

Assessing Wheat Quality Using Protein and Wet Gluten Contents

Protein is the most important component of wheat, dictating its processing and end-product quality.

Hard wheat with higher protein content typically leads to increased water absorption, stronger mixing properties, and more elastic doughs. This results in increased loaf volume, improved crumb structure and texture. Durum wheat with higher protein content results in improved pasta cooking quality and texture. Soft wheat with lower protein is preferred for most pastry products with a delicate texture.

Tests such as Kjeldahl, Dumas or Combustion Nitrogen Analysis (CNA) and Near Infrared Spectroscopy (NIRS) are accurate and consistent methods for assessing protein content in wheat, flour and semolina. Both the functional (gluten) and nonfunctional proteins are measured providing a more complete understanding of the functional and nutritional properties of a wheat sample. Since more than 80% of the total protein in wheat is functional protein, wet gluten content can also be used to indirectly assess the amount of protein present in a sample.

Assessment of wet gluten content of wheat and or flour has been used for many years to indirectly measure the protein content and provide an indication of wheat quality. This started at a time when it was difficult to quickly assess wheat protein content as the primary method for determination of protein content, Kjeldahl, generally took several hours. Hand-washing a ground wheat sample, by comparison, to determine the wet gluten content was considerably quicker and cost effective.

As technological developments followed, the Glutomatic was developed. It consisted of an automated washing chamber, centrifuge and optional dryer that standardized the assessment of wet and dried gluten contents thereby improving the accuracy over the traditional hand-washing method. At the same time, further developments in the assessment of protein content happened with improvements to:

- Kjeldahl methods that allowed for faster analysis, however they still require approximately 1 hour of analysis time. Kjeldahl methods are highly reproducible with reproducibility (R) results less than 1.0% for wheat¹.
- Dumas, or CNA methods which take less than 3 minutes and also have reproducibility (R) results less than 1.0% for wheat².
- NIRS equipment, which allows for rapid (< 1 minute) prediction of protein content with a high degree of accuracy.

Despite these improvements to methods that assess protein content, wet gluten content has remained a popular quality parameter for indirectly assessing wheat protein content and functionality.

For those relying on wet gluten content to assess wheat quality, there are several important considerations to keep in mind when using these results which are addressed below.

- While wet gluten content is strongly and positively related to wheat protein content, the ratio between wet gluten content and protein content will vary depending on wheat class and environmental conditions during the growing season.
- Occasionally the agglomeration of gluten can be delayed during testing, especially for samples with very strong gluten. This can potentially result in lower wet gluten content.
- The amount of water absorbed by functional proteins during the test can vary and impact the final wet gluten weight, potentially affecting results. Generally, very tight and strong gluten absorbs less water.
- Determination of wet gluten content only measures gluten forming proteins and does not account for other proteins present in wheat, such as non-gluten (non-functional) forming proteins which are washed away by saline solution.
- The reproducibility of wet gluten content for flour and wholemeal using the Glutomatic is 2.1 and 10.1% (respectively) among laboratories³.
- Other components in the wheat can influence the wet gluten results such as amount of pentosans and hemicelluloses which can co-agglomerate with functional proteins during the formation of wet gluten. These components have very high-water holding capacity.

The Glutomatic is a standardized method for a quick measurement for gluten content and quality. Best practices would recommend other tests such as protein content or rheological tests, are also conducted to help provide a more comprehensive assessment of wheat quality. Using standardized methods and minimizing variability are also important considerations.

For additional information please contact:

Kristina Pizzi, Manager Analytical Services

kpizzi@cerealscanada.ca

References

¹ISO. (2013). ISO 20483:2013 - Cereals and pulses — Determination of the nitrogen content and calculation of the crude protein content — Kjeldahl method. International Organization for Standardization.

²ISO. (2016). ISO 16634-2:2016 - Food products — Determination of the total nitrogen content by combustion according to the Dumas principle and calculation of the crude protein content — Part 2: Cereals, pulses, and milled cereal products. International Organization for Standardization.

³ISO. (2015). ISO 21415-2:2015 - Wheat and wheat flour — Gluten content — Part 2: Determination of wet gluten by mechanical means. International Organization for Standardization.

