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The processing performance of Western Australian Wools

By Rob Kelly, Ian Ralph and John Stanton, Sheep Industries Branch, Department of Agriculture, South Perth and Barry Harrowfield, CSIRO Division of Wool Technology, Geelong

The wool trade generally regards Western Australian wools as good blending wools, but unsuitable for making up complete processing batches. This reputation is reflected by the lower prices that our wools receive compared with the same wool types sold in the eastern States.

With the assistance of the Australian Wool Corporation (AWC), we have reviewed the potential factors contributing to the differences in prices paid for Western Australia's wools and their processing performance.

Where possible, we have predicted the processing performance of Western Australian wools using an equation developed by CSIRO's Division of Wool Technology.

The equation (see page 100), developed from more than 600 consignments in 28 different mills located in 12 countries (TEAM Project), evaluates the use of additional wool measurements in predicting that wool's processing performance. It allows us to predict hauteur (the fibre length in the wool top) from raw wool characteristics.

Wool processing
Wool processing in Western Australia is restricted to five scouring operations, one wool dyer and one carpet yarn manufacturer. At present, these companies process less than 20 per cent of the State's clip (see Table 1).

Limits to expansion of wool processing
Processors have stated that the lack of a suitable range in wool types, and high costs to transport wool to this State, limit the establishment of a top making factory here. Reported costs are about $30 per bale from the eastern States to Western Australia compared with transport costs in the other direction of $5 per bale to South Australia and $12 per bale to New South Wales.

There is also a belief that Western Australian wools have poor processing performance compared with similar types from other Australian selling centres, and can only be regarded as good blending wools.

The perception that our wools produce a lower fibre length in the top is reflected in the market place, where some types of wool have sold in Fremantle for about 100 cents/kg less than in other centres. This view is invariably reinforced when Western Australians visit mill owners in Europe.

To improve the attractiveness of Western Australian wools to processors, we believe that the industry must:

• overcome the inherent faults that lead to poor processing performance, and
increase the use of full specification in the selling and processing of wool.

In this way, all wools can meet customers' expectations.

This is the essence of a total quality management system for Western Australian, or for that matter, Australian wool. A pilot scheme for quality assurance is currently being developed for wool growers in Western Australia, and many brokers and wool processors now seek quality assurance certification.

**Wool prices at Fremantle compared with those in the eastern States**

Wool prices received at auction provide the clearest indication that Western Australian wools are not regarded as the same standard as those produced in the eastern States.

Two comparisons that were made of the wool prices achieved in Fremantle and the eastern States showed that wool sold at Fremantle can suffer a substantial penalty.

An AWC study of variation in fleece wool price during the second half of the 1991-92 selling season indicated that 96 per cent of the observed variation in the price of sale lots could be attributed to the intrinsic characteristics (mean fibre diameter, strength, etc. – see Figure 1) of the wool. Price variation owing to the location of wool sales was included in the unexplained 4 per cent.

The results suggested that sale lots containing identical wool, sold at the same time, would have received the same clean price whether sold in Melbourne or Sydney, but about 17 cents/kg clean less in Fremantle. Wool sold in Adelaide was discounted only slightly.

These price differences owing to selling centre narrowed during the first half of the 1992-93 selling season to about 6 cents/kg clean (see Table 2). There is some evidence that these differences widened in the second half of that selling season.

### Table 1. Production for the five wool scouring companies in Western Australia 1985-1991 (tonnes clean)

<table>
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<tbody>
<tr>
<td>Swan Wool Scouring (WA)</td>
<td>5700</td>
<td>6780</td>
<td>6500</td>
<td>6164</td>
<td>3013</td>
<td>2200</td>
</tr>
<tr>
<td>Jandakot Wool Scourers Pty Ltd</td>
<td>13600</td>
<td>18500</td>
<td>15600</td>
<td>13200</td>
<td>11800</td>
<td>12000</td>
</tr>
<tr>
<td>Hulme Wool Scourers Pty Ltd</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
<td>3500</td>
<td>3756</td>
<td>4000</td>
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<tr>
<td>AWP Holdings Ltd</td>
<td>2000</td>
<td>2600</td>
<td></td>
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<tr>
<td>Bakers Hill Wool Processors</td>
<td>1000</td>
<td>1000</td>
<td></td>
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</tbody>
</table>

