INTERNATIONAL WOOL TEXTILE ORGANISATION

TECHNOLOGY & STANDARDS COMMITTEE **NICE MEETING**
Raw Wool Group **November 2002**
Chairman: A.C. BOTES (South Africa) **Report No: RWG 05**

Report of the IWTO Colour Working Group

IWTO Colour Working Group — Australia, New Zealand, South Africa, United Kingdom

SUMMARY

In Barcelona, the National Council of NZ Wool Interests raised concerns about the operation of IWTO-56-00 in New Zealand[1]. The sources of the 'lack of harmony' of measurements in D65/10 colour space between the NZ test laboratories have been identified and corrected. Instruments used by one laboratory, whilst producing satisfactory results with CERAM reference tiles, produced results on wool samples that were different from the majority of instruments used in the commercial core test laboratories. Actions have been taken to eliminate the instrumental differences between the laboratories; one laboratory is purchasing alternative instruments and using an alternative measurement cell design. Actions have also been agreed to reduce residual effects caused by differences in sample preparation between the laboratories.

It is anticipated that by the Nice meeting, the above actions will have removed the former impediments to reporting of D65/10 tristimulus values on the IWTO certificates for NZ wool as required by IWTO-56. The Working Group recommends that the laboratories begin reporting data in D65/10 colour space on the 3rd December 2002 in accordance with the resolution of the Commercial Regulations Committee in Barcelona.

The Working Group recommends that where wool users require data in C/2 space, this data only be obtained by calculation from D65/10 data using baremes contained in the proposed amendments to the test method.

The Working Group has proposed a number of additional changes to IWTO-56 to simplify its use in testing and to remove the confusing array of options. These proposed changes are contained in Raw Wool Working Group Submission RWG01. In particular, amendments are proposed for the test method to prevent the use of inappropriate instruments in future.

The Working Group proposes that work be continued to assess whether new appendices to IWTO-56 which give additional guidelines to new and existing laboratories to ensure the appropriateness of their scouring and drying techniques used in preparation of samples for testing are required.

It is finally recommended that industry should implement the use of D65/10 measurements fully as quickly as possible so that the reporting of C/2 values can be withdrawn. Subject to further discussion with commercial interests and within the RWG, T&S and Commercial Regulations Committees, it is recommended that the reporting of C/2 values be discontinued on 1st July 2004.

Preamble

The IWTO colour working group was formed in response to a letter from the National Council of NZ Wool Interests[1] and a motion put to the Commercial Regulations Committee (Appendix 1), which was subsequently ratified by the Assembly at the Barcelona meeting.

At its first meeting, the Working Group agreed that its aims would be:

- To examine data obtained in attempts to harmonise colour measurements in the NZ labs and make any appropriate recommendations to facilitate this harmonisation process.
- To edit IWTO-56 to ensure clarity and remove references to direct measurement in C/2 colour space.
- To agree a new bareme (or baremes) for the conversion of D65/10 data to C/2 for NZ wools
- To reach world-wide agreement within key (certifying) labs on the interpretation of IWTO-56.
- To determine whether it will be necessary to conduct an international round trial (to include RSA and UK) on the revised test method to confirm worldwide harmony. If conducted, this trial would be conducted after any deadlines set for reporting of D65/10 data in NZ.

To facilitate free flow of information within the group, it was agreed that all discussions within the Working Group would be confidential.

Instrument Round Trial

The Working Group examined the data obtained from an inter-laboratory trial in which 80 prepared wool samples (40 from each of the NZ labs) were measured by a number of instruments (listed in Table 1). The trial was subsequently expanded to include a third Hunterlab ColorQuest instrument, two BYK Gardiner TCV Instruments and a second Hunterlab XE. The trial identified and confirmed that the Hunterlab ColorQuest instruments gave results that were at variance with the rest of the instruments (Table 1).

After viewing of videos of the techniques used in the Australasian laboratories, no obvious anomalies in the calibration and use of the instruments were noted. It was concluded that the instrument differences observed in the 'instrument round trial' were a feature of the Hunterlab ColorQUEST and not specific to the two instruments in New Zealand or the procedures used to calibrate the ColorQUEST. CERAM tile validation data from the ColorQUEST were within the specifications obtained following the procedures outlined in IWTO-56.

