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QUALITY AND SAFETY IN CANADA'S GRAINS AND OILSEEDS SECTOR

Concerns related to the quality and safety of commodities for human consumption have risen dramatically in recent years. Food safety incidents in other countries have increased consumer awareness about how food is produced, how it is stored, and how it is processed. The grains and oilseeds sector of Canada has been producing high-quality commodities for decades, and during this time, the monitoring of quality and safety has increased in importance. This issue of the *Bi-weekly Bulletin* examines the measures in place that the grains and oilseeds sector utilizes to maintain the quality and safety of the commodities that Canada markets.

Introduction
Canada has maintained an enviable reputation for supplying domestic and world markets with safe, high-quality grain. Underlying this reputation is Canada's use of grain varieties that produce superior food products and a regulatory system by which quality and safety are assured on a consistent basis. Since passing the *Canada Grain Act* in 1912, Canada has had a quality assurance system administered by a regulatory agency, originally the Board of Grain Commissioners, now known as the Canadian Grain Commission (CGC). Through quality and safety testing procedures, the CGC assures the quality of grains while at the same time 'branding' Canada with a globally recognized certificate of assurance. In a time of increased global concerns about the quality and safety of consumer goods, the Canadian grains and oilseeds sector has managed to preserve its reputation by this close monitoring of the commodities and products it markets.

Agriculture and Agri-food Canada (AAFC) has also made quality and safety of agricultural products a top priority. In its new **Agricultural Policy Framework** (APF), in partnership with the provinces, territories and industry, the Government of Canada has identified food quality and safety assurance as one of the APF's five priority pillars. Through an open dialogue with its partners, the federal government's goal under the APF food safety pillar is to maintain, enhance and, where necessary, facilitate the development of systems that will ensure Canada remains the supplier of choice for safe, high-quality agricultural products.

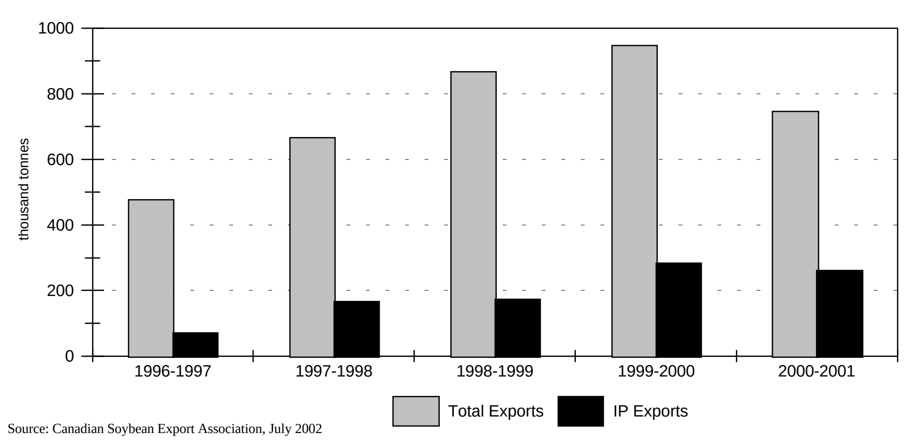
Awareness of food safety issues has been raised by incidents encountered in other countries. Such incidents have made consumers more cautious about what they eat and how their food is produced. While quality assurance in the Canadian grains and oilseeds sector has always included a safety aspect, testing by the CGC has evolved and now includes monitoring for many substances or contaminants that may be unhealthy for human consumption or animal feed. In this respect, the CGC responds to global market signals that have become more significant in light of food safety concerns and consumer awareness.

This article examines the Canadian system for quality and safety assurance of grains and oilseeds. Mechanisms such as Identity Preservation (IP) and closed-loop systems are also analyzed in the context of Canada's grain handling and transportation system.

