INTERNATIONAL WOOL TEXTILE ORGANISATION

NICE Meeting
December 1997

Commercial Regulations Sub Committee

Chairman: G. Beier (South Africa)
Vice-Chairman: S. Brickle (USA)

ASSESSING THE VARIABILITY OF CLASSED FLEECE LINES USING A UNIFORMITY INDEX

by

P.R. Byrne[1] T.J Mahar[2] and R.W. Connors[1]

1 AWTA Ltd, 176 Marine Terrace, South Fremantle, Western Australia, Australia.
2 AWTA Ltd, Corner Byron & Military Roads, Guildford, New South Wales, Australia.

SUMMARY

AWTA Ltd has developed a measure of the uniformity of wool characteristics in a lot viz. the Uniformity Index (UI). The Index was obtained using Multiple Regression Analysis and is based on measures of Coefficient of Variation of Staple Length (CVL), Coefficient of Variation of Diameter (CVD), and variation in Position of Break (SD of POB). The Index has been shown to differentiate between the majority of Bulk Classed and Classed Grower Lots in validation trials over a six month period. After further refinement , it is anticipated that the UI could be more useful than the wool preparation category in the specification of wool aimed at reducing variation within lots.

INTRODUCTION

The International Wool Textile Organisation (IWTO) Core Test Regulations[1] define different classes of wool lots based on wool preparation category. These definitions appear in Section 1.3 of the Regulations. Test Houses are required to identify the category on IWTO Certificates, and AWTA Ltd achieves this by attaching a suffix to the Test Number and by printing the category name on the Certificate.

These wool preparation categories are currently used in many trading contracts to specify “Classed Grower Lots Only”, or exclude particular wool types such as Bulk Classed Lots. These exclusions are an attempt by processors to reduce the variation in parameters within lots of wool included in the delivery.

Difficulties can arise for the Test House in clearly identifying any category of wool preparation based on an external examination of the bales during the sampling and weighing process. Comments have previously been made to AWTA Ltd that bales purchased as Classed Grower Lots appeared to be wool blended from various sources (Bulk Classed Lot) when opened up for processing.

The price differentials that are evident between Bulk Classed Lots and Classed Grower Lots indicate the industry’s belief that Bulk Classed Lots are inferior due to their variability and are therefore not permitted in some consignments.

The definition of Bulk Classed lots i.e. “bales containing wool blended from various sources”[1] gives the impression of variability within the lot of wool. Conversely, Classed Grower Lots i.e. “wool from an individual grower comprising bales classed from one clip”[1] would suggest a high degree of uniformity. These assumptions are generally correct however there are exceptions to the rule. Those Bulk Class operations dealing with significant volumes of wool, such as the larger Australian Brokers, have numerous bin types which help improve the matching of wool types within Bulk Classed Lots. Equally, the degree of variability in Classed Grower Lots is influenced by the uniformity of the flock of sheep and the standard of classing.

A recent trend in wool specification is to provide measurements of variation in addition to the mean for various wool parameters. Coefficient of Variation in Diameter and Coefficient of Variation in Length are two

characteristics that provide useful information on the variability that is evident within wool lots. To assist the industry to evaluate the uniformity of a particular Lot, AWTA Ltd have endeavored to combine available test information into a Uniformity Index (UI)

This paper reports on the development of the Uniformity Index, and summarises the observations on the Index over the six month period from February to August, 1997.

DEVELOPMENT OF THE UNIFORMITY INDEX (UI)

The initial step in the development of the Uniformity Index was to determine the wool characteristics that were most significant in the differentiation between Bulk Classed Lots and Classed Grower Lots.

