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Canada's agri-food sector takes on the world!

Pilot plants pave way to high efficiency

The scaling down of the malting and brewing equipment has enabled staff from the Canadian Malting Barley Technical Centre to work with smaller lots of barley and malt, a distinct advantage in being able to conduct commercially relevant research and testing in a time- and cost-efficient manner

The Canadian Malting Barley Technical Centre (CMBTC) is a non-profit, independent organisation that was set up to provide technical assistance to the malting barley and brewing industries.

It is funded primarily by its member companies, but it also does fee-for-service work for non-members. Canada produces one of the best malting barley in the world, and its job is to assist users of Canadian barley to fully utilise its potential.

Its mandate includes: Evaluating and demonstrating the suitability of newly registered varieties of malting barley for certain market niches and for specific customers' particular malt and beer specifications; providing technical marketing support to its member companies who market malting barley, and malt, around the world; undertaking market-linked applied malting and brewing research projects; and providing educational opportunities for customers of Canadian malting barley and malt.

The CMBTC focus is on conducting applied research and pilot scale malting and brewing tests of registered Canadian barley varieties. The facilities will be used to commercially evaluate the malting and brewing characteristics of new and existing varieties.

Facilities

The CMBTC has a pilot malting plant capable of processing 100 kg of barley, and a pilot brewery which has a brew size of 3 hectolitres.

The malting and brewing equipment uses technology commonly found in commercial facilities. Some of the design features of the malting plant are major innovations not available anywhere else in the world. The equipment's scaled-down size will enable CMBTC staff to work with smaller lots of barley and malt, a distinct advantage in being able to conduct commercially relevant research and testing in a time- and cost-efficient manner.

Research and support activities

Technical marketing and research support is provided on a fee-for-service basis to non-members. CMBTC can offer:

- Technical assistance, education and training for domestic and International customers;
- Feedback to malting barley plant breeders as they develop new malting barley varieties;
- Technical support visits to customer plants;
- Co-op projects with other research and educational facilities;
- Technical communications and publications;

and

• Brewing laboratory services.

The CMBTC also supplies a number of services to the malting and brewing industry. It can be consulted on any production issues, new product development, troubleshooting, etc. CMBTC has many years of experience in malting, and in brewing in both large and small brewery environments. It also offers pilot malting, pilot brewing and brewing analytical services.

Pilot malting

Micro-scale malting facilities have been widely used by malting companies, barley breeders and research institutes related to malting and brewing research as a cost-effective procedure to assess the malting performance of the barley being tested. However, the results can only be used as a guideline since in most cases the quality of the malt produced from these facilities cannot match the quality of commercial malt, and the processing conditions used by the micro-scale facilities cannot simulate the malting conditions in a commercial malthouse satisfactorily.

CMBTC has installed a sophisticated and automated pilot-scale malting system. The system was designed to produce malt of commercial quality while retaining the flexibility required by researchers and marketers to do applied research work, to evaluate new barley varieties, to be a demonstration and education facility for customers and clients and to develop new products for malting, brewing and food industries.

Consultation with malting experts from around the world resulted in a system with many novel features. The system is composed of both a three-vessel malting unit and a single-vessel malting unit. The three-vessel system consists of a separate steep tank, germination tank and kiln while the single-vessel unit performs steeping, germination and kilning in the same vessel.

All of the vessels are cylindrical and are designed to hold a maximum of 100 kg of barley with a bed depth of 1.2 m and an inside diameter of 0.5 m.

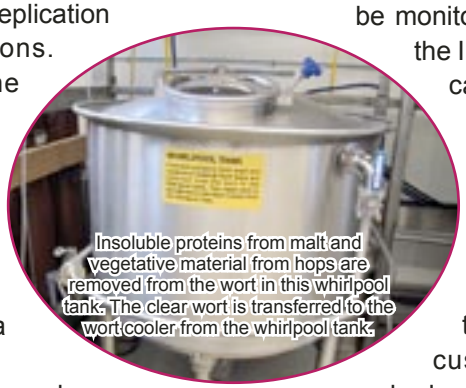
After the wort is cooled, oxygen and brewing yeast is added in these fermenters. The yeast turns the fermentable sugars in the wort into alcohol and carbon dioxide.

The kilning vessel performs the third step of the malting process. The green malt from the germination vessel is physically transferred to this vessel, and warm and dry air flows through the germinated grain taking off the excessive moisture and developing desired colours, flavours and aroma in the final product. Typical residence time in this vessel is between 24 and 36 hours.

The liquid from the mash is separated from the solid husk material in the lauter tun pictured here. The liquid, called wort, flows to the kettle.

Mr Aleksandar Egi, malting and brewing specialist at the Canadian Malting Barley Technical Centre, introduces the steeping vessel which performs the first step of the malting process.

The design allows for accurate replication of commercial malting conditions. The germination vessel and the single-vessel are equipped with centre-pivoted augers to provide for the turning of germinating grain. The Unimalter vessel can carry out steeping, germination, and kilning in the same vessel. Alternatively, it can be used as a second germination vessel.



Insoluble proteins from malt and vegetative material from hops are removed from the wort in this whirlpool tank. The clear wort is transferred to the wort cooler from the whirlpool tank.

The Unimalter is capable of performing all of the malting process (steeping, germination, kilning) in one vessel.

All vessels are equipped with sensors for temperature, humidity, oxygen and carbon dioxide. Sensors are connected to a data acquisition system to allow for continual monitoring of malting conditions such as temperatures, wet and dry steeping cycles, water spraying in steeping and germination, and fan speed and percentage air re-circulation. CMBTC also measures and logs pH, O_2, CO_2, and relative humidity on a continuous basis.

The pilot malting plant is controlled by Allen-Bradley PLC and *Cimplicity* automation software. This system provides various displays such as real-time control and monitor screens and trend charts. The processing recipes can be easily set up, and stored for future use. Processing conditions can be easily modified even while the system is executing a recipe. The malting process can also be monitored and controlled remotely via the Internet. All the operations can be carried out automatically except for barley transfers between the vessels.

Pilot brewing

CMBTC's pilot brewery is the technical support for the domestic and international customers of Canadian malting barley. The facility is able to duplicate any commercial brewing operation in the world. Pilot brewing can be used for a number of purposes: New brand development; trials of new varieties of barley, hops, etc.; process evaluation; and training.

Most breweries use their full-scale facilities for these purposes, but using a pilot brewery offers many advantages such as:

* As there is no experimental product to be blended off, the quality of the brewery's products is not compromised;

* The normal brewery production is not interrupted;

* In large breweries, brewers sometimes lose touch with experimental brews being processed through the brewery, and cannot be sure that there was no blending, O_2 pickup, etc. In extreme cases the experimental brew gets blended into commercial beer by mistake. In the pilot brewery there is complete control of the experimental product – no chance of

blending other beer into it, losing track of it, etc.; and

* It is cheaper. When all the man-hours, extra shrinkage from processing and reprocessing, the downtime on the bottling line, etc., are taken into account, large-scale brewing trials are quite expensive.

The CMBTC has two pilot breweries with capacities of 3 hl and 30l. The larger one can process a brew using virtually any commercial process. Its equipment includes: A four-roll malt mill, a cereal cooker, a mash mixer, a lauter tun, a mash filter (Meura 2001), a brew kettle, a whirlpool, four cylindro-conical fermenter-storage tanks, a sheet filter for regular or sterile filtration, a 50-litre bottling tank, a bottle filler and a pasteurizer. Process monitoring includes temperature, pH, turbidity and specific gravity. **FBA**

Canadian two-row malting barley

Canadian two-row malting barleys have long been recognised for quality all over the world. They are recognised for having low dormancy and good vigour. They malt readily and have a high enzyme potential. They are easy to handle, producing consistent predictable malting and brewing performance. Kernel size is uniform, with thin hulls, facilitating rapid, even hydration of the starchy endosperm during steeping. This in turn leads to homogenous modification and absence of beta-glucan problems. Adequate levels of alpha-amino nitrogen are produced, supporting good yeast fermentation. They possess high diastatic power for efficient conversion of high levels of unmalted adjuncts in the brewhouse. High extract yields are produced provided recommended malthouse procedures are followed.

Table 1: Recommended two-row barley varieties

VARIETY	DOMESTIC	EXPORT	MARKET DEMAND
AC Metcalfe$_4$	Established	Established	Stable, High Demand
CDC Copeland$_4$	Established	Established	Stable Demand
CDC Kendall$_1$	Established	Established	Stable Demand
Newdale$_3$	Limited	Limited	Limited Demand

Table 2: Comparative malt quality parameters

	AC METCALFE	HARRINGTON	CDC KENDALL	STEIN	CDC STRATUS	MERIT	CDC COPELAND
FINE EXTRACT, %	≥81.5	≥ 80.5	≥80.5	≥81.0	≥80.0	≥82.0	≥80.5
COLOR, EBC	3.0 - 4.0	3.0 - 4.0	3.0 - 4.0	3.0 - 4.0	3.0 - 4.0	3.0 - 4.0	2.0 - 3.0
TOTAL PROTEIN, %	≤12.5	≤12.5	≤12.5	≤12.5	≤12.5	≤12.0	≤12.5
SOLUBLE PROTEIN, %	4.7 - 5.3	4.7 - 5.3	4.7 - 5.1	4.6 - 5.4	4.6 - 5.0	4.8 - 5.2	4.5 - 5.0
KOLBACH INDEX	44 - 48	43 - 47	38 - 42	38 - 44	38 - 42	46 - 48	40 - 43
DIASTATIC POWER, °L	110 - 130	110 - 130	120 - 140	115 - 130	110 - 130	120 - 140	100 - 125
WORT BETA - GLUCAN, PPM	70 - 100	100 - 130	70 - 100	70 - 100	120 - 150	70 - 90	70 - 100

Putting a fingerprint on botanical extract manufacturing

Good natural health products can only be manufactured from premium raw materials. And together with the current advancement of high performance liquid chromatography (HPLC) technologies, this raw material (plant species) can be identified in either single herb or formulated botanical products

Canadian Phytopharmaceuticals Corp. (CPC) has carved out a reputation in the highly technical field of standardized botanical extracts, providing customised solutions for the natural health product industry.

Founded in 1996 and conveniently located in beautiful Vancouver, British Columbia, CPC is one of the leading custom manufacturers and private labellers of top-quality botanical herbal extracts and health food products, strictly following GMP (good manufacturing practice) requirements outlined in Part 3 of Natural Health Products Regulations by Health Canada.

CPC is among the few companies in Canada that have the full capacity to formulate, process, and manufacture botanical herbal extracts, dietary supplements, vitamin and minerals, and natural health products, directly from raw materials into various dosage forms of semi-finished and finished products. All products including raw materials, semi-finished and finished products are tested and analysed for compliance with both Health Canada standards and its own stringent specifications. In addition, every manufacturing process at CPC follows strict quality control procedures and the HACCP (hazard analysis and critical control point) system.

To meet the soaring demand for top quality botanical extracts and health food products, CPC has continued to expand over the last 10 years. In June 2005, CPC opened the doors to a new, GMP designed and constructed facility. The new two-storey plant has more than 30,000 ft^2 of space for production, research and the quality-control laboratories.

CPC has developed multiple manufacturing techniques and standards for the blueberry using sophisticated modern technologies.

Highly advanced manufacturing facility

Its highly advanced manufacturing facility enables it to custom design specific processing techniques (temperature, solvents, ratio, etc.) for individual products to specifically meet one's needs for purity, potency and consistency from batch to batch.

CPC boasts a sophisticated and complete range of manufacturing facilities in the industry, featuring:

1. A standardized liquid and powder extracts extraction line including large capacity stainless steel vacuum extractors, spray and vacuum dryers, large capacity Buchi Rotavapors, as well as large capacity liquid filtration and filling systems.

2. A highly advanced capsule and tablet manufacturing line including three-directional stainless steel motion mixer and blenders, high-speed fully automatic encapsulation machines, and large capacity automatic tablet press and tablet coating machines.

3. A fully integrated and automatic packaging line. As the name says it all, the NJM packaging line combines a variety of best-of-breed technologies to meet the exact needs of each customer with a "total solution" approach that provides single source responsibility.

Research and development

CPC is dedicated to the research, innovation and development of top- quality botanical herbal extracts, dietary supplements, vitamins and minerals, and natural health products for the North American and worldwide markets.

CPC brings together a very strong team of talented professionals. They are highly qualified and experienced scientists in pharmaceuticals, phyto-chemistry, herbal medicine and microbiology. It is this team of experts that allow CPC to offer a wealth of scientific and manufacturing knowledge, from raw herbal materials and manufacturing procedures to product formulation.

Botanical extracts

CPC's standardized botanical extracts are not only guaranteed to contain the marker compounds recognised by the industry, but the full-spectrum chemical profile of the original herb. Its liquid and powdered botanical extracts are used with confidence and satisfaction by pharmaceutical, cosmetic, and food and beverage industries around the world.

Over the past 10 years, CPC has developed multiple manufacturing techniques and standards for a variety of botanical extracts including North American ginseng, echinacea, blueberry, goldenseal and more, using sophisticated modern technologies. The high performance liquid chromatography (HPLC) methods developed for the identification of different ginseng species have been credited as "industry standards" by several international pharmacopoeia and organisations. These sophisticated techniques and standards enable CPC to produce homogenous botanical products with ongoing consistency derived from heterogeneous raw materials.

Its advanced manufacturing facility allows it to custom design specific extracting techniques in order to yield top-quality botanical extracts with consistency from batch to batch. Its in-house chemical analysis and microbiology laboratories are also equipped with a HPLC, TLC (thin layer chromatography) and UV (ultraviolet) spectrophotometer.

Its technology, combined with an experienced production and quality assurance team, guarantees extracts that are consistent in quality. CPC only sells products that have been produced according to its strict standards, under its supervision and every effort is put forth to ensure that all finished extracts match the botanical profile of the original plant.

Contract manufacturing

CPC is not only an expert in botanical herbal extracts, but also one of the industry leaders in the custom manufacturing of dietary supplements, vitamin and minerals, and natural health products. With the complete range of a highly advanced manufacturing facility and a strong team of scientists and experts, CPC is committed to providing a one-stop shop for essentially everything one needs, from customised product formulation, manufacturing and packaging, to technical support and analytical services.

The past 10 years have seen CPC combining traditional medicinal theory with advanced modern technologies to support its clients with formula creation, formula development and optimisation, as well as the development of new processing techniques.

Its services cover a full range of dosage forms, including: Capsules (gelatin, VegiCap, NP caps), tablets (plain, chewable, film-coated, enteric-coated, time-releasing coated), soft gels, granules, tinctures, liquid extracts and powder extracts.

Quality control of formulated botanical products

Based on the analysis of large quantities of genuine herbs, its strong in-house quality-control team have successfully developed a series of rapid and effective analytical methods to identify the marker compounds for a wide range of medicinal and nutraceutical herbs. These proprietary scientific databases, together with the advanced laboratory facilities, enable CPC to control all final products with accurate levels of active marker compounds.