Source: IBIS Enterprise Link Product C2342 – Wool Scouring and Topmaking – Vol 11 (16/7/92)

### Table 2. Wool selling centre price differentials relative to Melbourne (cents/kg clean; ns = not significantly different)

<table>
<thead>
<tr>
<th></th>
<th>1991-92 second half</th>
<th>1992-93 first half</th>
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<tbody>
<tr>
<td></td>
<td>All wool</td>
<td>Staple measured</td>
</tr>
<tr>
<td>Adelaide</td>
<td>- 5.3</td>
<td>- 4.3</td>
</tr>
<tr>
<td>Brisbane</td>
<td>- 5.5</td>
<td>- 18.9</td>
</tr>
<tr>
<td>Fremantle</td>
<td>- 17.5</td>
<td>- 15.7</td>
</tr>
<tr>
<td>Geelong</td>
<td>- 4.5</td>
<td>- 7.7</td>
</tr>
<tr>
<td>Newcastle</td>
<td>19.6</td>
<td>7.1</td>
</tr>
<tr>
<td>Sydney</td>
<td>6.1</td>
<td>ns</td>
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</table>
The quality of the State's wool also varies over the season. Wool sold in autumn usually has a lower yield, a higher average vegetable matter and lower percentage of mid-breaks.

Raw wool quality and processing performance

Quality of wool varies across the State's wool growing areas. Yield usually increases from low to high rainfall in the agricultural area, while mean fibre diameter and vegetable matter decrease. Pastoral wool usually has a lower yield, higher percentage of mid-breaks and more vegetable matter contamination than agricultural wool.

The quality of the State's wool also varies over the season. Wool sold in autumn usually has a lower yield, a higher average vegetable matter and lower percentage of mid-breaks.

The most important measurement for the spinner is mean fibre diameter because it determines how fine a yarn can be spun.

Fibre length in the top is important because it can define how well a yarn spins, particularly if the yarn is being spun near to the practical minimum limit for the average number of fibres in the yarn cross section; presently about 35 fibres.

Another way of comparing prices between selling centres is to examine the maximum prices paid for wool. To do this we extracted data from AWC catalogues for all fleece wools with additional measurement sold from August to October in 1990 and 1991, the time when average staple strength is lowest. From the variation in prices for a particular wool of mean fibre diameter and predicted hauteur characteristics, we determined the 95 per cent maximum price or 'potential top price'.

When we compared these 'potential top prices' between selling centres, they were usually less for wools sold in Fremantle, and the difference was greater at lower fibre diameters (see Table 3). For example, the 'potential top prices' for a 60 mm predicted hauteur were 5, 6, 8 and 18 per cent lower for Fremantle than eastern States wools as the diameter decreased from 23 microns to 20 microns. This was worth up to 140 cents/kg.
Another important measurement for the spinner is the short fibre content of the top, which can influence the number of nepes that develop in the drawing and spinning processes.

Short fibres can appear as faults in the resulting fabric. As short fibre content increases, more fibre is lost, and the amount of fly or fibre build-up on machinery increases. Some of this fly may make its way into the yarn in the form of short, thick faults. Increased short fibre is also thought to increase problems in drafting (drawing out of fibres in the processes that make yarn) as a result of reduced fibre control. The result is poorer yarn regularity.

Weak wools tend to give higher short fibre content.

The fibre length in a top can be predicted to a high degree of accuracy from the measured raw wool properties using the TEAM equation. Wools with a pronounced mid-break will also yield higher values of coefficient of variation of hauteur ($CV_h$), which is a measure of the range of lengths of fibres in the top. The higher the coefficient, the greater the range in fibre lengths in the top.

There is a widespread belief in the spinning industry that a high $CV_h$ is detrimental to spinning performance. Some spinners put limits on $CV_h$ that cannot be met by a wool with a high percentage of mid-breaks.

If we consider both the topmaking and spinning performance, and also note that weaker wools, which break more easily in carding, give higher values of noil or combing waste, it is easy to see why weaker wools fetch lower prices at auction, and are often seen mainly as blending wools.

If this variation in quality is translated into its effect on the wool tops produced from these wools using the TEAM equation, selling month (which reflects time of shearing) has about twice the effect on hauteur than does zone.

