in 1994. The data in this table also suggest that the differences between micron groups in bodyweight decrease as the time they have spent at Condobolin increases.

Sue H. and colleague

Table 1. Average bodyweight of each drop in each year (kg).

Micron Group	1993	1994	1995	1996
Superfine	51.5	51.0	52.7	53.0
Fine	52.5	54.2	51.7	52.2
Medium	52.2	53.0	51.3	54.0

Table 2 presents the same data in another format, body weights averaged for each drop (or age). Differences between generations probably reflect the sampling occurring within the fine wool flock at Armidale.

Table 2. Average bodyweight in each age group (kg).

Micron group	1991 Drop	1993 Drop	1994 Drop
Superfine	52.1	52.9	53.2
Fine	52.5	52.6	52.0
Medium	52.8	52.3	54.2

The differences in bodyweight between the micron groups presented here will be analysed fully in the coming months to determine the significance of the differences presented in the two tables. It is important to realise that the return from selling surplus sheep occurs only once per sheep in its lifetime. However, the increase in returns for the finer fleeces of these bloodlines is received each time the animal is shorn.

Additions to the breeding flock.

This year, cast for age ewes are available from all of the bloodlines in the Armidale flock. These were mated at Armidale (thanks to the wonderful people at Chiswick!) and were trucked down to Condobolin after mating. They then joined the ewes from the five bloodlines already present at Condobolin, which were mated here. So in a few months time, we will be able to start looking at the various characteristics of the growth and wool of the lambs and compare these to their full-sibs, either brothers born at Armidale but now at Condobolin and their sisters born at and remaining at Armidale.

Arding Report continued

showed three animals virulent and three animals with benign footrot. This of course created much extra work with foot bathing and hoof inspection and a quarantine regime so strict that even an ant with footrot would be detected.

The ewes were pregnancy scanned on 17th July 1998 and the results were disappointing. There were 23% dry and of the 77% of ewes were which were scanned as pregnant - 69% were carrying singles and 8% twins. Because we have single sire mating groups a larger number of dries than usual is expected. Although we carry out service records, all sires were working well, any that were not working were replaced. However, any infertility is not detected until scanning. The problem this year is traced back to 7 sires who performed very badly and in one case, all the ewes were dry. These seven sires are from two bloodlines and in another two bloodlines there was 60% of the maiden ewes dry.

Shearing finished on 6th August and the wool this year is outstanding. While the fleece weight/head appears to be on the low side, the outstanding characteristics this year are colour and crimp definition. Hopefully the price received at auction reflects this great clip.

Preg-scanning at Arding

Brad Hine (L) and John Smith on the board.

Wool away!

Wool Processing of the Future and the Demands on Finer Fibres

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1. Overview

Everybody who is concerned with the future of wool as a viable textile fibre is increasingly aware of changing behaviour of consumers. Yes, they want softness, lightness, comfort, easy care and difference; but they also want it at a price. There is a lot of competition out there for the consumer dollar. Wool yarns are 2.5 to 3 times the price of their polyester and cotton counterparts in a market which ultimately must provide products for consumers who are increasingly looking for value for money.

Traditionally wool is grown over a relatively limited range of fibre diameters and it is becoming increasingly difficult to provide yarns which in final product form meet consumer desires for softness, comfort and lightness at a competitive price. The concept of quality too must be lifted out of the specific context it sometimes has within wool circles to a more general meaning; that of fitness for purpose. Purpose includes the factors listed above together with quality specifications through the pipeline, but the wool industry will have to uphold and protect wool's quality image as a clean and natural fibre.

Consumers of the future will increasingly have caring for the environment in mind when they spend their dollars. There are real opportunities for wool here to build its positive environmental image into an even stronger competitive advantage.

The mission then of processing and indeed of all wool research, development and innovation must be to provide wool apparel products at a quality and price which will sustain and improve consumer demand.

It is of course impossible to carry out processing research in isolation from the development of new specification and prediction technologies from fibre to fabric, and the development of new products with greater differentiation at the consumer level. Examples can easily be found where new technologies which were initially targeted at efficiency and quality improvement led to new product opportunities.

Conversely, new product initiatives have given rise to cost reduction as a principal outcome. The exploitation of greater differentiation at the wool fibre level through more precise specification requires better knowledge of processes as well as an understanding of the opportunities offered by such differentiation for product handle and aesthetics. The crimp characteristics of wool may turn out to be an example, and they are a prime focus in CSIRO's Fibre to Fabric research program.