There was a note in later versions of the manual of the ColorQUEST under "System Description and Installation Instructions", Page 1-9 under the section titled "Reduced Area View (LAV sensor only)" :

"*Note: The reduced area view port should be used ONLY for color difference measurements"*

This refers to the use of a 2-inch diameter step-down port insert, which is supplied and fits into the 3.75inch diameter sample port of the instrument. It was confirmed that this warning appears in the manual of the Hunterlab ColourQUEST and that a warning on reduced area viewing also appears in the manual of the Hunterlab D25 instruments. Information from Hunterlab indicated that the native optical configuration of the ColorQuest 45/0 LAV reads a 3.75-inch diameter field of sample view within a 4-inch diameter port. As an option, HunterLab offers a 2-inch diameter step-down ring that can be snapped into the regular port for customer situations where the available sample area is too small for the 4-inch port. In this configuration, the ColorQuest 45/0 LAV still reads a 3.75-inch diameter field of sample view with the black inside of the 2-inch diameter port masking about half of the viewed sample area. When the instrument is standardized on its black glass and white tile standards, most of the photometric effect of this 2-inch port is negated. The difference observed in the trials is what is left. Hunterlab suggest that the optimal situation would be to read pressed wool in a 100-mm constant density cell averaging several readings with sample replacement for a representative measurement. Trials indicated that results obtained using this recommendation still varied significantly from the mean of other instruments.

It was noted that the 'errors' in Y and Z tristimulus values were roughly equivalent so that the Yellowness (Y-Z) values obtained using the Hunterlab ColorQuest with the step-down port were similar to those obtained using the other instruments. However, using the 3.75 in (LAV) port and the 100 mm wool cell, the yellowness values were significantly different to the results from the other instruments. In the BYK instruments, a separate lens system is used to compensate for the different area of illumination when a

step-down port is inserted. The instrument effect has been addressed by the purchase of new instrumentation by one of the NZ laboratories.

It was resolved that an Appendix would be written for IWTO-56 to ensure that any new instruments met agreed criteria and gave the same values as existing instruments to avoid any future problems.
Separate studies also showed that there could be a potential difference of 0.5 in Y and 0.1 in Y-Z depending on the cell type and construction.

Table 1 Effect of Instrument Type on Colour Measurement

	Tristimulus data					Differences from Grand Mean[#]			
Instrument	X	Y	Z	Y-Z		X	Y	Z	Y-Z
TCM	63.6	67.1	55.3	11.9		0.2	0.2	0.5	-0.3
TCM	63.5	67.1	55.4	11.7		0.2	0.3	0.3	-0.1
TCM	63.7	67.2	55.7	11.5		0.1	0.1	0.0	0.1
TCM	63.6	67.2	55.7	11.5		0.1	0.1	0.0	0.1
TCM	63.6	67.1	55.3	11.7		0.2	0.3	0.4	-0.1
TCM	63.4	66.9	55.2	11.7		0.3	0.4	0.5	-0.1
TCV	64.0	67.5	56.1	11.4		-0.3	-0.1	-0.3	0.2
TCV	64.2	67.6	56.2	11.4		-0.4	-0.3	-0.4	0.2
HXE	64.1	67.6	56.1	11.5		-0.4	-0.3	-0.3	0.1
HXE		68.1	56.5	11.6			-0.7	-0.7	0.0
HCQ	62.5	65.9	54.2	11.7		**1.3**	**1.5**	**1.6**	**-0.1**
HCQ	62.3	65.8	53.6	12.2		**1.4**	**1.5**	**2.1**	**-0.6**
HCQ		66.1	54.5	11.6			**1.2**	**1.2**	**0.0**

Grand Mean[#] –average readings across all instruments but excluding the HCQs
TCM BYK Gardiner TCM
TCV BYK Gardiner TCV
HXE Hunterlab Miniscan XE
HCQ Hunterlab ColorQuest LAV

Preparation Round Trial

The Working Group also evaluated the results of a trial conducted between the NZ laboratories to compare sample preparation.