There is a huge demand for standardized herb extracts on the market right now. According to the American Herbal Product Association's (AHPA) industry guidelines, standardization refers to the control and manipulation of every aspect of the agricultural and manufacturing process, and beyond, to ensure a consistent product.

The standard for the production of standardized extracts are based on three main things: Feasibility of commercialised processing methods; supporting data of ingredient's chemical profile; and proper quality monitoring or evaluation methods.

The active or effective compounds in the plant are a complex of many different, but related compounds. Therefore, the HPLC technique becomes more important especially in the quantification analysis for a group of compounds.

Today, the HPLC profile (or fingerprint) has attracted a great deal of attention to the botanical extracts industry, because it can effectively "force" the manufacturer to use correct plant species and, to put a sufficient amount of raw herb or its extract into the production. The establishment of a consistent HPLC profile is based on the analysis of large quantities of authentic herb samples. It has been found that many botanical extracts in the market were spiked with certain marker compounds to pass the analytical test. **FBA**

CPC is among the few companies in Canada that have the full capacity to formulate, process, and manufacture botanical herbal extracts, dietary supplements, vitamin and minerals, and natural health products, directly from raw materials into various dosage forms of semi-finished and finished products.

A drying success

EnWave Corporation's Radiant Energy Vacuum food dehydration technology scores an industry breakthrough

Food manufacturers looking for new technologies that will convert live, active probiotics to a dry format in order to introduce a wider range of probiotic-fortified food products, such as cereal bars, dry cereals and snack foods, will find their answer in Vancouver, British Columbia, Canada.

Hailing from Vancouver, EnWave is an innovative R&D company developing a new industry standard for the dehydration of food, live or active bulk liquids, and sensitive pharmaceuticals. It is working to provide manufacturers with technology that is significantly faster, more cost-effective, and produces a higher quality end product than freeze drying. The current industry standard of freeze drying is an expensive and time-consuming process.

Its current technology dates back to 1996 with the development of the first prototype Radiant Energy Vacuum (REV) machine at the University of British Columbia for dehydrating food and nutraceuticals. Since then, it has produced and sold the first commercial-scale, continuous machine for food dehydration, and developed prototype REV technologies to dehydrate bulk liquids and pharmaceuticals.

The company now has three distinct divisions: nutraREV® for food dehydration, powderREV® for the dehydration of bulk food cultures, probiotics and fine biochemicals such as enzymes, and bioREV® & freezeREV® for live or active pharmaceutical dehydration.

nutraREV

nutraREV technology uses a combination of vacuum pressure and microwave energy to dehydrate fruits, vegetables, low-fat snacks, herbs, meats and seafood at, or below, room temperatures.

"The start up of our first commercially designed nutraREV technology is a significant milestone for EnWave and we will be aggressively marketing this technology as a replacement for freeze drying in the food industry," comments Mr John McNicol, president and co-CEO of EnWave.

In 2008, EnWave built the first continuous nutraREV machine capable of commercial production levels of dried berries. In March 2009, EnWave completed the sale of this technology to partner CAL-SAN Enterprises Ltd, a major blueberry producer in Richmond, British Columbia. Together, the two companies have proven that a marketable, dried berry can be produced in commercial quantities using this state-of-the-art technology.

nutraREV technology is now being marketed by EnWave in North America for the dehydration of products such as berries, sour cherries, herbs, potatoes, tomatoes and onions.

"nutraREV gives the market a major advancement in food dehydration technology, and I truly believe that it will revolutionise the value-added food processing sector," reveals Mr Dave Sandhu, president, CAL-SAN Enterprises, Ltd.

The company also has a co-marketing agreement

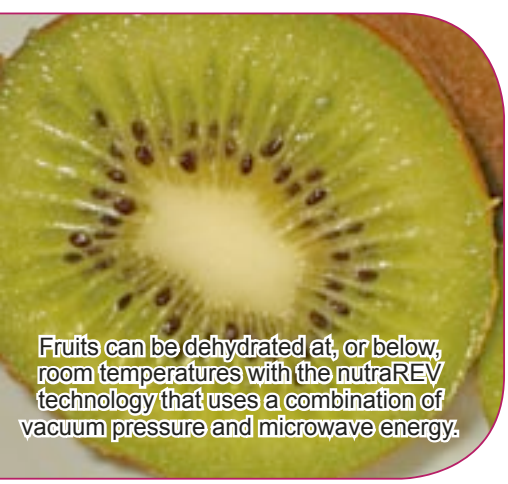
A CAL-SAN fresh blueberry beside a nutraREV dried, "puffed" blueberry.

with German engineering group Hans Binder Maschinenbau GmbH to sell and service nutraREV technology in Europe. The goal of the agreement is to accelerate revenue growth by each company, and to provide local machine service for their customers in the food sector in Europe and North America.

EnWave's nutraREV and Binder's MIVAP™ technologies both produce attractive dried food products with high nutritional retention, improved flavour and appearance, and significant cost savings in labour, energy and capital per kilogram of production over freeze drying. Although both companies use microwaves as an energy source, EnWave's continuous rotating basket design and Binder's continuous tray system both offer unique proprietary advantages with limited market overlap for dehydrating a wide range of fruit, vegetable, and meat products for the snack, cereal, soup and baking industries. Together, the two technologies will now compete directly for all aspects of the freeze dried food market which comprised over 400 products around the world.

In-laboratory tests have proven that the nutraREV process can have the following benefits over freeze drying:

- high-speed processing in minutes rather than hours or days
- significant reduction in energy usage, start-up costs and machinery footprint
- improved retention of flavour and colour
- reduced potential for large batch losses with continuous processing
- potential for creation of new product attributes such as "puffing"
- potential for improved re-hydration characteristics
- manufacturer controls over final moisture content



Fruits can be dehydrated at, or below, room temperatures with the nutraREV technology that uses a combination of vacuum pressure and microwave energy.

powderREV

The latest addition to EnWave's platform of REV technologies is powderREV which dehydrates a continuous stream of liquid using microwave energy as a heating source in a low-pressure vacuum environment. This technology is designed for the bulk dehydration of starter cultures, probiotics and fine biochemicals such as enzymes.

In April 2009, EnWave successfully completed the first phase of a series of tests with partner Danisco A/S, one of the world leaders in food ingredients, enzymes and bio-based solutions. Together, the two companies will create a dehydration method delivering high-speed continuous bulk powder processing capable of handling sensitive biological materials, such as cultures.

Based on the success of these early results, EnWave and Danisco are now undertaking the second phase of testing to evaluate the commercial viability of EnWave's powderREV dehydration technology on a wider scope. EnWave and Danisco expect this second phase to be completed in the second quarter of 2010.

If testing proves successful, commercial-scale dehydration of probiotics and enzymes using powderREV could serve to dramatically reduce manufacturing and distribution costs while improving retention and shelf-life of live material in the end product.

"Danisco has always been proactive in searching for innovative technologies to improve the drying process of cultures. The initial results from the tests with EnWave's technology are encouraging. We are looking forward to expanding the testing on a larger scale prototype to better evaluate potential product and economic advantages," says Mr Egon Bech Hansen, cultures division vice president of R&D, Danisco.

bioREV and freezeREV

EnWave's proprietary REV technology combines microwave energy with vacuum pressure to produce high-speed dehydration of live or active pharmaceuticals in sterile vials. This process is particularly suitable for creating room temperature-stable pharmaceuticals containing live organisms, such as viruses, bacteria and antibodies, where an emphasis must be placed on maintaining the maximum possible survival rates of these organisms until they are delivered to a patient.

Production of dried vaccines storable at room temperatures for long periods of time would be considered a major industry breakthrough. Dried vaccines with long shelf-life could be shipped worldwide, stored without the need for expensive, constant refrigeration, and stockpiled to protect against pandemic diseases and bioterrorism. The current standard for dehydrating many liquid pharmaceuticals is freeze drying (lyophilization). This process is expensive, time consuming and often results in significant loss of live organism activity during dehydration.

EnWave has developed two versions of REV for use in drying live or active pharmaceuticals:

* bioREV – a dehydration method for materials which require a gentler drying process without extreme temperature changes or freezing.

* freezeREV – a dehydration method for frozen material where low moisture levels in the final product are imperative for long product shelf-life.

Both methods dry material in minutes compared to days required for conventional freeze drying, and both technologies are designed to offer the potential for significant reductions in processing costs through labour, raw material, energy and time savings. bioREV and freezeREV technology is currently available as a single-vial prototype to collaboration partners. **FBA**

EnWave granted new patent for REV dehydration technology

The Canadian Patent Office has granted the University of British Columbia (UBC) a technology and process patent for the use of radiant energy vacuum (REV) dehydration technology in the production of dried biological materials. The patent covers vacuum microwave dehydration of a wide range of materials in either solid, liquid or frozen state including enzymes, drugs, vitamins, antimicrobial agents and preservatives, and is intended to protect intellectual property developed at the UBC laboratory of Dr Tim Durance, EnWave's chairman and co-CEO. UBC has licensed this patent exclusively to EnWave under its ongoing collaboration agreement with the company.

"This is a general, broad-based patent which serves to substantially bolster EnWave's growing patent portfolio over the use of vacuum microwave dehydration technology globally," says Dr Tim Durance. "As a technology company, we put significant and continuous effort into protecting our intellectual property. A strong patent portfolio provides EnWave with a competitive advantage, and places the company in a stronger position when negotiating with global food, ingredient and pharmaceutical producers looking to replace freeze drying with our faster and cheaper technology."

EnWave holds an expanding intellectual property portfolio designed to protect the technology and knowledge base of the company. In addition to the company's own patent filings on other REV dehydration processes and equipment, EnWave holds an exclusive world-wide license from the university for a number of food and biopharmaceutical dehydration patents. The company expects the new patent to pave the way for expedited protection over the coming year in the United States, the European Union, China, Hong Kong, Australia and India where it was simultaneously filed in July 2005.

Turning bright ideas into profitable products

Armed with more than 14 years of industry-proven expertise, Guelph Food Technology Centre has been helping clients stay competitive by offering confidential and creative solutions in process development and food safety training, as well as turning bright ideas into profitable products

With a membership programme of 260 industry members, Guelph Food Technology Centre (GFTC) is Canada's only independent, not-for-profit, self-sustaining food technology centre with broad-based services for the food industry. For more than 14 years, GFTC has been helping its clients create healthy, safe, affordable food in an environmentally and socially responsible manner that companies can market profitably to their customers and consumers.

Each year, GFTC experts audit and consult with over 1,500 businesses in the food and beverage industry and train more than 3,000 professionals. Its services reach across the globe to 26 countries in eight languages. Each business it work with has unique needs and challenges, from developing new products to meeting global food safety standards to incorporating sustainable practices. Here are some examples of the creative, confidential solutions it offers:

1. Help food processing facilities implement or improve food safety and quality management plans.
2. Offer auditing and consulting in global standards for food safety and microbiology such as HACCP, SQF, BRC, GMA-Safe and ISO.
3. Provide rapid-response training in new food regulations.
4. Develop new products according to upcoming trends and for specific needs.
5. Test and improve products for shelf life, quality, safety and packaging requirements.
6. Provide nutritional labelling, from individual foods to entire product lines.
7. Create sustainability programmes that improve profitability while minimising environmental footprint.
8. Develop and deliver customised training solutions for a company's workforce.

GFTC's focus is to improve its clients' performance in three fundamental areas: Their products (through product development, packaging services and process improvement), their processes (looking at food safety, quality management and environment) and their people (through training).

Product development

Whether it is new product development, food processing techniques or a reformulation challenge, GFTC's team of experienced product developers can focus on the unique nature of one's challenge, allowing one to benefit from their in-depth knowledge

of the food processing business. The GFTC team can conduct market analysis for the client and examine the product formulation and its cost effectiveness, determining how the product must be formulated to meet Canadian or US regulations. The team will conduct the laboratory trials needed to develop the formulas and evaluate the prototypes. The ingredient performance can also be evaluated. If the client is an ingredient supplier, GFTC can act as third-party evaluators.

Shelf-life analysis can be performed to evaluate the product's micro and sensory qualities to determine product shelf life. A sensory evaluation will use a variety of panels and testing methods to assess the product. Product troubleshooting will allow GFTC to help the client redevelop his or her product for shelf-life extensions, stability, cost reduction strategies or line extensions.

One of the most crucial steps in any food product development programme is food packaging. Clients can make the most of their research and development strategy by tasking GFTC to do a package integrity testing where the product's integrity and strength is tested under various environmental conditions. Closure testing and barrier testing, which includes oxygen transmission rate and water vapour/moisture transmission rate, can also be done. Clients can also make use of GFTC's patented oxygen indicator technology to assess the oxygen barrier properties of packaging.

Clients can also take advantage of the following scale up possibilities during the important phase of their food product development programme: Flexible processing configurations, food product commercialisation studies, process equipment demonstrations, ingredient application testing, commercially representative prototype generation, interim co-packing services and market sample preparations.

When planning one's research and development strategy, one can take advantage of GFTC's pilot plant facilities to try out innovative processes or new products without production downtime. Using GFTC's pilot plant, clients can conduct trials, investigate equipment technologies and test different formulations.

GFTC's area of expertise includes: Beverages, sauces, condiments, prepared meals, baking and cereal technologies, dairy, eggs, soy and functional foods, with a special focus on entrepreneurs and start-ups.

Management systems development

Major clients who have consulted GFTC for

Guelph Food Technology Centre has been helping clients stay competitive by offering confidential and creative solutions in process development and food safety training, as well as turning bright ideas into profitable products.

their process improvements include the Canadian Bottled Water Association, the Canadian Council of Grocery Distributors, the Brewers Association of Canada, the Packaging Association of Canada, etc. GFTC consultants have provided them with the right solutions for their food/beverage operation. To have their projects completed on-time, on-budget and hassle-free, GFTC Consulting Services has helped them to: Develop or improve their quality management programmes, solve product or organisational quality challenges, and meet their customer quality requirements.

GFTC can also help clients manage their auditing processes and reduce the risk to their brand. More than 1,000 audits are conducted per year, on issues like food safety, food security, animal welfare, etc. The GFTC team offers a broad range of third-party auditing services that will meet the needs of their customers or their supply chain. Its global reach paired with experienced auditors in all industry sectors allows GFTC to audit to multiple standards for each of their clients. GFTC Consulting Services is managed and operated independently from GFTC Auditing Services, in compliance with internationally accepted product and process certification standards.

Course and training

As Canada's largest trainer of food industry employees, GFTC provides training to more than 3,600 professionals representing 500 agri-food companies from 26 countries each year. Over 150 courses are delivered annually in eight languages, making GFTC one of the leaders in international training. The courses touch on subjects like business basics and management skills, product development, packaging, processing methods, food quality and food safety, sanitation and microbiology, among many others.