The centre of gravity of wool textile processing will continue to shift to the Asia Pacific region. Australia can capitalise on this trend through its natural competitive advantage of producing a premium quality raw material and the ability, particularly in early stage processing, to add value to that material better than its competitors.

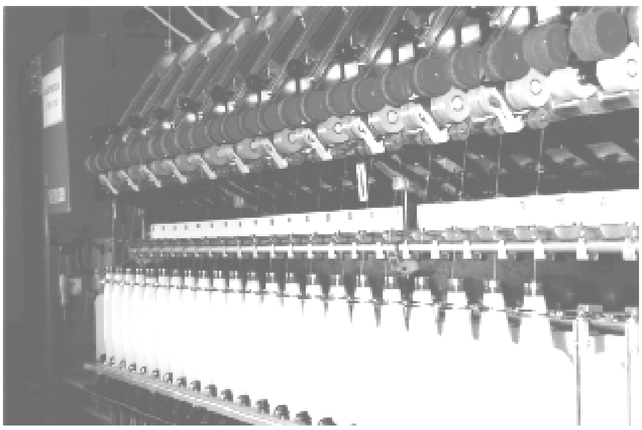
More than this, the processing in Australia of a much higher proportion of its wool to top stage by 2010 is essential to the more rational gathering and marketing of wool for the early stage processing industry and to the production of tops into an appropriate range of specification which truly addresses spinners' needs at optimal cost. Only in this way can wool begin to approach the level of precision and reliability presented by synthetic fibres to the spinning industry. Wool in the form of top needs to become a more predictable, reliable, less expensive and accessible industrial raw material.

The provision of advantage to Australian owned or based early stage processors will have a powerful influence in bringing about such a change. The growth of collaboration in process innovation in Australia is therefore much to be desired.

Environmental regulations, availability of skilled labour and a strong culture of industrial innovation will all be major additional drivers of such a change.

Closer to the consumer, the modern retailing emphasis on "just-in-time" delivery and late stocking decisions is pushing the colouration process closer to the market, with preference for garment dyeing rather than dyeing the fibre before spinning, weaving or knitting. New methods for dyeing and printing wool must be more environmentally friendly, produce new special effects, and be suitable for blends with other fibres as well as being applicable to new yarns which will be developed.

Systems for quality management in fabric and garment manufacture are needed to move wool processing from a subjective art to an objective materials fabrication technology. This requires new equipment for the measurement of wool fabric properties, control systems for finishing, and the development of more productive processes.



Worsted spinning frame

Sitting at the heart of the pipeline, spinning places most of the demands on the fibre regarding specifications. Yet it is here that least progress has been made in productivity and process development relative to that of competing fibres. Here is a major challenge for the processing researcher.

There are plenty of opportunities then for innovators in processing. It is valuable to examine some of these in more detail and with particular reference to finer wools. The clip has, and will continue to edge finer in diameter and processors must be equipped to exploit the changed input.

2. Specific Process Issues

2.1 Chemical Residues

By October 2000 European authorities will agree on acceptable levels of pesticides in wool products. Means exist to manage the application of required pesticides on sheep so that pests can be controlled while allowing the anticipated limits in raw wool to be met. The majority of the problem is caused by 5% of growers and there is adequate clean wool to service the European market provided effective monitoring procedures are in place.

CSIRO is currently commercializing economical pesticide residue measurement technology. Quality conscious growers will soon be able to confirm the efficiency of their sound management on farm and hopefully gain a market premium for their wool. As far as is known there are no specific issues here for finer wools, however environmental monitoring and prediction technologies which are in place in the UK will also be applied in Italy where much fine and superfine wool is processed.

CSIRO Wool Technology is closely monitoring developments and is modifying environmental assessment techniques for the needs of wool processors.

2.2 Lifecycle Analysis

There are now IS0 standards relating to the analysis of products through their lives. Life cycle analysis examines energy and resource usage, waste management and recycling potential. It is a planning and organisational tool for producers and processors but most importantly for wool it can be a powerful marketing tool provided the story is favourable from an environmental point of view.

2.3 Entanglement in Wool Scouring

Aqueous scouring will continue to be the most widely applicable technology for cleaning raw wool in preparation for combing.