The assessment involved each of the three AWTA Ltd laboratories selecting 50 Bulk Classed Lots and 50 Classed Grower Lots that were similar in micron and were described as fleece types. Test data for Clean Colour, Laserscan MFD, Coefficient of Variation of MFD, ATLAS Staple Strength, Coefficient of Variation of Strength, Staple Length, Coefficient of Variation of Staple Length, variation in Position of Break, Wool Base, and Vegetable Matter Base were then assessed for each of these lots using Multiple Regression Analysis. This analysis identified variation in Position of Break (SD of POB), Coefficient of Variation of Length (CVL), and Coefficient of Variation of MFD (CVD) as the characteristics that had a significant influence on the differentiation between Bulk Classed Lots and Classed Grower Lots.

The equation developed from this initial analysis was then validated using a new set of data from the three AWTA Ltd laboratories. Again, data for 50 Classed Grower Lots and 50 Bulk Classed Lots was obtained from each laboratory. The validation confirmed the importance of SD of POB, CVL, and CVD in the Uniformity Index equation.

A final version of the Uniformity Index (UI) was developed by combining both the original and validation data sets and performing a Multiple Regression Analysis. The equation obtained from that analysis was as follows:

$$UI = 325.4 - (10.3 \times CVD) - (5.5 \times CVL) + (1.8 \times SD\ of\ POB)$$

The equation attempts to distinguish Bulk Classed Lots from Classed Grower Lots by calculating an estimate of the uniformity within the lot. Improved uniformity is indicated by a higher Uniformity Index value. It should be remembered that the ultimate purpose of the equation is not to predict Bulk Classed or Classed Grower Lots. The objective is to provide a system which can replace these categories as the method of specifying uniformity within lots of wool.

An additional investigation was initiated for non-fleece wools in which 50 Classed Grower Lots and 50 Bulk Classed Lots were analysed using Multiple Regression Analysis. This investigation indicated that a different equation was required. Based on the limited availability of Bulk Classed Lots with the necessary test information, the investigation into developing an equation for non-fleece wool was deferred.

VALIDATION OF THE MODEL

To confirm the stability of the Uniformity Index equation over a twelve month period, AWTA Ltd have commenced data collection from each of the three laboratories on a monthly basis. Each laboratory is collecting information for 50 Bulk Classed Lots and 50 Classed Grower Lots that are similar in MFD each month. All of the lots selected are fleece wools that have Staple Test data available. The CVD data is obtained by subsequent measurement of each of the selected lots on Laserscan.

The validation of the model for the past six months indicates a distinct separation of the Uniformity Index of Bulk Classed Lots and Classed Grower Lots. Appendix 1 presents a histogram of the Uniformity Index values that have been obtained for the six month period. Values range from -50 for Bulk Classed Lots to 150 for Classed Grower Lots. The distributions of the two preparation types are both normal. Bulk Classed Lots have a mean Uniformity Index value of 27, and Classed Grower Lots a mean of 72. Table 1 separates the UI distribution into four groups showing the proportion of preparation type in each group.

Table 1: UI Distributions for Bulk Classed and Grower Classed Lots

Uniformity Index	Proportion of Lots (%) Bulk Classed	Grower Classed
Group 1 (<0)	16.8	0.4
Group 2 (0-50)	62.5	20.7
Group 3 (51-100)	19.7	61.5
Group 4 (>100)	1.0	17.4

The data reveals there is a degree of overlap in Uniformity Index between the two categories. This supports the view that some Bulk Classed Lots are better classed than others, and conversely, some Classed Grower Lots exhibit more variation than others.

FUTURE DIRECTIONS

AWTA Ltd will continue developing the Uniformity Index model for another six months. At the completion of this period, a detailed analysis will be made in which both regional and seasonal factors will be investigated. A Multiple Regression Analysis will be conducted to see if the prediction of uniformity can be further improved.

The results of the final analysis will be included in a Technical Paper that will be presented at the IWTO Meeting in Dresden.

Thereafter, it may be possible for processors of Australian wool to include the Uniformity Index value as a means of specifying an acceptable level of variation within the lot, instead of using the wool preparation category.

REFERENCE

1. IWTO Core Test Regulations.

Uniformity Index for Australian Fleece Wools