DEFINING THE MECHANISMS

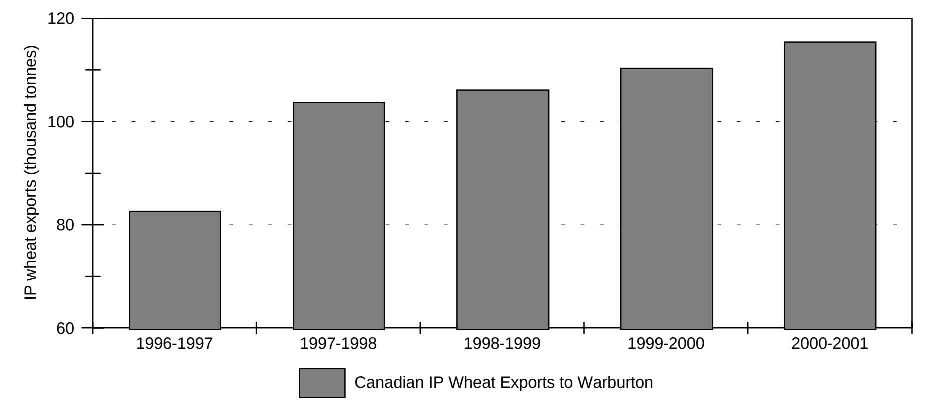
Kernel Visual Distinguishability
Most grains with different end-use characteristics are currently classified based on visual inspection. In wheat this is done using Kernel Visual Distinguishability (KVD). Through the application of KVD at the

CANADA: SOYBEAN IDENTITY PRESERVATION GROWTH



Source: Canadian Soybean Export Association, July 2002

WARBURTONS: CANADIAN IDENTITY PRESERVATION WHEAT GROWTH



Source: Canadian Grain Commission, Canadian Wheat Board, July 2002

breeding stage, each of the seven main wheat classes in Canada has a combination of seed-coat colour and physical kernel shapes and sizes that are distinctive. This allows elevator managers and CGC inspectors to distinguish the class, and consequently, based on a set of grade standards, establish a grade for the grain shipment. Furthermore, each class of wheat has specific end-use quality characteristics. For example, Canadian Western Red Spring (CWRS) is a high-protein, strong gluten, high-quality milling wheat ideal for bread-making. Canada Prairie Spring White Wheat (CPSW), which has lower protein and gluten levels than CWRS, is more suited for the production of Asian noodles, while Canada Western Amber Durum Wheat (CWAD) has characteristics suited for high-quality pasta [/1].

Increasingly there are grains that are not visually distinguishable, with different end-use characteristics. Because the Canadian grain handling and transportation system (GHTS) is a bulk system, in which commodities share the same handling infrastructure, there are points in the system where co-mingling of non-visually distinguishable grains with different quality characteristics can occur. Theoretically this could happen on-farm, at the grain elevator, during the loading of hopper cars, at the terminal, or during the loading of a laker or sea-going vessel. To prevent or limit co-mingling, mechanisms such as IP and closed-loop systems have been put in place.

Identity Preservation

Although IP is a relatively easy concept to understand, it is difficult to define. In addition, there are the related concepts of traceability, and closed-loop systems. According to Stuart Smyth of the Department of Agricultural Economics at the University of Saskatchewan, many of the stakeholders involved in the study or implementation of these mechanisms tend to use these terms interchangeably, creating confusion. Smyth refers to IP as identity preserved production and marketing (IPPM), defined as a premium-based, voluntary system developed by industry as a method to capture the value associated with a specialized commodity. In this system, arrangements are made to ensure that a particular crop is monitored throughout its production and processing chain to ensure its quality integrity. The underlying rationale is to facilitate the niche marketing of products, for example, variety-specific high quality wheat grown in the Canadian prairies for use by the Warburtons Family Bakers in the United Kingdom(UK), or soybeans from Ontario sold into the Japanese tofu market.

Traceability

Smyth defines traceability as a liability management tool used by industry to inform consumers about their products. In essence, this is the ability to trace the path followed by a commodity from seed to shelf by means of comprehensive records[/2]. This definition is similar to the one proposed by the Codex Alimentarius Commission, an international organization that coordinates global food standards. The definition put forth by the Codex Alimentarius Commission states that "traceability is the ability to trace the history, application or location of an entity by means of recorded identifications." This approach, while not common in the grains and oilseeds sector, is extensively used as a marketing tool for livestock products.

