INTERNATIONAL WOOL TEXTILE ORGANISATION

Woolgrowers, Traders & Early Processors Committee — Nice Meeting

Chairmen: G. Beier (South Africa)
R. Thirkell-Johnston (Australia)

Secretary: R. J. Quirk (Australia) — December, 1997

Industry Review of the TEAM Prediction Formulae

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Background

Out-of-session discussions during the IWTO Cape Town meeting (April, 1996), following presentation of a report querying the efficiency of the TEAM formulae on Western Australian wools, stimulated a request for IWS to conduct a review of the TEAM formulae. IWS agreed to coordinate an industry-based review group which debated the suitability of the formulae. The review committee also conducted a world-wide survey on the use of the TEAM formulae for the prediction of the top length and other processing parameters of combing wool. This paper presents the findings of the review committee and the world-wide survey.

Since its release in 1988, the TEAM formulae have been used by many mills, topmakers and exporters throughout the world to assist in the prediction of Hauteur, CV Hauteur and Romaine. Developed from large-scale industry processing trials on commercial consignments over 7 years, the TEAM formulae are the recognised prediction formulae for these specifications. However, with increasing use of staple measurements on auction sale lots, greater awareness of the relationship between sale lots and consignments has stimulated discussion on the use of alternative prediction formulae for sale lots, and the limitations of prediction formulae such as the TEAM formulae.

Industry Review

IWS has encouraged a review of the TEAM formulae, and in the first half of the 1996/97 wool season a Review Group was established. The Group comprised representatives from CSIRO, AWTA Ltd, NCWSBA Ltd, ACWE, AWPC, WA Wool Strategy Group and IWS. The Terms of Reference were to determine whether or not:

* the TEAM formulae are fulfilling the needs of industry;

* the TEAM formulae provide a benchmark for mills;

* the TEAM formulae provide predictions (with appropriate mill adjustments) to allow for efficient trading and processing of Australian wool;

* adjustments or refinements to the TEAM formulae are required and/or desirable to accommodate current processing conditions;

* there is a need for additional or specific formulae for the prediction of processing outcomes e.g. carding wool; and

* the SIRO1 and SIRO2 formulae are relevant to industry.

Industry Survey

A key feature of the review was a world industry survey to which 28 mills and 14 exporters/topmakers responded. From their responses, the survey indicated that:

- there is general satisfaction with the TEAM formulae;
- the TEAM formulae are being used in many countries;
- there is awareness of differences in the performance of TEAM for different wool categories and in the relationship between predicted and actual results; and
- most mills used their own mill adjustments with the formulae.

In addition, interest was shown in sale lot prediction but little interest was noted from respondents for specific sale lot formulae, such as SIRO1 and SIRO2. A summary of the responses appears at the end of the paper.

Understanding TEAM

TEAM is a series of simple published formulae for predicting the length characteristics of combing wool. All the data used to derive the formulae were based on commercial consignments, as it is consignments, and not individual sale lots, which are normally processed.

The TEAM General Formulae for the prediction of

(1) Hauteur is:

$$Ha = 0.52L + 0.47S + 0.95D - 0.19M^* - 0.45V - 3.5 + MA$$

(2) Coefficient of Variation of Hauteur is:

$$CVHa = 0.12L - 0.14S - 0.35D + 0.20M^* + 49.3 + MA$$

(3) Romaine is:

$$Rom. = -0.11L - 0.14S - 0.35D + 0.94V + 27.7 + MA$$

where

Ha = *Theoretical Hauteur (mm);*

CVHa = *Theoretical Coefficient of Variation of Hauteur (%);*

Rom. = *Theoretical Romaine (%);*

L = *Staple Length (mm);*

S = *Staple Strength (N/ktex);*

D = *Fibre Diameter (µm);*

*M** = *Adjusted Percentage of Middle Breaks (M) (%) (all values of M up to 45% are replaced by a value of 45% for M*. For values of M greater than 45% the measured value itself is used as M*).*

V = *Vegetable Matter Base (%);*

MA = *Mill Adjustment factor, note: the value of 0 should be used if unknown.*

These formulae are documented within the IWTO Staple Testing Regulations Section 4.2.1).