Courses designed and taught by industry experts – that is what one gets when one signs up for a GFTC course. One will not only acquire the core competencies one seeks, one will learn from the best in the business.

To ensure courses remain practical, relevant and timely, over 25 new courses are introduced each year so that attendee can keep abreast of changes in food safety practices, regulatory guidelines, food quality, research and development and new technologies. Web-based courses are also in the pipeline.

Sustainability services – a new growth area

Sustainability is innovation's new frontier. Mr Gary L. Fread, president and CEO of GFTC, believes that its Sustainability Services business unit will be a new area of growth. When one goes lean and green, one do not just help the environment, one helps one's business. By realigning one's business for sustainability, one can improve productivity, strengthen one's brand and save money.

To integrate sustainability into one's business plan, there must be strategic plans to guide the decision making. Benchmarks and key performance indicators must be in place to spur continuous improvement. There must be action plans to build sustainability into one's operations. Communication strategies must be devised to maximise employee awareness and buy-in.

This business unit can help clients identify key opportunities to develop competitive advantages in the areas of: Energy efficiency, environmental compliance, operational behaviour, sustainable packaging and sustainable business planning. Identifying key opportunities for sustainability and productivity can give clients a competitive advantage and GFTC's assessment services can help clients find both technical and operational opportunities to reduce energy and water consumption, waste production and emissions. Clients can also tap into GFTC's extensive database of Canadian funding and incentive programmes for help in implementing their projects.

Summing up GFTC's vision, Mr Fread stresses that GFTC strives to be a globally recognised organisation delivering innovative solutions that enable agri-food companies to capture market opportunities. It is also GFTC's vision to be a catalyst in revolutionising the food and value-added agricultural sector through the art and science innovation. **FBA**

Pulsating to challenges ahead

What challenges lie ahead for Canada's pulse industry?

Canada has emerged as the world leader in the production and export of pulse crops – pea, chickpea, lentil and bean – through the benefits of research, advanced technology, and its natural production advantage. World-class processing and handling systems meet customer needs for product quality and safety. Through the investment of grower organisations, provincial and federal governments, and Canadian agri-business, Canada is one of the leaders in innovative pulse research. Canadian pulse producers, processors, exporters and scientists are committed to the development of new varieties, conducting agronomic and processing research and providing quality products.

Growing pulses naturally

Canada's large and diverse agricultural land base is suited for growing a range of pulse crops including pea, lentil, bean and chickpea. More than 2.3 million hectares are seeded to pulse crops each year. Long sunny days and suitable soil conditions provide Canada with a natural production advantage, which is enhanced by the use of the latest farm management technology and research. Cold winters not only protect Canadian pulses from disease and insects, but also reduce storage quality concerns.

Mr Peter Watts, director of market innovation, Pulse Canada, reveals: "We are the largest 'splitter' of lentils in the world. Canada splits more lentils than any other country and export them all around the world. And there has been a big growth in red lentil production, particularly destined for markets like Turkey and the Middle East."

Global pulse production and trade

Global production of these crops has remained steady over the past 10 years at around 40 million tonnes per year* (see page 30). At over 18 million tonnes in 2006, bean production accounted for the largest share of the world's pulse production followed by peas, chickpeas and lentils.

India is the world's largest pulse producer, followed by Canada. Brazil is a large bean producer, but produces virtually no other pulses, while countries like Canada, China, the US and Mexico produce some of all the pulses. Turkey produces large amounts of lentils and chickpeas, but very few peas or beans. France and Russia produce peas.

Over the last 10 years international pulse trade has averaged 7.4 million tonnes. In this period, peas accounted for 43% of world pulse trade on average, followed by beans (32%), lentils (15%) and chickpeas (10%).

Canada's pulse production and exports

The Canadian pulse industry has grown tremendously over the past

20 years to become a major player in global pulse production and trade, with a strong base of Canadian processing and exporting companies. Over this time, Canada has emerged to become the world's largest exporter of lentil and pea, and a top five bean exporter.

Canadian pulse production peaked in 2005 at more than 4.8 million tonnes, with pulse production normally in the range of 4 to 4.5 million tonnes per year. This is a 500% increase from the early 1990s, with near record area and yields. The rise of pulse production in Canada has been driven by a combination of market opportunity and new technologies that have improved Canadian farmers' ability to grow and harvest pulses. For example, world class breeding programs have led to new varieties better suited to Canada's climate and soil conditions.

Relative to other crops, pulses have become the fifth largest crop produced in Canada in terms of volume after wheat, barley, canola and corn. Pulses are now seeded on approximately 7% of arable land. With the rise in pulse production, Canada is now the world's largest exporter of peas and lentils and a world leader in chickpea and bean exports. In 2006, the Canadian pulse industry was valued at over $1 billion, with the following percentage of sales for each crop: Peas 47%, lentils 28%, beans 18% and chickpeas 7%.

Quebec and Ontario produce bean crops (a wide array of coloured beans as well as the white navy bean), Manitoba produces white and coloured beans, as well as pea and lentil. Saskatchewan is the largest producer of pea, lentil and chickpea with a small bean industry, and Alberta produces beans under irrigation as well as pea, lentil and chickpea.

The Canadian animal feed market normally uses approximately half a million tonnes of peas each year. However, Canadian consumption of pulses as human food is low relative to many parts of the world. Approximately 75% of Canadian pulse production is exported each year, normally to 150 countries around the world.

*** (from page 29): UN Food & Agriculture Organization (FAO). Excluded from the figures are crops like pigeon peas, broad beans and cow peas which are produced in significant quantities in Asia. Also excluded are lupins which are primarily produced in Australia and the EU. These crops account for an additional 20 million tonnes per year globally.**

Peas

Canada is the world's largest producer and exporter of yellow and green field peas. In 2006, Canada produced 2.8 million tonnes of peas, more than double that of the next largest producing country, Russia. The largest export market for Canadian food peas is South Asia (for example, India, Bangladesh, Sri Lanka) as well as South and Central American countries. The largest feed market for Canadian peas is the European feed industry.

Another very important market for Canada's peas is the domestic feed market, which has used an average of 550,000 tonnes annually over the last five years. Saskatchewan produces approximately 75% of all peas grown in Canada, followed by Alberta with 20% of production and Manitoba with 5%.

Beans

Bean production has a long tradition in Southern Ontario. Over the last 20 years, however, production has grown, particularly in the fertile Red River valley of Manitoba and irrigated regions of southern Alberta. Quebec also produces 10 to 20,000 tonnes of dry beans each year. Canada produces many types of beans: Navy (white pea), pinto, kidney, black, cranberry (Romano), great northern, and small red, among others. About 70% of Canada's bean crop is exported each year. Major export destinations include the US, the UK and Italy.

Lentils

Canada produces several types of lentils,

including large, medium and small greens, as well as red lentils. Since the early 1990s, Canada has been producing between 400 and 600,000 tonnes of lentils each year (75% green, 25% red) and is the world's largest exporter ahead of other major players such as Turkey, Australia and India. In 2006, as a result of poor prices for green lentils, producers made a significant switch into red lentil production. The result was a 50-50 split between red and green lentil production in 2006. In 2007, 42% of lentils seeded were large green and 35% were red.

In 2005, Canada's lentil crop reached over 1.2 million tonnes making Canada, for the first time, the world's largest producer of lentils. In that same year, Canada exported a record 650,000 tonnes of lentils, accounting for approximately 60% of global trade in pulses. Saskatchewan produces over 95% of all the lentils grown in Canada each year. Since 2005, area seeded to lentils in Canada has declined due to lower prices.

Mr Peter Watts, director of market innovation, Pulse Canada, reveals: "We are the largest 'splitter' of lentils in the world. Canada splits more lentils than any other country and export them all around the world. And there has been a big growth in red lentil production, particularly destined for markets like Turkey and the Middle East."

Chickpeas

Canada's chickpea production rose in the late 1990s peaking at 450,000 tonnes in 2001 to 2002. However, a combination of disease problems and poor weather pushed producers away from planting chickpeas, and production dropped to 50,000 tonnes in 2004. Since then this area has crept back up as new varieties have been introduced that are resistant to key foliar diseases.

Pulse processing in Canada

Processing of pulses in Canada has expanded following the increase in production. The industry has pulse cleaning, de-hulling and splitting operations, a number of canning facilities as well as milling operations producing pulse flours such as green and yellow pea flour, chickpea flour and certain bean flours (for example, black, pinto, kidney).

Canada has pea fractionation facilities that are separating peas into fibre, starch and protein to be used in a host of food and industrial applications. Products are used domestically or exported around the world. Canada also has a facility that uses infrared technology to pre-cook pulses to be used as ingredients.

Canada's pulse industry partnerships

Canada's pulse industry has undergone significant development over the last 15 years as a result of the rapid rise in production. Five pulse grower groups represent producer interests in four provinces and include the Alberta Pulse Growers Commission, the Saskatchewan Pulse Growers, the Manitoba Pulse Growers' Association, the Ontario Bean Producers' Marketing Board and the Ontario Coloured Bean Growers Associations. The processors and exporters of Canadian pea, lentil, bean and chickpea are represented through membership in the Canadian Special Crops Association (CSCA).

In 1997, Canada's pulse grower associations and the CSCA established a national body, Pulse Canada, to help develop international markets, coordinate research and provide a voice for Canada's pulse industry. The member organisations provide funding

Since the early 1990s, Canada has been producing between 400 and 600,000 tonnes of lentils each year (75% green, 25% red) and is the world's largest exporter ahead of other major players such as Turkey, Australia and India.

The largest export market for Canadian food peas is South Asia (for example, India, Bangladesh, Sri Lanka) as well as South and Central American countries.

based on program objectives that are established by industry committees and approved by the Pulse Canada board of directors.

Canada's pulse industry meets the needs of over 150 markets around the world. Canadian pulse exporters supply whole, split or milled peas, chickpeas, beans and lentils in a variety of shipment sizes. Pulse Canada does not sell pulse crops however pulse processors, exporters, dealers and brokers are represented through the CSCA.

The government of Canada also provides funding under the Canadian Agriculture and Food International (CAFI) programme, the Advancing Canadian Agriculture & Agri-Food (ACAAF) programme and through the science and innovation and business risk management pillars of the agriculture policy framework.

Pulse Canada focus

Pulse Canada's purview includes activities in policy, research (market, scientific), transportation, crop protection, marketing and communications.

Since its inception, the mainstay of Pulse Canada's activities has been market access work. Ensuring that Canada's pulse producers have the best possible access to international markets has been key to the growth of the industry. Pulse Canada's work has been an important component of Canada's success in reducing tariff and non-tariff barriers in countries such as India, China, Thailand, South Korea and Algeria.

Market development work has also been a key element of Pulse Canada's mandate over the years. Each year, Pulse Canada has worked to create new feed markets where peas are not a traditional ingredient and attends key trade shows representing the Canadian pulse industry.

Pulse Innovation Project

A new initiative, the Pulse Innovation Project, is underway with $3.2 million in funding from Agriculture & Agri-Food Canada's Science and Innovation programme. The project's objective is to increase pulse utilisation in North America, targeting the food processing industry to foster the expansion of new market opportunities for whole pulses and pulse components with a particular focus on their associated nutrition and health benefits (for example, functional foods).

High in complex carbohydrates, protein and fibre, and low in fat and sodium, pulses are a true "superfood" and a great fit for healthy eating. Their nutritional composition includes complex carbohydrates (for example, fibre, resistant starch, oligosaccharides), vegetable protein, important vitamins and minerals like folate and iron as well as antioxidants and only very small amounts of fat. All support a healthy diet.

Pulses have about twice the protein content of cereal grains and are also high in complex carbohydrates including fibre. In fact, a one-cup serving of pulses provides almost half of the daily

amount of fibre recommended for Canadians. Pulses also have a low glycemic index which results in slower digestion. This makes pulses a valuable food choice for people with diabetes as well as those at risk for both diabetes and cardiovascular disease.

Research suggests that regular dietary intake of pulses can reduce serum cholesterol and triglycerides and can also reduce the risk of developing nutrition-related health problems including obesity, diabetes, heart disease and cancer.

Animal Feed

The Canadian pulse industry works to develop feed markets for pulses and to increase the relative value of pulses in animal feed. The industry undertakes market development activities and has developed a Feed Pea Network that is dedicated to cooperation between pea producers, traders, livestock producers and the research community. The vision is to enhance the value of Canadian peas in domestic and international feed markets.

Transportation

Weather delays, labour disruptions, equipment shortages and unpredictable schedules for movement from prairie to port have made it difficult for the Canadian pulse and special crops industry to be recognised as consistent and reliable suppliers.

Transportation is a priority for the industry given returns on other investments cannot be realised if transportation costs and inefficiencies fail to provide reliable delivery of product. By including transportation in its focus and actively working to become a solution provider, the industry will address all links within the value-chain and confront one of the biggest threats to the reputation and competitiveness of the pulse and special crops industry.

Mr Peter Watts explains: “That is why we have a dedicated transportation arm to help the industry improve on our record of delivering the products to

About 70% of Canada’s bean crop is exported each year. Major export destinations include the US, the UK and Italy.

our customers."

Reduced risk crop protection

Pulse Canada is working with industry and government partners so that Canadians benefit from timely access to lower risk crop protection products that ensure environmental protection and competitive Canadian agri-business. By working with all elements of the pulse production chain, this work also ensures that Canada's pulse industry is prepared to meet global demand for, and to be seen as a reliable supplier of, safe food.

Pulse and special crops outlook

For 2010 to 2011, total area seeded to pulses and special crops in Canada is forecast to increase by 8% from 2009 to 2010. The areas seeded to lentils, chickpeas, canary seed, sunflower and dry beans are expected to increase. The areas seeded to dry peas and mustard seed are expected to decline. Average yields are generally assumed to decrease to a trend level for both western and eastern Canada. Total production in Canada is forecast to decrease slightly to 5.5 million tonnes (Mt) but supply is expected to increase slightly to 6.6 Mt due to high carry-in stocks. Exports and domestic use are forecast to rise slightly due to the higher supply. Average prices are generally forecast to fall, except for chickpeas which remain unchanged. The main factors to watch are: commodity prices, input costs, the Canada-US dollar exchange rate and planting progress in major producing regions, especially the Indian subcontinent, United States, European Union, Australia and the Middle East.

Future strategy

Initially, Pulse Canada was focused on the North American market because it is close and easier but now Pulse Canada is trying to communicate the health benefits of pulse around the world and working with other groups in other countries who are interested in promoting these benefits. Pulse Canada wants to build from this into promoting not only the consumption of whole pulses but also looking at the potential use of pulses as ingredients.

Mr Watts sums up their strategy in a nutshell: "We are broadening our focus to look at food manufacturing and food service. In terms of the food manufacturing and food processing, we are looking at the opportunity for ingredients where we can have more value-added processing in Canada. Instead of shipping the raw products, we process it and add value before it is exported or sold on the market."

