

SCIENCE

at Work



Safeguarding Canada's
Food Supply and Our Plant
and Animal Resources



Canadian Food
Inspection Agency

Agence canadienne
d'inspection des aliments

Canada

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Message from the Vice-President, Science Branch

The Canadian Food Inspection Agency (CFIA) is Canada's largest science-based regulator. As such, we rely on high-quality, timely, and relevant science to make informed decisions that contribute to international capacity-building for global health and food security.

Science in today's environment is complex. The type of scientific advice that decision-makers require has become increasingly complicated, and the demand for scientific services is always rising. Our scientists meet these needs by providing specialized laboratory testing, research, surveillance, risk assessment, product evaluation, and expert scientific advice. They also continuously develop the new technology required to support the CFIA's activities in its three business lines — food safety, animal health, and plant health.

Scientific activities require coordination and partnerships. We work regularly with universities, federal and provincial counterparts, industry, and national and international scientific communities. These connections help us maximize flexibility in a constantly evolving regulatory environment by leveraging our investments in testing, research, and development.

This document provides an overview of the important work conducted by our scientists as they meet the CFIA's regulatory needs of policy development, program maintenance, and operational delivery. The examples provided here focus on 2009 and 2010 and represent the multi-faceted work that CFIA scientists do every day.

For many years, our scientists have continued to demonstrate commitment to scientific leadership. Their expertise is used at the national and international levels to develop science-based standards and guidelines. This dedication contributes directly to public health, economic growth, and environmental protection in Canada.

Dr. Martine Dubuc,
Vice President, Science Branch



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Mission of the Canadian Food Inspection Agency

Our mission is to safeguard food, animals, and plants, which enhances the health and well-being of Canada's people, environment, and economy.

The CFIA is the largest science-based regulatory agency in Canada. It is responsible for delivering all federally-mandated programs for food inspection, plant and animal health, and consumer protection as it relates to food.

The CFIA relies on sound science as the basis of its program design and regulatory decision-making. The specific scientific activities include laboratory diagnostic tests, research, surveillance, and technology development. Our scientists also conduct risk assessments, analyze scientific data, and provide advice in order to identify and prepare for emerging issues. This expertise is an integral component of regulatory policy and standards development within Canada and internationally.

Safeguarding our food, animals, and plants is complex. CFIA employees work diligently to stay abreast of new technology, processes, and practices, both by being aware of what is happening in the international community, and by innovating new techniques at home.

CFIA scientists develop and maintain strong working relationships with universities, federal and provincial departments, and various agencies, nationally and internationally. These relationships help the CFIA to

- enrich science and innovation
- translate knowledge into useful applications
- develop regulations to protect Canadians.

This document highlights the CFIA's science activities and demonstrates the critical role that our science plays in protecting Canada's consumers and economy from emerging animal diseases, plant pests, and food safety issues. It also demonstrates the importance of collaborating with other science-based government departments and agencies, academia, and stakeholders. CFIA scientists understand that collaboration helps all partners to provide high-quality, effective, and efficient scientific advice and research products.

Strategic Outcomes

- Healthy Canadians
- Strong Economic Growth
- Clean and Healthy Environment
- Fair and Secure Marketplace
- Prosperous Canada through Global Commerce



Our Laboratories

The CFIA's Science Branch has a network of 14 laboratories across the country and approximately 1000 dedicated staff, including a broad range of specialists, professionals, and research scientists. Four of these laboratories are recognized as reference laboratories for the World Organisation for Animal Health (OIE) and are considered to be international centres of expertise for designated diseases.

The CFIA is committed to enhancing the security and safe work practices of containment facilities in Canada through the provision of regulatory controls for animal pathogens, containment standards, biosafety advice, and training. The work is divided into the following program areas: Animal Pathogen Importation, Biocontainment and Certification, Standards and Guidelines, Biosafety Services, and the safety program for CFIA laboratories. The CFIA has also implemented the *Containment Standards for Facilities Handling Plant Pests* and the *Containment Standards for Facilities Handling Aquatic Animal Pathogens*.

The International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC) have published a joint international standard for laboratories. All CFIA laboratories are accredited to ISO/IEC 17025:2005 by the Standards Council of Canada for specific tests.

While some laboratories conduct diagnostic tests and research activities in only one of animal health, plant health, or food safety, others support more than one business line. In 2009–2010, more than 2 million test results were produced from food samples. These tests are used to detect allergens, toxins, pesticides, veterinary drug residues and chemical contaminants, extraneous