Limitations of TEAM

Because individual sale lots may have greasy wool characteristics which are outside the range used to describe the characteristics of the consignments processed in the TEAM Project, some anomalous Hauteur predictions can occur for such sale lots. The TEAM formula was developed from 545 consignments with the following characteristics.

	Mean	Minimum	Maximum
Mean Fibre Diameter (um)	22.0	17	31
Vegetable Matter Base (%)	2.1	0	10
Staple Length (mm)	86	59	123
Staple Strength (N/ktex)	39	23	60

Thus, a consignment with average specifications outside these limits may show an anomalous prediction. Similarly, if applied to individual sale lots which are more likely to exceed these specifications an abnormality can be obvious.

At the sale lot level, experimental data has indicated that some lots which don't predict well can have a fibre length to staple length ratio different from the mean value of 1.17, i.e. on average the length of fibres in a staple are 17% longer than the staple length. For extreme wools this ratio may be closer to 1.00 or at the other end 1.35. While this might have a critical effect on prediction at the sale lot level, at the consignment level it is not so critical as the likelihood of putting a blend together with all lots at the same extreme is small or negligible. Further, the prediction of Hauteur on sale lots is additive as the consignment is put together i.e. a combination of individual predicted Hauteurs is usually similar to the Hauteur predicted from the average greasy wool measurements of the consignment.

However such limitations need to be acknowledged and recognised. Some exporters highlight anomalies on sale lots of premature shorn sound wools, irregular length types, weaners wool of combing length and some superfine fleece.

Alternative Formulae

In recent times, 2 commercial software packages have been produced, i.e. LOTSPEC (CSIRO) and TOPMAKER (Aust. Software for Topmaking Ltd). Both of these programs make use of the TEAM formulae, along with formulae based on CSIRO processing trials of sale lots in a pilot plant. Users of LOTSPEC can compare the predictive ability of all the formulae. These programmes also provide estimates of short fibre content and Almeter diagrams and may be a useful tool to improve knowledge of processing performance.

Some individual mills have developed their own confidential prediction formulae based on their own measured data. Some have different formulae for different blends or types of wool.

Conclusions of Review

The Group concluded that while other options are available, and others may become available, the TEAM formulae are simple models, are easy to understand and have been remarkably robust over time. TEAM now provides a benchmark. Improvements in processing technology are recognised by individual organisations with a change to the Mill Adjustment factor in the prediction formulae.

Suggestions for amendments or refinements to TEAM may be required and should be encouraged where anomolous predictive results are prevalent, but this will have to rely on research by individual organisations, as large-scale process research is now impossible with the shortage of research funds in the industry.

It is recommended that any of these positive suggestions or refinements to TEAM be in a form which can be added on, or converted from the published TEAM formulae which are currently widely used.

TEAM Survey 1996

In September/October 1996, 60 mills and 47 exporter/topmakers throughout the world were surveyed on their knowledge and application of the TEAM formulae for the prediction of Hauteur, CV Hauteur and Romaine.

39% of recipients (42) responded to the survey, 46% of the mills (28) and 30% of the exporter/topmakers (14). The analysis has been split wherever possible to indicate separately the responses of the mills and the exporter/topmakers. The percentages expressed reflect the comments of the respondents.

1. Who uses prediction formulae?

75% of mills (21), and 75% of exporter/topmakers (10) use prediction formulae. 79% of mills and 93% of exporters/topmakers have used the TEAM formulae, while 75% of mills and 86% of exporter/topmakers continue to use it.

The number of mill respondents and their location are summarised below:

Region	Use TEAM	Do not use TEAM
USA/W. Europe	6	3
Japan/Taiwan	4	0
Central Europe	2	3
Australia	4	1
India/M. East	5	0
	21	7

2. What is the main purpose in using TEAM? The survey asked for up to 3 purposes. The ranking found as follows.

Purpose	Mills	Exporters/Topmakers
Prediction	16	5
Buying	16	2
Specifications	4	2
Meeting Orders	3	3
Blending	4	3
Quality Control	3	3
QC on Commission Combers	4	2
Benchmarking	0	1
Machine Settings	1	0
Additional Information	1	0
Help Mills	0	1

The number of responses from the mills indicates that TEAM has multiple uses for most mills, with its use for prediction and buying being its major application.