"There is a huge food manufacturing sector for ingredients, such as baked goods, extruded products, etc. We also see a real opportunity in the food service industry which is also a big sector as the food service industry is also trying to identify healthier menu items," he continues.

"And we are also trying to build on the nutrition and health benefits of pulses as well as the environmental sustainability," he adds. "All the big food companies are developing their environmental and sustainable corporate policies. As those policies become more developed, the potential for the pulse industry to gain some benefits from being well-positioned as a low-input crop to be desirable for these food companies who are trying to look at producing environmental friendly crops."

Pulses are unique in the plant kingdom in their ability to partner with certain soil bacteria to take nitrogen, an essential plant nutrient, from the air and turn it in to a form that can be used by plants.

Nitrogen is an essential nutrient for plant growth. While most agricultural production relies on commercial fertilizer, pulses have the ability to convert nitrogen from the air into a form available for plants. While commercial nitrogen is produced from natural gas and uses more energy to store, transport and apply to the field, nitrogen fixation by pulses can supply up to 90% of the plant's nitrogen requirements.

Plant pulses, save energy

With more than 1.4 million hectares of peas planted in 2006, the pea crop is estimated to have 'fixed' 282,000 tonnes of nitrogen, equal to 613,000 tonnes of urea valued at $280 million. With 25.6 gigajoules

(Gj) of natural gas required to produce one tonne of urea, this equals a saving of nearly 15.7 million Gj of natural gas or more than $115 million in natural gas costs. A full calculation of the savings would need to factor in storage, transport and application of fertilizer, and the additional savings from reduction in related reduction in GHG emissions.

Consideration would also need to be given to energy savings by inclusion of pulses through noted improvements in soil tilth (ease of cultivation), reduction in disease and insect pests through crop rotation (reduced pesticide use), and improvements in quality and yields of subsequent crops (higher yields, higher protein). Imagine the benefits if nitrogen fixing pulse crops constituted 25% of cultivated area in Canada!

The challenges ahead

"The health and wellness benefits are there. It is an easy sell but it is difficult for companies to figure out how to use pulse ingredients in their food products," reveals Mr Watts. "We have been working with companies to identify where pulses might fit within their food products."

Key components in pulses like soluble and insoluble fibre, resistant starch and protein and the functional properties of these components make pulses suitable for a wide range of food product applications. Pulses also have a low glycemic index and are gluten-free. Whole pulses are available as whole dry seeds, in the form of flour, or processed (canned, frozen or pre-cooked). The fibre, starch and protein fractions from yellow peas are also commercially available.

Innovative food products made from pulses are making their way onto grocery store shelves, including gluten-free breads made with bean flour, gluten-free cookies containing pea starch, fibre and protein, peanut free "pea-butter" made from yellow peas, and high protein pasta that contains with chickpea and lentil flour.

"There are a lot of research and product development work that needs to be done. Canada has done a good job of producing pulses and now with significant increase in production, it is now a good time to look at how we can process or use them in other applications," says Mr Watts. "It is critical to work with the food processing and food service industry to feedback to the research, to find out from them what they are interested in and then invest the money in research based on what the end users are demanding. Then you can focus your research efforts on processing and manufacturing."

"Pulse ingredients are not being used on a wide scale in the food processing industry right now. And that is the type of thing we would like to explore," reveals Mr Watts. "It is a bit of the chicken and the egg issue because we don't produce a lot of these products and so if people are going to use them, they want to know if there is enough supply. It is a slow process to build up the demand and the supply at the same time." **FBA**

What are pulses?

Pulses are the edible seeds of legumes, like lentils, beans, peas and chickpeas. Each of these pulse crops come in a wide range of colours and sizes. The name pulse is derived from the Latin *puls* meaning thick soup or potage.

Pulse crops are grown for food and feed in countries around the world and hold significant cultural and historical importance. Many early civilizations developed around diets of pulses for protein, combined with a cereal crop to provide energy. Beans and corn are the example from the Americas, while *pita* and *humus* (chickpea based) are a Middle Eastern illustration.

Functional foods – the way to go!

The Richardson Centre for Functional Foods and Nutraceuticals is moving past doing things regionally and heading to the international level

The Richardson Centre for Functional Foods and Nutraceuticals (RCFFN) is in the midst of exciting and ongoing research. Located in Smartpark Research and Technology Park, University of Manitoba, the centre is dedicated to the discussion, discovery, and development of functional foods and nutraceuticals, with a focus on the crops of the Canadian prairies. The centre's mission is to lead functional foods and nutraceuticals research for the improvement of health and nutrition and to support the development of an economically viable functional food and nutraceutical industry in Manitoba and western Canada.

According to Agriculture and Agri-Food Canada, a functional food is similar in appearance to, or may be, a conventional food that is consumed as part of a usual diet, and is demonstrated to have physiological benefits and/or reduce the risk of chronic disease

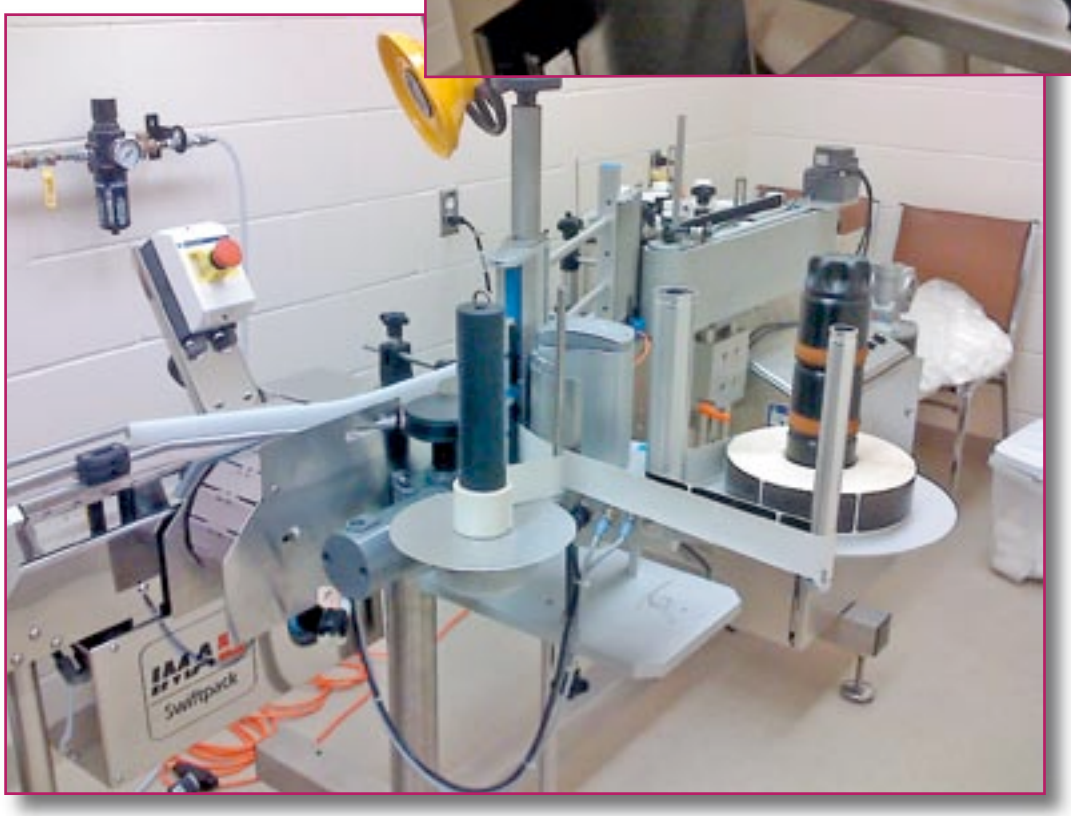
The centre's mission is to lead functional foods and nutraceuticals research for the improvement of health and nutrition and to support the development of an economically viable functional food and nutraceutical industry in Manitoba and western Canada.

beyond basic nutritional functions. Functional foods contain bioactive compounds that typically provide such benefits.

A nutraceutical is a product isolated or purified from foods that is generally sold in medicinal forms not usually associated with foods. A nutraceutical is demonstrated to have a physiological benefit or provide protection against chronic disease.

Dr Lee Anne Murphy, coordinator from Manitoba Agri-Health Research Network (MAHRN), comments: "Functional foods have to taste good. They have to look like what they used to look but also have to be better for you."

Located in Winnipeg, Manitoba Canada in heart of the Canadian Prairies, the MAHRN serves as the gateway to innovation in the research, development



The centre provides expertise and equipment for effective product delivery forms including encapsulating, tableting and coating into the appropriate dosage form in a customizable batch size.

and commercialisation of agricultural products for health. MAHRN promotes and builds this unique bioactives cluster in partnership with three facilities: The Food Development Centre (FDC), the Canadian Centre for Agri-Food Research in Health and Medicine (CCARM), and the RCFFN.

Located 70 miles west of Winnipeg, FDC is a fee-for-service research and development organisation for the agri-food industry with expertise in product development, food engineering, regulatory affairs, nutritional labelling and HACCP consulting. FDC has a federally (Canadian Food Inspection Agency) licensed pilot plant for processed food production that allows companies to produce and market their products nationally and internationally.

CCARM is dedicated to understanding the health benefits of nutraceuticals, functional foods and natural health products. Strategically located within the St. Boniface Hospital Research Centre, CCARM is home to some of Canada's top researchers in cardiovascular disease and neurodegenerative disorders. CCARM oversees world-class research teams, made up of both agricultural and medical scientists, who explore the safety and efficacy of value-added foods and natural health products.

Combined, the three facilities provide testing and assessment of plant and animal-based bioactive compounds, from the producer through clinical proof of safety and efficacy to product development and commercialisation.

Dr Peter J.H. Jones, director of the Richardson Centre for Functional Foods and Nutraceuticals points out: “We work as part of the Manitoba Agri-Health Research Network as one of the three principal entities. The Richardson Centre is geared towards driving the fundamental and applied research, looking at the milling and the pilot plant capacities around preparation for primary and secondary processing to derive bioactives out of crops and food derivatives. We focus on prairie crops but we also look at things like milk and probiotics in which we have just finished a clinical trial. But at least, our mission is oriented more towards looking at prairie crop systems which are the major players here in Canada.”

RCFFN’s two primary roles

1. Research

To lead functional foods and nutraceuticals research for the improvement of health and nutrition, the following key goals have been identified:

* Facilitate discussion, discovery and development of new products, analytical techniques and technology innovation;

* Focus the related research capabilities and human resources currently in place in the University Faculties of Agricultural and Food Sciences, Human Ecology, Medicine, and Pharmacy;

* Coordinate the multi-disciplinary collaborative R&D efforts necessary for taking bioactives from identification to ready-for-clinical examination and pre-commercialization;

* Attract new researchers and scientists involved in core and related areas of study;

*Attract, train and retain students in all aspects of research and development in FF&N area; and

* Expand the technical infrastructure available at the University, within the province and the region.

2. Promote an economically viable industry

To promote and support the development of an economically viable industry in Manitoba and western Canada, the following key goals have been identified:

* Be the main source for scientific and regulatory information concerning bioactive compounds, nutraceuticals, functional foods and natural health product in western Canada; and

* Act as a catalyst for the development of plant-based products, increasing the processing of western Canadian agricultural commodities and the capturing of related economic spin-offs.

Exciting research projects

Many exciting research projects are underway at the RCFFN. Examples of current research projects include:

* Effects of a diet rich in diaclyglycerol (DAG) oil on body weight, body composition, and blood lipid levels in women;

The "nose" (above) and the "tongue" (below) in the analytical lab.

* Effect of heart-and-stroke portfolio diet on lipid metabolism and weight loss in men;

* Effect of pulses and pulse fractions on indices of lipid, carbohydrate and energy metabolism, as we as oxidative status in overweight, hyperlipidemic individuals;

* Use of conjugated linoleic acid (CLA) as a nutraceutical for weight loss in humans;

* Evaluation of very long chain fatty acids/alcohol and plant sterols as functional food ingredients for cholesterol-lowering in hypercholesterolemic humans;

* Effects of dietary cholesterol with and without simvastatin on cholesterol absorption and synthesis and sterol profile in Smith Lemli Optiz syndrome (SLOS) patients;

* Effects of unique algal-based polysaccharides on plasma lipid levels and energy metabolism in hamsters;

* Evaluation of plant sterol and cholesterol absorption in overweight, hypercholesterolemic men with and without coronary heart disease;

* Extraction and characterisation of flax lignans using supercritical fluid extraction; and

* Structure-function properties of novel bioactive peptides.

Other exciting areas are: Molybdenum in infant formulas; antioxidant status of athletes; flax oil and firefighters; and bioactives in human milk.

Capabilities

The RCFFN has a special interest in research directed towards value-added functional foods and nutraceuticals which offer health promotion, performance enhancement, as well as disease prevention and management.

The centre is available to the agri-food, natural health product, and pharmaceutical industries to determine structure, function, efficacy, and safety of functional foods and nutraceuticals as well as evaluate products in controlled animal and human studies for potential health claims and palatability.

If one is developing a functional food or

nutraceutical product or formulation, the RCFFN has the expertise and equipment to move from lab through mini-scale to pilot plant to ensure processes are fully scalable and optimal for commercial activity. The centre possesses research expertise and equipment directed to:

• Bioactive identification, functionality, and enhancement;

• Bioactive extraction and product formulation;

• Bioactive and formulated product safety and efficacy; consumer acceptability;

• Product and market valuation and development, business planning and supply chain optimisation.

Research and development capabilities are all encompassing and include fully equipped genomic, analytical and proteomic, cell and tissue culture, clinical research animal trial, human clinical trial (Richardson Centre Clinical Research Unit), formulation development and nutraceutical manufacturing, and pilot plant bioprocessing units. The experience and credibility of scientists in tandem with a fully equipped facility make it possible to define the health claim for each functional food or nutraceutical developed through the centre with an "enhanced function claim" and/or a "disease reduction claim", which is critically important for the reputation of one's company and ultimately consumer acceptance of one's product.

The analytical labs

The analytical labs are designed and equipped to facilitate targeted and non-targeted identification and classification of all gene products, enhancement of these, and extraction of these. These gene products encompass transcripts, proteins and metabolites.

The analytical labs include the nutrigenomics lab, the protein characterization lab, the pathology and toxicology lab, the microbiology lab, the cell/tissue culture lab, the quality control (QC) lab, and the growth and stability chamber unit.

The successful sequencing of the human genome will have a dramatic impact on the manner in which pharmaceutical or agri-food companies discover and develop new drugs or bioactive compounds for the prevention, management and cure of diseases or general maintenance of health. The research expertise and equipment at the RCFFN will enable bioactive discovery programmes to be based on the identification of the best targets for a particular disease by studying the products of gene expression – nucleic acids and proteins. Gene structure and function as it relates to expression of bioactives in plants and animals can be determined, specifically: Gene structure, function and regulation; gene expression profiling; gene/haplotype mapping and sequencing; and biomarker development.