Fine and superfine wools are more prone to entanglement in scouring than broader wools and scouring production rates must also be lower. These are added cost imposts and the Division is active in trying to reduce entanglement. Staple configuration and crimp properties play a role but this awaits closer study. It is likely that moving to finer diameter while maintaining fleece weight is a positive move in this regard because of the resulting reduced fibre crimp frequency.

Siroscour

Remember that there is no step equivalent to scouring in the processing of polyester and cotton. Both fibres are appropriately clean in their raw and ginned states respectively to be submitted to the carding process. In addition to the cost of scouring itself, the effluent from wool scouring must be managed. A significant effort is still required to commercialise technology such as SIROLAN CF and SWIMS which can handle and even enable the re-use of the effluent load of scouring.

2.4 Worsted Carding Productivity

With the release of the CA7, a joint development between CSIRO, the Woolmark Company and the French company Thibeau, a quantum leap in worsted carding productivity has been realised.

This is a particularly important development for finer wools since, if the fibre number density on the carding surfaces is to remain constant, carding productivity is approximately inversely proportional to the square of the fibre diameter. Again there is a cost impost as fibre diameter is reduced.

CA7 Card

Vegetable matter contamination remains a problem for wool and the technology required to remove most of it in carding adds considerable to the cost of the worsted card.

One of the most beneficial research projects undertaken by CSIRO Wool Technology in recent years has been the identification of highly efficient worsted carding lubricants and the transfer of the technology to the industry. As a result, fibre breakage in the card is considerably less and the consequent Hauteur or mean fibre length of the combed top is greater.

For finer wools, there is evidence that the application levels must be slightly higher because of the greater fibre surface area per kilogram of wool. This work will continue in order to improve the efficiency of lubrication and static charging control during very high speed carding.

2.5 Combing Productivity

Approximately 80% of the Australian wool clip is combed, a process which adds considerably to the cost of conversion. Combing removes the remaining vegetable matter and entanglements as well as short fibre. Again productivity has to be reduced as the fibre diameter decreases, and the waste or noil also tends to increase.

Most cotton and polyester is spun on the short staple system without combing although cotton destined for finer yarn counts is combed. CSIRO's response is to pursue significant increases in worsted combing productivity, hopefully with an improvement in product quality; much like the approach taken in worsted carding research.

Throughout the gilling, combing and subsequent further gilling operations to produce top, there is removal and generation of small entanglements or neps in the slivers. Again, the management of neps is likely to be more important as the fibre diameter reduces and the role of fibre crimp is yet to be determined.

2.6 Worsted spinning

Ring spinning is the only technology of importance in use at present for wool. While topmaking adds more than 50% to the value of wool, the cost of converting wool top to yarn is about four times that of topmaking. It is easy to see why spinning presents an attractive challenge to the processing researcher. Significant reductions in the cost of spinning would lead to very useful reductions in the cost of consumer products.

In this context, it is valuable to examine two alternative ways of using finer fibres in spinning. Firstly, finer fibres enable the production of finer yarns which in turn can be used to make lighter weight fabrics. However, the productivity of ring spinning falls dramatically with reduction in fibre diameter for yarns having the same number of fibres in the cross section.

For example, the production in kilograms per hour of a singles yarn intended for weaving with say 40 fibres in the yarns cross-section, is inversely proportional to the cube of the fibre diameter. This means that the production of a worsted weaving yarn using 17micron wool fibres is only 53% that of a yarn using 21 micron fibres. The yarn count will be 35% less. So while it is highly desirable that we move the clip to finer diameter for comfort and softness reasons, it must be born in mind that the production of lighter weight fabrics from these fibres is generally more expensive.

The same argument applies of course for cotton and synthetic fibres, however, there are very high speed, high productivity, low cost spinning processes which partly alleviate this problem. In Victoria, there is a modern mill spinning polyester cotton yarns for knitwear at a rate of 400 metres per minute using the latest Murata roller jet spinning technology.

The denim industry is heavily dependent on rotor spinning technology which typically produces cotton and cotton blend yarns at about 100m/min. These two technologies are respectively 20 and 5 times the productivity of ring spinning. Unfortunately, the structure of the yarns and the higher limits on the needed number of fibres in the cross-section, has severely restricted the use of such modern high speed technologies for wool.

There is a need to develop much more productive spinning for wool and wool blend yarns which will still allow the production of fabrics which are appealing to the consumer. This is even more important because of the high cost of fine and superfine wool relative to cotton and polyester.

