CSIRO *Finewool Newsletter*

Issue 10 October 1997

Editorial

This issue of the Fine Wool Project Newsletter sees the New England Tablelands delivering a substantial rebuff to the "El Nino" projections of the national weather forecasters. I trust those in other fine wool growing areas have received a similar favourable spring opening.

Lionel Ward has settled in as the new Director of the Wool CRC and has kindly provided the Newsletter with a article on an area that is the concern of all in the industry. He has some very thoughtful words on the need for ever improving productivity.

For those of you wondering what Laurie Piper is now doing, he has returned to CSIRO Division of Animal Production's Pastoral Research Laboratory at Armidale and is getting back into the swing of being a practising research geneticist. Those wishing to contact him can do so by phone on 02 6776 1349 or by email: lpiper@chiswick.anprod.csiro.au

Crimp has come in for a lot of attention in the past few years. The industry is awash with lots of opinion about crimp frequency in particular. Should you be breeding wool that is highly crimped, relative to its mean fibre diameter, or should it be the reverse? In this issue of the Newsletter we have attempted to bring objectivity into the discussions by providing some results from the Fine Wool Project. In addition, Peter Lamb, the spinning guru from CSIRO Division of Wool Technology at Geelong, has produced a challenging article about the impact of crimp in later stage processing.

I hope you enjoy the reading. Any questions about any of the material can be obtained by ringing Ian Purvis on 02 6776 1373.

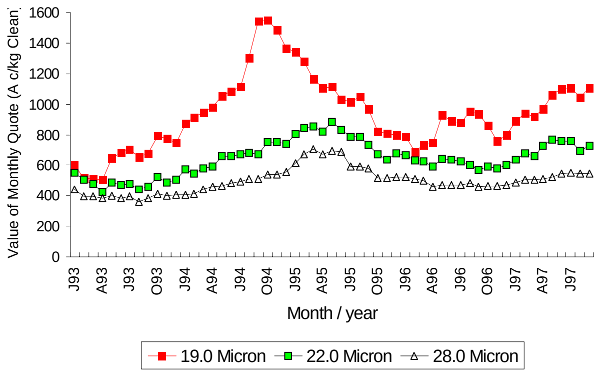
Ian Purvis

In this Issue:

PRICE RECOVERY HAS A STING

The buoyancy of the wool market in the closing months of the 1996-97 season, particularly for fine fleece wools, has been understandably welcomed throughout the wool industry. By 30 June, the Eastern Market Indicator had reached 706 cents per kg clean, 28% above the season's low and AWEX's 19 micron quote for the Northern Region was 1100 cents, 45% above the season's low point (see Figure 1).

Figure 1 Monthly Quotes for selected micron categories in Australia; WI indicators Jan '93 - June '95; AWEX Guides July '95 - September '97



Source: Wool International, AWEX

There is, however, a point of caution. Spinners and weavers at the intermediate stages of the pipeline, are already having difficulty passing the price increases on to downstream apparel manufacturers. Were it not for the looming global short supply of fine wool, the stage would soon be set for a negative reaction to the extent and speed of the price rise. Uncertain supplies however, make forward price predictions extremely difficult.

Demand Factors

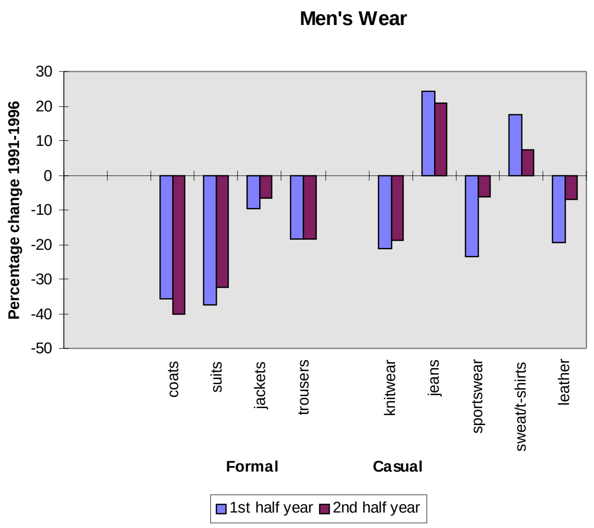
The causes of the sharp recovery in prices are relatively short term in nature, but growers need to be aware of the long-term factors that are also at work. The two are related.

In the short term, prices rose rapidly because mills in the industrialised world had allowed stocks of yarn and fabric to run down so that when retailers and, subsequently, garment manufacturers placed strong orders for early delivery (for the northern retail autumn/winter '97), there was a scramble for prompt delivery of raw material supplies. That situation contrasted with the past two seasons when yarn and fabric stocks had been built up in 1994 in anticipation of strong retail orders which never eventuated. Fine wool categories were particularly affected because the industrialised countries are the principal source of demand for these wools.

The long-term situation explains the background to these developments. Over the past four to five years, consumers in the principal wool consuming countries have registered a distinct shift in expenditure patterns:

- They spend much less on apparel and much more on recreation and leisure;
- When they do buy apparel, the choice has been away from formal wear towards casual wear (see Figure 2).
- Consumers have become increasingly price conscious, purchasing a much higher proportion of apparel at "sale" prices.