Dr Jones explains: "We have an interest specifically in separating out bioactives that we feel will have a health connection, enriching or maybe modifying them, and identifying what is in them through our fully equipped analytical lab which will tell us what's good and what's not so good in these mixtures."

Consumers with different genetic backgrounds respond to nutrients and functional foods in different ways. The genomic laboratory and the Richardson Centre Clinical Research Unit combine to offer research capability in nutrigenomics, which is the interface between the nutritional environment and genetic processes. Nutritional genomics seeks to provide a molecular genetic understanding for how common dietary chemicals affect health by altering the expression and/or structure of an individual's genetic makeup. Fundamental to this field is that the progression from a healthy state to an unhealthy state in an individual frequently occurs as a result of changes in gene expression or by differences in activities of proteins and enzymes and that dietary chemicals, directly or indirectly, regulate the expression of genomic information within an individual.

The centre has capability and capacity to explore changes in bioactive expression and target site activity, which are essential for understanding performance and benefits of functional foods and nutraceuticals. The identification and measurement of peptides and proteins, particularly at the nanoscale level, will become a critical area of research due to their importance as potential targets for functional

food/nutraceutical research. The centre has expertise and equipment for:

* Extraction of bioactive molecules and compounds including supercritical fluid extraction;

* Structure and function of bioactive molecules and compounds;

* Bioactive composition analysis;

* Target site activity and interaction with bioactive molecules and compounds;

* Protein and peptide detection, isolation, fractionation and purification;

* Protein and peptide identification and sequencing;

* Gene/protein expression patterns.

Cell and tissue culture facilitates understanding of site and magnitude of expression of bioactive compounds, as well as elucidation of bioactive molecules and compounds on targeted cells and tissues. In addition to being a crucial tool for basic research into biological processes integral to developing functional foods and nutraceuticals, cell and tissue engineering has direct commercial applicability. Protoplast isolation and fusion and cell selection are germane to the engineering and commercialization process. The centre has two cell/tissue culture laboratories for cell and tissue culture equipped with: Fermentors/bioreactors, bio-safety cabinets, protoplast fusion, microscopy and cell sorting for complete in vivo analysis.

In order to be of maximum benefit to one's organisation, research will be conducted in lab facilities that are fully GLP-compliant to ensure quality, reliability and reproducibility of results.

Price-competitive pre-clinical animal facilities

Basic research using animals is vital to furthering the centre's understanding of the impact of functional foods and nutraceuticals on health promotion and disease management. A variety of small animals in special care housing exists for clinical evaluation of bioactives used for functional food and nutraceutical efficacy/metabolic evaluation. The facility provides expertise, advice, animal housing and surgery personnel, as well as training and assistance, for food and nutraceutical related research that incorporates animal models. Pre-clinical trials can be conducted utilising either immune competent or immunocompromised animals.

In addition to being a regulatory prerequisite for human clinical trials, clinical trials utilising animals may lead to groundbreaking research for functional food or nutraceutical products or formulations for companion animals.

Dr Jones adds: "Once we isolated and characterised the components then we can assess whether these have advocacy and safety using our animal facilities which is one of the best developed in western Canada."

The 6,500-ft^2 facility is situated on the ground floor of the centre. A wide variety of housing options are available for conventional laboratory animals. Each animal caging room is a full barrier suite capable of housing multiple Ventilated Caging Units (VCUs).

The care and use of animals in research, teaching, or testing at RCFFN is carried out in accordance with Canadian federal and Manitoba provincial legislation and regulation. In addition, the centre adheres to the standards of the Canadian Association of Laboratory Animal Medicine and the Canadian Veterinary Medical Association.

All animal activities at the centre meet or exceed the guidelines and standards set forth by the Canadian Council on Animal Care (CCAC). The CCAC is the federal organisation responsible for setting and maintaining standards for the care and use of animals in research, teaching and testing throughout Canada. The Province of Manitoba's Animal Care Act, which also regulates the centre, reinforces these CCAC guidelines as appropriate in its regulations.

As part of the University of Manitoba, the animal-based activity at the Centre is also overseen by the University of Manitoba Senate Committee on Animal Care. This committee is responsible to recommend policy for the entire University, and ensures that all committees concerned with the care and use of animals are functioning effectively and that all animal facilities are inspected.

Representatives of the Canadian Council on Animal Care make regularly scheduled detailed assessments of animal care and use, which include an inspection of animal laboratory service and housing facilities as well as evaluation of policy development and review mechanisms, and methods of protocol management and review.

The animal facilities are also inspected annually by the animal Protocol Management and Review Committee (PMRC). Additionally, the University of Manitoba veterinarians make regular rounds of inspection. The university veterinarians monitor all animal care and use and are responsible for ensuring adequate veterinary / health care is available, that animal welfare receives top priority and is consistent with CCAC guidelines.

University of Manitoba veterinarians have been delegated authority to terminate any procedure or animal use which, in their opinion, causes deleterious effects which were not anticipated at the time the protocol was approved, and euthanizing any animal which is in pain, distress or ill beyond that which can be alleviated by medical intervention.

Each study or intervention protocol involving the use of animals must be reviewed and approved by the Protocol Management and Review Committee (PMRC). Approval is granted only after the proposed animal care and use has been carefully examined. The PMRC ensures that the study is ethical and the animals are humanely and responsibly treated; the appropriate species of animal is being used; the principles of reduction, replacement, and refinement are applied and the minimum number of animals are being used; and the potential benefits of the proposal are sufficient to warrant the use of animals.

Together, the facility, researchers, oversight committees, guidelines, and regulations function to ensure that the very highest standards of animal care are utilised in animal-based research teaching, or testing. The RCFFN is committed to maintaining very high standards of animal care.

Clinical research unit

Clinical research is that part of the continuum of functional food and nutraceutical research which is conducted in human beings. The discipline incorporates the discoveries from the analytical science laboratories with the measurements and observations of clinicians to delineate the mechanisms of functional food and nutraceutical products on human health and disease. Clinical research is necessary to prove the safety and efficacy of the functional foods and nutraceuticals that are developed. Efficacy, performance, palatability, and safety of functional food and nutraceutical bioactives and products require verification through well designed, well executed human clinical trials.

The Richardson Centre Clinical Research Unit (RCCRU) helps investigators conduct safe, controlled inpatient and outpatient studies of children and adults. The RCCRU has:

- An advanced metabolic kitchen facilities which permit careful preparation of fixed diets where nutrients and foods are specifically controlled to several dozen individuals simultaneously;
- Clinical office for physical examination;
- Blood collection facility. Specific blood tests including cardiovascular, immunological, hormonal, other measurements;
- Pulse-oximeter;
- Electrocardiogram;
- Respiratory metabolic unit for energy expenditure;
- Dual x-ray emission absorbtiometry for bone density and body composition analysis; and
- Retinography.

"We have done clinical trial work with the Unilever group and the Danone group," adds Dr Jones.

The involvement of human subjects in research is not permitted until the research protocol has been approved by an ethics committee which oversees all trials conducted in the clinical research unit. The protocols are designed to ensure that trial subjects receive nutritious, dietary balanced meals.

Formulation development and nutraceutical manufacturing

Increasingly, nutraceutical manufacturers face similar challenges as pharmaceutical companies – they must comply with government and industry regulations, manage complex supply chains, often involving numerous subcontractors and import controls – without the benefit of patent protection on products.

A key requisite for managing these challenges is the product delivery method. Nutraceutical development and manufacture should place special emphasis on consistent delivery to the consumer. The centre has equipment for bio-product formulation, manufacture, and delivery. Specifically the centre provides expertise and equipment for: Extrusion; blending and filling; and effective product delivery forms including encapsulating, tableting and coating into the appropriate dosage form in a customizable batch size.

The RCFFN places emphasis on quality control and inspection throughout the test process, including material verification, homogeneity testing, weight deviation measurements and package quality sampling.

Pilot plant bioprocessing

Bioprocessing is critical to the success of the functional food and nutraceutical sector and encompasses a wide range of techniques used in the development and manufacturing of products for the marketplace. The science and technology underpinning the translation of functional food and nutraceutical inventions into safe and economic disease management and prevention products is crucial as is speed to market.

As these products become more complex, and the product and process becoming increasingly linked along the supply-chain, the RCFFN's strong-skill set and facilities will be crucial for driving the speed, efficiency and cost-effectiveness needed for one's organisation and products to be innovative and competitive in this sector.

The RCFFN provides access for:

- Primary and secondary extraction of bioactives;
- Ingredient or product processing, formulation and manufacture;
- Purity and potency testing; and
- Technical and economic feasibility in order to optimise production or manufacturing processes for an economically profitable and successful market entry.

As functional food and nutraceutical manufacturers increasingly need to take product conformance to a higher level, they need to incorporate technology and processes in real-time on the production line. Pilot plant bioprocessing activities will be carried out accordance with Good Manufacturing Practice (cGMP) as recommended for the food industry by the Canadian Food Inspection Agency (CFIA) and Health Protection Branch (HPB).

The centre's dedication to regulatory compliance and quality assurance allows clients to substantiate their processes and products with respect to compliance with required regulations or meet regulatory auditing standards for auditing of process protocols.

This ensures that product conformance and economic manufacturing are seamless when full-scale commercial manufacturing is initiated.

Going international

Dr Jones sums up the future direction of the RCFFN: "We are constantly engaging and working with groups on a multi-national basis. We are moving past just doing things regionally, doing things at the national level and right over to the international level."

Dr Murphy Lee adds, "Functional food is such a global business that we decided earlier on that we have to be part of the global business or you will just be an interesting experiment." **FBA**

A green boost to health!

Lutein-rich alfalfa extract stands out from the competition

Sun Prime Extracts Ltd (Sun Prime) was incorporated in Manitoba in 2005 to investigate alfalfa fractionation for the functional food and nutraceutical markets. Owned and operated by Mr Garry Halwas, Sun Prime is a separate division of Sunridge Forage Ltd (Sunridge). Mr Halwas also owns Sunnyside Farms Ltd, a grain and horse operation that supplies the hay land for Sunridge Forage.

Sunridge is a timothy hay processing plant located in Russell, Manitoba. Sunridge was established in 1997 and is currently the major Manitoba supplier of compressed timothy hay for export. Sunridge markets the timothy to Asian markets – Toyota, Kanematsu, Nichemen and Arts Trading – through NAFTAC Commodities, based in Lethbridge, Alberta. Sunridge is a family owned and operated business – owned 60% by Mr Halwas and 20% each by sons Mark and Chris.

Sunridge prides itself on being one of the leaders in the hay industry, applying innovation and new technology to increase efficiency and continually improve products to meet the growing demands of the marketplace. In November 2004, Sunridge Forage Ltd became one of the first hay facilities to become certified under the Canadian Hay Certification Program (CHCP). This programme, regulated by the Canadian Food Inspection Agency (CFIA), is designed to ensure baled hay for export meets all requirements of the importing country.

Experiment paves way to innovative health product

Mr Halwas began experimenting in 2005, extracting and analysing juice from a variety of crops for nutritional content. The alfalfa juice caught the attention of Dr Nancy Ames at the Cereal Research Center (CRC) located at the University of Manitoba. Analysis indicated concentrations of lutein in both the juice and the pulp comparable to the high lutein extractions from marigolds and spinach. Further experiments at the Food Development Center (FDC) in Portage involved drying the product to a powder to increase the versatility of applications and stability. The resulting product was a concentrated, vibrant green, fine textured alfalfa powder with a super-concentrated dense, fibrous, dark green alfalfa paste by-product. All research and feedback from scientists and health professionals to date has indicated that this lutein-rich powder is a new and innovative health product worth pursuing.

The birth of Mativa green

Sun Prime developed this lutein-rich alfalfa powder, which is ready to market as a bulk functional food ingredient, to be branded as Mativa green. A pre-commercialization strategy for the Japanese market has been completed, confirming a strong market opportunity. This business plan is intended to support the full scale launch of Mativa green, including construction of a commercial scale processing facility.

An alfalfa flower gets a visit from a bee. Mativa green is a pure alfalfa powder extracted from Manitoba alfalfa (*Medicago sativa*).

Sun Prime has internal management capabilities, valuable external technical and research resources, and access to an extensive land base, equipment, and buildings. This winning combination of resources, manpower and expertise, will create a strong position to successfully capture the market opportunity available to Mativa green.

Global trends in the food industry have created increasing demand for "green" products that improve health and vitality. In an otherwise stagnant industry, the health and wellness trend has provided food manufacturers with a point of differentiation to help their products stand out from competition. The concept of functional foods originated in Japan, and this market remains one of the strongest in the world. Japanese consumers spend over $134 per person on functional foods, almost double the rate in the US and Europe, the next two strongest markets for this category.

Mativa green is a pure alfalfa powder extracted from Manitoba alfalfa (*Medicago sativa*). Using no chemicals or solvents in production, Sun Prime uses cutting-edge technology to extract an all-natural juice. The juice is dried into a fine, smooth, vibrant green powder. Mativa green enhances energy levels, detoxifies, and aids in digestion. It offers high concentrations of lutein and chlorophyll. While competing products require additional ingredients to increase nutritional value, Mativa green's strength lies in its simplicity. Boasting concentrated levels of antioxidants, vitamins and minerals, high-quality protein, all the essential amino acids, and eight enzymes key to the body's metabolic processes, Mativa green supports the body's requirements to achieve a consistent, vibrant, healthy lifestyle.

The majority of alfalfa products in Japan are in the form of tablets, capsules, and powders made from drying the whole alfalfa plant or just the leaves. Prices, product attributes and nutrition varies considerably. None of the existing products on the Japanese market is a concentrate made from juice, nor do any focus on lutein content. Sun Prime's proprietary technology and unique processing capabilities result in significantly better product attributes that are highly appealing to the marketplace.

Target market

The target market for Mativa green includes food and beverage manufacturers that have a particular focus on foods with enhanced nutritional qualities. Further development of Mativa green for retail will continue, with expected launch into this market in 2011 to 2012. While Sun Prime continues to evaluate and develop other markets, Sun Prime's initial focus will be on the Japanese market. Mativa green is particularly appealing to the Japanese consumer, who highly values the vibrant green colour, and concentrated nutritional value.

Sun Prime introduced its alfalfa extract at the 2006 and 2007 HI Japan Functional Food Expos. Mr Hiroshi Takakura of Takakura Corporation has been working on Sun Prime's behalf to establish a network of potential clients, and has achieved a base of interest and several product trials. Mr Harsono Ngujiharto of Canakin International Trading Inc is also working with Sun Prime on product development and client relationships. Advertising and promotion efforts will focus on promoting the unique nutritional benefits of Mativa green through trade shows, industry organisations and industry publications as well as ongoing direct client relationship development.

