OMAFRA–University of Guelph Partnership

Research magazine

2011-2012 Agri-Food Yearbook Edition

A better bottom line

Prof. Istvan Rajcan is developing higher-oil soybeans to benefit producers and consumers. See page 11

Ontario

University of Guelph

Changing Lives Improving Life

Investments yield benefits for our food, health and environment

Imagine tomato plants that can defend themselves against disease, tea that relieves the pain of arthritis sufferers, a smart-phone application that helps protect soybeans from aphid infestations, or an entire Ontario city covered in green roofs. These innovations and many more are possible as a result of the collaboration between the Ministry of Agriculture, Food and Rural Affairs and the University of Guelph.

This partnership continues to be a key part of our agri-food industry's path to progress. It is an excellent example of investments that yield high returns, for the industry, the economy, and the people of Ontario. It speaks to our growing presence in the world as leaders in innovation. It also demonstrates the power of co-operative effort.

Good quality food is a basic human need. Ontario has more than half of the highest quality agricultural land in Canada. From that land comes nutritious food, warm clothing and increasingly, medicines, manufactured products and fuels. All contribute to making our life easier and healthier.

The land is also a major economic driver, supporting communities, businesses and jobs across the province.

I invite to you read on, and see for yourself the exciting advances that we are making together.

Kindest regards,

Hon. Ted McMeekin
Minister of Agriculture, Food and Rural Affairs

A commitment to the best in agricultural education and research

I am pleased to share with you the 2011 Agri-Food Yearbook. This publication describes a novel and prosperous partnership between the University of Guelph and the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) that makes Ontario a leader in agricultural innovation.

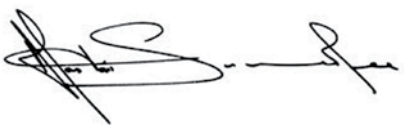
Agri-food is Ontario's largest industry, worth $33 billion to the province's economy and employing more than 700,000 people. The sector is evolving and facing new challenges.

Through our decades-long partnership with OMAFRA, the University of Guelph stands as a natural leader in meeting those challenges.

By supporting the OMAFRA-U of G Partnership, the provincial government invests directly in research that improves the health, well-being and prosperity of people in Ontario, Canada and beyond.

In turn, this partnership benefits the province by returning more than $1.15 billion to the Ontario economy every year. The agreement's numerous other benefits include research breakthroughs, safer food, better disease monitoring and prevention, and new products and technology. No wonder that many view the OMAFRA-U of G Partnership as a model for creative and effective government-university relations.

To learn more about how this partnership supports Ontario's agri-food industry and provides social, economic, environmental and health benefits for Ontarians, please read on.



Alastair J. Summerlee
President and Vice-Chancellor
University of Guelph

PHOTO: GRANT MARTIN

Research magazine

uoguelph.ca/research
2011-2012 Agri-Food Yearbook Edition
Focus: OMAFRA–U of G Partnership

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Highlighting the partnership for research, laboratory and veterinary programs between the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) and the University of Guelph

Ontario

UNIVERSITY of GUELPH
Changing Lives Improving Life

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OMAFRA–U of G Partnership

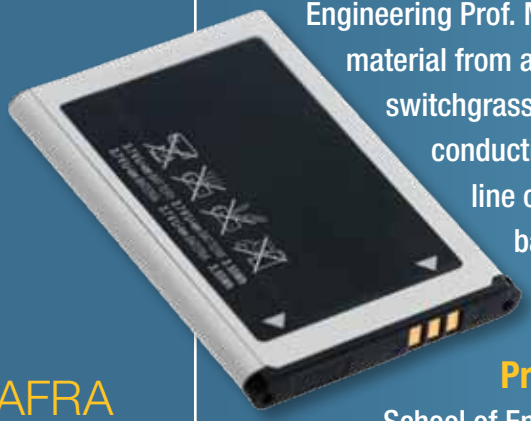
Research for

The OMAFRA – U of G Partnership funds research for strong rural communities, safe food and a prosperous, sustainable agri-food sector in Ontario.

The Ontario Research Advisory Network, comprising agri-food and rural stakeholders, helps address these objectives by providing recommendations to OMAFRA for research priorities. Thanks to this input and the U of G's unique agri-food research capacity, the partnership generates real results – like those highlighted here.

Environmental Sustainability: Geography Prof. Wanhong Yang is applying GIS technology – a geographical computer modelling program – to find out how water-based environmental practices affect farm businesses' bottom line. Using GIS technology could help both producers and policy-makers forecast where funding would most effectively increase environmental benefits and reduce costs.