Figure 2 'Formal' vs 'Casual' apparel end-uses in Germany - Percentage change in retail turnover of apparel end-uses 1st half year 1991 - 1996; 2nd half year 1991-1996

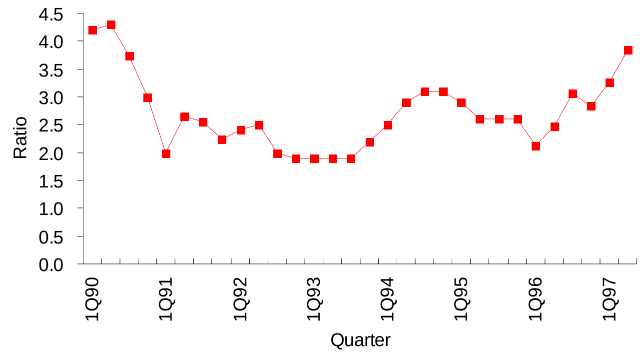


Source : Textile - Wirtschaft

Those three factors have created nightmares for retailers who have become more cautious in their ordering, holding less stock and re-ordering for prompt delivery. They have also had predictable implications for the wool textile industries who have to be able to respond to a less certain demand.

An added problem for Australia's wool growers has been the upward pressure on wool prices in user countries caused by the strong Australian dollar for much of the past eighteen months (less a factor over the past three months). As a result, spinners in much of Europe, Japan and some other Asian countries faced steeply rising wool prices long before the recent recovery in auction prices. With synthetic fibre prices barely over their lowest point for the 1990s, the combined effect caused the wool synthetic price ratio internationally to rise to 3.9 by June, a level considered unsustainable in the long term (see Figure 3). However, the trend in wool prices over the next two years may be influenced increasingly by supply factors, particularly as Wool International's stocks approach depletion.

Figure 3 Quarterly World Wool to Synthetic Price Ratio 1st quarter '90 to 2nd quarter '97



Source : International Wool Secretariat

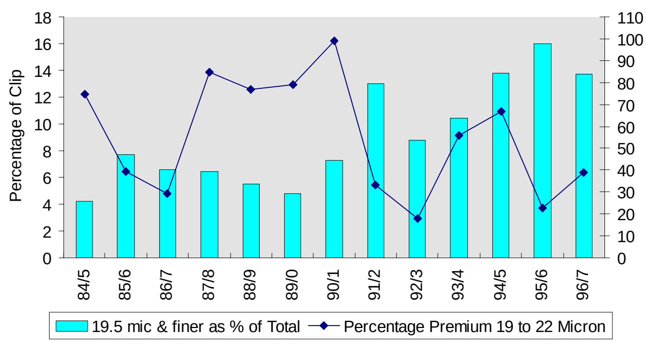
<u>Supply Factors</u>

The availability of wool for sale consists of production plus stocks.

Wool Production: There seems to be little chance of wool production in Australia over the next two or three years recovering significantly from the estimated 641mkg in 1996-97 and forecast 645mkg in 1997-98. Relatively low ewe matings, continuing high slaughtering and rising live sheep exports should keep a lid on any marked recovery that higher wool prices may induce. The renewed El Nino won't help either.

Fine wool producers, however, need to be aware that production

Figure 4 Proportion of Australian Wool 19.5 Micron & Finer & 19 to 22 Micron Price Differentials; 1984-85 to 1996-97



Source: Wool International, AWPFC, AWEX

of wool 19 micron and lower is now, proportionately, much higher than a few years ago (see Figure 4). They are also producing more fine wool in New Zealand - but in all other respects global wool production will stagnate at current levels.

Wool Industry Stocks: The rundown of WI stocks is less predictable now that Wool International can exercise flexibility in making sales above the 90,000 bales per quarter minimum, but stocks (now below 1.5 million bales) can be expected to run out sometime during the 1999-2000 season. However, more important for fine wool producers is that the quantity of wool 19 micron and finer held by WI is negligible and unlikely to negatively influence fine wool prices.

Raw Wool Stocks: With the demise of the reserve price scheme, growers have been exercising their own price protection strategies so that unsold stocks of growers' wool held on farms and in brokers' stores have become an important part of the equation. The quantity presently held on farms is not known with accuracy (probably around 50,000 bales above "normal"), but the quantity held by brokers was 615,000 on 30 June, still 323,700 bales above two years ago.

That supplementary source of supply can be expected to diminish in 1997-98 if improved prices are sustained - and wool growers from the wheat/sheep zone are less concerned about hefty tax bills! It is regrettable that little can be said about the composition of stocks held in store; the data are not available publicly.

Pipeline Stocks: Only a few countries like Japan, France and Germany regularly publish details of stocks held at various stages of the pipeline. We do know, however that stocks are generally fairly low and are probably entering a recovery phase - particularly if price resistance causes textile sales to be below expectations. An exception is China, where anecdotal evidence indicates that stocks are above normal due to declining exports to the US and Europe.