Closed-Loop Systems

Regulated closed-loop systems are required to manage varieties subject to contract registration under the Canada Seeds Act. These are varieties with biochemical or biophysical characteristics different from the majority of the registered varieties of the same class or crop type and therefore have the potential to cause harm if they enter the traditional GHTS. Consequently, there must be an assurance of an appropriate level of quality control to ensure that varieties subject to contract registration are not "leaked" into the bulk GHTS[/3]. An example is high erucic acid rapeseed which is used for non-food products, but is visually indistinguishable from canola which is used to produce an edible oil.

In summary, IP and closed-loop systems are mechanisms in the grains and oilseeds sector that are used to minimize or eliminate the risk of commodity contamination and undesirable co-mingling. Depending on the commodity, the need for these two mechanisms may stem from quality assurance - the need to maintain the integrity of the commodity as specified by the end-user, or safety - the need to keep commodities free from contaminants that may harm human and/or animal health.

QUALITY ASSURANCE

Quality assurance in Canada's grain industry is a two-step process. First, a new variety of grain or oilseed must go through three years of rigorous testing to establish that it is at least substantially equivalent to other benchmark varieties in terms of agronomic performance, quality and disease resistance. After completion of this step, the Variety Registration Office (VRO) of the Canadian Food Inspection Agency (CFIA) determines whether to grant approval to the new variety for commercial release. The VRO's decision is based on the recommendation of an evaluating committee such as the Prairie Registration Recommending Committee for Grains. Therefore, once producers begin planting grains and oilseeds, a certain level of quality assurance is already 'built' into the crop through the varietal registration system. The second step is the regulated grading system administered by the CGC under the *Canada Grain Act*.

Grades of grains, oilseeds, pulses and special crops are set out in schedules of the Canada Grain Regulations. As explained above, wheat classes are segregated on the basis of KVD. Each class or type of grain is further segregated by grade based on factors such as presence of foreign material or disease, degree of soundness (or freedom from damaged kernels), moisture, protein levels and colour. For example, there are three milling grades that are assigned to CWRS eligible varieties. Producer deliveries of CWRS graded No.1, No.2, or No.3, the top three grades in descending order, will be marketed for human consumption, whereas any delivery with factors that lower the grade of a wheat delivery below No.3 will likely end up being marketed as animal feed.

One drawback of the KVD criterion is that it makes the development of new varieties more difficult. Although KVD helps maintain the consistency and quality of Canadian wheat, a new variety with the same kernel characteristics as one of the seven main classes must have the same end-use qualities of the class it resembles in order to be registered.

According to former CGC research scientist Phil Williams, the determination of quality in grains and oilseeds changes depending on the focus: nutrition, processing, or marketing. Factors governing nutrition are chemical composition, flavour, texture, toxicities, and infestation. Those factors governing processing are physical condition, chemical composition, physical and chemical properties, foreign materials, infestation, and financial aspects. Marketing factors are appearance, physical condition, chemical composition, infestation, foreign materials, price, and assurance of delivery. All of these criteria are taken into account when grade standards are established by the CGC in consultation with the grain industry.

Processing, marketing, and nutritional requirements within a quality assurance system each define quality differently. Processors, such as flour mills, oilseed crushers and maltsters, measure deficiency in quality as anything that detracts from 100% utilization of the grain they have purchased. If a processor receives a commodity that contains degrading factors such as foreign materials, broken or weather-damaged kernels or seeds, high moisture levels or disease, undesirable oil or protein levels, quality is judged as poor and financial repercussions, for the grain company, producer, and processor ensue. Marketers judge quality by appearance, physical condition, and certain quality tests. Again, physical damage, moisture levels, oil and protein content are relevant in influencing end-use quality and hence price. If moisture, oil, and protein are not at the optimum levels needed for successful processing, the grain or oilseed will be down-graded and may be discounted for alternative markets, such as feed[/4]. Finally, attention to quality and safety along the supply chain will help to maintain the nutritional integrity of grains and oilseeds, including the level of minerals and vitamins.