When we searched for actual results from the processing of Western Australian wool, only a limited number of processing trials (44 in total) could be found.

In the TEAM project, processing batches which could be identified as only Western Australian wool had similar processing performances to that of eastern States batches.
Additionally, in some AWC studies, wool lots from Western Australia performed better than expected.

These small numbers of results for Western Australian wool only are not enough to support a categorical statement that today's Western Australian wools will process as well as their eastern States counterparts. More work is needed, and this will be achieved in the future by:

- Processing experimental wools in which quality has been manipulated. We have started processing trials at Geelong, using wool from some flocks in which staple strength has been manipulated by either breeding or feeding treatments.
- Collaborative involvement with wool growers who are processing their own clips, to assist in the preparation and selection of wools and analysis of processing performance.

Both of these activities are a major focus of the Cooperative Research Centre for Premium Quality Wool, which involves staff and resources from the Department of Agriculture and CSIRO.

**How hauteur is affected by both fibre strength and position of break**

We used a more advanced form of TEAM type calculation, called CSIRO2, to predict the interaction of different staple strength and percentage of mid-breaks on hauteur (see Table 4).

The ranges simulated represented the likely extremes that might be expected in the Western Australian wool clip. As the position of break in the staple usually occurs in autumn, the percent mid-breaks could be varied from 15 per cent to 85 per cent by changing from an autumn to a spring shearing.

Staple strengths could be as low as 15 newtons per kilotex (N/ktx) in poorly fed autumn lambing ewes, or as high as 45 N/ktx in well managed wethers.

Our analyses showed that 'poorly fed autumn lambing ewes' shorn in autumn could have a similar predicted hauteur (68.7 mm) to that of 'well managed wethers' shorn in spring (67.2 mm). If, however, 'poorly fed autumn lambing ewes' were shorn in spring, the time when most ewes are shorn in Western Australia, the predicted hauteur was only 60 mm.

This effect of shearing time is similar to that found in several experimental projects conducted in the 1970s, where differences in shearing time resulted in substantial variation in hauteur - up to 19 mm. In other words, by only changing time of shearing it is possible to significantly change the processing performance of a weak wool (see Table 5).

**Areas for research to improve processing performance**

Although Western Australian wools suffer a significant price penalty, the limited processing data indicate that similar fibre lengths to eastern States wools can be obtained in the top.

We need further clarification as to whether the price penalties are caused by:

- real differences in processing performance that our study has not yet addressed;
- greater exporters' costs on the western than eastern seaboard;
Altering the time of shearing can change the processing performance of a weak wool considerably.

- conservative bidding limits based on some past experience of Western Australian wools not processing to expected levels, but no longer relevant to today's wools.

To improve the value of the Western Australian wool clip, we believe we must increase the proportion of wool sold with the added measurements for staple length and strength. We also need to know more about how extremes of staple strength and position of break interact and affect processing performance.

We need documentation on the effect of selling season, district of origin, flock management and feeding on the variation in predicted hauteur and vegetable matter of Western Australian wools, using AWC Sale Catalogue and on-farm data. This will allow us to evaluate the relative merit and cost effectiveness of available on-farm techniques for manipulating hauteur. It will help wool growers target future production and times of shearing for stipulated diameter/hauteur specifications.

We need to determine how staple strength affects the maximum speed at which carding can take place without significant additional breakage of fibre. This is particularly important for the high processing speeds of modern machinery.

The Wool Program of the Department of Agriculture and the Cooperative Research Centre for Premium Quality Wool have started this research.

Acknowledgements

The authors wish to acknowledge the assistance provided by John O'Connor, Russell Pattinson, Bob Couchman, Kerry Stott and Philip Hanson of the Australian Wool Corporation.

<table>
<thead>
<tr>
<th>Table 5. Actual hauteurs achieved in processing trials on Western Australian wools from experimental projects</th>
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<tbody>
<tr>
<td>Experiment</td>
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<td>---------------------</td>
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<td>Yalumba 1974-75</td>
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<td>Wongan 1966</td>
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<td>Mt. Barker 1971</td>
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<td>Newdegate 1974</td>
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Rob Kelly can be contacted on (09) 368 3563