Long-term Outlook

The above outline of factors influencing wool prices shows a confusing picture in which fibre substitution away from wool (or from finer microns to broader microns to reduce costs) is almost certain. Whether that translates into renewed low wool prices cannot easily be predicted, partly because of improved retail demand and the weaker Australian dollar, but particularly because of the prospect of contracting supplies over the next two seasons.

What we can say with certainty, however, is that Australia's wool growers need to face the reality that prices are not sustainable long-term at current levels - levels which many growers believe are necessary to restore profitability. The solution lies in a very substantial improvement in productivity over coming years that will allow wool to be grown profitably at average prices as low as 600 cents (EMI).

A recent issue of the Wool CRC's 'Wool Press' has addressed the issue of productivity in a bit more detail and has signalled that, working with the IWS, the CRC will be devoting increased resources to encouraging wool growers to adopt technologies and practices that will generate productivity gains.

Contact the Wool CRC Office (Ph: 03 9416 5180) for a copy of Wool Press.

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THE FARM REPORT

February 25, 1997 marked the end of an era for me, and for the Fine Wool flock. Until this day, the Fine Wool flock had been running at Longford since its inception in 1990, and I had been working at Longford since 1967.

On February 25 this year, the breeding ewes were transferred to Arding Field Station and the weaners to the Pastoral Research Laboratory at Chiswick where they remain until eighteen months of age. At this point, the ewes join the breeding flock at Arding and 80% of the wethers are transferred to Condobolin.

The ewes have settled into their new environment and continue to do very well. Arding is part of the Pastoral Research Laboratory and comprises 325 ha of rich basalt soil. Pastures are predominately phalaris and white clover.

The breeding ewes were mated in May and although rainfall since April has been below average, feed conditions were excellent. Scanning results proved to be a little disappointing with 78.5% scanned as single; 8% as twins and 13.5% as dry. Some bloodlines performed better than others and the high number of dries can be apportioned to four sires and in one case a large number of 1995 drop ewes (maidens).

The breeding ewes were shorn during August and again wool weights appeared to be average or better and colour and wool style was excellent. This wool was sold at the Newcastle sale on 23rd September and our top price was 1351c/kg for 15 bales of Sup AAA, 17.8 micron. Hogget shearing was carried out in mid September and it would seem fleece weights may be down a little, but the wool certainly looked brighter and more stylish than previous.

Lambing is due to commence on the 8th October and with the excellent rain received in the last three weeks, the scene is again set for a good lambing.

Till next time,

Dick Farrell.

Much Ado About Crimp

Ian Purvis
CSIRO Division of Animal Production, Armidale

Crimp is as much a feature of wool as David Campese has been to Rugby Union or Plugger Locket is to Aussie Rules. You can't look at a sale lot, a fleece, or a staple without being confronted by the crimp of the wool. How clearly the crimp is defined and how regular is its pattern is one feature, usually called crimp definition or character while the frequency of the crimp, crimps per centimetre is another. More detailed analysis of a staple or fleece might involve consideration of how deep are the loops that define the crimp, and the actual shape of these loops. In a well grown wool that has had minimal interference from adverse environmental factors, there is no doubt that the image presented is one of nature's great visual pictures. The fact that wools that bring high premiums in the auction market usually have the highest grade of crimp definition merely reinforces the desire of the wool producer to aim at producing such a product.

Crimp frequency is a more controversial subject. In days gone by the crimp frequency of a wool was used as a visual indicator of the underlying mean fibre diameter; the latter being the major determinant of price in a sale lot. 'Quality number' was a system of classifying wools so that lines of wool of similar crimp frequency could be formed in the shearing shed. The wool buyer was thus given the best opportunity possible to 'guess' the underlying mean fibre diameter.

The advent of wide scale measurement of mean fibre diameter - initially at the sale lot level, but increasingly at the animal level, by breeders, has meant that crimp is less and less used as an indicator of fineness. Increasingly, it has had to stand on its own as an attribute.

The questions that are increasingly being asked are:

i) Does crimp frequency have a role in determining processing performance and downstream product value; and is that role consistent across the range of Merino wools that form the national clip?
ii) What are the associations between crimp frequency and other biological traits of economic importance or of traditional interest to stud breeders?
iii) At the genetic level, if I adopt a certain selection strategy, how will I change the average crimp frequency of the flock?

To answer these questions we need the following information:

i) How variable is the crimp frequency between sheep (take the frequency at the midside as the average of the sheep) - if there is no variation we can't change the flock average anyway.
ii) Is there significant genetic control of crimp frequency? Will an animal's performance be passed strongly to the progeny?
iii) What is the genetic relationship between crimp frequency and other traits that breeders might consider important in their flocks and flocks of clients?
iv) What is the relationship between crimp frequency of a fleece and the processing potential of the fleece - as measured by the factors that determine processing yields and processing costs and price in processed products?

Let's have a look at the information coming from the Fine Wool Project.

How variable is crimp in fine wool flocks

If we take the Fine/Superfine bloodlines that form the Fine Wool Project flocks and plot the average value for the hogget animals over five years, we see the differences as pictured in Figure 1a below. Perhaps unexpectedly, these differences are not very large. This is especially so when viewed against the range of crimp frequency found in the hoggets from any of the flocks (see Figure 1b).