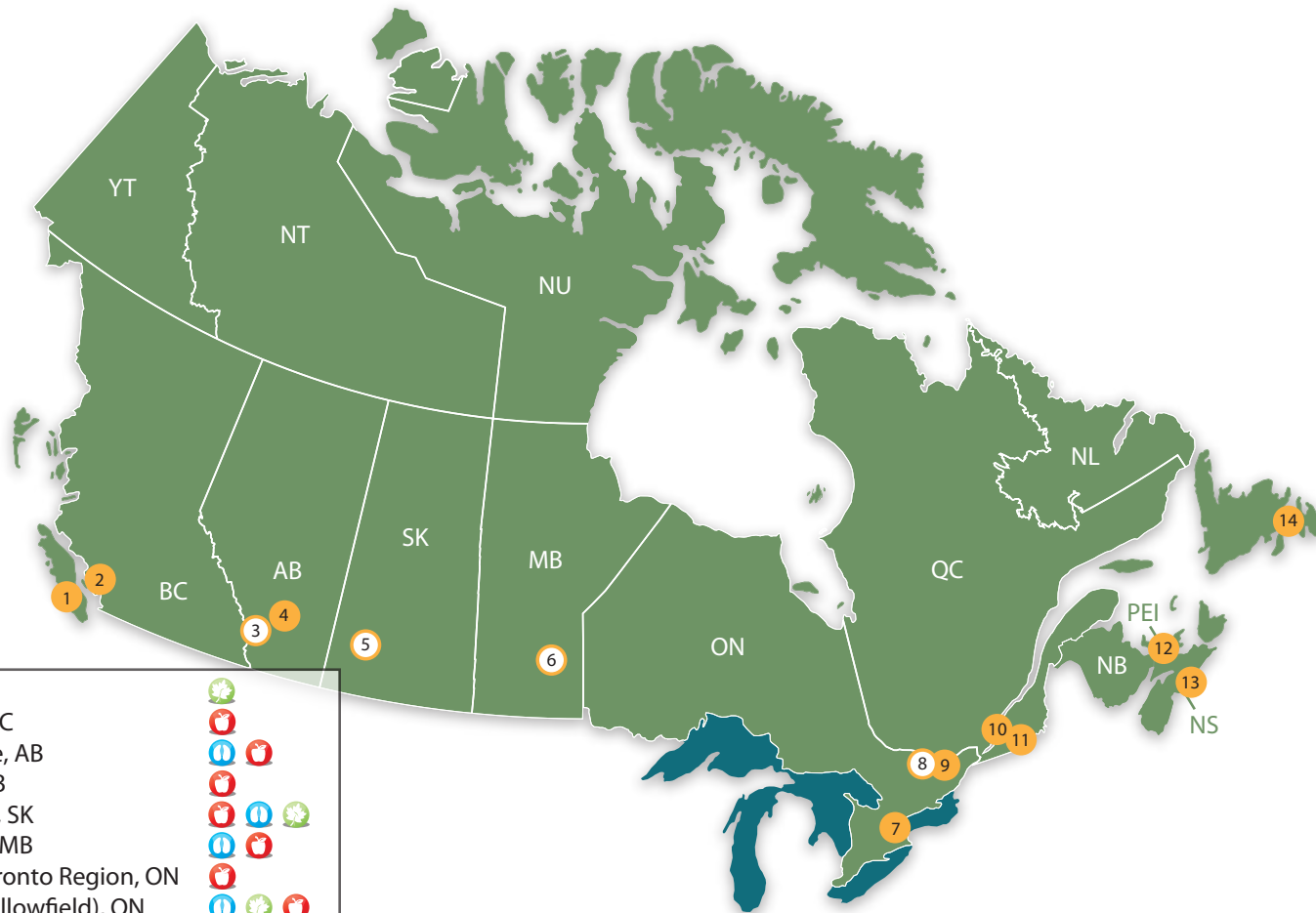
matter, and microbial pathogens. CFIA plant health laboratories performed more than 94 000 routine diagnostic analyses and more than 189 000 diagnostic tests to support emergency response programs for *Phytophthora ramorum* (sudden oak death), plum pox virus, and potato cyst nematode. In addition, almost half a million animal health tests were conducted, including those for ongoing surveillance for animal diseases in Canada.

Laboratory tests can result in food recalls or be used to improve surveillance programs, develop risk-based programs and demonstrate the safety of the Canadian food supply. Emerging hazards influence the number of test results produced by laboratories. As an example, when melamine was identified as an issue in imported milk products in 2008, the CFIA produced 600 additional test results. These stemmed from a quick testing method developed by CFIA scientists to screen multiple food commodities that potentially contain milk-based ingredients.



CFIA's Lethbridge, Alberta Laboratory

CFIA Science Branch Laboratories



1. Sidney, BC
2. Burnaby, BC
3. Lethbridge, AB
4. Calgary, AB
5. Saskatoon, SK
6. Winnipeg, MB
7. Greater Toronto Region, ON
8. Ottawa (Fallowfield), ON
9. Ottawa (Carling), ON
10. Longueuil, QC
11. St. Hyacinthe, QC
12. Charlottetown, PEI
13. Dartmouth, NS
14. St. John's, NL



Modernizing our laboratories

In 2009, the CFIA received more than \$24 million to modernize laboratories. Thirty upgrade projects were completed in CFIA laboratories across Canada in 2009–2010. Modern facilities are critical for our scientists to continue researching and advising on the health and safety concerns of Canadians.

Preparing for the Future

Forward thinking is required to enable leaders to make informed decisions and plan for the future.

Governments, industry, and policy makers around the globe are increasingly working together to anticipate future challenges to the world's food supply and plant and animal resources. The CFIA is a leader and active participant in a variety of future-focussed endeavours. The following activities allow the CFIA and its stakeholders to be proactive in managing long-term threats to food safety and plant and animal health.

Food safety

As filter feeders, shellfish have the capacity to accumulate pathogens introduced into the water around them from discharges of human and animal waste. Particles as small as viruses can accumulate in the digestive tract of bivalves during filter feeding. Since only a few infective particles are believed to be required to infect an individual, accumulation of intestinal viruses in bivalves can pose a risk to consumers if the shellfish are consumed raw or minimally cooked.

The CFIA is leading a series of projects with Health Canada to research, validate, and test strategies for the detection, characterization, and control of hepatitis A virus, noroviruses, and bacterial and viral indicators in bivalve shellfish.



The CFIA is responsible for a large range of commodities including fish and seafood products.

To date, researchers have compiled the baseline data on the presence of *Escherichia coli*, M-specific bacteriophage, and their correlation with selected enteric viruses in sampled oysters and surrounding waters from sites in the Pacific and Atlantic regions of Canada. The ultimate goal is to develop an alternative screening approach that will reliably predict viral contamination, and be complemented by the search for specific viruses to better identify the viral contamination source.

