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# "AUSTRALIAN CARBONIZING YIELD"



A SUMMARY OF THE TRIAL WHICH ESTABLISHED THE EQUATION FOR  
CALCULATING THE AUSTRALIAN CARBONIZING YIELD



*Prepared by the Australian Wool Corporation  
Research & Development Department*

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#### **BACKGROUND**

With the rapid growth of pre-sale testing in Australia since 1972, virtually all greasy wool types, including washing and carbonizing wools used in the carding sector of the industry, have been sold by sample with objective measurement.

In the past, the yields reported in sale catalogues only gave estimates of commercial combing and washing yields. There was no corresponding yield which estimated a commercial carbonizing result. A carbonizing yield calculation should be based on the fibre loss that occurs when wool is carbonized.

In response to buyer and processor requests, a large scale trial was carried out to establish the average fibre loss with a view to reporting an estimated commercial carbonizing yield in sale catalogues.

The trial established a formula for calculating the estimated mill result from the coretest results for yield and vegetable matter on the greasy wool. The results of the trial were reported to the IWTO Technical Committee in 1976.

The IWTO has given approval for the yield to be included on IWTO Yield Certificates on a trial basis.

The JWSO called the estimated mill yield the "Australian Carbonizing Yield" (ACY) and has given approval for the yield to be reported in sale catalogues.

For further information on the trial or for a copy of the trial report published in the Journal of the Textile Institute please contact Ian Purvis or David Charlton of the Australian Wool Corporation - Research & Development Department, 261 George Street, Sydney. Telephone Sydney 27-6172.

## THE TRIAL

### 1. MILLS

The trial was conducted by the Australian Wool Corporation's Research and Development Department with the co-operation of eight Australian carbonizing mills, all members of the Scourers, Carbonizers and Fellmongers' Association of Australia. The design of the trial was such that:

- i The mills which participated in the trial process virtually all the wool that is carbonised in Australia.
- ii There was a wide range in the type and age of the machinery in the eight mills.
- iii No control over mill practices was attempted. Therefore the results should accurately relate to commercial performance.

### 2. WOOLS

The 90 batches of wool which were processed in the trial covered the range of types which are commercially carbonized. The number of batches of the various types reflected the frequency with which they occur in the Australian wool clip. These are listed in Table 1.

**TABLE 1**  
Wool Type Categories for the 90 Batches

Wool Type Category	Commercial Batches	A.W.C. Type Blocks	Total
<b>MERINO</b>			
Locks (lks)	7	12	19
Crutchings (crs)	2	8	10
Lks/Crs Blends	12	-	12
Carding Lambs	9	1	10
Carding Stains	1	6	7
Carbo Pieces & Bellies	2	2	4
Carbo Bellies/Lks Blend	1	-	1
<b>TOTAL</b>	<b>34</b>	<b>29</b>	<b>63</b>
<b>CROSSBRED</b>			
XB Locks	1	2	3
XB Crutchings	7	6	13
XB Carding Lambs	-	4	4
XB Carding Stains	2	1	3
XB Carbo Pieces & Bellies	1	3	4
<b>TOTAL</b>	<b>11</b>	<b>16</b>	<b>27</b>
<b>GRAND TOTAL</b>	<b>45</b>	<b>45</b>	<b>90</b>

### 3. TRIAL PROCEDURES

Prior to carbonizing, each greasy wool batch was core-sampled by an accredited test house to determine:-

- wool base (%) (i.e. clean oven-dry fibre free from all impurities)
- vegetable matter (%)
- mean fibre diameter (um)

The carbonized product was likewise core-sampled and tested.

The "carbonizing loss" was calculated as the amount of clean fibre which was effectively lost from the main carbonized product, i.e. the combination of the fibre lost in scouring and carbonizing and the fibre collected as wastes.

#### 4. RESULTS

In seeking to get the most precise prediction of actual mill yield, the results from the 90 batches carbonized in the trial were analysed to see what factors influenced the mill result.

It was found, that of the greasy wool characteristics that were either measured or subjectively appraised, only two had any influence on the mill yield. These were:-

- WOOL BASE % OF THE GREASY WOOL
- VEGETABLE MATTER % OF THE GREASY WOOL

All other factors such as: *mean fibre diameter, estimated length, processing batch size*, were found to have no effect on the yield of carbonized product.

Similarly with *differences between mills*, even though there was a considerable range of types of equipment and ages of plant in the 8 mills which participated in the trial there was no indication that there was any consistent difference in the yields of the product or in the fibre losses, between the mills.

#### **EFFECT OF CARBONIZING ON MEAN FIBRE DIAMETER**

The comparison of mean fibre diameter of the greasy wool with the mean fibre diameter of the carbonized product proved very interesting. The *product*, on average, measured almost *half a micron coarser* than the greasy wool. This average difference was independent of the mean fibre diameter of the processed batch.