Figure 1a Between bloodline Variation in Crimp Frequency

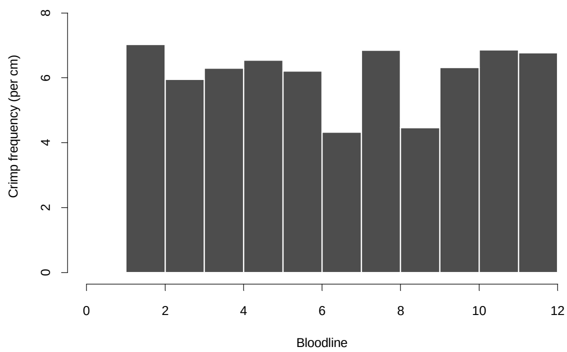
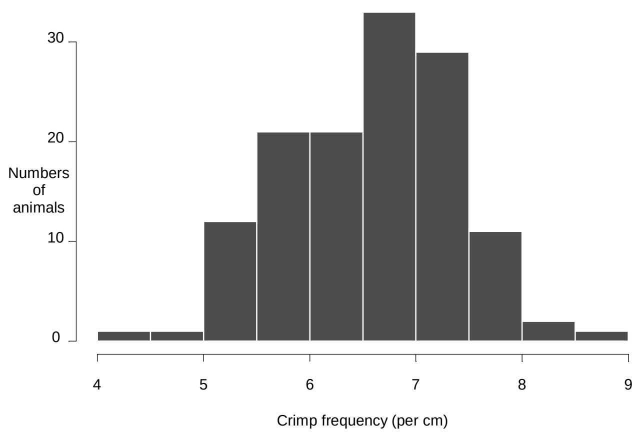


Figure 1b Crimp frequency distribution within a finewool flock.



Now what proportion of those differences in a typical fine wool flock are due to the effects of genes - and will therefore influence the performance of the next generation?

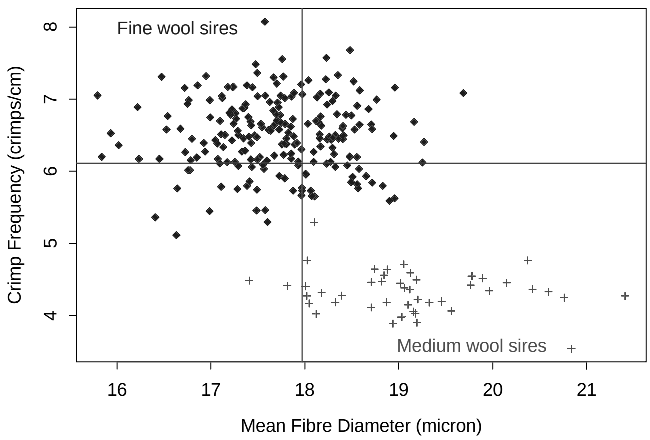
This is measured by the heritability. Crimp frequency is moderately heritable (approx. 0.3). This means that selection will be reasonably effective in achieving permanent change in the crimp frequency of the flock.

Associations with other raw wool traits

Crimp and Diameter in Fine Wool Flocks. As indicated before, crimp frequency has been used in the past as a visual indicator for mean fibre diameter. It therefore comes as a bit of a shock when confronted with objective evidence that within a flock, or a bloodline, or even a strain of Merino, the association between crimp frequency and mean fibre diameter is *essentially zero*. This is both as we see and measure it, (phenotypic association, i.e., genes + environmental effects) and also at the genetic level alone as illustrated in Figure 2. The implications of this are extremely important:

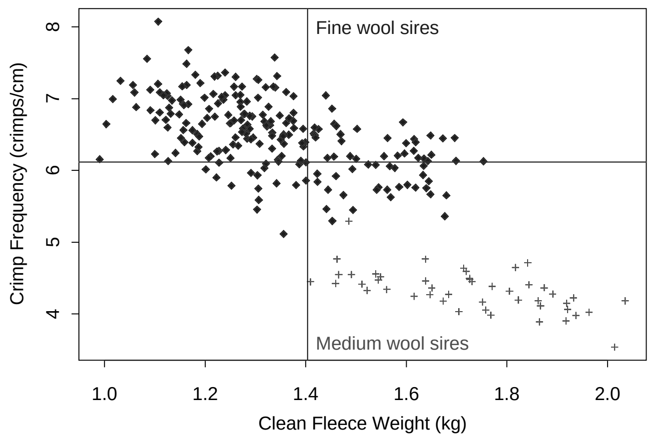
Selection within a flock or bloodline for lower mean fibre diameter alone *will not change crimp frequency.*

Figure 2 Sire EBVs for Crimp Frequency and Fibre Diameter.



Crimp Frequency and Fleece Weight in Fine Wool Flocks. The association between fleece weight and crimp frequency is slightly more complex. The phenotypic correlation is virtually zero. This means that if we ranked a group of animals within a fine wool flock from the highest fleece weight to the lowest, we would not find any corresponding change (up or down) in crimp frequency. However, when we look at the genetic control, things are different - as pictured below in Figure 3 . The sires (and dams) with the highest clean fleece weights tend to have lower crimp frequency. The impact of this is that selection within a fine wool flock for increased fleece weight will produce animals in subsequent generations with lower crimp frequency.