Animal health

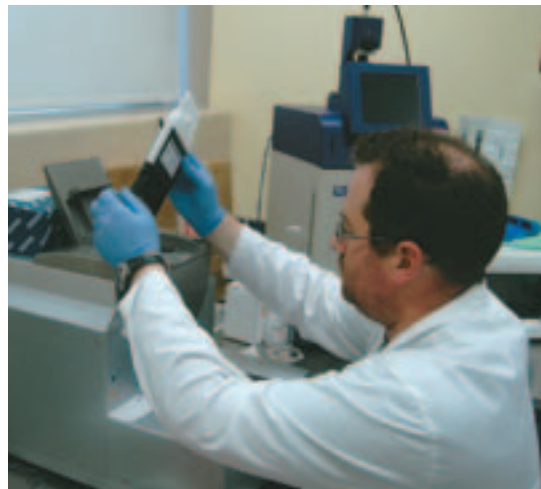
The Foresight for Canadian Animal Health Project (Fore-CAN) is a multi-partner initiative led by the CFIA and sponsored by the Chemical, Biological, Radiological-Nuclear and Explosives Research and Technology Initiative (CRTI) of Defence Research and Development Canada. It is focused on stakeholders in the animal health emergency management community working together across disciplines and jurisdictions to learn about and apply foresight methods, which will help build an effective, robust, and anticipatory animal health emergency management system. CFIA partners include Agriculture and Agri-Food Canada, the Public Health Agency of Canada, the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), the Alberta Ministry of Agriculture and Rural Development, Canada's veterinary colleges, and the Dairy Farmers of Canada.

To date, Fore-CAN results include developing emerging priorities for action centred on surveillance and intelligence, communications and collaboration, education and training, regulatory tools and systems, and new science and technology.

The CFIA has also engaged key federal players including Defence Research and Development Canada to work with the United States government to develop a coordinated and strategic science and technology collaboration in animal health. The Joint United States-Canada Workshop on Science and Technology Collaboration for Animal Health Threats has established working groups in risk assessment, science surveillance, diagnostics, biologics, research, and strategic planning.



The CFIA St. Hyacinthe laboratory tests for food health risks such as *Escherichia coli*, *Listeria* and *Salmonella*. It also plays a central role in food virology, and is recognized as the CFIA's National Reference Laboratory Centre for food virology. In animal health, the laboratory offers diagnostic services, conducts research in animal diseases that can have an impact on public health and international trade, and provides training and certification for non-CFIA laboratories as required.



Plant health

The CFIA hosted the first plant health foresight workshop in 2009 to position itself to address future challenges in plant health. Subject matter experts from Australia, Canada, Germany, Israel, Mexico, New Zealand, the United Kingdom, and the United States presented and discussed challenges and best practices regarding weather, global trade, innovative products, and regulatory requirements for genetically modified crops.

The symposium offered an opportunity for the science community, policy colleagues, industry, and regulators to exchange perspectives and share science, challenges, and foresight concepts and techniques. The CFIA will build on the knowledge gained from the symposium to develop a path forward to integrate foresight and scanning activities in order to position the CFIA for future challenges related to plants.



Canadian canola products are in high demand around the world.

Responding to Changing Demands Through Integrated Science

The CFIA provides timely and effective science support through a broad range of activities ranging from laboratory-based science (e.g., testing, surveillance, and research) to risk assessments, policy studies, and disease surveillance.

Innovative science and technology for food safety

Food safety is the CFIA's top priority. Our food safety science includes improving and developing new testing methods, verifying industry practices and protocols, and determining whether industry is in compliance with food safety policies and standards. CFIA scientific activities supporting food safety include: allergen testing; pathogen surveillance and detection; laboratory testing and analysis to support investigations and recalls; and researching, developing, validating, and implementing rapid methods.

Increasing the efficiency of chemical residue testing

The CFIA is responsible for monitoring chemical residues in food and determining compliance with the allowable limits to ensure food safety. CFIA food safety scientists are always looking to improve the efficiency and accuracy of testing methods. For example, our scientists conducted a study on the methods used to detect dithiocarbamates, a class of fungicides used on many fruits and vegetables in Canada and the United States. The researchers determined that the method of headspace gas chromatography is more cost effective, sensitive, and provides more detailed information towards detecting dithiocarbamates.



The CFIA's laboratory in Longueuil provides diagnostic testing to verify nutritional labelling and nutritive compositional standards of food. The laboratory also provides diagnostic services for food allergens, food colours, and analysis of marine toxins.

Spectrometry expands pesticide residues program capabilities

The capacity of the CFIA's pesticide residues program has increased dramatically with the addition of a multi-residue high performance liquid chromatography/mass spectrometry/mass spectrometry (HPLC/MS/MS) method. This method adds testing capabilities for 140 additional pesticides after the nearly 300 residues already covered by the CFIA's original multi-residue method. This additional capability gives the CFIA's pesticide monitoring program one of the broadest regulatory scopes in the world.

The new method was validated for a variety of fresh and processed fruits and vegetables and will be transferred to accredited private sector labs for use in the CFIA's National Chemical Residue Monitoring Program. The CFIA plans to

further expand the scope of the method to grain and pulse (legume seeds such as peas and lentils) crops and eventually to the animal feeds program.

New screening methods for *Listeria*

The CFIA constantly strives to improve food safety technologies and provide the best approaches for detecting foodborne pathogens as quickly as possible. For example, CFIA food microbiology laboratories across Canada have been working together on a modified screening method for *Listeria monocytogenes* in food. The new screening method was validated for use in processed meat products in early 2009, and has since proven to be more efficient at detecting *L. monocytogenes* in fruit and vegetable samples and environmental swabs, when compared to the established method of growing the organism in culture.