The IP system developed by Warburtons' is a good example of the response to more sophisticated demands for quality assurance and safety of Canadian grains. This British bakery has explicit demands for high-quality milling wheat, and some areas of the Canadian prairies are better suited than others to produce that quality. Fusarium head blight (FHB) is a fungal disease that can affect wheat quality. Fusarium graminearum is a species of FHB, that can have an impact on yield and quality and can produce several different mycotoxins that may affect a parcel's fitness for consumption by humans, and to a lesser extent, animals. For many grains, the CGC has incorporated tolerance limits for Fusarium damaged kernels (FDK) into the grading system in order to limit the maximum levels of FHB-affected grain and mycotoxins that may be present in commercial shipments. High levels of FDK in a producer delivery of wheat will lower the grade thereby limiting the marketability of FHB-affected wheat to customers who demand high-quality. For reasons of quality assurance, Warburtons has been purchasing wheat specifically from the areas of Manitoba, Saskatchewan, and Alberta where FHB is less prevalent. In addition to specifying areas of cultivation for their wheat, Warburtons demands that tests be carried out for deoxynivalenol (DON) using an enzyme-linked immuno-sorbent assay (ELISA) based test to ensure that the concentration of this mycotoxin is within strict European Union (EU) guidelines[/5]. Furthermore, the Warburtons IP approach requires that the CGC conduct electrophoresis tests on the wheat purchased at several cargo transferring points to ensure that varieties are those in the contract specifications. Tests such as these act as a verification that the IP system's integrity is maintained from the farm to the end-user.

FOOD AND FEED SAFETY

Today, the need for safety testing is much more important and the means by which these tests are carried out are much more sophisticated than in 1965 when the CGC first began to test for pesticide residues in Canadian grain. Some of the factors that account for this development are:
- consumers are much more aware of food safety issues;
- governments and organizations, such as the Codex Alimentarius Commission, are more vigilant in the setting and harmonization of safety standards;
- grain processors and importers are highly demanding with respect to grain safety assurance;
- specifications on grain safety matters in grain sales contracts are more common and meeting these specifications is more difficult;
- buyers of Canadian grain are routinely demanding inspection/testing of shipments for toxic substances, safety-related information, and official assurances on safety matters from a recognized government authority;
- diseases such as FHB and its mold byproducts, mycotoxins, have become more prevalent;
- pesticide use has increased and scientific methods by which to detect and analyze grains and oilseeds for anomalies have evolved[/5].

CGC's Safety Assurance Program

The CGC's safety assurance program monitors export cargos and crop samples for a wide range of toxic substances or contaminants, including pesticide residues, mycotoxins, radionuclides, toxigenic fungi, bacterial contaminants, foreign materials, heavy metals, and noxious weed seeds.

There are five major aspects of CGC safety assurance:
1. To prevent contamination, the CGC scrutinizes potential entry routes of poisonous substances into grains and oilseeds and recommends appropriate regulations. This may include analyzing crop-related diseases, monitoring new agricultural practices, and participating in the review process for proposed new pesticides.

2. The CGC identifies and controls suspect grain shipments. The Grain Research Laboratory (GRL) provides an analytical service for the testing of suspect grains which assists grain inspectors in keeping contaminated grain out of food and export channels. These grains are segregated until chemical tests determine an appropriate disposition.

3. The CGC monitors export shipments for grain safety. Extensive monitoring of Canadian grains for toxic substances, such as pesticide residues, mycotoxins, and trace elements, is currently focused on selected vessel loadings. The CGC will also analyze new crops to determine the presence of undesirable substances and the extent and source of contamination.

4. The fourth aspect of the CGC program is research and development. The CGC is developing improved methods to detect toxic substances in grain. For example, they are studying the relationship between mycotoxin development and storage and processing conditions, and also analyzing the relationship between the presence of toxic substances and relevant degrading factors.

5. The final aspect of the CGC program for grain safety assurance is market support and technical assistance. The CGC provides scientific advice and technical assistance on grain safety matters to marketers, processors, and importers for dealing with consumer demands in this area. This includes reviewing grain safety specifications outlined in tenders and sales contracts, issuing official statements of assurance on safety related matters, and providing analytical testing services to further sales[/6].