Figure 3 Sire EBVs for Crimp Frequency and Fleece Weight.



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

	% Change in		
Strategy	**CFW**	**MFD**	**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.

Crimp frequency and processing performance

There have been many trials conducted over the years by wool textile research institutions aimed at establishing the relative effects of variations in crimp frequency on processing efficiency and product value. The South African Wool Research Institute (SAWRI) conducted a number of trials over several decades, many on Merino wools. In Australia, there has been a large body of work conducted by CSIRO Division of Wool Technology. In general the results of these trials have shown that up to topmaking stage there are small advantages in fibre length and processing losses from having lower crimped wools.

What do the processing results from the Fine Wool Project show us?

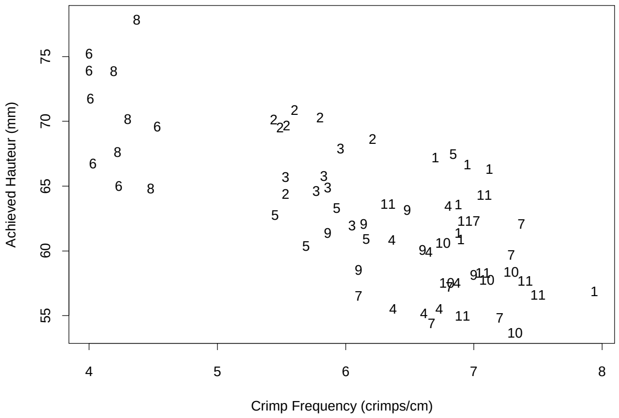
Sire batch processing trials As part of our effort to collect objective genetic information on the relationship between raw wool characteristics and processing performance, more than 200 batches representing the pooled fleeces of the progeny of individual sires have been processed through to top at the Geelong research mill of CSIRO Division of Wool Technology. The results of these trials will give us the capacity to predict with confidence, the processing consequences of different selection strategies.

One of the many raw wool attributes measured on the individual fleeces which formed the processing batches was crimp frequency. This measurement allows us to relate the average crimp frequency of a processing batch to the subsequent performance of that batch through to top stage.

Hauteur, or mean fibre length in the top is an important feature of top specifications and is an important determinant of top price.

How does crimp affect hauteur? In Figure 4 below, the relationship is pictured. As crimp frequency increases, so hauteur decreases - and the relationship is best described by a straight line i.e., it is linear.

Figure 4 Relationship between Crimp Frequency and Hauteur

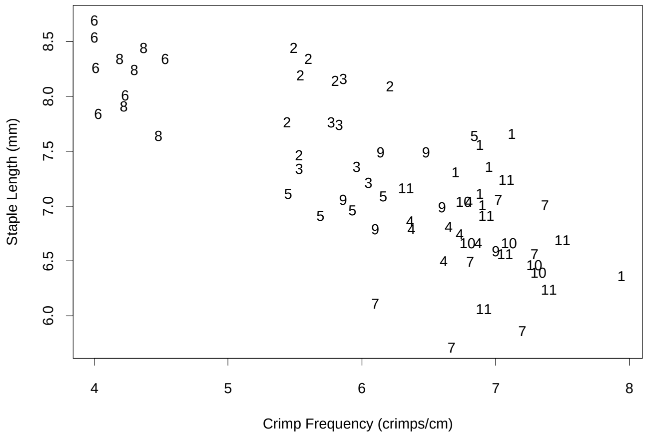


Note: Numbers refer to experimental bloodlines

Comment:
On first examination this graph suggests that high crimp frequency wools produce tops of lower top length, that is, there is some intrinsic negative effect of higher crimp on top length and therefore, lower crimp-frequency wools are better.

This would be true if it was just crimp that was *causing* the differences in hauteur.

Figure 5 Relationship between Crimp Frequency and Staple Length in Sire Processing Batches



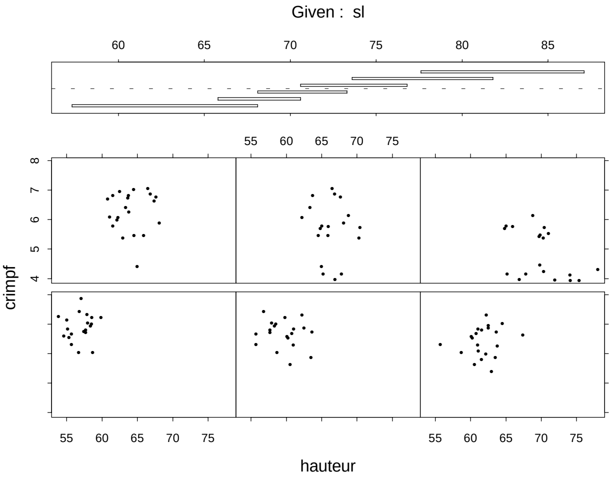
Comment:
As can be clearly seen from Figure 5, there is a very similar relationship between staple length and crimp frequency. On average, longer staples are characterised by having lower crimp frequency. This applies even when bloodlines 6 and 8, the two medium bloodlines, are disregarded.