New processing facility

To produce Mativa green, Sun Prime will renovate a 28,000-ft^2 commercial processing facility on an

existing site shared with Sunridge Forage in Russell, Manitoba. This region has strong advantages for alfalfa production, including reliable rainfall, suitable temperatures, soil conditions, and an extensive land base. Major equipment requirements include a forage harvester, the proprietary mobile press and extraction unit (MPEU) designed by Mr Halwas, a high-capacity spray drier, and supporting transfer and storage equipment. The MPEU enables immediate juicing of the cut alfalfa to maintain peak nutritional profile. Total initial capital requirements for facility and equipment are $10.6 million.

The construction of a new agri-food processing facility will contribute significant new employment to the Russell area. Sun Prime will require 26 employees by the second year, including management, technical and professional positions.

Quality assurance

Rigorous quality assurance is integral to the success of Mativa green, from alfalfa production through harvest and processing. Sun Prime has conducted extensive research with the assistance of various organisations such as the Manitoba Food Development Centre to understand required protocols. A full quality-assurance programme, including Good Manufacturing Practices (GMP) and Hazard Analysis and Critical Control Points (HACCP) programme will be developed concurrent with the physical construction of the plant.

From the field, to juicing, to the final spray dried powder, specific quality control measures will be implemented to guarantee a quality end product. The in-field process involves careful selection of alfalfa varieties to achieve maximum lutein concentrations. Fields are inspected on a continuous basis to ensure cleanliness and proper crop growth and management. The harvest schedule is designed to extract the highest degree of nutrition from the plants and careful attention is paid to the harvested juice all throughout the final drying process and packaging. All these steps are crucial to maintain the premium quality of the product. **FBA**

Packing a nutritional punch

Alfalfa is traditionally known as a nutritive tonic containing protein, vitamins and minerals to energise, detoxify the body, alleviate bursitis and menopausal symptoms, reduce cholesterol and increase immunity. Since Mativa green is derived from alfalfa juice, all the imperfections can be left behind with only the "good stuff" becoming concentrated, thus Mativa green takes the nutritive effects of alfalfa to an all new level. Unlike traditional alfalfa powders which are dark green, have a coarse texture, tend to be bitter and do not dissolve well or stay suspended in solution, Mativa green surpasses all expectations of traditional alfalfa powders. Its vibrant green colour and good solubility along with its high concentration are just a few qualities that create Mativa green's competitive nutritional profile.

While its nutrient content is its primary advantage, Mativa green also offers a unique extraction/concentration method, combined with a delicate drying process, to deliver a nutrient-dense product without the coarse texture and bitterness of existing alfalfa products on the market. The result is a fine, smooth powder with good texture and dissolvability containing concentrated levels of many important vitamins and minerals – higher than healthy foods such as spinach, broccoli, kale and seaweed!

Mativa green meets all the requirements of the evolving and sophisticated health food sector quality – a unique ingredient supported by scientific evidence. The extraction/concentration method is mechanical and thus does not involve solvents or chemicals. The drying process preserves the true nutrition of the alfalfa and maximises the lutein concentration. Also, since it is derived from the all-natural juice of the alfalfa, versus traditional alfalfa products derived from drying the whole plant or leaves, the result is a vibrant, smooth powder with a sweet taste and good dissolvability, suitable for a wide range of food and beverage applications.

Soy far soy good

Since 1980, Canadian soybean production has climbed 450%, and current forecasts suggest further steady growth

Soy consumption continues to rise worldwide, spurred by the thickening volumes of research that attest to its positive nutritional impact on long-term health. Soy has come a long way from its association with Asian foods (although the continued growth of this ethnic segment in North America certainly helps) and it is becoming an increasingly indispensable component of a food formulator's toolkit when it comes to creating healthy alternatives for consumers who are relooking their intake of animal protein. Soybeans are used to make a diverse range of products. Tofu, soymilk, soy flour and soy meal are all made from soybeans. Soybeans are used to make soaps, cosmetics, resins and other products. In agriculture, soybeans are used in livestock feed.

Canada's affair with soy goes back to the first trial plantings of soy in Ontario during the 19th century, followed by the development of productive new strains in the 1920s, also in Ontario. With its mild climate and suitable soils, Ontario is the heartland of Canada's soy growing industry, accounting for nearly 78.5% of the national crop with an estimated production at 2.62 tonnes in 2009. The total soybean export in 2008-to-2009 crop year was close to an astounding 2 million tonnes. Since 1980, Canadian soybean production has climbed 450%, and current forecasts suggest further steady growth.

Growing areas

Soybeans are primarily grown in Ontario, Quebec and Manitoba, with some production in Atlantic Canada and Saskatchewan. Until the 1970s, soybean production was limited to southern Ontario. Advancements in soybean breeding have resulted in the development of shorter-season varieties that are suitable for eastern Ontario, Quebec and Manitoba. The majority of Canadian soybeans are grown in Ontario and Quebec, between the Great Lakes and St. Lawrence River basin. The temperature climate

AAFC researcher Dr Vaino W. Poysa strives to develop soybean varieties that are new and improved, not only from a health and nutrition perspective, but are also higher-yielding and more disease resistant.

and fertile soils found in this area are key components in producing the highest quality soybeans for food uses.

Sustainable farming

Soybeans grown in Canada are typically grown as part of a crop rotation (corn-soybeans-wheat). There are a number of benefits to growing crops in rotation, such as: Reducing disease, pest and weed pressure; protecting against erosion and building soil structure; good crop rotations will provide consistent yields; and increased profit potential for producers.

In addition, many growers also use no-till or minimum tillage in their operations. In Canada, approximately 55% of soybeans are no-tilled. An additional 15 to 20% is minimum tilled. Minimal tillage and no-till management practices are helpful in promoting soil health. These management practices reduce erosion and increase organic matter and the presence of earthworms.

Another advantage of soybeans is that similar to legumes. Soybeans can "fix" the nitrogen they need from the air. Microbes that colonize the roots of the soybean plant take nitrogen from the air and convert it into a form the soybean can use to grow. This means that soybeans require little in the way of purchased nitrogen fertilizers, which is advantageous to producers.

Unique elevator system

Canada's unique elevator system plays an important role in supplying food-grade soybeans to the world. Elevators contract soybean growers to produce soybeans with the specialty traits required by their international customers. Based on the needs of the customer, the elevator determines the production standards and practices that need to be followed by the grower. These standards and practices are detailed in an Identity-Preserved (IP) contract. The elevator works closely with the growers throughout the growing season to ensure the highest standards are met.

Upon delivery to the elevator, the soybeans are graded and tested for presence of GMOs (genetically modified organisms). It is very important that each farm delivery is tested. If no GMO contamination is found, the soybeans are binned separately to prevent contamination between different varieties and commercial soybeans until they are ready for export. (For more details on the elevator system, see stories on page 57 and 60).

Production volumes

Canada accounts for less than 2% of the world's soybean production. But, is an important supplier of specialty, high quality food grade soybeans. Approximately 35% of Canada's production is destined for premium export markets such as Japan and Europe. In 2006, soybeans were Canada's fifth most valuable field crop – after canola, wheat, potatoes, and corn – with farm cash receipts amounting to C$680 million. Exports of Canadian soybeans contributed to the value of soybean receipts. During the 2006-to-2007 crop year (September 1 to August 31), over 1.7 million tonnes of soybeans were exported.

Soybean production in Canada for 2009 increased to 3.5 million tonnes when compared to 2008's production averages of 3.34 million tonnes (Table 1 on page 50). In Ontario, production increased to 2.62 million tonnes from the 2008 production averages of 2.48 million tonnes. In Quebec, production decreased to 530,000 tonnes and in Manitoba increased to 321,000 tonnes respectively. Yields on harvested areas, in both the eastern and western regions decreased when compared to 2008 yields. In Ontario, yields for 2009 harvested area was 2.7 tonnes/ha, a decrease from 2008's 2.9 tonnes/ha. The harvested yield for Manitoba in 2009 was 2 tonnes/ha a decrease from 2008's 2.2 tonnes/ha and in Quebec the harvested yield was 2.2 tonnes/ha a decrease from 2008's 2.6 tonnes/ha.

Canada is a leading exporter of food-grade soybeans to Asia (see Table 2 on page 51), for instance, Ontario's soy industry also produces, harvests, stores and ships soybeans in a fully segregated manner, using the Canadian Identity Preservation Recognition System (CIPRS).

The fertile, high-nutrient soils in southern Ontario support the development of strong roots and good soybean crops.

Identity Preserved soybeans

Identity preserved (IP) is a process that ensures the purity or identity of soybeans with unique attributes. This process ensures quality measures are documented from seed through to export. IP soybeans can be segregated by variety, quality, or specialty trait such as high protein, high sugar or isoflavone content.

In Canada, the CIPRS provides assurance to domestic and international buyers regarding quality attributes. Operated by the Canadian Grain Commission (CGC; *http://www.grainscanada.gc.ca/*), CIPRS is a comprehensive system covering all aspects of soybean production and processing from purchasing seed through to export. In addition, the CGC accredits third-party audit firms to evaluate company IP systems. CIPRS gives buyers a paper trail providing full traceability back to the producer and the seed used.

Canada's IP soybean grower

Canadian soybean growers are progressive and can adapt to meet the ever-changing needs of the market. Canadian family farms treat their soybeans as a food crop that will make its way into the kitchens of international homes. Its skilled soybean growers are the first step in the IP process. Canadian soybean growers have grown IP soybeans for specialty markets for over three decades. Producers usually grow food grade soybeans under contact from their local elevator. The IP contract, signed by the grower, outlines production standards and quality requirements which will meet the needs of its international customers.

Growing IP soybeans

Typically, soybeans are planted in Canada from mid-May to early June, depending on the weather and the growing region. IP soybeans are grown from certified seed, which ensures the purity of the variety. IP soybean growers also thoroughly clean out all planting equipment to ensure that no contamination occurs between varieties and other crops. In addition, growers keep meticulous records of all operations in each IP soybean field. These fields are thoroughly examined by experts a number of times throughout the growing season to inspect for insects and weeds. The grower will receive a written report after each inspection, which will help in the management of their land and their ability to attain the best quality product possible.

Harvesting IP soybeans

The soybean harvest usually occurs between mid-September to mid-October, depending on the weather and the growing region. Ideally soybeans are harvested at 14% moisture. Harvest cannot begin until soybean stems and weeds have dried down completely to avoid staining of the soybean seed. For IP soybeans, Canadian soybean growers must ensure that seed quality is maintained during harvest. Prior to harvest, combines, trucks, wagons and storage bins are thoroughly cleaned to prevent contamination. IP soybeans are stored in separate bins based on variety or specialty trait and segregated from other grains and oilseeds.

Table 1 - Production of Canadian soybeans			
Year	**Seeded area, hectares**	**Production, tonnes**	**Yield, tonnes/ha**
1999	1 002 000	2 775 000	2.8
2000	1 066 500	2 698 300	2.5
2001	1 058 000	1 594 100	1.5
2002	974 700	2 220 100	2.3
2003	1 050 800	2 268 300	2.2
2004	1 225 900	3 041 500	2.6
2005	1 176 400	3 161 300	2.7
2006	1 213 500	3 465 500	2.9
2007	1 180 100	2 695 700	2.3
2008	1 202 400	3 335 900	2.8
2009	1 394 400	3 503 700	2.5

Source: Statistics Canada, Field Crop Reporting Series, No. 8, 1999-2009

Soybean research programmes

The government of Canada has conducted research on soybeans since the 1920s when the crop was first introduced into this country. Research on farming practices, including planting date and seeding rates, was part of the early work undertaken, as well as developing varieties suited to the Canadian environment.

In 1923, Agriculture and Agri-Food Canada (AAFC) researcher Dr F. Dimmock started a soybean breeding programme at the centre, producing many new varieties. The centre's first variety, Harman, was released in 1943. Harosoy followed in 1951 and within eight years, it became the predominant variety in Canada, occupying 75% of Ontario's soybean acreage. The first soybean variety developed in the programme for natto production, Nattawa, was released in 1981 by Dr Harvey Voldeng and the first tofu variety, Harovinton, was released by Dr Richard Buzzell in 1984. In the years that followed, several varieties were released, such as AC Hime (Japanese for "princess") and the Harovinton soybean which won the "Seed of the Year" award in 2006. These food-grade varieties are very high in protein and are used to make *miso*, tofu and soymilk.

Soybeans are used to make a diverse range of products, for example, soy cheese.

The fertile, high-nutrient soils in southern Ontario support the development of strong roots and good soybean crops, making Essex-Kent County soybeans sought after worldwide. Japan leads the Canadian soybean-importing countries, with 346,911 tonnes imported in the 2008-to-2009 crop year. Canadian soybeans are particularly coveted for processing Nigari tofu, a tofu considered to be "premium" because of its silken texture and refined flavour. The United States, Belgium, China and the Netherlands are also amongst the top Canadian soybean-importing countries (see Table 2 on next page).

Today, AAFC soybean research programmes integrate diverse research disciplines to create economic benefits for all industry participants and enhance human health through improved nutritional quality of soybeans and soyfood products. AAFC researchers work cooperatively with other public institutions, private sector industry groups and individual companies, striving to develop soybean varieties that are new and improved, not only from a

2003-2009 Canadian Soybean Exports (Metric Tonnes)

CANADA SOYBEAN INDUSTRY

Country/Region	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
Brunei Darussalam	0	0	19	19	142	41	59
China	2,254	15,299	13,001	7,617	2,400	9,948	236,387
Hong Kong	21,252	20,215	19,146	21,754	30,126	28,899	28,389
Indonesia	41	611	154	43,081	523	122	4,949
Japan	140,149	252,814	267,830	322,739	276,888	343,450	346,911
Korea, North	0	0	1,307	0	0	182	0
Korea, South	0	118	576	0	60	161	300
Macao	0	0	0	0	20	0	0
Malaysia	119,758	96,849	98,152	138,627	136,448	98,585	148,541
Philippines	0	4,132	9,026	12,253	12,975	9,084	7,180
Singapore	14,656	16,130	13,730	16,906	42,833	15,553	15,486
Sri Lanka	0	0	0	0	0	365	1,182
Taiwan	417	2,847	4,237	6,724	8,168	8,788	2,825
Thailand	6,370	4,656	4,077	7,805	20,741	9,578	20,647
Viet Nam	0	0	140	86	241	1,083	2,195
Asia Total	311,988	413,672	431,396	577,611	531,565	525,839	815,021
Austria	6	52	0	0	3	10	27
Belgium	12,524	91,093	63,323	130,677	182,202	206,741	166,562
Denmark	13,000	19,351	0	0	30,210	62,156	26,000
Finland	0	0	0	20,302	0	0	0
France	33,918	1,386	78,731	50,952	32,811	81,324	21,432
Germany	467	34,864	14,996	66,284	919	82,698	82,555
Greece	0	0	0	0	0	0	17,952
Ireland	0	0	44	78	1,750	6,993	120
Italy	29,547	1,025	1,295	4,450	874	12,191	8,907
Netherlands	34,178	138,346	95,880	63,756	321,202	179,919	149,950
Norway	0	0	0	0	26,840	41,100	16,316
Portugal	102	20	27,511	107,378	65,503	57,223	94,743
Serbia and Montenegro	0	0	0	21	0	0	0
Spain	40,123	10,053	17,136	17,008	8,694	2,284	3,027
United Kingdom	0	0	0	0	0	269	0
Western Europe Total	188,088	300,454	298,915	460,906	671,008	732,909	587,591
Africa	424	491	18,039	24,388	43,730	481	114,523
Latin America/Carribean	1,544	399	539	568	1,134	813	709
Eastern Europe	1,660	2,504	5,426	3,665	3,333	26,950	18,268
Middle East	61,764	63,404	234,870	192,797	296,029	206,335	174,508
Oceania	431	1,856	470	490	613	610	790
South America	39	0	77	292	125	374	170
United States	131,395	129,175	91,798	45,913	198,380	216,166	283,525
Northern America(exc.US)	0	0	26,159	128	69	70	0
Total Exports	**723,195**	**913,019**	**1,107,689**	**1,306,759**	**1,745,986**	**1,710,547**	**1,995,105**

*Crop Year is September 1 to August 31 **

Source: Statistics Canada

Overall, exports of Canadian soybeans during the 2008-09 crop year increased 14 percent from the 2007-08 crop year.