While grain safety assurance is an essential component in a comprehensive approach to grain quality assurance, the CGC does not regulate grains and oilseeds. The responsibility for safety and risk assessment related to food and contamination rests with Health Canada and the CFIA. Health Canada assesses for unconfined release: commodities that have never been used in food; foods that are the result of a process that has not previously been used to produce foods; and foods that have been modified by genetic manipulation. Concurrently, the CFIA is responsible for the establishment and maintenance of policy directives to prevent the introduction and spread of regulated quarantine pests of grains and oilseeds into Canada. According to the CGC's Grain Safety Program Manager, Tom Nowicki, information related to grains and oilseeds is commonly shared between the CGC and Health Canada.

The grain safety assurance activities of the CGC are a result of the combination of the Commission's responsibility for quality assurance of Canadian grains and market issues. The goals of these activities are to ensure that grain is fit for consumption and that the marketability of Canada's grain is not jeopardized by food safety issues. Ultimately, the CGC ensures that Canada's export shipments will be able to meet the safety standards of its grain customers. The CGC's safety testing services in the grains and oilseeds sector are neither mandatory, nor comprehensive, but simply a customer service to which fees apply. This is a service which has become progressively more complex. Tom Nowicki states that there are 200 different pesticides tested for and 25 methods by which to test for their residues. Add to that the methods required to test for mycotoxins and trace elements, and it is clear that testing can become an expensive, time-consuming activity[/5].

The criteria outlined for grain quality and the discussion surrounding FHB and mycotoxins, indicates an overlap in testing for quality assurance and testing for food safety. Testing for FHB and foreign materials, for example, is a quality concern because their presence will negatively affect the processing of the grain. However, testing for mycotoxins, which are derived from FHB, is a safety issue because they will taint food and feed products. This overlap allows the CGC to monitor for some quality and safety issues simultaneously, thereby reducing costs. With the increasing demands by consumers for information pertaining to the products and commodities they purchase, increased safety testing may become a requirement for both domestic and foreign sales of grains and oilseeds.

CONCLUSION

As this discussion has shown, IP, closed-loop systems, and segregation approaches, such as KVD, are important tools in the GHTS. While they aid in the efficient marketing of grain, they also allow the capture of premiums related to quality. These systems have served the Canadian grains and oilseeds industry well and provide a good basis for the system of the future. The changing marketplace, however, demands that more be done. Not only do we need to expand and improve existing systems, but we may also need to add traceability as a working component in the system as more consumers insist on it.

Advances in technology are being pursued through the Automated Quality Testing (AQT)project and will provide more sophisticated techniques for identification and safety testing purposes. The potential advantages that expanded safety testing would provide the entire supply chain, and the development of more varieties that cannot be managed with visual segregation suggest that it may be time to reassess the regulations in the grains and oilseeds sector. It should be asked whether the CGC's grain safety monitoring is sufficient to meet increased consumer demand for food safety assurances. It should be asked whether the benefits of registering non-visually distinguishable varieties outweigh the additional costs of keeping them separate. It should be asked whether non-visual segregation systems are a practical replacement to the KVD approach. Such reassessment may present another opportunity for a government and industry partnership to re-engineer the GHTS for the new millennium. Indeed, such reassessment may be necessary to preserve Canada's advantage in a highly competitive market.

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[/1] Agriculture Agri-Food Canada (AAFC). 2002. "Canadian Wheat Classes" in *Bi-weekly Bulletin*, April 26, 2002, Volume 15 Number 7.
[/2] Stuart Smyth. 2002. "The battle between GM crops and public, private and collective interests: Defining and documenting the costs and benefits of identity preservation, segregation and traceability." University of Saskatchewan.
[/3] Laura Anderson. May 23rd 2002. "Article Review" interview with Canadian Grain Commission Analyst.
[/4] Phil Williams. 1998. "Varietal development and quality control of wheat in Canada." http://www.cgc.ca/Cdngrain/VarietyDev/variety2-e.htm
[/5] Tom Nowicki. May 27th 2002. "Article Review" interview with Canadian Grain Commission Scientist.
[/6] Tom Nowicki. 2002. "Canadian Grain Commission Program for Safety Assurance of Canadian Grain."