A second way of exploiting reduced fibre diameter is to maintain the same yarn count and fabric weight while increasing the number of fibres in the yarn cross section. Moving from 21 to 17 micron fibres will result in an increase of 50% in the number of fibres in the yarn cross section. Spinning productivity and yarn uniformity will improve as a result and the feel or handle of the resulting fabrics will be much softer. The fabrics will in general be more expensive because of the raw material cost.

For the woolgrower there is a challenge to produce finer wool fibres more economically so that breeding objectives relating to the maintenance of fleece weight, while reducing fibre diameter, will be of immense value in improving wool's competitive position in the softer, lighter weight market area. The challenge for processing researchers is to do something about the low productivity of wool yarn spinning.

We are trying of course, and technology which enables the weaving of singles yarns is in the process of being commercialised. This allows the bypassing of the two-folding step in weaving yarn production. Two folding is a second twisting step, and costs nearly as much as spinning. We are also developing technology which will enable productivity increases in the spinning of yarns destined for knitting, and we are examining cost effective ways of modifying yarn structures in order to bring about desirable changes in final products.

2.7 Fabric Finishing

Woven and to some extent knitted fabrics must undergo finishing processes to improve their aesthetic properties in preparation for garment making. Finishing processes are still mainly of a batch nature for wool and wool blend fabrics. There is a challenge for the processing researcher to develop continuous and more precisely controlled finishing procedures that reduce the cost and improve the quality of wool fabrics.

It's the same story here for fine fibres: the technical demands of the finishing processes become greater as fibre diameter is reduced. We are still clarifying the role of style related parameters, particularly crimp in finishing and in the subsequent handle and aesthetic properties of the fabrics. When we do, there may be implications for breeding objectives. It is possible, for example, that crimp may play a different role in determining the properties of knitted fabrics compared to woven fabric.

2.8 Dyeing

Dyeing is a process which makes a major contribution to consumer appeal. Colour is one of the principal attractive features of a garment. However, dyeing is costly and wool and wool blend fabrics can be damaged in the process. Work at CSIRO in relation to dyeing has centred around procedures for minimising damage during dyeing.

Our studies have resulted in two processes: Basolan AS and Sirolan LTD. Dyeing at the top stage, using the Basolan AS process, allows for the spinning of finer yarns and the weaving of finer fabrics.

There is a continuing need to reduce the environmental impact of dyeing procedures. A high proportion of wool is dyed using an afterchrome procedure. The problem with this is that it leads to high levels of chromium in the effluent. Work at the Division is aimed at developing a procedure which reduces chromium in the effluent by approximately 95%.

2.9 Easy Care

Easy care properties are important for fine and superfine fibres, especially in view of their increased tendency to felt. It will become important to increase the usage of these fibres in a broader range of consumer products. In view of impending environmental legislation concerning the use of chlorine, we need to develop methods for shrink resisting wool which do not involve the use of chlorine.

This has been addressed through the development of the Sirolan ZAOX process for shrink proofing wool top. Essentially this process replaces chlorine/Hercosett, although the products produced are also whiter and softer.

Coupled with this is the need for an automated method to perform repeated wash, tumble dry testing for the easy care performance of wool garments.

3. Summary

Improvement of process efficiency and quality in the wool textile pipeline is a necessary condition for a sustainable future for wool. There is much to be done but the good news is that process development almost invariably leads to greater product diversity and attractiveness at the consumer level.

Finer fibres will play a major part in the future of wool. They must be produced more cheaply on farm and any remaining fibre properties which significantly influence process or product must be identified and exploited.

Acknowledgements

I wish to acknowledge the financial assistance of Australian woolgrowers through The Woolmark Company and the Australian Government through CSIRO in support of the research work which forms the basis of this article. Thanks also to my colleagues at CSIRO Wool Technology for their input.

How long should my wool be?

Ian Purvis
CSIRO Animal Production and
CRC for Premium Quality Wool

Staple Length

Like crimp frequency (which I dealt with in Finewool Newsletter No.10), staple length is a distinctive feature of raw wool. Pull out a fleece from a bin in a shearing shed, or a few staples from a display sample in a wool store, and the length of the staple is one of the most distinctive features.

But just how important is staple length as an attribute of a fleece or sale lot? This is an especially relevant question because the length of a staple loses its meaning once the wool enters the scour.

One way of determining the importance of staple length is to trace batches of wool that have been carefully measured for staple length and examine what happens to it at various points through the processing pipeline.