The CFIA conducts world-class research on new testing methods for food allergens, new and emerging foodborne pathogens (such as parasites, viruses, and emerging bacterial pathogens), residue testing of additives and contaminants (veterinary drugs, agricultural chemicals, industrial and environmental pollutants, and natural toxins), and diseases.

Increased food colour testing capability

The CFIA Laboratory in Longueuil recently completed a scope extension and rationalization of its food colour methods. This gives the CFIA the capability to identify over 200 different water and fat-soluble colours in food, which includes permitted colours and illegal dyes.

New methodology for fish species identification

The substitution of low value commercial fish species for more highly valued species is a worldwide problem regulated in Canada under the *Fish Inspection Act*. With the objective of continually improving our testing capabilities, the CFIA Dartmouth Laboratory is implementing state-of-the-art DNA technologies to identify commercial fish species.

To support the testing, the laboratory is also:

- collaborating with scientists from the United States Food and Drug Administration in the development of a new regulatory DNA database for verification of fish species
- building on the contribution of the Canadian Centre for DNA Barcoding (University of Guelph), to develop a protocol for species identification of canned fish using short sequence DNA barcodes.

New technology: leading the world in shellfish toxin testing

The CFIA is developing a chemical-based assay to replace the traditional mouse bioassay method for paralytic shellfish toxins (PST) testing. This study, led by the CFIA Dartmouth Laboratory, may yield a non-animal based alternative that could revolutionize PST testing in Canada and abroad.

This initiative has generated interest from more than a dozen countries wishing to participate in the pilot project. Such interest substantiates Canada's position as the world leader in implementing non-animal-based testing methods for monitoring shellfish for marine biotoxins.

New benchmark for ractopamine residue monitoring in meat

Our laboratory scientists are always looking to improve techniques to put in place the best surveillance program for food safety. Ractopamine is an approved feed additive used to promote growth in pigs and was recently approved for use in beef cattle. However, the test CFIA used for ractopamine monitoring in pigs presented some significant challenges when applied to cattle. The CFIA conducted a comparative evaluation of methodology and implemented a testing regime that satisfies the regulatory requirements for ractopamine residues in cattle. The CFIA is also involved with AOAC INTERNATIONAL (Association of Analytical Communities) in selecting and validating a new global standard to detect ractopamine.



International attention has been focused on the Dartmouth Laboratory's new technique for paralytic shellfish toxin testing. This post-column oxidation (PCOX) method is more sensitive and has shown potential as an alternative to both previously approved methods of analysis.



The CFIA and the Public Health Agency of Canada share a state-of-the-art facility in Winnipeg, which houses the National Centre for Foreign Animal Disease. It is also a hub of the Canadian Animal Health Surveillance Network and the Canadian Public Health Laboratory Network.

Innovative science and technology for animal health

Animal diseases can threaten the health of Canadians and can lead to multi-million-dollar losses for the livestock industry. The CFIA aims to prevent the introduction and spread of animal diseases in Canada and to monitor, control, or eradicate these diseases.

Among the many scientific activities that support Canada's animal resource base, the CFIA:

- conducts research to better understand diseases of concern to Canada
- develops surveys to detect known and emerging diseases
- performs research and provides advice on adopting state-of-the-art technology by Canadian labs

- assesses risks associated with key animal diseases for disease control and import/export purposes
- performs diagnostic tests to detect disease.

The Canadian Animal Health Surveillance Network

The Canadian Animal Health Surveillance Network (CAHSN) is a network of federal, provincial, and university animal health diagnostic laboratories that has significantly improved the national capacity to detect emerging animal disease threats in real time. The CAHSN focuses particularly on those animal disease threats that could have zoonotic potential (diseases that can be transmitted to humans from animals) and provides a rapid response to minimize human health and economic risks to Canada.

The network is centred around the National Centre for Foreign Animal Disease (NCFAD) in Winnipeg, Manitoba. It is linked to the Canadian Public Health Laboratory Network, which gives CAHSN the ability to combine surveillance data received from many sources and simultaneously alert both human and animal health authorities in Canada when potential animal disease threats are identified.

World Organisation for Animal Health (OIE)

A number of CFIA animal health laboratories have been designated as international reference laboratories by the World Organisation for Animal Health (OIE).

- Lethbridge for bovine spongiform encephalopathy, anthrax, and bovine viral diarrhea
- Ottawa (Fallowfield) for rabies, brucellosis, scrapie, and chronic wasting disease

- NCFAD in Winnipeg for avian influenza and classical swine fever
- Saskatoon for trichinellosis (this lab is also an OIE Collaborating Centre for Food-Borne Zoonotic Parasites).

A lab designated as a reference laboratory by the OIE functions as a centre of expertise and standardization for a particular disease or topic. Under this designation, the laboratory performs a variety of functions related to that disease or topic, including:

- developing new procedures for diagnosis and control
- providing scientific and technical training for scientific personnel from other OIE member countries
- coordinating scientific and technical research in collaboration with other labs
- providing diagnostic testing and surge capacity to other countries.