While the Market Analysis Division assumes responsibility for all information contained in this bulletin, we wish to gratefully acknowledge input from the following:
Canadian Grain Commission, Canadian Wheat Board, Canadian Soybean Export Association, University of Saskatchewan

GRAIN SAFETY TESTING (PESTICIDE RESIDUES, MYCOTOXINS, AND TRACE ELEMENTS)

NAME OF TEST	DESCRIPTION OF PARAMETER TESTED
Mycotoxin Cargo inspection/testing	Chemical tests are applied for vomitoxin, ochratoxin A, aflatoxins and citrinin and using methods of analysis based on ELISA[/1] technology
Organochlorines, Organophosphates and Organonitrogens	A gas chromatography-mass selective detector method is used to test for the presence of a wide variety of common pesticides.
Fusarium Trichothecene Mycotoxins	A gas chromatography-mass selective detector method is used to test for the toxic by-products of *Fusarium* .
Ochratoxin A, Zearalenone and Aflatoxins	A method based on use of liquid chromatography with fluorescence detection is used to test for trace levels of these mycotoxins.
Aluminum Phosphide/Phosphine	A gas chromatography-flame photometric method is used to test for residual phosphine and uncreated aluminum phosphide.
Glyphosate	A liquid chromatography method using fluorescence detection and sequential post-column oxidation and derivatization is used to test for the presence of glyphosate and its major metabolite AMPA[/2].
Trace Element Testing	Low levels of heavy metals and other trace elements are measured using a combination of microwave digestion and atomic absorption spectrometry with either graphite furnace or flame technologies.

[/1] ELISA - Enzyme-linked Immunosorbent Assay [/2] AMPA - Amino methyl phosphonic acid

Source: Canadian International Grains Institute, *Grains and Oilseeds: Handling, Marketing, Processing* 4th edition, 1993

CANADA: IDENTITY PRESERVATION PROJECTS

Canadian Soybean Export Association

In eastern Canada, the Ontario Soybean Industry has been operating IP programs for more than twenty years. Canadian soybean exporters are currently world leaders in developing an IP marketing chain which ensures traceability of product from end-user back to the producer. As a result of developing IP marketing, Canada has been able to increase exports of non-genetically modified (GM) soybeans into Europe by ensuring that GM and non-GM varieties are kept separate. This is done using a strip test, ELISA and Polymerase Chain Reaction methods. Exports of IP soybeans as a proportion of total soybean exports have increased since 1996, when approximately 15% of all soybeans exported were identity preserved. In five years that proportion had increased to 35%.

More recently, this industry introduced their Approved Identity Preservation Standard, which is a minimum guideline that outlines IP procedures for each step of production, from growing to processing. The program emphasizes good farming and handling practices and extensive documentation for each step of the production and processing stages. It involves using certified seed, clean operating equipment, approved isolation distances, second or third party inspections, and as stated, very thorough process documentation.

Warburtons

In western Canada, Warburtons of the UK has been working with the Canadian Wheat Board to contract for specific wheat varieties with Canadian farmers since 1996. Participating grain companies include Agricore and Paterson Grain which handle approximately 200,000 tonnes annually. In order to operate this program, Warburtons pays a price premium to the Canadian Wheat Board and, through the grain handling companies, directly to the farmers involved. Warburtons currently uses up to four varieties, which it contracts by variety, farmer, and car lot. Following harvest, farmers submit a two kilogram sample to Warburtons in Brandon, Manitoba. This sample is inspected to ensure that it meets certain quality specifications. As grain is called forward to be shipped another sample is taken at the elevator as the car is loaded. This sample is retained by Warburtons in Brandon until the cargo is received and unloaded in England. Tests are conducted on cargo loading samples by the Canadian Grain Commission (CGC) and on cargo unloading samples by Warburtons in the UK to verify varietal purity.

Canadian Seed Institute

In order to further develop a quality assurance program for identity-preserved crops of the grains, oilseeds, pulses and special crops sector, the Canadian Seed Institute (CSI) is working in partnership with the CGC to develop a National IP Recognition System. The partnership draws upon the expertise of the CSI in standard development, conformity assessment, and service delivery through accreditation systems, and the international reputation of the CGC as a credible and trusted organization with a mandate for grain quality certification.

