



YIELD MEASUREMENT

Background

NZWTA Ltd has a wool testing laboratory with equipment to carry out tests to accurately and reliably describe the characteristics of wool, and predict its processing performance. The tests are performed using the procedures specified by the International Wool Textile Organization (IWTO). These test methods are constantly being reviewed and refined by IWTO in order to achieve the greatest accuracy and precision in determining objectively measured results

The Yield Test

Yield is the weight of clean wool, after the removal of impurities, expressed as a percentage of the greasy wool weight. These impurities may be natural, such as grease and suint, or acquired, such as seeds and burrs along with sand, soil or other mineral matter. In addition, wool naturally absorbs moisture and this can vary from day to day depending on climatic conditions. Because it is used to estimate the quantity of usable wool fibre in a lot it is a significant factor in wool trading, although it does not, as such, affect the processing efficiency of the wool.

The skilled wool buyer can attempt to appraise these impurities and arrive at a yield which is used as the basis of establishing a price for the material. However, with the need for independence, and consistency, nearly all wool is traded on a tested basis.

Yield Measurement

Sampling

Samples for testing are drawn by core sampling. Core sampling produces a statistically precise sample of sufficient size for the test house to perform the required tests in a laboratory. The samples are representative of the lot irrespective of the number of bales.

The yield test, IWTO-19, involves the removal of natural and acquired impurities, including the moisture, to arrive at a percentage termed WOOL BASE. This Wool Base is used as the basis of all the mathematical calculations later applied to establish a variety of yields demanded by the various sections of the industry.

Blending

The first stage in testing is to ensure that the core samples drawn from all bales in the lot are thoroughly blended. This ensures that sub-samples drawn later for testing are as representative of the bulk as possible. This blending is carried out in a sealed drum where the wool is agitated by compressed air until it is thoroughly mixed. After blending, test sub-samples are accurately weighed out and then used as the basis of all calculations. It is essential that no fibre or vegetable matter impurities are lost during this process.



NZWTA WOOL TESTING

Testing

The testing process involves a washing and drying process to remove most impurities and moisture. After the test sub-samples have been weighed they are scoured in hot water and detergent where wool grease, Suint (dried sweat), dust and dirt are removed. The wool is rinsed to remove detergent and the minimize fibre loss. The sub-sample is then dried at 105°C until the sample is dry. This constant dry weight is recorded for use in later calculations. After scouring there will still be residual impurities remaining in the wool and these must be measured by more sophisticated methods.

Residual impurities – Vegetable Matter (VM)

The most important impurity is vegetable matter. The percentage of the vegetable matter present will have an effect on the commercial processing of the consignment. The amount of vegetable matter is determined by weighing a 40g test specimen of the dried scoured sub-sample and dissolving this in hot 10% caustic soda solution. Once the wool is dissolved, only the alkali insoluble impurities, including all vegetable matter, remain. These insoluble's are then rinsed, dried and weighed. This total weight of alkali insoluble is then expressed as a percentage of the 40g test specimen and forms an important part in the calculation of Wool Base.

Residual impurities – Ash Content

Other impurities remaining in the scoured sub-sample will be small amounts of mineral matter (referred to as 'ash') and residual grease which can either be natural fats or detergent which has not been completely removed by rinsing.

The percentage of ash is determined from a 10g test specimen of the dried scoured sub sample which is incinerated at a temperature of 750°C for two hours. Residues representing mineral matter not removed during scouring along with metallic elements naturally occurring in the wool structure remain, and after weighing can be expressed as a percentage.

Residual impurities – Fatty matter Content

The percentage of Residual Grease is determined on a Soxhlet apparatus which uses Ethyl Alcohol as the extraction solvent. Hence this test is commonly referred to as the Alcohol Extractable Matter test, to reduce the confusion with Residual Grease test conducted on scoured wool which uses Dichloromethane as the extraction solvent.

In this test, a 10g test specimen of the scoured, oven-dry sub-sample is subjected to a washing cycle in ethyl alcohol which dissolves the fatty residues and transfers them in solution to the Soxhlet flask. After 20-22 cycles the ethyl alcohol can be evaporated off leaving only the fatty residues which can then be weighed and expressed as a percentage.

Both the Ash Content and the Alcohol Extractable Matter can also be measured using Near Infra (NIR) Analysis. Where these are used, NIR instruments are calibrated to the respective tests by testing thousands of samples on the reference method and also collecting spectra over the NIR range from these samples. A series of mathematical transformations and equations are then calculated to allow say NIR Spectra to 'predict' the equivalent reference results. These



NZWTA WOOL TESTING

instruments are very accurate, and are constantly monitored to ensure this accuracy is maintained.

In basic terms the Total Residual Impurities can be expressed as the following:

$\text{Alkali Insoluble\%} + \text{Ash Residue\%} + \text{Fatty Residue\%}$

At each stage of the testing process these values are transferred electronically to the computer system from the testing apparatus. The computer examines whether or not the differences between test results on the same lot are statistically acceptable. If not, it indicates the need for additional tests to be done before a certificate can be issued.

When a test meets the range checking criteria the computer will issue a certificate showing a variety of yields which the buyer can then use to determine the price he is willing to pay for the specific lot. Where all sampling and testing has been conducted in accordance with the appropriate IWTO Regulations and Test Methods, this Certificate is referred to as an IWTO Test Certificate.

Certificates and Calculations are discussed in the Yield Calculations fact sheet.

For further information, contact **NZWTA** on **+64 6 835 1086** or email: testing@nzwta.co.nz