Canada's top five importers of Canadian soybeans were:

Japan = 346,911 MT

United States = 283,525 MT

China = 236,387 MT

Belgium = 166,562 MT

Netherlands = 149,950 MT

health and nutrition perspective, but are also higher-yielding and more disease resistant.

They consult widely with international soybean customers to ensure that the soybeans developed, grown and exported for food use meet the requirement of the end user. Some beans are even being bred to have a less "beany" flavour. These varieties are more suitable for use in food such as ice cream sandwiches, soy shakes and veggie burgers which are suitable for people with food allergies, preferences or intolerances. Research into agronomic practices and pest management contribute to optimal returns to the grower and protection of the environment.

AAFC scientists continue to respond to consumer demand through the soy breeding programme at the centre. Soy is being studied for its potential in novel technologies such as bioplastic and biofuel. Canadians will profit greatly from the adoption of new soy that has improved flavour, nutrition and functional qualities. Canadian growers will reap benefits from increased soybean yields that result from AAFC research on crop management, disease and pest control.

Food beans are varieties of soybeans that have been bred for specific qualities required in the production of traditional soyfoods. The quality of these beans is measured by such attributes as a clear or white hilum, larger seed size, and higher protein content.

As the world's breeders keep boosting yields with crush-quality soybeans, the soyfood sector will be under pressure to either boost their own yields or to raise their premiums in order to attract growers into IP contracts. Developing new soybean genetics for soyfood processors and putting them into commercial varieties will be a challenge. The traits will be beneficial for consumers but they must also work for the farmers too or else it will not materialise.

Finding opportunities for the future

Canada is a good portal for Asian companies looking to enter the US and European markets because they will be in an area that is recognised as having an IP system which is good for entering the EU, and at the same time, they are within a day's driving distance to over 100 million people in the Northeast United States and Canada.

Consolidation in Asian soy processing is pitting huge companies against each other, leading to calls from marketers for their brands to develop their own distinctive tastes and flavours. The future of soy in Canada lies in research and market deepening measures. Much more research can be done on IP soybeans to develop differentiated products that will be of major interest to companies globally. Canadian growers have focused on capturing greater value down the soy supply chain, by promoting the use of soy protein and other derivatives in the domestic and international food industries as well as developing strains that meet specific user requirements in terms of protein profile, sugar levels, isoflavone content and suitability for applications such as soymilk and tofu (see box story on page 56).

The research links between Canada and Asia are already well-established but more exchange with the private sector is needed because many players in Asia do not really understand the potential in Canada. Soybean researchers need to get plugged in more closely with what is happening in Asia, to understand completely what companies in Asia are trying to do in their soyfood markets.

Soybeans are of particular importance to Asian countries where they are used to prepare traditional food products such as soymilk (pictured here) and tofu.

Facilitating information exchange

A number of outreach programmes have already been executed. Since 2005, the Canadian Soybean Council (CSC) has hosted technical programs for current and prospective customers that encompass all elements of Canada's food grade soybean industry. Programmes held to date have involved representatives from the key markets of Southeast Asia, Japan and Vietnam. Its programmes are organised and delivered by the Canadian International Grains Institute (CIGI), a key partner in helping Canada's soybean industry develop and maintain relationships with customers around the world. Soybean programmes are customised and tailored to showcase IP production practices, soybean handling and processing, market-driven research, and soybean breeding. In addition, the programmes help to promote technical exchanges between Canadian researchers and participants.

Programmes are typically 10 days to two weeks long and feature stops in Manitoba, Quebec and Ontario where the majority of Canadian soybeans are grown. The programme itinerary includes visits to farms, research facilities and processing facilities, coupled with lectures and demonstrations by industry experts.

The CSC was established in 2005 as a partnership between Canada's soybean growing provinces: Manitoba, Quebec and Ontario. Its original focus was identifying and developing new export markets for high quality Canadian soybeans. The role of the CSC has grown to include:

* Building relationships with the Canadian government to ensure advantageous policies for Canadian soybean growers in areas including international trade, environment, transportation, and research and innovation.

* Facilitating information exchange.

* Pursuing innovation in international market development.

* Expanding domestic market opportunities including attracting new investment of Canada and new uses for soybeans.

In his remark to international customers, Mr Jim Gowland, CSC's chair, says: "We remain committed to producing and supplying high-quality soybeans to our international customers in the years to come. We look forward to continuing to work with you to bring soybean varieties to market that meet your processing needs."

In May 2009, the CSC started posting crop reports for Manitoba, Ontario and Quebec on a bi-weekly basis. Its goal is to keep one informed on how the Canadian soybean crop is progressing from planting through to harvest.

To address inquiries for quantitative information about Canadian soybean varieties grown specifically for the soy food industry, the Canadian Food Grade Soybean Database was initiated. The database is a collaboration involving CIGI, AAFC, the Ontario Oil and Protein Seed Crop Committee (OOPSCC), the Ontario Soybean Growers (OSG) and Soy 20/20.

In order to provide reliable information, the database has been created using soybean samples taken from the Ontario Soybean Variety Trials and

As the world's breeders keep boosting yields with crush-quality soybeans, the soyfood sector will be under pressure to either boost their own yields or to raise their premiums in order to attract growers into IP contracts.

Soybean production in Canada for 2009 increased to 3.5 million tonnes when compared to 2008's production averages of 3.34 million tonnes.

the Ontario Food Soybean Performance Trials operated by OOPSCC, a committee operating under the Ministry of Agriculture, Food and Rural Affairs, province of Ontario. The trials are replicated across multiple sites covering the crop heat unit zones of the soybean production areas. The trials are operated according to standardised procedures and undergo inspection.

The samples included in the database represent food-grade varieties currently available or expected to be available soon for commercial production. Inclusion of varieties in the database is voluntary.

After harvest, the yield, seed size, oil and protein were determined by the OOPSCC trial cooperators. This data, along with agronomic performance data, are published by OOPSCC and are available on their website: *www.oopscc.org*. Seed size, oil and protein data were used in preparing this database. Sucrose, oligosaccharide, total fermentable carbohydrate and isoflavone contents were analysed at the AAFC research centre in Harrow, Ontario.

The data are reported for each variety for the crop heat unit zone in which it was grown. To see a map illustrating test sites for the crop heat unit zones please visit *http://www.oopscc.org/test_loc.php*. Some varieties can be grown over several heat unit zones and therefore appear in more than one zone. Varieties entered in the trials vary from year to year and therefore may not appear each year in the database. Missing values in the tables occur if a sample was not available for full analyses.

Assessing the quality attributes of Canadian soybeans

The Canadian Grain Commission (CGC) supports the Canadian soybean industry by providing technical quality analysis for the new soybean crop through an annual harvest survey that assesses overall crop quality. Soybean samples for the survey are obtained from producers across Quebec, Ontario and Manitoba. The quality of the crop can vary from one area to another. By surveying all growing areas, the Canadian Grain Commission provides a good representation of crop quality.

The Canadian Soybean Council (CSC) works with the CGC to coordinate producer participation in all soybean producing regions to ensure good representation of overall soybean quality in the survey. In addition, elevators and export companies are approached to submit samples. The results gathered from the harvest survey illustrate the processing qualities of both food grade and crush soybeans.

The survey is important to identifying the effect weather conditions have on the processing qualities of soybeans from one year to another. Information from the survey reaches marketers, buyers and processors around the world. It tells millers, bakers, brewers and food manufacturers how this year's crop will perform in processing. This helps make sales and keeps buyers coming back. **FBA**

In his remark to international customers, Mr Jim Gowland (pictured first from the left), CSC's chair, says: "We remain committed to producing and supplying high-quality soybeans to our international customers in the years to come. We look forward to continuing to work with you to bring soybean varieties to market that meet your processing needs."

Investigating the quality of soymilk and tofu made from Manitoba-grown food-grade soybeans

For centuries soybeans have been an important food source in many parts of the world. Soybeans are of particular importance to Asian countries where they are used to prepare traditional food products such as soymilk and tofu. In recent years the popularity of soymilk and tofu, has spread to North America where soy foods have gained acceptance and are recognised as a healthy alternative to animal products. The increased demand for food-grade soybeans has generated interest in growing soybeans in Manitoba that are well-suited for soymilk and tofu production.

Food beans are varieties of soybeans that have been bred for specific qualities required in the production of traditional soyfoods. The quality of these beans is measured by such attributes as a clear or white hilum, larger seed size, and higher protein content. White-hilum soybeans that do not meet quality standards for food processing are used as oil beans or feed beans.

Currently, there is insufficient data on the quality characteristics of Manitoba-grown food-grade soybeans. Therefore, the University of Manitoba and the Canadian International Grains Institute embarked on a research to examine the effects of variety, growing location and crop year on soymilk and tofu yield and quality. The soymilk and tofu quality of Manitoba-grown food-grade soybeans was evaluated.

Conclusion

From the results, they conclude that seed protein and seed size are major determinants of soymilk yield, tofu yield and tofu texture. These findings support the general belief of processors and breeders that large-seeded, high-protein soybeans produce higher quality soymilk and tofu.

Both genotype and site-year significantly affect soymilk and tofu quality with site-year having the strongest influence.

Although the protein quality of Manitoba-grown soybeans may be low, results from tofu texture analysis indicate that the protein quality may be high. High-protein quality may be accounted for by an ideal ratio of 115/75 globulins which is believed to have a positive influence on soymilk and tofu quality. Further testing of the 115/75 globulin ratio is required to determine the protein quality of Manitoba-grown food-grade soybeans.

Getting seeded with a competitive edge

Variety selection can have major impact on processing results and consumer choice. We examine how Hyland Seeds can develop varieties tailored to one's needs, giving one a competitive advantage in today's marketplace

Hyland Seeds was founded in 1975 as a division of W.G. Thompson & Sons Ltd. This major Canadian grain exporter and supplier of seed, fertilizer, and crop inputs was renamed Thompsons Limited in 2004. Through Ontario grain-handling facilities, Thompsons has built a reputation for trading top-quality products and food type grains for over 80 years. Headquarters for Hyland Seeds' Canadian research, development and sales is located in Blenheim, Ontario – one of the prime seed producing regions in North America. Hyland Seeds United States' research facility is located in Grand Forks, North Dakota.

On January 1, 2010, Hyland Seeds became a business division of Dow AgroSciences Canada Inc, allowing Hyland Seeds to expand an already strong portfolio of products and strengthen the future for Hyland Seeds' customers.

Food soybean research

Hyland Seeds has a large multi-crop breeding programme. Using traditional and state-of-the-art technology, Hyland's internationally recognised plant breeders and research technicians are active in all areas of variety development for corn, soybeans, edible beans and cereal grains. For instance, Mr John Van Herk Jr and his breeding staff, with more than 75 varieties to their credit, have successfully introduced several varieties into the food soybean market. These Hyland varieties include Crown, Crystal, Marathon, Starburst, Enterprise, Bounty, Apache, Dominator, and its high-protein tofu variety, HL95. Hyland Soybean Research develops oilseed and specialty soybean varieties for oil, meal, flour, soymilk, tofu, natto and miso production.

For the past 10 years, specific processing traits have played a key role in soybean variety development. Agronomic performance and food processor requirements steer the direction of its extensive breeding programme. Thousands of individual experimental varieties are screened by the programme each year – only a fraction of them make the 8- to 10-year journey to be sold commercially in Canada and the USA. It customers receive these varieties first, and in many cases, exclusively.

Whether elevated protein levels, sugar content, high or low lipoxygenase, or a myriad of other sought after attributes, Hyland Seeds' research team has the experience and knowledge to give its customers the edge they need in today's competitive market. Its research facility includes one of only three fully automated, climate-controlled greenhouses in Canada dedicated to plant breeding and selection. Hyland's successful seed research, production, and extensive testing programme extends to all parts of Canada, the Northern United States and Europe.

The development of a new soybean variety has three main phases: Creation of variable populations of plants (crossing); advancing those populations to become “true breeding”; and evaluation of stable (true breeding) lines for desirable agronomic and quality traits.

Soybean breeding process

Soybean breeding is a time-consuming, methodical process that is both an art and a science. The development of a new soybean variety has three main phases: Creation of variable populations of plants (crossing); advancing those populations to become “true breeding”; and evaluation of stable (true breeding) lines for desirable agronomic and quality traits.

The use of seed multiplication facilities in Puerto Rico, Hawaii, Chile and Argentina enable Hyland Seeds to extend the growing season well beyond traditional northern spring and summer seasons.

Seed treatment

Seed treatments have played an important role in the production of healthy, profitable corn and cereal crops for many years and how these seed treatments are applied is important to establishing a high-yielding crop.

There is a growing trend towards purchasing commercially treated certified soybean and cereal seed. Seed protection is limited, to some extent, by the quality of seed treatment application. Uniform, precise application is important to ensure correct rates are applied to each seed. When establishing a crop, it is important to do everything one can to reduce insect and disease pressure. Applying the proper amounts of treatment to the seed will provide the best control.

Convenience, environmental stewardship and yield gains are important considerations that have led many farmers to purchase commercially treated seed. Commercial application does more to ensure that the seed is treated with the appropriate amount of product to prevent unnecessary leaching into soil. Excess application can also harm the seed, reducing quality and yield while unnecessarily increasing treatment cost.

To improve the accuracy of all its commercially applied seed treatments, Hyland Seeds recently invested in a new Gustafson continuous flow commercial seed treater that accurately applies treatments on a variety of crops, with the flexibility of applying up to nine products in a continuous, closed-loop system.

A continuous increase in the use of seed treatments is expected, especially in soybeans, and this new investment will ultimately offer growers more options and flexibility for new advancements in seed treatments.