Canadian Grain Commission

The project allows the CGC to respond to the evolution of the industry into two parallel streams: the commodity stream, which deals with bulk lower-valued product, and the value-added stream, which deals with high quality, high value product. The objective of the project is to develop a voluntary audit and certification program for IP systems operating in the value-added stream. It is expected that the program will help producers, handlers, and marketers who have implemented IP systems by providing buyers with a greater level of assurance that these systems will deliver the specific quality characteristics they demand. A national IP standard and recognition system will contribute to the “branding” of Canada’s specialized, high quality grain, oilseed, pulse and special crops products. The program involves industry consultations, a pilot project, and the development of IP standards and audit systems.

WHEAT MULTI-USE QUALITY TESTS

NAME OF TEST	DESCRIPTION OF PARAMETER TESTED
Alveograph, Extensigraph, Mixograph, Farinograph	These measure dough strength. Dough that is either too weak, or too strong is not good for baking.
Amylograph	This measures the content of alpha-amylases. Amylases are required for baking at a given level, the desired quantity varies according to other characteristics of the wheat.
Ash	This provides a measure of flour purity, and milling efficiency. Wheat with a lower ash content results in a higher flour quality with improved yield.
Baking Test	Dough is baked into a loaf of bread. This directly measures the quality of the dough for baking, in terms of colour, loaf rise, and water absorption.
Varietal Identification (Biochemical)	This provides a chemical identification of the wheat variety. Wheat varieties tend to have unique quality traits. This can be an important quality factor if wheat with certain characteristics is desired.
Colour	The colour of the wheat (and quantity of bran) is measured through the amount of light reflected off a flour-water paste. The colour of the wheat is closely related to how much flour it yields.
Falling Number	This tests for sprout damage by measuring the speed with which a plunger falls through a slurry of ground wheat. In general, higher numbers mean less sprout damage, which leads to better baking qualities.
Gassing Power	The measure of how much carbon dioxide is produced by bread dough. A sufficient level of gassing power is required for bread to rise, and otherwise bake well.
Hardness Index	A measure of the hardness of the wheat. Harder wheat is both more easily milled, and yields higher quality flour.
Maltose Value	The number of milligrams of maltose produced from 10 g of flour. Maltose contributes to gassing power, and is essential for good baking quality.
Gluten Index, Wet Gluten Content	A measurement of the gluten content. Higher gluten content generally indicates stronger dough, and in many cases, better baking characteristics.
Moisture	The moisture content is measured using a variety of processes. A proper level of moisture is important to avoid spoilage during storage and to improve performance during milling.
NIT Oil, NIT Protein	Near Infra-red is a testing method that can test wheat and oilseeds for many quality parameters. It is often used to test oil and protein content.
Particle Size Index	Particle size index is a test that gives an indication of gassing power and water absorption, which are both desirable for high quality bakery flour.
Protein Combustion	A sample is burned to test the protein content. Higher protein content leads to better loaf volume, and better baking qualities.
Starch Damage Determination	Starch damage is fracturing or cracking of starch granules during the milling process. Starch damage must fall within a range (dependent upon the protein content of the wheat) to be suitable for bread making.
Starch Determination	The form in which plants store sugar, the starch content is essential to determine the quality of wheat for bread making and milling.
Weight per 1000 kernel	A measure of potential flour production. The higher the 1000-kernel weight is, the greater the flour yield.
Yellow Pigment (durum)	This test determines the yellow pigment content in ground durum or semolina using alcohol extraction.

OILSEEDS SPECIFIC QUALITY TESTS

NAME OF TEST	DESCRIPTION OF PARAMETER TESTED
Oil Content	This test can be done either through extracting the oil or through a nuclear magnetic resonance spectroscopy analysis. It determines how much oil is in each seed.
Fatty Acid Composition	Fatty acids are the constituents of vegetable oil. Some fatty acids are “healthier” than others.
Chlorophyll Content	This measures the green colour of a seed or oil. It is generally undesirable due to the appearance, and processed out. The higher the chlorophyll content, the poorer the quaility of the oil.

Source: Canadian International Grains Institute, *Grains and Oilseeds: Handling, Marketing, Processing* 4th edition, 1993