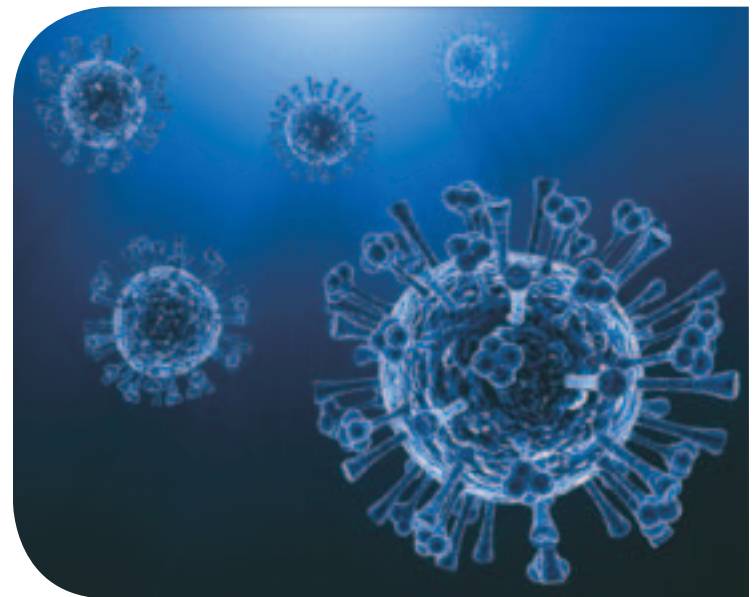
This recognition by the world's pre-eminent animal health organization highlights Canada's role as a leading contributor to international science in the management and eradication of animal diseases. It is a tribute to the expertise and commitment to excellence of the individuals working in these laboratories to protect animal health and maintain the safety of Canada's food continuum.

H1N1: Science excellence in a crisis management situation

When an influenza-like illness was reported in a swine herd in Alberta in April 2009, there was no test worldwide to confirm if pigs had the new pandemic H1N1 flu virus. In less than 48 hours a test method was completed. Within days of receiving samples, CFIA scientists at NCFAD confirmed the presence of pandemic H1N1 flu virus in the pigs.

In a few weeks, the new techniques were transferred to the CAHSN to increase the ability to detect H1N1 across the country. Working closely with colleagues from the Public Health Agency of Canada, CFIA scientists decoded the genetic makeup of the virus and provided this information to the international scientific community to facilitate and improve their diagnostic work and research.

Throughout the H1N1 pandemic, the CFIA continued to play a significant role in developing international policies and procedures for managing the virus in pigs. During this time, the CFIA engaged national and international scientific networks, shared research and test methods, and communicated research results in a timely manner.



When H1N1 was suspected in a swine herd in Alberta in 2009, the CFIA quickly confirmed the virus and transferred new detection techniques to provincial and university veterinary diagnostic laboratories across the country.

Innovative science and technology for plant protection

Canada's plant resource base includes forestry products, fruits and vegetables, grains and oilseeds, and ornamental plants. Ever-changing global trade patterns present new challenges because they create new paths with the potential to introduce unprecedented numbers of pests into the country. Regulatory programs and policies must be flexible, science-based, and responsive to this complex situation.

The CFIA performs a wide range of scientific activities that contribute to these decisions and actions. Activities include:

- risk assessments to determine whether pests, commodities, weeds, and new genetically modified crops could pose risks to Canada
- surveillance programs for foreign plants, pests, and diseases that could damage Canadian agriculture and forestry
- diagnostic testing to support import and export inspections and domestic control programs
- new tool development to detect plants and pests that threaten Canadian agriculture and forestry.

National Invasive Alien Species Strategy

The CFIA protects Canada from potentially harmful plants and plant pests by focusing on prevention through science-based regulation, surveillance, pest eradication, risk management, and public awareness. The CFIA provides leadership in implementing the national Invasive Alien Species Strategy as it relates to plant pests, such as the phytophagous (plant-eating) beetles from the Asia Pacific region. Eleven invasive alien species established in North America, for example, belong to the beetle genus *Agrilus*. One of these is the emerald ash borer (EAB), arguably the most infamous recent invasive species, responsible for unparalleled losses of ash trees.

The CFIA is involved in a capacity-building program to recognize the threat that these beetles pose to Canadian plant resources. This includes building knowledge on these organisms prior to their arrival in Canada, and sampling beetles in their native habitat.

Every year, CFIA surveillance biologists provide training for inspectors within the Agency as well as partners across the country to aid in the early detection of invasive alien species of interest to the CFIA. The training includes class and field sessions on pest biology and surveillance techniques for potential invasive species in each area.



Protection against phytophagous beetles

Entomologists at the CFIA's Ottawa (Fallowfield) Laboratory are conducting taxonomic research on phytophagous beetles in China, Eastern Russia, and some neighbouring countries. These beetles could pose a risk to Canadian plant resources if they enter Canada. The project involves fieldwork where insect samples are brought back to Ottawa for identification and preserved for morphological and DNA studies as voucher specimens.



This *Anoplophora chinensis* was found by CFIA entomologists conducting beetle taxonomic research in China. This pest has been brought to North America inside wood and wood packaging materials. The larvae of this pest burrow into susceptible trees, often causing premature death of young plants.

International scientists collaborate on pest risk analysis standards

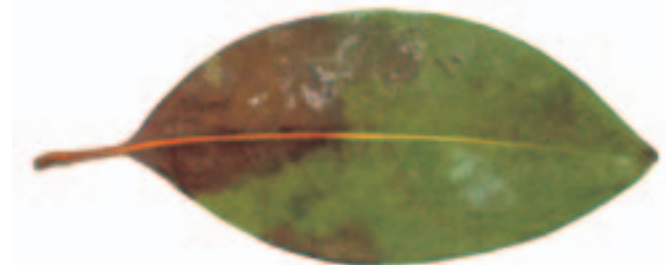
In 2010, the CFIA hosted a workshop to explore the concept of enhancing North American plant health risk analysis methodologies and tools. Collaborative efforts between Canadian and American scientists will build on a similar European project entitled Enhancements of Pest Risk Analysis Techniques (PRATIQUE), which is focussed on improving approaches to plant health risk analysis. By sharing information and exchanging ideas, scientists are able to improve the quality and efficiency of an important scientific element in the CFIA decision-making process.

Diagnostic tests to prevent sudden oak death

Phytophthora ramorum (*P. ramorum*) is a fungus-like plant pathogen that affects a wide variety of nursery plants, such as rhododendron and camellia. Sudden oak death is one disease caused by this pathogen, and now occurs as far north as southern Oregon.

