USING FLEECE MEASUREMENT TO IMPROVE FARM INCOMES
Part 1: Key Technical Factors

There are many factors that will impact on the economic return from the investment in fleece testing. Examples include:

- **the price-premium relationship with mean fibre diameter;**
- **the position of the average diameter of the flock relative to the price-premuim relationship;** and
- **the cost of the testing method, including labour and time.**

Wool producers are encouraged to carefully consider their objectives and do their sums prior to committing to fleece testing.

These fact sheets are supplied to assist in this process by describing some of the key technical factors that should be considered in applying the different measurement systems available. However, selecting a **measurement system** that is appropriate for the required outcome(s) requires an understanding of the influence of some key technical factors on the results obtained.

ELEMENTS OF MEASUREMENT SYSTEMS

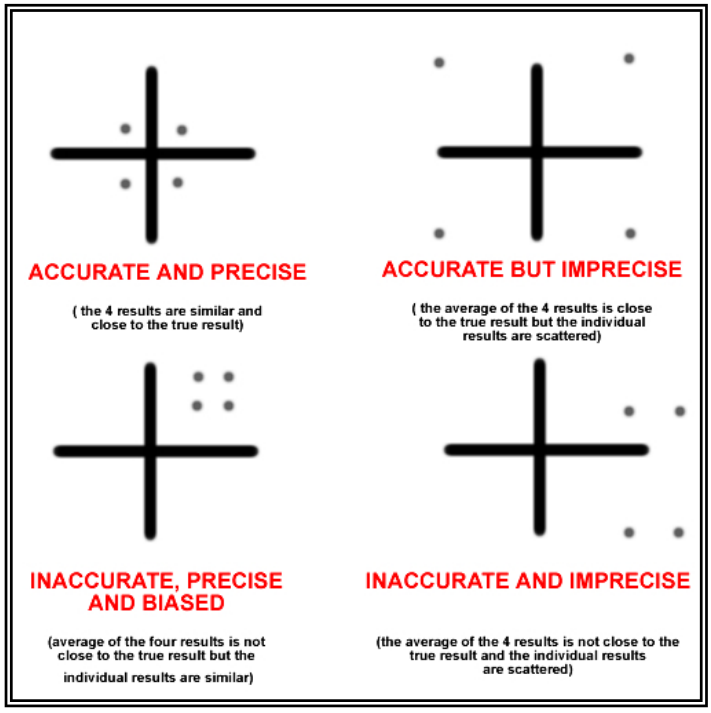
Most measurement systems consist of four elements:

- **sampling;**
- **sample preparation;**
- **measurement;** and
- **documentation** (including sample identification and reporting).

All these elements should be considered in conjunction with the desired outcomes when selecting a fleece measurement system.

KEY TECHNICAL FACTORS

Accuracy (closeness to the "true" result), **Precision** (repeatability) and **Bias** are the key technical factors that impact on economic returns from investment in fleece testing, whether samples are submitted to a laboratory or tested on-farm.



UNDERSTANDING ACCURACY

Accuracy simply describes the correctness of a test result. In practice the "true" result can never be known as all measurements contain errors and are really only approximations or estimates.

For example, in order to determine the "true" Mean Fibre Diameter of a fleece, one would have to measure the diameter along the full length of every fibre in the fleece, without error. Clearly this is totally impractical.

Accuracy is often used in a broader context to express the closeness of a measurement to that provided by a recognised Standardised Test Method. For example the accuracy of instruments measuring fibre fineness characteristics is usually assessed by reference to direct manual measurements of magnified fibre snippets.

UNDERSTANDING PRECISION

The precision (repeatability) of a test result simply relates to the variation that can be observed if the same sampling and measurement procedures are repeated over and over again. Ideally one would like the repeat measurements all to be exactly the same but the reality is there is always some variation.

This variation is caused by variation in the ***material*** being sampled, variation within the ***sample*** itself, variation introduced by *sample preparation* and variation inherent in the *measurement* and ***documentation*** processes. A **measurement system** can often be designed to achieve a required precision.

Precision is quantified using a statistic such as Standard Deviation, from which the confidence level of a measurement can be derived. Precision (or confidence level) is normally expressed as a range within which 95% of repeated measurements can be expected to lie.

UNDERSTANDING BIAS

Bias is a result of systematic errors. Systematic errors always act in one direction, resulting in a consistently larger or a consistently smaller result than the "true" result. Bias can result from several causes, and generally, these can be classified into one of six groups.

- **Sampling**:
  Inadequate design of sampling systems can result in a sample that is biased.
- **Differences in fundamental assumptions**:
  In the case of wool fibre fineness, different assumptions about the geometry of the fibre by different instrumental methods, may lead to bias.
- **Personal Errors:**
  Bias can also be the result of blind prejudice. Most of us, however honest, have a natural tendency to estimate scale readings in a direction that improves the precision of a set of results, or causes the results to fall closer to a preconceived notion of the true value.
- **Instrumental Errors:**
  Bias can be caused by instrument drift, or by assumptions made by the technology used in the instrument.
- **Method Errors:**
  An example of this type of bias is the failure to maintain rigid control over the environmental conditions that impact upon the measurement.
- **Interferences**:
  Bias can also be caused by interferences that arise from other constituents of the sample.

Bias may be constant over the range of variation of the characteristic being measured, or it may vary over this range. One of the objectives of standardising wool testing systems is the elimination or at least the minimisation of bias. Where bias cannot be eliminated, provided it is not level dependent, the measurement technology may still be useful, provided the bias is known and can be taken into account before making any decisions.

USING FLEECE MEASUREMENTS TO IMPROVE FARM INCOMES

In order to maximise their economic return from Fleece Measurement, Wool Producers need to be aware of the key technical factors that impact upon the value that can be added by appropriate use of this information. **However, the importance of Accuracy, Precision and/or Bias depends upon the intended use of the information**. Measurement systems can be developed for different uses that deliver different degrees of Accuracy, Precision and/or Bias.

Part 2 of this series of fact sheets provides some guidelines as to how Wool Producers can assess the relative importance of each of these factors and therefore select a measurement system appropriate for their intended application.

Part 3 provides some quantitative information for assessing the services and technologies currently available, while Part 4 discusses the practical implications of the differing precisions provided by the various measurement systems.

FURTHER INFORMATION

Peter Sommerville
Corporate Development Manager
AWTA Ltd
Ph: 03 9371 4105
Fax: 03 9371 4191
Email: peter.sommerville@awta.com.au