So is it the crimp or is it the staple length driving these differences in top length?

One way to look at this is to examine the association between crimp frequency and top length within different staple length classes. If crimp does have a major effect on hauteur, then there should still be a relationship irrespective of the staple length.

Wool Processing. Does crimp frequency have a role in processing performance?

Figure 6 Relationship between Crimp Frequency and Achieved Hauteur within Six Staple Length Classes



Comment:

The series of graphs in Figure 6 show the crimp and achieved hauteur characteristics of 6 classes of processing batches. The classes are divided on the basis of staple length - as indicated in the top rectangular box, and are divided so there are roughly the same number of points in each box. The small graphs are read in order from left to right and from bottom to top. So, the first small graph refers to the relationship between crimp frequency and hauteur in the processing batches with the lowest staple lengths, from around 55 to 60 mm.

What does it show?

Simply, in the wools considered in this trial, when we consider batches of roughly similar staple lengths there is then no association between crimp and hauteur.

This is a simple explanation of a very complex issue and we will present further analyses and explanations in future articles.

Condobolin Fine Wool Flock

1997 Shearing results ….

The Condobolin Fine Wool wether flock were shorn in the 3rd week of August. The greasy fleece weights and off-shears body weights for each micron group and drop are in the following table:

	GFW (kg)			**Body weight (kg)**		
	Superfine	*Fine*	*Medium*	*Superfine*	*Fine*	*Medium*
1993 Drop	4.12	5.12	6.30	45.28	47.49	50.10
1994 Drop	4.72	5.6	6.98	49.37	51.22	53.44
1995 Drop	2.80	3.47	4.36	32.95	36.01	37.80

The results between micron groups are as expected with both the greasy fleece weights and off-shears body weights being highest for the Medium bloodlines and lowest for the Superfine group. Unexpectedly, the 1994 drop is outperforming the 1993 drop in greasy fleece weight and bodyweight for each micron group.

The wool from the wethers was sold in the middle of September to a top price of 949c/kg greasy, averaging 823 c/kg greasy for the fleece lines.

For the first time, we entered a couple of superfine, fine and medium fleeces from the wethers into the Condobolin show, one of which won second place. Next year we hope to go one better!

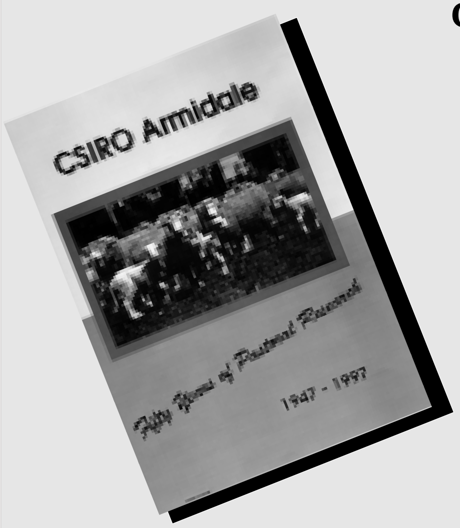
Lambing results to date ….

The first lambs from the Fine Wool breeding flock at Condobolin were born at the beginning of September. A number of ewes are still to lamb, but the lambing results to date (1/10/97) are shown in the following table:

	Lambing (%)	**Twins (%)**	**Birth weight (kg)**
Superfine	76	38	3.98
Fine	82	39	4.13
Medium	74	31	4.99

Sue Hatcher

CSIRO Armidale Golden Jubilee



In February 1995 a committee was formed to produce a history of CSIRO at Armidale. Its purpose was to publish a book to coincide with celebrations on the 50th Anniversary of the purchase of Chiswick and Arding and the establishment of the Regional Pastoral Laboratory by CSIR in 1947.

The book is a social history of the development of first class research facilities by CSIRO and the Rural Industry Research Funds in and around Armidale, rather than a strictly objective view of scientific research, although the latter is carefully assessed.

CSIRO Armidale: Fifty Years of Pastoral Research launched on October 20, 1997 is available in paperback ($25) or hard cover ($40). For further information contact David Paull, phone - 02 6776 1406, fax - 02 6776 1333 or email: dpaull@chiswick.anprod.csiro.au

The Downstream Effects of Crimp

Peter Lamb
CSIRO, Division of Wool Technology, Geelong

At present, most buyers of superfine wool will pay more for high crimp frequency wools. So why should a woolgrower choose to breed broad-crimping sheep? Sure, there seem to be small advantages in fibre length and reduced losses in processing lower crimp wool, but what about the topmaker's customer? Does crimp affect spinning or fabric properties?