The CFIA conducts annual surveys for *P. ramorum* and, in the past, has detected the presence of the organism on plants in a number of nurseries in the southern coastal area of British Columbia. Detection is difficult as the organism is microscopic and symptoms of *P. ramorum* resemble those of other plant diseases. As CFIA researchers recently discovered, the species also has three lineages with varying origins and levels of pathogenicity. The study, conducted in collaboration with researchers from Washington State University, the Canadian Forest Service, and the United States Agricultural Research Service, developed molecular tests to differentiate among the three lines.

The CFIA prepared a comprehensive assessment of the phytosanitary risks posed by *P. ramorum* to Canada. This Pest Risk Assessment includes information from hundreds of scientific papers and posters as well as expert opinions and unpublished results from over a dozen researchers from North America and Europe. The document was finalized following peer review by a panel of national and international experts and is now used by the CFIA as a basis for effective regulation of this pest.



Phytophthora ramorum is capable of infecting a wide variety of plant species, including rhododendron, which is an important host species for the dissemination of disease across borders.

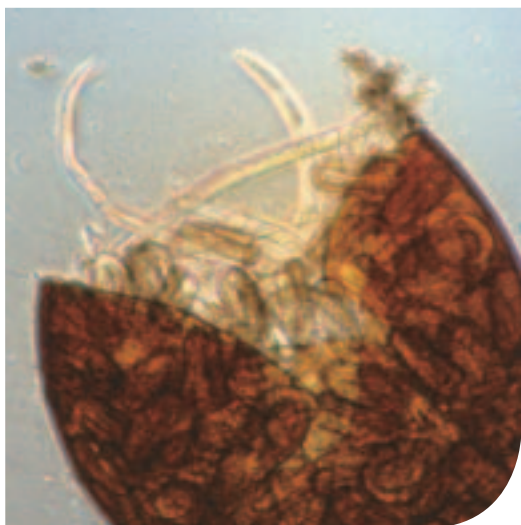
Determining World Distribution of Gypsy Moth Genotypes

In 2009, the Entomological Society of America (ESA) presented its Editors' Choice Awards for the best articles in 2008 from each of the ESA journals and from the *American Entomologist* publication. CFIA research scientist Marie-José Côté received this award for her work on a project led by Melody A. Keena of the United States Department of Agriculture Forest Service. Together with Phyllis S. Grinberg

and William E. Wallner, the group received the Editors' Choice Award for their article "World Distribution of Female Flight and Genetic Variation in *Lymantria dispar* (Lepidoptera: Lymantriidae)." The gypsy moth is considered a serious forest pest in North America. For the project, the group examined different strains of gypsy moths from Asia, Europe and North America to determine the flight propensity of each strain and their genotype.



Dr. Marie-José Côté, Ph.D.,
Ottawa Laboratory (Fallowfield)



CFIA moves quickly to determine potato cyst nematode distribution

Potato cyst nematodes (PCN) are internationally recognized as pests of concern because they can remain dormant in the soil for decades. When no measures are taken to suppress an infestation, they can reduce yields of potato and other host crops, such as tomatoes and eggplant, by up to 80 per cent. They do not pose a risk to human health.

The female PCN develops into a spherical cyst in the later stage of her life cycle. The female then dies and her cuticle forms a tough protective cyst containing 200-500 eggs. The eggs inside of cysts can remain dormant in soil for years. At left, a photo of a ruptured cyst of PCN with eggs and juveniles is shown.

When Canada confirmed the presence of PCN in Quebec in 2006, the CFIA immediately put measures in place to prevent the spread of the infestation and greatly increased soil sampling and testing capacity. Extensive PCN soil surveys have been conducted annually since 2006. Most recently, in 2010 the CFIA conducted an extensive PCN soil survey of the fields used to produce a seed potato crop. PCN was not detected in any of the soil samples. These extensive PCN surveys have been essential to quickly delimit any infestation, provide reassurance domestically and internationally that this pest is not widespread in Canada, and to maintain and regain market access for Canadian potatoes and other horticultural products.

Supporting Innovative Research, Development, and Partnerships

The CFIA welcomes opportunities to leverage its science capacity and capability through collaboration.

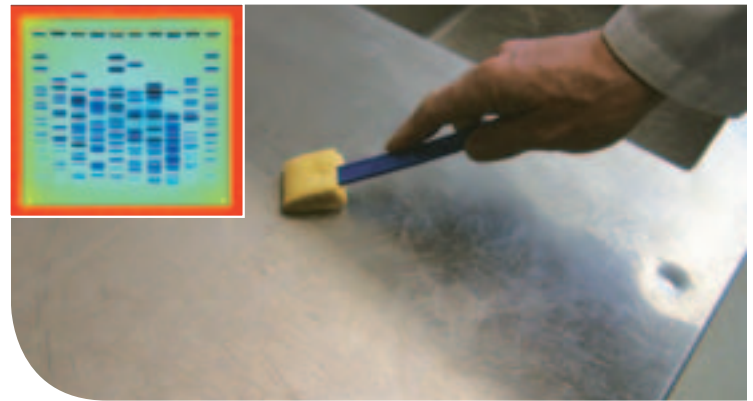
Best practices in food safety

Food safety science is complex, and CFIA scientists work to stay abreast of new technology, processes, and practices. Essential to this effort is developing strong national and international working relationships. These partnerships help to develop test methods, translate knowledge into useful applications, and develop regulations to protect Canadians.

Collaborative E. coli research will save lives

Infection with verotoxigenic *Escherichia coli* (VTEC), which includes *E. coli* O157:H7, can cause a range of reactions from uncomplicated diarrhea to severe haemorrhagic colitis and life-threatening haemolytic uremic syndrome. Beef products have been historically associated with VTEC outbreaks, although other commodities such as fresh produce have also been implicated.