3. Which TEAM Formulae have been used?

Those respondents who indicated they have used TEAM formulae were asked to indicate whether that was for Hauteur, CV Hauteur or Romaine. The response was:

	Hauteur	CV Hauteur	Romaine
Mills	100%	86%	73%
Exporter/Topmakers	100%	85%	54%

4. How reliable is the relationship between TEAM predicted values and actual results?

The survey asked whether the relationships were generally reliable. Those responding positively were:

	Hauteur	CV Hauteur	Romaine
Mills	82%	59%	27%
Exporter/Topmakers	69%	38%	15%

The survey also asked whether these relationships had changed. Those respondents agreeing that changes had occurred were:

	Hauteur	CV Hauteur	Romaine
Mills	36%	32%	9%
Exporter/Topmakers	15%	23%	15%

5. Are there differences in the performance of TEAM for different wool consignment categories?

The survey asked whether there were differences in performance between:

- 100% Fleece consignments and Fleece/Skirting blends; and
- 100% Fleece consignments and 100% Skirtings consignments.

Those responses that agreed there were differences are summarised below.

	Hauteur			CV Hauteur			Romaine		
	Different	Not Diff.	No Resp	Different	Not Diff.	No Resp	Different	Not Diff.	No Resp
100% Fleece and Fleece/Skirtings Blend									
Mills	63%	19%	18%	59%	9%	31%	45%	9%	46%
Exporter /Topmakers	46%	8%	46%	38%	8%	54%	23%	15%	62%
100% Fleece and 100% Skirtings									
Mills	45%	14%	41%	41%	9%	50%	27%	14%	59%
Exporter /Topmakers	46%	8%	46%	38%	8%	54%	23%	15%	62%

6. Are Mill Adjustments used with the TEAM Formulae?

Those respondents who indicated they did use a mill adjustment are summarised here:

	Hauteur	CV Hauteur	Romaine
Mills	82%	50%	41%
Exporter/Topmakers	31%	23%	23%

7. Is there general satisfaction with the General TEAM Formulae?

91% of mill respondents were happy with the application of the TEAM Formulae. Only 54% of exporter/topmaker respondents felt the same way.

8. Why do some mills and exporter/topmakers not use prediction formulae?

The survey showed that 25% of mills and 25% of exporter/topmakers that responded did not use prediction formulae. Of those that provided additional comment, it was both visual assessment and experience which was used to estimate processing performance. Interestingly, 43% of these mills (3) and 75% of these exporter/topmakers (3) indicated they would like assistance to improve their understanding in the application of TEAM Formulae.

A number of other questions were included in the survey to determine the interest in other predictive formulae or additional specification.

9. Do mills provide combing results back to their suppliers?

59% of the mills using the TEAM formula provided processing results back to their suppliers. Not one of the mills which did not use predictive formulae provided information.

10. Do mills routinely receive staple measurement data from their suppliers?

54% of the mills using the TEAM formula receive staple measurements routinely. This suggests that despite their use of TEAM prediction, the remaining mills have to demand staple measurement data when they wish to predict performance using the TEAM formula.

11. Are mills and exporter/topmakers interested to have access to sale lot predictions?

50% of mills and 50% of the exporter/topmakers who responded to the survey were interested in sale lot prediction.

12. What other prediction formulae are being used?

One (1) mill and 3 exporter/topmakers indicated they used other prediction formulae, and not TEAM. Two (2) exporter/topmakers use the SIRO2 formula, the others have their own mill formula.

13. If appropriate to business interest, would the development of a formula for predicting carding wool performance assist the industry?

Only 68% of the mill respondents answered this question, and 53% of these indicated some interest. Similar figures were evident for exporter/topmakers. Here, 71% of the respondents answered the question and 60% of these indicated some interest.

Conclusions

Acknowledging the 39% response rate to the survey of 107 mills, exporters and topmakers, the survey has indicated that:

- there is general satisfaction with the TEAM General Formula;

- the TEAM Formulae are being used in many countries;

- not only the TEAM General Formula for Hauteur, but the ancillary formulae for CV Hauteur and Romaine are beginning to be used;

- there is awareness of differences in the performance of TEAM for different wool categories, and in the relationship between predicted and actual results; and

- most mills used their own mill adjustments with the formulae.

In addition, there is interest in sale lot prediction, but little interest was noted from respondents for specific sale lot formulae such as SIRO1/SIRO2.