Bioeconomy: Demand for renewable energy sources are taking on a whole new significance with the increased use of portable electronic devices such as cellphones, MP3 players and notebooks. Plant Agriculture and School of Engineering Prof. Manju Misra is transforming material from agricultural biomass, such as switchgrass and lignin, into electricity-conducting components in a new line of environmentally friendly batteries.



Product Development: School of Environmental Sciences Prof. J. Christopher Hall has developed genetically modified tobacco plants that efficiently express an antibody that is biosimilar to the breast cancer drug Herceptin. Hall hopes his plant-based manufacturing platform will prove to be an inexpensive source of therapeutic pharmaceuticals to help fight cancer and other critical illnesses.

real results

Food for Health: Cows can be fed selenium, a mineral high in anti-cancer properties, to combat diseases such as mastitis. Now, Animal and Poultry Science Prof. John Cant is incorporating selenium into milk protein to create high-selenium products for humans. He and his team are studying whether high-selenium products consumed as part of a regular diet can reduce the risk of breast tumours and insulin resistance.

Emergency Management: Modern greenhouses create the perfect conditions for many plant varieties – and a whole host of harmful pests and pathogens. Prof. Robert Hanner from the Biodiversity Institute of Ontario is modifying the Barcode of Life Data Systems (BOLD) database so that it can be used as a bio-surveillance tool for the Ontario greenhouse industry. Producers will be able to identify and manage pest threats using the BOLD database, which will provide timely pest information, forecasts and analysis.

Agriculture and Rural Policy: A new software tool that will help poultry farmers assess green energy alternatives is being created by Prof. Bill van Heyst, School of Engineering. The software will help farmers understand their specific on-farm energy needs, determine targets for conservation, and learn about the most economical, reliable and available green technologies.

Animal Production Systems: Animal and Poultry Science Prof. Steve Leeson is looking into several dietary and environmental strategies that could help improve bird and worker health – and reduce ammonia output in chicken houses. He's investigating whether dietary changes, such as manipulating protein and amino acid content, or the use of ammonia-sequestering agents and absorption technologies, will provide producers with practical, economical ways to limit ammonia emissions.

Plant Production Systems: Soon, tomato plants may be able to fend for themselves – without the help of pesticides to control fungal diseases. Plant Agriculture Prof. Paul Goodwin is using micro-organisms that he calls "defence activators" as a way of spurring the plant's natural defence mechanisms into action. From here, he hopes to develop new, natural disease-control regimens to maintain the health of the plants.

Contributors

The University of Guelph *Research* magazine is written and co-ordinated by students involved in the university's Students Promoting Awareness of Research Knowledge (SPARK) program.

Yearbook co-ordinator **Joey Sabljic**, a fourth-year English student from Guelph, Ont., may be inheriting his father's battered, gas-guzzling car. So he was thrilled to get the inside scoop about efforts under way to breed soybean varieties with higher oil content that could be used to produce biodiesel as a renewable fuel source. Read this story on page 11.

Born and raised on a dairy farm near Enniskillen, Ont., third-year marketing management student and SPARK photographer/ videographer **Bruce Sargent** knows that any business depends on competitiveness and profitability. He writes about competition between Ontario's pork producers and their American counterparts, on page 18.

Thousands of Canadians suffer from inflammatory bowel disease (IBD), a chronic disease that affects the digestive system. **Carol Moore**, a recent animal science graduate from Sussex, N.B., writes about how Guelph researchers are using a simulated human intestinal tract device to better understand IBD. Read about this innovative research on page 12.

Fourth-year international development student **Samantha Beattie** of Hamilton, Ont. believed lush, green vegetation only existed in rural areas. But that's changed now that she's found out how Guelph researchers are helping bring urban green roof technology to southern Ontario. See her article on page 8 to learn more about this environmentally friendly trend.

Drinking tea could sooth osteoarthritis sufferers' pain. That's what **Laura Stratton**, a master's student in human health and nutritional sciences, found out. Stratton, from Milton, Ont., explains how specially bred, locally grown mint tea can function as an alternative to pharmaceuticals. Read more about mint tea and osteoarthritis on page 23.

Bachelor of Arts student **Johnny Roberts** of Chatham, Ont. has always been interested in research showcasing Canada's multiculturalism. So when the opportunity arose to write about the new Ethno-Cultural Vegetables Ontario project at U of G, he got to cover two of the things he loves most – culture and food. Read more about ethno-cultural vegetables on page 26.

Coming from a long line of dairy farmers just outside Guelph, Ont., fourth-year biomedical sciences student **Natalie Osborne** knows that disease surveillance is no easy task. She writes about how Guelph researchers are helping develop an efficient and low-cost surveillance system on page 21.

Emily Padhi, a human health and nutritional sciences master's student from Mississauga, Ont., writes about a study examining how healthy and natural bioactive compounds in whole foods, such as asparagus, can impact gut health, and help ease the symptoms of inflammatory bowel disease. Check out Emily's story on page 25.