CFIA researchers joined forces with Health Canada, the Public Health Agency of Canada, and Agriculture and Agri-Food Canada to address critical knowledge gaps related to VTEC and food production and to work together to develop solutions to detect VTEC across the whole supply chain, from the farmer to the consumer. Each department brings a unique expertise and perspective to developing a cohesive method to detect key VTEC strains in foods. Researchers hope that a similar model can be used for other emerging issues such as *Listeria* contamination.



As part of the CFIA environmental monitoring program, swabs are analyzed for the presence of *Salmonella* and *Listeria*. Bacterial isolates from positive samples are further characterized by molecular typing (inset).

Toward new allergen regulations

Several years ago, Health Canada and the CFIA recognized the need for a forum of open discussion among food labs involved in allergen testing, and jointly established the Allergen Methods Committee. This committee provides direction and coordination in the development, delivery, and advancement of allergen testing and research programs. It formalizes guidelines and performance criteria for allergen methods, and develops reference materials and standards to be used as a common ground for method evaluation and implementation in our laboratories.

The CFIA and Health Canada are working to prepare for revised *Allergen Regulations*. The CFIA is responsible for new analytical methodologies and has made significant progress validating a new method for allergen testing of soy proteins at its laboratories in Longueuil and Burnaby. The test kits will be used by the CFIA, as well as private sector labs or companies that have their own allergen control programs. The CFIA also recently developed a test kit for walnuts. These test kits, along with guidance documents such as the “Guide to Food Labelling and Advertising,” assist industry to comply with requirements.



Soy, just like nuts, may cause allergic reactions. It can be an undeclared ingredient in many processed foods, including canned tuna, beverage mixes, and baked goods. The CFIA has validated a new method to detect soy and walnuts in food.

The CFIA and laboratory accreditation

The CFIA has programs whereby other laboratories may conduct tests for the CFIA or other clients to meet regulatory requirements. We work in conjunction with recognized accrediting bodies such as the Standards Council of Canada (SCC) wherever possible to accredit technically competent external laboratories. The SCC assesses the laboratories, while the CFIA provides trained, qualified technical assessors. This arrangement covers more than 70 laboratories. The majority conduct food, feed, and fertilizer testing, but several labs are accredited for plant and animal health tests.

In some instances, the CFIA is involved in overseeing accreditation with the SCC. For example, through an arrangement with the Canadian Seed Institute, the CFIA's Saskatoon Laboratory accredits seed testing laboratories, while the Canadian Seed Institute conducts follow-up audits. In other instances, the CFIA provides an approval program for laboratories that carry out certain animal and plant health tests.

Supporting Higher Education Opportunities in Food Safety Research

In 2009, the CFIA partnered with McMaster University to support two post-graduate researchers — a Masters student studying the mechanism by which *Listeria monocytogenes* is able to form biofilms, and a PhD student working on the development of a diagnostic test to detect food-borne pathogens in a manufacturing environment. The partnership provides the CFIA with valuable knowledge on the production and possible control of biofilms, as well as more sensitive and rapid detection methods for pathogens such as *Listeria*.

Leveraging best science for animal health

CFIA scientists partner with universities, federal and provincial government departments, and private sector researchers to continually improve Canada's early warning system and diagnostic capability for animal and zoonotic diseases.

Bridging the gap between animal and human disease science

Recognizing the need to coordinate a joint response to animal and human health surveillance, issues, and possible threats, the CFIA and the Public Health Agency of Canada work together on multiple fronts. Researchers collaborate on a daily basis, whether to solicit or provide science advice or share laboratory testing capabilities. One important collaboration involves comparing the effectiveness of commercial conventional vaccines against the H5N1 influenza virus and the new pandemic H1N1.

The CFIA and the Public Health Agency of Canada have also established several joint working groups — risk assessment, surveillance and information sharing, and science and research — to propose and implement solutions toward greater collaboration on zoonotic diseases. Several positive advances in prevention and preparedness have already occurred as a result. These include an integrated risk assessment for pandemic H1N1 infection in people and swine, and a zoonotic alert module for use by the Canadian Network for Public Health Intelligence.

CFIA partnerships for public safety and security

The CFIA has been involved in several projects funded by the CRTI, (e.g., Canadian Animal Health Surveillance Network, Animal Health Foresight), which is one of the programs managed by Defence Research and Development Canada's Centre for Security Science. For example, in partnership with the Public Health Agency of Canada, the University of Calgary, the United States Department of Agriculture, and the United States Centers for Disease Control and Prevention, the CFIA is working to extend human and veterinary diagnostic capability of Rift Valley fever in North America.

The CFIA is also working with the United Kingdom and industry on an automated portable integrated instrument for the diagnosis of bovine and avian diseases that may have serious consequences.

Canadian Regulatory Veterinary Epidemiology Network

The CFIA and Atlantic Veterinary College are collaborating to enhance animal health expertise in regulatory veterinary epidemiology in Canada. The new Canadian Regulatory Veterinary Epidemiology Network (CRVE-Net) links Canada's five veterinary schools with federal and provincial agencies.

This initiative supports epidemiological surveillance, risk analysis, and disease modeling. The partnership is attracting further investors such as the Ontario Ministry of Agriculture, Food and Rural Affairs, and the Public Health Agency of Canada, as well as providing excellent training opportunities for veterinarians and students. This network further strengthens Canada's ability to understand and respond to emerging animal health and zoonotic disease challenges.

