

Use of Biochemical and Molecular Techniques (BMTs) in the Canadian Grain Quality Assurance System

The Canadian Grain Quality Assurance System (GQAS) provides end users of grain with assurances that the Canadian grain they buy is of the quality they need to consistently meet their processing specifications. The Canadian Grain Commission (CGC) is mandated under the *Canada Grain Act* to maintain and deliver the GQAS for 20 crop types.¹ It does this by:

- Defining and establishing grain standards and grades
- Establishing protocols for the inspection and testing of grain
- Conducting research on quality attributes of grains and impact of variety, environment, and grading factors on quality and end product performance
- Inspecting export shipments and certifying quality based on either grain grades or customer specifications of quality

Grain grades are a tool used to define the quality of grain. Grades relate to a grain's end-use quality, meaning grades relate to how grain characteristics affect performance during processing (e.g. how much flour is produced during milling) or the quality of the end product (e.g. texture of cooked pasta). Grades are

also a part of transactions in the Canadian grain industry. For example, producers receive payments based on the grade of grain delivered to a country elevator and grain dealers receive payments from a domestic or export customer based on the grade of grain being sold.

Grain grades are made up of grading factors, tolerances for factors that influence quality, and in some cases variety composition. A grading factor is a physical condition of grain, the result of growing conditions, handling procedures or storage practices. It is a visual characteristic that indicates a reduction in quality, for example, frost damage, sprouted kernels, or heated kernels. Non-visual factors that influence quality, such as test weight and protein content for wheat, and tolerances for unregistered varieties or other classes for each class of wheat and barley are measured using biochemical and molecular techniques (BMTs). BMTs are methods that examine or detect chemicals such as proteins (which include enzymes), carbohydrates, lipids and nucleic acids (which include DNA) as indicators of specific traits or for identification of plants or seeds. In general, BMTs are used when morphological differences related to the trait do not exist or are difficult to discern.

¹ Barley, oats, rye, triticale, wheat, canola, flaxseed, mustard, rapeseed, safflower seed, soybeans, sunflower seed, beans, chick peas, fababeans, lentils, peas, mixed grains (mixture of wheat, rye, barley, oats, triticale, wild oats and domestic or wild oat groats), buckwheat and corn.

How are BMTs used by the CGC to verify the efficacy of the GQAS?

The grain grading system is largely a visual system, with some non-visual quality factors measured by tests that can be conducted quickly and easily outside of a laboratory environment. There are, however, two areas where the CGC's Grain Research Laboratory regularly uses BMTs to ensure that the GQAS is working:

1. Wheat – samples from all export cargos of wheat are tested using BMTs to ensure that the grade tolerance for wheats of other classes is met for each wheat class. Since the elimination of (kernel visual distinguishability) KVD in 2008, classes have been segregated on the basis of the class declaration made by farmers when delivering grain to a country elevator. This monitoring ensures that each wheat class shipment contains those varieties that have been designated for delivery into that class. In other

words, it verifies that farmers are declaring class correctly, and the subsequent segregation and blending by grain handlers is successful in maintaining the intrinsic end use quality of the class.

2. Canola – samples from all export cargos of canola are monitored by ISO 5508:1990 (E) for erucic acid to ensure that the cargos are within the maximum erucic acid standards to meet the definition of canola. They are also tested for total glucosinolate content with ISO 9167-3: 2007 (E) method, to monitor the low glucosinolates content of the meal, which is also part of the canola definition. This monitoring ensures that shipments have not been comingled with rapeseed, which is not visually distinguishable, so the term canola may be used in the grading of the seeds (e.g. Canola No 1, Canada).

Other areas that BMTs are used by the CGC

There are three other areas where BMTs are used by the CGC:

- 1.** The Grain Research Laboratory (GRL) may use BMTs to test grain shipments for specific genetically modified (GM) events to help address international grain trade issues.
- 2.** The GRL uses BMTs to provide varietal purity testing of malting barley samples under contract with grain handling

companies when foreign buyers require CGC certification.

- 3.** The GRL uses BMTs to monitor the geographic distribution and frequency of fungal pests such as *Fusarium* and storage molds and provides the data to stakeholders including producers, grower associations and provincial governments for risk management purposes.