Ian Purvis has covered the measurement and effects of crimp seen in the Sire Processing Trials. Since these wools are only now being processed beyond top to yarn and fabric I will report mostly using data from other CSIRO trials. I will present results in terms of **fibre curvature**. It turns out that curvature, or the rate at which a fibre bends, has a close relationship to the crimp frequency. Some of this crimp is pulled out in processing to top but the amount that remains is directly proportional to the crimp frequency of the greasy wool. This is shown in Figure 1 where crimp frequency is plotted against curvature, as measured in the top by the Sirolan-Laserscan, for the wools of the Sire Processing Trials. Moreover, until the fibre is set permanently into a new configuration by, for example dyeing, nearly all the initial crimp can be recovered by relaxing the fibre in water.

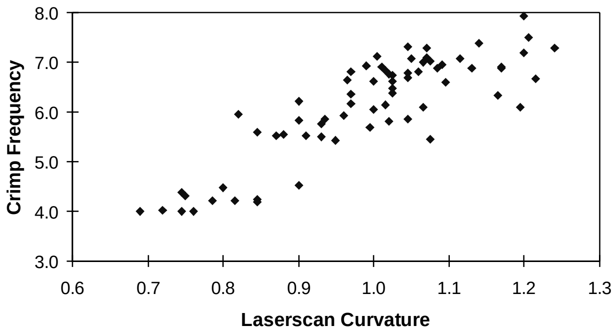


Fig. 1 Crimps/cm of the greasy wool vs. Fibre Curvature of the top.

It is important to stress that curvature relates well to the initial number of crimps per centimetre. However, curvature in the top tells us nothing about crimp definition of the greasy wool, which is a measure of whether all the fibres are curving in phase. To my knowledge, no-one has studied whether curvature in top is also related to the depth, or amplitude, of the crimp in greasy wool.

As Ian has discussed crimp properties appear to have a small effect on average fibre length in top. This will also have an effect on yarn properties but we must ask whether crimp or curvature in the top has any effects in spinning when all other fibre properties are matched. Spinning is a process whereby the strand of fibres is gradually reduced, or drafted, until the desired average thickness is reached and twist is inserted to lock the fibres together. A typical fine weaving yarn from 17mm wool has only about 40 fibres in cross-section, but requires 800 turns of twist per metre and weighs only 12.5 g per km. Each spindle of a spinning frame will only produce about 50 kg of such yarn per year. As a result, a large number of spinning spindles and a large number of operatives to look after the spindles and mend any breaks are needed. Hence, spinning is expensive**. For such a yarn it is likely to be at least five times as expensive as all of topmaking**. It is also important that very few spinning breaks occur because they have to be repaired by the operatives (yarn piecening).

How often breaks occur is primarily governed by the average number of fibres in the yarn cross-section. Finer wool allows more fibres for a given weight of yarn. This, and the resulting softness of the fabric, is the essential reason why 70% of the price of wool is determined by the mean fibre diameter. After diameter, the next most important fibre parameter, for spinning, is mean fibre length. Longer fibres give a stronger and slightly more even yarn. The average strength of the fibres can matter if, for example, the fibres have been damaged by shrinkproofing or dyeing. For most Merino wool tops, of similar diameter, the average strength of the fibres is fairly similar and only very weakly related to the staple strength of the greasy wool. The staple strength measurement can be measuring the one weak point along an otherwise strong staple. Staple strength has its major effect in spinning via its effect on the length of the top. Diameter distribution has a small effect with a 17mm wool with CV(D)=22%, behaving almost identically to an 18mm wool with CV(D)=16%. If length and strength are matched then these two wools will yield the same yarn properties and spinning performance.

Extensive trials at CSIRO, backed up by ongoing industry trials have validated this ranking of fibre properties. The know-how has been incorporated into a series of algorithms and made available by a computer program called Sirolan-Yarnspec. The accuracy with which this program can predict yarn properties and spinning performance has shown that the effects of any remaining parameters, such as crimp, must be small.

This extensive preamble was written to stress that, although crimp is beginning to be shown to have a measurable effect, relative to other fibre properties, particularly diameter, the effects are small. It is also difficult to clearly demonstrate the effects because we cannot readily match all other fibre properties and just vary crimp.

Higher fibre curvature has been shown to be associated with poorer yarn evenness. The latest results are shown in Figure 2 where the difference between measured and predicted CV% of yarn evenness is plotted against fibre curvature. The predicted evenness has taken into account the effects of diameter, length, diameter distribution and measured yarn linear density, but not fibre curvature. However, a word of caution is needed as most of the high curvature values (■) come from one early trial and the curvature values are much higher than normally encountered in top.

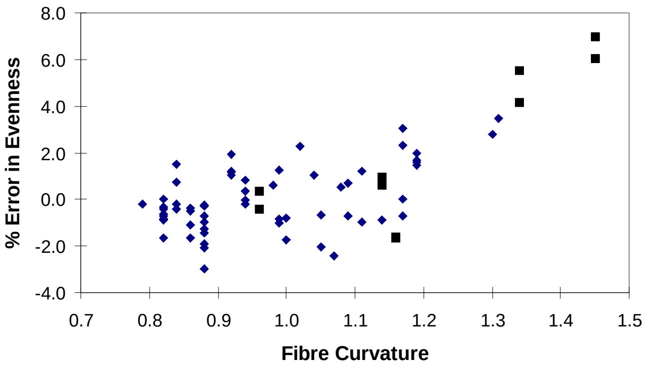


Fig. 2 The percentage error in Uster CV% (yarn unevenness) vs. fibre curvature.