The other is to determine how much the trade values differences in staple length relative to other price determining factors. The price paid at auction will not be a perfect reflection of processing considerations because issues like currency fluctuations, variation between selling centres and sale dates will cloud any analysis. However, if data are collected over sufficient number of sale lots, and over a significant period of time, account can be taken of most of these influences.

Staple Length and Auction Price

The wool market is influenced by many things that have nothing to do with processing potential. How can we then work out the price that the "market" is prepared to pay for differences in a particular biological feature - free from the influences of these other factors? The answer is to make sure we have a:

- sample of sufficient size of all sale lots sold so that it reflects the way all factors vary over time
- sample which is taken over a long enough time period that it reflects the size of differences that might occur over a future time frame.
- sample that has sale lots measured or assessed or documented for as many variables that might potentially be important. In this way we can work out which are the important ones. **(See Box below)**

To collect the information on factors affecting staple length in fine and superfine clips, we have analysed Wool International auction sale data for the period 1991-94. We have taken all the information associated with sale lots of adult fleece wools sold in this period that originated from three typical fine-wool

-------------------------- **SAMPLING ISSUES** --------------------------

Unless we take great care with the sample, we are in danger of coming to the conclusion that a certain factor has a significant effect on price, when in fact the supposed effect is due to some bias in the sample. For example, if we took the last 5 of 500 animals that ran up a classing race and weighed them and said this was a reflection of the overall average of a mob, we could be seriously in error. The crocks, the weedy and the needy tend to hang back in a mob when drafting, and thus the last group may not represent the average very well. I have laboured this point, because it is vitally important. Too often people are influenced towards a particular way of doing things by a demonstration or a set of figures that are based on potentially flawed data. Grossly inadequate sample size, poor attention to sampling procedures, taking one point in time for calculations - all potentially dangerous!

growing areas. By restricting our analysis to those sale lots that come from clips where the weighted average of the whole clip was less than 21.5m, we gain a sample of sale lots that is a good representation of the target production, that is, fine and superfine wool clips.

By further restricting our focus within these brands (clips) to sale lots measuring 21.5m and finer we eliminated any production that might come from prime lamb related genotypes. A further refinement was to eliminate sale lots with prices greater than 10,000 cents per kg. These lots are normally single bale lots formed from selected components of individual fleeces. Hence they don't represent the entire production of individual animals.

The Analysis
We used a technique called multiple regression. This technique derives an equation that best describes variation in sale price. By some complex statistical calculations it is possible to calculate the value of a "per unit" change in each individual effect free from the influence of all other effects.

What we found

Firstly let's look at the figures for each of the three wool statistical areas:

Table 1. Summary of attributes of sale lots included in the analysis of staple length

Descriptor	Year				
	WSA	1991	1992	1993	1994
Number of Sale Lots	*N03*	1068	1098	1663	2069
	N23	2632	2002	2700	3817
	V21	1702	1491	2033	2381
Mean Staple Length (mm)	*N03*	83.0	83.7	81.9	80.3
	N23	84.9	88.9	87.5	86.4
	V21	87.3	92.5	86.6	86.9
Mean Staple Strength (N/kt)	*N03*	41.6	41.1	40.4	43.8
	N23	35.7	39.9	39.0	38.8
	V21	34.6	33.2	36.2	36.1
Mean Fibre Diameter (μm)	*N03*	19.4	19.0	18.9	19.1
	N23	19.7	20.1	20.0	19.9
	V21	19.7	20.0	19.7	19.6
Vegetable Matter %	*N03*	1.1	1.1	1.2	0.9
	N23	0.6	0.8	1.0	0.7
	V21	0.4	0.4	0.5	0.5
Price ($)	*N03*	885.2	672.2	957.4	1515.9
	N23	778.8	621.0	765.4	1218.5
	V21	795.0	587.1	838.9	1232.9

The highlights:

- The variation in most of the wool quality attributes and in price was greater across years than across the three wool statistical areas.
- Sale lots from the New England area (N03) were the finest, shortest, and highest in staple strength, vegetable matter, and price.
- Sale lots from the Southern Tablelands of NSW (N23) tended to be intermediate for most attributes, although in one year were the longest.
- Sale lots from the Victorian fine wool area (V21) were intermediate for price and fibre diameter in most years, but were generally the longest and weakest sale lots.

So what about prices for sale lots of different staple lengths? The summary is presented in Table 2.