#### **MILL CARBONIZED YIELD ESTIMATED FROM CORETEST YIELD AND VEGETABLE MATTER**

The trial established that there is an *average fibre loss* of about 3% of oven-dry fibre, or about 3.5% of *conditioned* fibre. This loss *does not change* with the yield of the wool, that is, the average percentage fibre loss is the same for either high or low yielding wools.

However this loss *does change with the vegetable matter* content of the greasy wool. The *change* is about 1%, that is, for the majority of carbonizing wools, the *fibre loss is in the range of 2.5% to 4.5%*.

The way in which the fibre loss in *carbonizing* is influenced by vegetable matter is the *opposite* to the effect of VM on fibre loss in *worsted processing*.

For VM levels of 10% the fibre loss is about 3.5%. However on *low* fault wools the fibre loss *increased* (by about 1%) to 4.5%, and for *high* fault wools the fibre loss *decreases* (by about 1%) to 2.5%.

## THE FORMULA FOR CALCULATING ACY%

The actual formula for calculating the estimated mill result from coretest yield and VM data is:

$$\text{ACY\%} = \text{IWTO Clean Wool Content Yield \%} + .1616 * \text{VM\%} - 5.12^*$$

\* These figures adjust the Clean Wool Content Yield to account for the fibre loss due to the level of the vegetable matter and the carbonizing treatment.

### *Example:*

*For a carbonizing wool yielding 55% on an IWTO Clean Wool Content Yield basis (i.e. 17% regain and 2.27% residuals) the estimated mill carbonizing result, i.e. Australian Carbonizing Yield (ACY) is:*

*For IWTO C.W.C. of 55%*

$$\begin{aligned} \text{A.C.Y.} &= 50.4\% \text{ for a } 3\% \text{ VM wool} \\ &= 51.5\% \text{ for a } 10\% \text{ VM wool} \\ &= 52.3\% \text{ for a } 15\% \text{ VM wool} \end{aligned}$$

## VEGETABLE MATTER INFLUENCE ON FIBRE LOSS

Trade opinion, prior to the trial, was that the percentage of fibre lost in carbonizing would increase with the increasing vegetable matter in the greasy wool. The results of this trial do not support this since the fibre loss decreased with increasing vegetable matter content.

In considering this result, it must be recognised that the mechanical actions associated with carbonizing are distinctly different from those of worsted carding where the "tearing" action of the card and the removal of fibre-entangled burr does result in increasing card loss with increasing vegetable matter contamination.

One hypothesis which could account for the relationship found in this trial is that there may be a constant percentage of material (wool fibre, carbonized vegetable matter, dust, etc.) lost during willeying. The action of the willey is such that the wool fibre and carbonized V.M. mixture is forced against a mesh screen in the willey. In the wools with lower vegetable matter levels, the material passing through the screen may be composed largely of wool fibre. With increasing vegetable matter the carbonized vegetable matter may make up an increasingly greater proportion of the material lost and therefore, less fibre, as a percentage of the weight carbonized, may be lost. It is likely, however, that more than one factor causes the fibre loss to vary with the VM level.

**NOTE FOR JAPANESE TRADE**

ACY is an estimated mill carbonizing yield based on standard IWTO conditions of 17 per cent regain, and 2.27% residuals

In order to compare a mill result with the carbonizing yield estimated from coretest results, both the mill yield and the coretest estimated yield must be at the *same conditions* for *regain* and *residuals*.

For those buyers and mills more familiar with trading on the standard Japanese Clean Scoured (JCS) conditions of 16% regain and 1.5% residuals, a mill result on JCS conditions requires adjustment to IWTO conditions for comparison with ACY.

To adjust a mill result based on JCS conditions, to IWTO conditions, the mill result must be multiplied by 1.0166\*

Example:

ACY = 55%

Mill carbonizing yield at 16% regain and 1.5% Residuals = 53.5%

Mill carbonizing yield at 17% regain and 2.27% Residuals = 53.5 x 1.0166  
= 54.39%

Difference between ACY and mill result = 55.00 - 54.39  
= 0.61%

\* Derivation of conversion factor between IWTO and JCS standard conditions:

$$\begin{aligned} \text{IWTO CWC} &= \text{WOOL BASE} \times \frac{100}{97.73} \times \frac{117}{100} \\ &= \text{WOOL BASE} \times 1.1972 \\ \text{JCS} &= \text{WOOL BASE} \times \frac{100}{98.5} \times \frac{116}{100} \\ &= \text{WOOL BASE} \times 1.1777 \\ \text{Therefore IWTO CWC} &= \text{JCS} \times \frac{1.1972}{1.1777} = \text{JCS} \times 1.0166 \\ &\text{or JCS} = \frac{\text{IWTO CWC}}{1.0166} \end{aligned}$$