It would be plausible for yarn evenness to be affected by crimp because the quality of drafting relies on fibres being able to move independently. It seems that the higher the curvature the more interaction and the less even the yarn. In the above plot none of the wool was dyed before spinning. Some wool is dyed as top and this can provide measurable reductions in fibre curvature. The advantages of such processes need to be more fully examined. However, some crimp is desirable to give the fabric bulk and because it is the crimp that holds the slivers together in the earlier processing steps. For the latter reason, synthetic fibres, processed on both worsted and cotton systems, along with mohair usually have to be artificially crimped or twisted.

It should be noted that, in these results, there is little evidence for an effect of curvature below a value of 1.1. Normally, only superfine wools with more than 7 crimps/cm (by reference to Figure 1) would have a curvature value above 1.1 in the top. In fact, the only clear evidence of an effect comes from superfine lots specially assembled to examine the extremes of crimp and, to my knowledge, there is no evidence for effects of crimp on spinning for the majority of Australian wools.

Yarn unevenness can have a small effect on fabric appearance but it also affects yarn strength and breaks in spinning. The experimental results for the effect of crimp on ends-down (breaks) in spinning are not fully consistent but the results are broadly in agreement with the effect expected (using Yarnspec) from the observed deterioration in yarn evenness[1].

The Yarnspec predictions take into account differences in Hauteur (mean fibre length), so the observed deterioration in evenness is independent of Hauteur. However, it has been observed previously that higher crimp frequency wools also give rise to shorter Hauteur tops. This shorter length also causes poorer yarn evenness and poorer spinning performance. Very high crimp thus appears capable of giving a double penalty to spinning performance.

The effects of fibre crimp have been detected in the resulting fabrics, both woven and knitted. The major fibre property affecting fabric handle is diameter but when diameter and yarn parameters are carefully matched it appears that lower crimp wools provide a smoother, leaner fabric and a preferred softer handle[2,3]. Again, these effects only appear to have been observed for super-fine wools.

Higher crimp wools lead to bulkier yarns and, if the crimp can be recovered after dyeing and knitting, then a bulkier fabric will result. This is a desirable attribute for knitwear and needs further investigation. It has also been speculated that it is the bulkier yarn in a woven fabric that makes the fabric stiffer. Therefore, changes in the yarn spacing and finishing processes might be used to compensate for the crimp effects and enable identical fabric handle. Again, further work needs to be done to substantiate these possibilities.

The work at CSIRO has gone a long way towards an understanding of the effect of fibre properties and processing from greasy wool to top and from top to yarn. It is highly desirable that we improve our understanding of the step from yarn to fabric and tie it in with the extensive work on tailorability and fabric finishing. The CRC for Premium Quality Wool is playing a useful role in facilitating this additional work to complete the Fibre-to-Fabric picture. Both the woolgrower and processor will then be in a better position to appreciate the total implications of fibre properties.

In conclusion, it can be said that very high crimp is probably detrimental to yarn properties, spinning performance, and fabric handle where softness or leanness is desired. No detrimental effects of low crimp on processing have been observed but, in some circumstances, it may lead to less bulky knitwear. Clarification of the extent of this effect is urgently needed as warmth-without-weight is a highly-prized attribute. On the other hand, removing the need to maintain high crimp as a breeding objective should allow faster progress in increasing fleece weight and reducing diameter.

Acknowledgments

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References

1. P.R. Lamb, G.A. Robinson and T.J. Mahar, *The Effect of Fibre Crimp on Yarn Evenness and Spinning Performance*, Proceedings of Top-Tech '96 Symposium, CSIRO, Geelong, Nov., 1996, pp324-331.
2. D. Stevens and T.J. Mahar, Proc. 9th Int. Wool Text. Res. Conf., Biella, 1995, V,. 134.
3. T. Madeley, T.J. Mahar, R. Postle, Proc. 9th Int. Wool Text. Res. Conf., Biella, 1995, II, 182.

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Contents

How far have we progressed since 1805?

If John and Elizabeth Macarthur were to return today, they would be amazed by some of the progress we have made in the breeding of their flock. We used information from the combined wether trial data to compare the Macarthur remnant flock to bloodlines of similar mean fibre diameter. The progress is obvious:

Wool traits	**No of Teams**	**FD** (μm)	**CFW** (kg)	**YLD** (%)	**BWT** (kg)
Macarthur flock (av.)	3	19.10	1.6	63.5	41
Other flocks (av.)	10	18.92	3.7	73.1	48

Although there are considerable differences in clean fleece weight and body weight, differences in wool style are very slight.

We wish to acknowledge the co-operation of John and Elizabeth Macarthur of Camden and Kathy Coelli of NSW Agriculture, Orange (personal communication) for the above information.

Spanish Merino c.1790[1]

Auchen Dhu rams c.1995

1. Vermont Sheep Breeders Association Register (vol.1, 1879). In: C Massey, *The Australian Merino*, Viking O'Neil, Australia, 1990

Historical Perspective - Fine Wool Prices and Premiums

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