Table 2. Estimated effect on Price (cents/kg) of one mm change in Staple Length within Micron Categories - by Wool Statistical Area.

	WSA N03		WSA N23		WSA V21	
Micron category	(n)	Length (c/kg/mm)	(n)	Length (c/kg/mm)	(n)	Length (c/kg /mm)
<17.0	102	4.4	15	-3.6	57	-15.0
17.0-17.4	206	-0.3	73	2.5	141	-8.1
17.5-17.9	448	-1.5	242	0.8	270	-3.5
18.0-18.5	1270	-0.4	840	1.8	687	-0.9
18.6-19.5	2100	2.4	2819	-0.7	1970	0.9
19.6-20.5	1160	4.6	3684	-1.6	2498	2.1
20.6-21.5	641	5.3	3478	6.0	1984	3.7
Average		**2.07**		**0.75**		**-3.0**

Highlights:

- Although there was a length premium (2c/kg/mm) in sale lots sold from the New England area, it was variable across micron groupings, and there was no clear trend.
- For sale lots from the Southern Tablelands region (N23), on average there was a small premium for length but there was an inconsistent premium across the micron categories.
- Sale lots from the Victorian fine wool area around Hamilton show on average a discount for increasing length. However, closer examination showed that the discount was only apparent in wools of 18.5m and finer; sale lots broader than this show an increasing premium for length.

The bottom line:

Price premiums for wools of longer staple lengths are small, and in some instances will be not existent. In the very fine wools from south-western Victoria there is evidence of price discounts for longer lengths.

Staple length and processing performance

Trials have been conducted over many years aimed at establishing the relationship between staple length, measures of processing efficiency and product value at various stages of the process of converting raw wool into fabric. CSIRO Wool Technology, in conjunction with large and small scale processing companies, developed a capability of predicting several of the important downstream processing valuables that are influenced by the length of fibres in the raw wool.

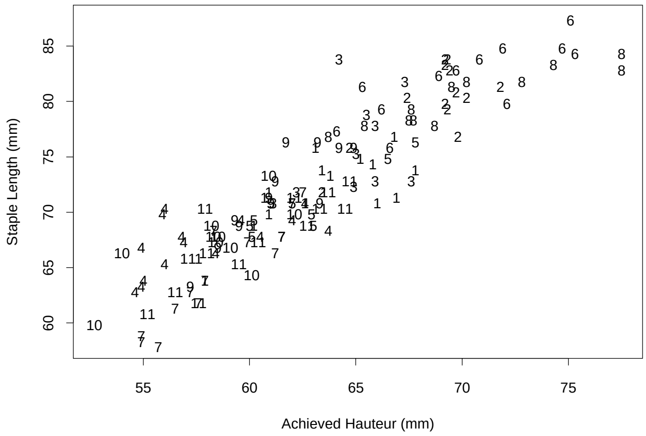
The TEAM trials (Trials Evaluating Additional Measurements) of the 1980's resulted in the development of the TEAM equations, and there have been additions and modifications since them.

In terms of fine and superfine wools, trials conducted by the CSIRO and the CRC for Premium Quality Wool (of which the Finewool Project is a part) have provided for the first time, objective information about the genetic relationships between staple length, processing efficiency and product value.

By processing batches that have been formed from the pooled fleeces of progeny of individual sires, it is possible to calculate the genetic relationship between the staple length of these fleeces and the length of top produced from them. This then allows us to model the processing consequences of selection programs that change staple length.

For example, Figure 1 illustrates this relationship for hogget wools from the Finewool Project grown at Armidale.

Figure 1. Relationship between staple length (mm) and hauteur (mm) from Finewool Project sire processing batches.



Staple length and processing performance beyond the top.

Peter Lamb, a senior researcher from CSIRO Wool Technology and a leading expert on spinning performance says that,

> *"Length is important because staple fibres are bound into a yarn with twist. The end of a fibre is not gripped by friction with other fibres until some way in from its end. The larger the applied load the more friction points and longer distance from the end before the fibre will not slip. If there is not enough gripping from twist and having enough other fibres then this fibre will not be able to take up a share of the load. The longer a fibre is, the greater the part of it that is load bearing. In other words* ***the longer the fibres the stronger the yarn****."*

Peter says that at mean fibre lengths below 55-60 mm, wools are too short for good fibre control on worsted drafting systems and consequently yarn uneveness and machine stoppages, due to ends down, increase.