The CFIA assists Colombian veterinary laboratory in avian disease surveillance

The CFIA's National Centre for Foreign Animal Disease is working with the National Veterinary Diagnostic Laboratory in Bogota, Colombia, to



With funding from the Defence Research and Development Canada's Centre for Security Science, the CFIA and several project partners have been investigating the most effective methods to safely contain and dispose of animal carcasses.

implement laboratory diagnostic methods for the surveillance, identification, and characterization of avian influenza and Newcastle disease viruses. Workshops and hands-on training, including diagnostic test methods, test result evaluation, trouble-shooting, and quality assurance, will form the basis of the three-year twinning project.

Foreign animal disease recognition training

Each year, the National Centre for Foreign Animal Disease hosts a foreign animal disease recognition course to assist front-line veterinarians who may be faced with making critical decisions at the site of a potential foreign animal disease outbreak. Participants attend presentations from Canadian and internationally-recognized experts and participate in clinical rounds and diagnostic training.



Canada's ability to respond to and mitigate an animal disease outbreak depends on the CFIA working with practicing veterinarians, provincial and university diagnostic laboratories, and other federal government departments.

Collaborative projects in plant health

The CFIA works with several partners in universities, colleges and governments, in Canada and abroad, on plant protection initiatives and to provide leadership for implementation of the national Invasive Alien Species strategy to manage non-native plants and plant pests.

New survey detection tools for Asian gypsy moths

The Asian gypsy moth (*Lymantria dispar*), pink gypsy moth (*L. mathura*), and nun moth (*L. monacha*) are destructive forest pests native to Asia that can hitchhike on international vessels and marine transport containers. Methods to effectively detect these foreign pests are crucial for prevention and eradication. The CFIA provided funding to scientists at Simon Fraser University to conduct studies examining the semiochemical ecology of the moths, as well as their physiological attraction to port lights. They also improved synthetic pathways for production of *L. mathura* pheromone and provided the CFIA with enough chemicals to implement more effective pheromone-based trapping surveys. This work will help in multi lateral efforts to design better port monitoring systems in Asia, and to decrease the likelihood of these moths laying their eggs on vessels and containers.

Sirex woodwasp surveys in Ontario and Quebec

The CFIA teamed up with the Ontario Ministry of Natural Resources and the Ministère des Ressources naturelles et de la Faune du Québec to conduct extensive detection surveys for Sirex woodwasp (*Sirex noctilio*). The surveys were based on technical recommendations of scientists in the Canadian Forest Service and allowed the CFIA to tap into the wealth of forest health field expertise in the provincial ministries of natural resources. These ongoing surveys help gather valuable distribution information and support regulatory policy development.

The Sirex woodwasp caused extensive damage to pine plantations after its introduction into the southern hemisphere. Native to Eurasia, this species was detected in the northeastern United States in 2004.

Investigating Canadian beetle trapping techniques

The CFIA has conducted national surveys for the European spruce bark beetle (*Ips typographus*) — one of the most destructive spruce pests in Europe — and other exotic forest pests since 1998. The CFIA and Slovakia's National Forest Centre collaborated on field trials to evaluate the attractiveness of Canadian trapping systems to the bark beetles in their native European environment. Since the pest does not exist in North America, any tests determining effective trapping techniques must be conducted offshore. Data from this trial will assist in refining Canadian survey protocols and increase the likelihood of detecting *I. typographus* and other regulated forest pests.

Emerald ash borer biosurveillance

The emerald ash borer (EAB) is a very difficult pest to detect because infestations usually begin in the upper tree canopy. Traditional EAB detection methods, including ground or visual surveys and sticky traps, are costly, labour-intensive, and at times destructive or impractical.

The CFIA and the Province of Ontario supported a series of studies to determine whether a solitary wasp species that preys on buprestid beetles, called *Cerceris fumipennis*, could be used to detect the presence of EAB. Results from the studies, undertaken in collaboration with the University of Guelph, the United States Department of Agriculture, and the United States Forest Service, revealed that natural colonies of the wasp can detect EAB, and that mobile wasp colonies are more sensitive than current detection tools. The research culminated in the publication of a *C. fumipennis* guidebook for use by provincial governments, municipalities, and other organizations interested in adopting this methodology. Studies are ongoing to optimize the technique and evaluate operational feasibility as a tool for detection surveys.



Photo: Natural Resources Canada



Specially designed traps are used to detect the emerald ash borer.

Communicating Our Science

Publications

Some of the CFIA's scientific accomplishments have recently been published in books, journals and websites. A sampling of these publications include

Analytica Chimica Acta

Analytical Biochemistry

Biocontrol Science and Technology

Canadian Journal of Veterinary Research

Canadian Veterinary Journal

Canadian Journal of Plant Pathology

Compendium of Analytical Methods

Journal of Agricultural and Food Chemistry

Journal of Food Protection

Journal of General Virology

Journal of Immunoassay and Immunochemistry

Journal of Liquid Chromatography and Related Technologies

Journal of Veterinary Pharmacology and Therapeutics

Journal of Virology

Journal of Wildlife Diseases

Plant Disease

Scientific and Technical Review (OIE)

The Canadian Entomologist

Vaccine

Veterinary Parasitology



Recent CFIA Publications: Working with key collaborators at the University of Guelph, the CFIA issued a brochure to assist in early identification of emerald ash borer. The CFIA also produced a guide titled "Identifying Land Snails and Slugs in Canada." This publication, produced with the collaborative efforts of Bishop's Mills Natural History Centre, is a thorough review that includes information on collection and identification. It also catalogues these groups in Canada.

Adjunct professorship

One of the ways that CFIA scientists communicate science to academia is through adjunct professorship in universities across Canada. This allows reciprocal movement of information and talent between academia and the CFIA to meet our current and future needs. Tasks may include supervision of students and collaboration on graduate student programs and projects.

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