



Wheat Quality Analysis

An introductory guide



Protein

The protein fraction in wheat is crucial to the development of the gluten structure of dough and how well flour performs in processing. The interaction between high, intermediate and low molecular weight gluten proteins ensure strong, cohesive dough with excellent rising properties and texture.

Various wheat varieties have different protein content and therefore different baking qualities. Regional conditions relating to climate, weather and soil type as well as fertilizer usage are also factors relevant to protein development in the grain.

How is protein content determined?

Protein content in grain can be determined by various methods. The primary, or reference methods commonly used are the Dumas (or Combustion) method and the Kjeldahl method. The latter has diminished in usage in recent years as it is slow by comparison with the alternatives and it entails the use of corrosive and toxic chemicals which require careful handling and disposal. The other widely used technique is Near Infra Red Spectroscopy (NIR). This is known as a secondary method and must be calibrated against one of the approved reference methods. The Dumas principle determines nitrogen content by combustion. In the presence of oxygen, a sample is combusted to produce nitrogen oxides and other gases. The use of a catalyst allows the nitrogen oxides to be reduced to elemental nitrogen. The amount of nitrogen present in the sample is measured using a thermal conductivity cell and will be displayed as a percentage of nitrogen and/or protein. Side products produced from combustion are removed through absorption.

In Australia wheat protein results are generally reported on an 11% moisture basis unless otherwise specified.

Why is protein content determined?

Due to the many end uses for wheat, several different varieties are grown to cater for various markets. The classification or grading system that exists is therefore necessary with protein content being the primary specification for classification.

The determination of the protein content in wheat is important as it is a key factor in determining grade, storage and blending during loading.

Millers producing flour for baking will look at protein as a one of the indicators of how well the flour will perform for its intended use.



Moisture

Moisture is a term used to describe the water content within the grain.

During the plant growth stage moisture is important for starch development as well as ensuring the filling out of the endosperm resulting in optimum milling yield. Post harvest low moisture content is expected, which is necessary for the storage life of the grain prior to being milled for its intended use. Excess moisture is detrimental as it can lead to mould growth, toxin formation, insect infestation and sprouting in storage.

How is Moisture Determined?

Moisture is determined by measuring the loss of weight upon heating the sample at 140°C. Moisture is expressed as a percentage.

Calculation:

$$\% \text{ Moisture} = \frac{\text{loss in weight}}{\text{Wt. sample}} \times 100$$

Why do we determine moisture content?

The assessment of moisture content in seeds is an important parameter as it influences the seed quality and storage life of the seed.

Excessive rain during the final plant growth phase can result in high moisture content which will have the effect of reducing the protein content as a percentage of total weight.

High moisture content above 12% may cause rejection at receival point to prevent the risk of mould and insect growth during storage.

Grain with excessively low moisture will result in a hard grain with low flour yield.



Test Weight

Test weight is a measure of the density of a grain and is calculated as kg/hL. It is a good way to measure how well the endosperm has filled out and is referred to as a general indicator of the final development of the grain.

How do we determine test weight?

Test weight is obtained by pouring (until it just overflows) a well-mixed sample into a Schopper Chondrometer which consists of a half litre aluminium measuring cylinder equipped with a cup and a striking blade. The Chondrometer is weighed empty prior to use and in testing a grain sample with the use of the striking blade the grain is allowed to flow through into the cup and the excess grain is leveled off. The grain in the cup is weighed and divided by five to obtain the test weight.

Why do we determine test weight?

Milling companies refer to test weight as a guide to flour yield as well as the overall soundness of the grain of end use. Density is also used in determining the storage and transport requirements as well as the stowage factor in shipping.



Falling Number

Falling number is a measure of the degree of weather damage that results in sprouting. A result of sprouting from weather damage is the development of alpha-amylase activity which is detrimental to wheat quality.

The falling number test does not directly measure the amylase enzyme activity; it measures the change in physical properties of the starch portion of the wheat kernel caused by the enzyme during the test. The viscosity of the starch gel is directly proportional to the level of enzyme damage.

The falling number is reported in seconds, falling number values of 350 seconds or longer indicate low change in physical properties and very sound wheat while low falling numbers indicate weather damaged wheat.

How do we determine the falling number?

This method is performed using a Falling Number instrument which has been designed to perform the physical operation in a repeatable manner. The sample is prepared by firstly milling the wheat in a seed mill. The resulting milled sample is weighed into a viscometer tube in duplicate. Next, 25mL of distilled water is added to each sample and the tubes are shaken to obtain a homogeneous suspension.

The viscometer tubes are then equipped with a stirrer and inserted into a boiling water bath and the instrument started. The total time in seconds it takes for the stirrer to fall a measured distance is recorded by the instrument. This number in seconds is the resulting falling number.

Why do we determine the falling number?

The degree of weather damage can affect the usability for bread production. Alpha-amylase activity resulting from sprouting can reduce extensibility, strength and performance of the dough, affecting loaf volume and shelf life.

The importance of selling milling wheat that is not weather damaged can't be overstated. A quick and effective test such as falling number is a good way to confirm that weather damage hasn't occurred.



Screening

Screening is an important parameter in testing grain to determine the percentage of split, small, shriveled grain as well as chaff and foreign material.

The Grain Trade Australia standards require screenings to be expressed as a percentage of the total hectolitre weight.

Screenings standards are published to allow for a small amount of screenings relative to the grade being delivered.

How do we screen?

Screenings are determined by weighing the particles falling through a 2.0mm sieve after 40 shakes. Many laboratories and receival sites in the industry use the Agtator sieve shaker to ensure repeatability in shaking the grain over the sieve.

A representative sample of wheat is taken and passed through a nominated sieve (normally 2.00mm). The screens are then collected and weighed. The results are calculated and expressed as percentage.

Why is the screenings test required?

It is important for the buyer to know that the grain is full in volume and that chaff and foreign material are not excessive.

Screenings, being any particles that fall through a slotted 2.0 mm size screen, are not considered useful in the production of milling wheat and as such are considered a direct loss as a percentage of the overall shipment tonnage.