By contrast, Peter's research has identified that spinning performance continues to improve with increasing hauteur out to at least 95 mm.

Meanwhile back on the Farm

What does all this mean for the finewool ram breeder and the finewool grower?

Let's have a look at the relationship between staple length and clean fleece weight in the CSIRO Finewool Flock. Within-flock level the genetic relationship is positive and moderate, i.e., 0.37. This means that sheep with the heaviest fleece weights will tend to produce progeny with fleeces having longer staples. However, if an objective is to take the flock slowly finer, then selection for mean fibre diameter will favour sheep with genes for slightly shorter staples (genetic correlation is -0.04).

The upshot is that staple length changes will depend on the relative emphasis the breeder applies to fleece weight vs. reducing mean fibre diameter. Whatever the objective, changes in staple length from within-flock selection will be relatively small.

This is highlighted from results of a simulated selection program that shows selection for an objective of holding micron constant, and increasing fleece weight with maximum emphasis will produce correlated changes in staple length of approximately 8% or 6 mm over ten years.

Errata

In the previous edition, Issue 10 of the CSIRO Finewool Newsletter, October 1997, we transposed crimp frequencies in Table 1 in the article "Much Ado about Crimp". The correct message is as follows:

Putting it all together

Very few breeders these days think of fleece weight or mean fibre diameter in isolation from each other. More likely, breeders will have one of three scenarios:

1) Holding Fleece Weight constant while reducing Mean Fibre Diameter (MFD selection)
2) emphasis on increasing Fleece Weight and reducing Mean Fibre Diameter (CFW/MFD selection)
3) Holding Mean Fibre Diameter constant while increasing Fleece Weight (CFW selection).

What happens to crimp frequency under each of these selection scenarios? Table 1 below shows the consequences of selection focused solely on fleece weight and fibre diameter over a period of 10 years.

Table 1 Predicted changes in CFW, MFD and crimp frequency over a period of 10 years, using three different selection strategies

	Strategy	CFW	MFD	% Change in Crimp frequency
1.	MFD Selection	2.0	-17.7	0.0
2.	CFW/MFD Selection	7.5	-15.9	-1.0
3.	CFW Selection	18.9	0.0	-4.0

So, even in this very focused selection program, the maximum change that could be expected in crimp frequency is a decrease of 4%, i.e., about 0.3 of a crimp/cm. The message here is very clear. **Despite concerns about changing crimp frequency, within-flock selection that is focused on the major traits of economic importance, will only result in very small changes over a period of ten years.** Greater changes will occur if sires used are from a medium wool bloodline - where the average crimp frequency is very different.

select

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As Australia's key national research organisation, CSIRO has a vital role in supporting Australian industries.

CSIRO Animal Production not only employs world class geneticists and animal scientists, it has the benefit of over 50 years of wool research at Armidale, as well as its facilities at Prospect (NSW) and Floreat Park (WA).

CSIRO Animal Production has specialist knowledge in three key areas:

- ✰ Fine wool production. As the Australian clip moves finer in search of higher prices, breeders need to ensure they have the appropriate selection strategies to capture the premiums for quality.
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SELECT Services

Some of the more common services provided to Merino breeder clients include:

- Genetic evaluation of wool, production and disease resistance traits eg. Estimated Progeny Values (EPVs)
- Development of customised Selection Index(es) for a personal breeding objective
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- Advice on use of DNA pedigreeing and Gene Marker information
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Meeting YOUR Objective

Your breeding objective may include elements such as:

- Decrease Fibre Diameter
- Increase Fleece Weight
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- Reduce Chemicals

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SELECT Breeding Services (SBS) is an exciting initiative to help Merino breeders take advantage of genetic technologies that are available now or becoming available.

CSIRO's **Lindsay Brash** has been involved in wool research for several years, and most recently worked with fleece testing laboratories to improve ram evaluation services for their breeder clients. By establishing SELECT at CSIRO's Armidale laboratory, Lindsay will have direct access to world leading expertise in sheep genetics and wool technology. "It is very much a horses-for-courses approach", he says, "when a breeder approaches us we will take the time to go through their situation and select the tools which are going to be beneficial for them - there are many different ways we can help a breeder to achieve their breeding goal, whatever that may be".

SELECT Breeding Services was unveiled to the industry at the PIBA Dubbo National Ram Show, held August 25 to 27 1998. **Lindsay Brash** can be contacted by phone on 02 6776 1463 or fax on 02 6776 1333

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