- Prepared by scour and Shirley analyser at LAB1 and measured in D65/10 at both labs
- Prepared by scour and Shirley analyser at LAB2 and measured in D65/10 at both labs
- Prepared using the Waring Blendor at LAB1 and measured in C/2 (rather than calculated using a bareme) at both labs
- Prepared using the Waring Blendor at LAB2 and measured in C/2 (rather than calculated using a bareme) at both labs

The results of the differences between the New Zealand laboratories are summarised in Table 2. The conclusions from this trial were

- The differences between the laboratories for the D65/10 measurements with a Shirley Analyser preparation were 0.5 for Y and 0.2 for Y-Z. There was a difference in the preparation techniques (preparation only) between the two labs that created a difference in Y(0.8) and Y-Z(0.4) in D65/10. In this colour space, the differences in preparation were partially offset by the differences in instruments.
- The instrumental differences between measurements in D65/10 confirmed those found in the earlier trial.
- The differences between the laboratories for the C/2 measurements with a Waring Blendor preparation were 1.4 for Y and 0.3 for Y-Z. The difference in the Waring Blendor preparation techniques (preparation only - Y(0.9), Y-Z(0.2) measured in C/2, rather than calculated using a bareme) was similar to that found using a 'Shirley Analyser' preparation. However, the differences in measurement and preparation compounded in the Waring Blendor – C/2 measurements so that the final differences were worse than those using the Shirley analyser - D65/10

It was agreed that, although differences caused by instrumental effects between the NZ laboratories (in D65/10) were partially offset by the differences in preparation, both the instrumental and preparation differences would be addressed to harmonise the results obtained by the two laboratories. The preparation differences have been addressed in further trials conducted between the NZ laboratories and overseen by the Working Group. The results were consistent with those from the round trial conducted in 1999.

TABLE 2 Differences between Laboratories caused by Preparation and Instrumentation.

		X	Y	Z	Y-Z
C/2 Waring Blendor Preparation (Includes Differences Between TCM and HCQ)	Preparation	0.9	0.9	0.8	0.1
	Measurement	0.7	0.4	0.3	0.2
	Total	1.6	1.4	1.1	0.3
D65/10 Shirley Analyser Preparation (Includes Differences Between TCM and HCQ)	Preparation	-0.7	-0.8	-1.2	-0.4
	Measurement	1.2	1.3	1.5	0.1
	Total	0.5	0.5	0.3	0.2
D65/10 Shirley Analyser Preparation (Corrected for the Differences Between TCM and HCQ)	Correction from Table 1	1.4	1.4	1.6	-0.2
	Theoretical Total* With Similar Instruments	0.8	0.9	0.7	0.4

Proposed Changes to IWTO-56-02

Proposed changes to the text of IWTO-56 have been developed to address:

- Additional wording to verify data obtained with new instruments
- Removal of the option to make direct measurements in C/2 colour space
- Removal of the option to calibrate with Reference Wool
- Removal of the option to prepare samples using the Waring Blendor
- An appendix to specify baremes to be used for conversion of D65/10 data to C/2

The current wording of IWTO-56 for the preparation of samples for testing is being reviewed to determine if any improvements can be proposed and to give new and existing laboratories more guidelines with which to ensure the appropriateness of their scouring and drying techniques used in preparation of samples for testing. These could take the form of two new Appendices:

- Confirmation of suitability of the water supply and drying procedures
- Confirmation of scouring procedure

Baremes

The bareme currently published in IWTO-56 was verified in the 'preparation' trial and, it is proposed that this bareme will be retained for conversion of D65/10 data to C/2 colour space when there is no change in the preparation technique. Where conversion to measurements in D65/10 colour space also involves a change in the preparation procedures, the different base points will not be resolved by a single international bareme. New Zealand will use a single bareme to enable trace back to Waring Blendor C/2 Base results.

These baremes will be listed in a proposed Appendix to IWTO-56. Furthermore it is proposed that laboratories will be required to identify the bareme used to calculate the C/2 value on the certified value.

A sunset clause for the reporting of data in C/2 colour space is proposed.

Other issues

The NZ delegates gave verbal reports of progress of the work of the Group to the NZ National Committee (16th August 2002). Laboratories planning to purchase instruments for colour measurement were advised of the measurement differences.

References

1. C.L. MacGillivray Letter to all IWTO National Committees from National Council of NZ Wool Interests, 13th May 2002

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Appendix 1 Extract From Minutes of the Commercial Regulations Committee (Barcelona 2002)

9.2 As foreshadowed earlier in the Meeting, Mr John Ward proposed the following Resolution from his Crossbred Users Committee:

"That the Commercial Regulations & Contracts Committee recommends to the Assembly that the previously agreed date for the full implementation of the changes to TM 56 (Colour of Raw Wool) and TM 31 (Calculation of Combination Formulas) be changed for wools tested in New Zealand.

"The implementation date will be 1 week after the announcement of the resolution of perceived technical difficulties in the use of TM 56, by the Working Group or not later than the date of the Assembly in Nice 2002 (i.e. December 3).