In the past, seed treatments were applied based on bulk weight which could lead to over- or under-applying, as seeds vary in size. Today, seed treatments are often applied by seed count – a much more accurate application method.

Seed production in Canada

Seed production for agricultural crops in Canada is regulated under the federal legislation – the Canada Seeds Act. Regulations from this Act are delivered by the Canadian Seed Growers Association, the Canadian Food Inspection Agency and the Canadian Seed Institute, who work closely with seed companies and seed producers to supply agricultural producers with top-quality seed. Purity standards for seed produced in Canada are among the highest in the world. The resulting system is the backbone of the food production sector – an important component of the Canadian economy.

Identity preservation systems

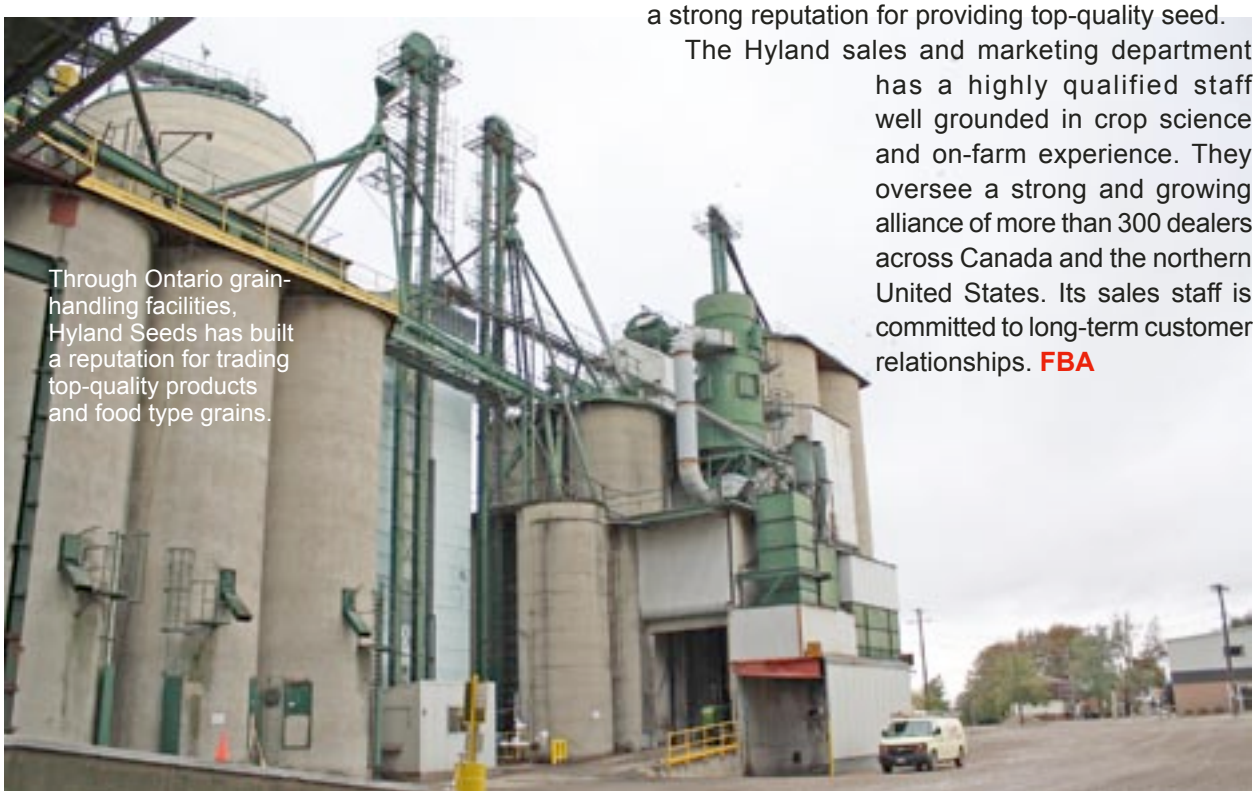
Hyland Seeds has experience with identity preservation of crop varieties that spans over 25 years. Its identity preservation systems have evolved as a natural extension of its seed production systems. Hyland offers a wide range of identity preservation programme options to fit one's requirements for quality and genetic purity. From plant breeding to seed products, crop consulting, crop inputs, crop scouting, crop receiving, quality assurance, state-of-the-art processing and shipping, Hyland Seeds can provide the soybean products one need.

Quality standards

Quality standards for seed and food production are vital. Hyland's quality control programme ensures customers that the products they buy, meet or exceed international standards for quality. All seed processing plants are inspected and certified by the Canadian Seed Institute to comply with strict regulations. Its accredited seed laboratory provides numerous tests required by the Canadian Seeds Act.

Hyland customers at home and worldwide can be confident they are receiving quality seed when they purchase Hyland brand. It understands identity preserved markets that demand specific quality characteristics and throughout its history, have built a strong reputation for providing top-quality seed.

The Hyland sales and marketing department has a highly qualified staff well grounded in crop science and on-farm experience. They oversee a strong and growing alliance of more than 300 dealers across Canada and the northern United States. Its sales staff is committed to long-term customer relationships. **FBA**



Through Ontario grain-handling facilities, Hyland Seeds has built a reputation for trading top-quality products and food type grains.

Seeded for success

Semences Prograin's success is rooted in its strong attachment to the land since its beginning. The family-owned company started with visionary seed growers who wanted to offer the best quality products and services to the producers of their area

Semences Prograin Inc is one of the largest private developers and producers of value-added soybeans in Canada. Its head office is located in Saint-Césaire, in the heart of Quebec, not far from the Port of Montréal.

Semences Prograin offers a large choice of specialty soybean varieties in the industry and its value-added soybeans were developed specifically to fulfil the needs of its clients who can use them for: Premium tofu, natto, sprouting, *moyashi*, premium miso, premium flour, baby food, bakery ingredients, beer and ale, cereals, meat products, noodles and vegan, soy beverages, yogurt, puddings, soy desserts and *tempeh*.

Semences Prograin's expertise and technology have made it internationally recognised in the field of soybean production. It is recognised as one of the leaders for its early-maturing varieties (group 000 to 1), as well as for its high-protein, edible and value-added soybeans. Its conditioning centre is one the of most advanced in Canada. Semences Prograin has built a world-wide customer network in Asia, Europe and North America.

Semences Prograin believes that research is a vital part of its operations. It sells soybeans that meet the needs of producers, buying back harvested crops at a very attractive price. Semences Prograin guarantees top-quality processing and conditioning. It also sells its value-added edible soybeans to processors throughout the world. A portion of its soybeans is also sold to the animal market to processors and traders.

Research and development

Research and development are at the core of its operations. In 1985, Semences Prograin invested in the promising future of value-added soybeans and created a research department. This decision was a turning point for the expansion and growth of our company.

Today, it evaluates thousands of cultivars each year. These are spread over 90 acres that are dedicated to research and located in the heart of the most fertile farmland in Quebec.

Its research covers three areas: Early maturing soybean varieties, soybeans adapted to the needs of growers, and varieties that meet the needs of processors.

An IP non-OGM certified soybean is what Semences Prograin offers its producers and processors as well as international merchants. Its research centre focuses on developing soybeans with nutritive qualities. It develops varieties for traditional Asian soy foods and to meet the increasing need of the North American market for soy-based products. Among those: Soybeans used specifically in oriental products (tofu, natto and others); specialised soybeans for generic applications (soy milk, yogurt and others); and cultivars with a higher protein and sugar content.

Its private laboratory, in North America, evaluates its newly developed soybean varieties for their quality

Semences Prograin Inc is one of the largest private developers and producers of value-added soybeans in Canada.

in making of tofus, soy milks, miso and natto. On an experimental basis, it makes tofu, soy milk, miso and natto. Its standards were established in collaboration with its customers and meet or surpass their requirements. Its testing protocol allows Prograin to clearly identify the characteristics of all the soybean varieties currently available for sale for Asia and North America. Prograin's working relationship with South America allows it to benefit from the use of winter nurseries and as a result, it can bring new varieties to market much faster (five to six years rather than 10). Semences Prograin conducts growing trials in winter nurseries in Chile and Argentina, enabling it to select cultivars much faster.

The pursuit of quality

Prograin launched its line of Quali-Pro™ soybeans in 1997. These soybeans benefit from rigorous management trials in the field and meticulous quality control during supply. This is done to identify the very best lots and offer customers the nutritional qualities that are most in demand on the international markets. Top-quality lots are separated during entry. Soybeans are uniformly conditioned to specific sizes and roll-sorted. Roll-sorting technology is the latest innovation in soybean processing and has become an integrated part of Prograin's commitment to quality.

The Quali-Pro programme guarantees its supply of soybeans. It gets most of its seeds from Quebec producers with whom it has a close, long-standing relationship. Prograin also secures reserves from its network in Ontario, Western Canada and the American Mid-West.

In 1987, Prograin was the first company to offer an IP programme for its production in Quebec. Today, all its soybean productions are made from certified seeds. The integration of its departments and services guarantees the reliability and traceability of its IP programme. The HACCP certification guarantees the nutritional safety of its soybeans. In accordance with Prograin's own quality standards, it guarantees a level of GMO tolerance that meets one's requirements.

At Prograin, the pursuit of quality goes beyond HACCP certification. Since 1995, it implemented a fully integrated cycle, from seed development to final end use, which ensures food traceability and safety.

Besides the HACCP certification, Prograin also offers the following certifications: Organic, JAS and Healthy Grain. Healthy Grain certified crops are produced in Quebec without the use of GMOs. Healthy Grain contain no herbicides, fungicides, insecticides or chemical fertilizers and crops can be certified within the first year. This production is inspected and certified by Quebec Agricultural Inspectors, who make sure that each grower has

Today, it evaluates thousands of cultivars each year. These are spread over 90 acres that are dedicated to research and located in the heart of the most fertile farmland in Quebec

followed the strict production guidelines. They offer better rotation flexibility to the farmer and cost less to process.

Quality at the research centre

Innovation and renewed germplasm assures future commercial growth for its dedicated growers and soyfood manufacturers. Its seed lots are certified according to the standards of the Canadian Food Inspection Agency (CIA) and the Canadian Seed Growers' Association (CSGA).

Quality of supplies

Prograin buys from farmers who bought its seeds and whose production it monitored so it knows exactly where its supplies come from. Identification and grading of the soybean crop takes place in its facilities according to the standards of the Canadian Grain Commission and the Régie des marchés agricoles du Québec. It tests for GMOs (SDI or PCR negative) according to client specifications. Its samples are kept for 12 months after delivery to the customer. Varieties are stored separately at its facilities. To ensure quality, Prograin monitors storage conditions throughout the year.

The SATAKE colour sorter detects differences in grain colour and maximises the visual appeal of soybeans.

Quality of conditioning

Prograin's conditioning centre is specifically equipped for conditioning soybeans and delivers a product of greater quality than those obtained with conventional equipment. Prograin practises just-in-time production. Its conditioning order is: 1) pre-cleaning, 2) precision sizing, 3) sorting with a Harada conveyer belt, 4) metal detection, 5) SATAKE colour sorting, 6) Destoner, 7) VDMC and 8) elevator magnets.

Its new automated bagging and palettisation system, provides quality packing and increased volumes. The SATAKE colour sorter detects differences in grain colour and maximises the visual appeal of soybeans.

Quality at delivery

From its geographical location, it can easily deliver to Europe, Asia, and anywhere in North America at very competitive rates. Delivery is by truck, ship, train or other means. The bags are mechanically loaded. Its shipments of bags are girded with strong plastic. Prograin controls the quality during and after loading. All its containers are inspected from top to bottom. The content of each container is fully traceable.

Taking extreme measures

Prograin's HTS (highly tolerant to sclerotinia) varieties offer growers peace of mind when producing soybeans on their farm. Having been the subject of a rigorous selection, HTS varieties enable one to maximise the yield even with a strong infestation of white mould. It is suitable for growers who seek security and performance while producing quality soybeans. With increasingly short rotations, the presence of this disease can cause considerable losses in the field. Thanks to these HTS varieties, Prograin stands out in the development of varieties with defensive characteristics adapted to its climatic conditions.

For more than seven years, Prograin's research team, in collaboration with the University of Laval, have developed a very effective evaluation method for the tolerance to sclerotinia in soybean varieties.

The bags are mechanically loaded. The container is inspected from top to bottom and its content is fully traceable.

The multiple tests in greenhouses and research fields made it possible to measure the reliability of HTS varieties. With this tool, the research team can select the best varieties offering growers protection against sclerotinia.

Yield and profitability

Seeds are the heart of Prograin's business. Therefore, all the steps of seed production (planting, harvesting, conditioning and delivery) are closely supervised. Harvested seed is processed at the plant, utilising advanced bulk handling techniques and automation.

Everyone at Prograin believes in the strength of long-term commercial relationships and is committed to conduct such partnership's agreements and alliances with total integrity.

Mr Alain Létourneau, vice president of Semences Prograin Inc, says: "Prograin is committed to the development of soybean cultivation and seeks to build long-lasting, mutually-profitable relationships with its partners."

Mr Alain Létourneau, who has a degree in marketing, focuses on the development of the distribution network and the research centre. He continues, "While all other seed companies have only the yield in mind, we have another priority: Yield and profitability!"

Explaining to the soybean growers, he says: "While aiming solely for the volume harvested we all stray off course. At Prograin, we of course attach great importance to the production aspect but more especially in maximising the income for each ton of soybeans harvested on your farm. Our IP and Quali-Pro production agreements offered with highly advantageous premiums are the key to the profitability of your next season soybean production." **FBA**

How it all began

Mr Clément Létourneau started out as an innovative grower who was very involved in his community and who surrounded himself with competent and dedicated people. In 1979, he proceeded to build a seed-cleaning facility in order to sell seeds directly to growers.

In 1980, with his son André and wife Marie-Claire Bourgeois, he established Semences Prograin Inc, a company specialising in the production, conditioning and sale of seeds. 1983 marks a turning point in the history of Prograin. Passionate about soybeans, Mr Clément Létourneau decides to focus the company's efforts on their cultivation, roasting and micronising (a first in America).

Aware of the increasing cultivation and popularity of soybeans in Quebec, Semences Prograin recruited two dynamic key managers whose talents were to prove invaluable. Mr Alain Létourneau, nephew of the president, had just finished his marketing studies when he joined the management team and applied his knowledge to the research and cultivation of soybeans.

In 1987, Semences Prograin started to export soybeans to Europe and Japan, some of which were used specifically to make tofu. This is when Mr Patrick-Marc Ham became part of the Prograin family. It is largely thanks to him that this foray into foreign markets was so quick and so successful.

With the help of agronomists and researchers, and propelled by its own initiatives, the Prograin team progressed rapidly, showing leadership in the field of development and cultivation of soybeans in Quebec.

Today, Mr André Létourneau and Mr Alain Létourneau are the owners of the company.