Psychology and neuroscience doctoral candidate **Katharine Tuerke** of Oshawa, Ont. writes that Guelph is leading a multi-institutional research team investigating the western bean cutworm's biology and behavior in order to develop management strategies against this corn-destroying pest. Read about these efforts on page 14.

Meaford, Ont.'s **Joshua Gauci**, a human health and nutrition master's student, got an inside look at an innovative study that could help reduce the risk of heart disease by understanding how different ethnic groups' genes affect the way they metabolize fats. Read more about this ethnic gene connection on page 22.

SPARK

www.uoguelph.ca/research/spark

Illuminating the secrets of effective nitrogen management

BY NATALIE OSBORNE

A new tool based on firefly and jellyfish DNA could help make agricultural practices around the world more economically and environmentally sustainable.

University of Guelph researchers have engineered a special strain of bacteria that glows in response to soil nitrogen, a critical element in plant growth. This accurate and inexpensive soil test could minimize harmful chemical runoff into the environment and help revolutionize agriculture in developing nations.

Plant Agriculture Prof. Manish Raizada and graduate student Michael Tessaro inserted the fluorescent genes found in fireflies and deep water jellyfish into bacteria that respond to nitrogen in their environment.

The bacteria are added to soil samples in the lab. The amount of light given off by the bacteria is then measured to quantify the soil's nitrogen content.

Here's one of the best parts: the test can be performed for $1 per sample, a fraction of the cost of existing soil tests. Raizada says this could help farmers at home and abroad.

"In developing countries, most farmers have no access to nitrogen testing. If it costs a farmer in Ghana $20 for a single soil sample, and if a poor farmer produces the equivalent of $1 a day, you can imagine even a single soil sample is essentially out of range," he says. "So, we have hundreds of millions of dollars going into agricultural aid programs in developing countries, but what we're missing are cheap soil tests to accompany those programs."

A centralized lab could be set up where farmers would send their soil samples for testing. Expert technicians are not required, and most of the test's materials are reusable, making the test ideal for areas of developing agriculture where poor soil quality is a huge concern. The test could help farmers find natural sources of fixed nitrogen, as well as assess the effectiveness of remediation strategies or indigenous agricultural practices.

Raizada says strains could be developed to test for many other agriculturally significant compounds, including phosphate, potassium and iron, as well as micronutrients that farmers don't currently test for. He's currently developing biosensor bacteria for glutamine and ammonium in addition to nitrogen.

The biosensor bacteria may be more accurate than conventional soil tests because they only detect the nitrogen forms that could be used by a living organism, known as "bioavailable" nitrogen, and not the unusable forms bound up in soil particles. This attribute provides a better indicator of how living plants will do in the field.

More accurate nitrogen tests could lead to better nitrogen management practices. For example, they could prevent the over-application of fertilizer, which can pollute groundwater and contribute to greenhouse gases.

"We know that in the century ahead we need to focus more on ecologically sustainable farming," says Raizada. "These technologies are designed to make more efficient use of fertilizers, and hopefully also to develop more ecologically friendly alternatives."

This research was funded by the OMAFRA-U of G Partnership. Additional funding was provided by the Canada Foundation for Innovation and the Ontario Research Fund. R

Prof. Manish Raizada developed an inexpensive, environmentally friendly test that uses fluorescent genes found in fireflies and deep water jellyfish to detect soil nitrogen content.

PHOTO OF JELLYFISH: COURTESY OF MANISH RAIZADA | PHOTO OF MANISH RAIZADA: BRUCE SARGENT

Developing green roof technologies for Canadian climates

BY SAMANTHA BEATTIE

Looking out over the rooftops of Berlin, you see an unusually verdant green blended among the black, brown and grey shingles. That's because rooftops sporting ornamental and vegetable gardens have taken hold and proliferated in this vibrant city. Up to 30 per cent of Berlin roofs are green, a trend that's seen in other great cities such as London, New York City and Tokyo. They're being adopted as an environmentally friendly innovation that provides storm water management, aesthetics and warmth.

Now, University of Guelph researchers are helping Canadian cities adopt green roofs by making them suitable for a northern climate. Guelph's green roof research is headed by Environmental Sciences Profs. Youbin Zheng and Mike Dixon. Their goal is to improve upon existing green roof technology and provide Canadian-adapted technologies to green roof companies.

"What is missing in the Canadian green roof industry is the horticulture knowledge and technology for northern climates that will make our green roofs successful," says Zheng.

In May 2009, when Toronto became the first North American city to pass a bylaw that requires green roofs to be built on new developments, the industry boomed. And, Zheng says, while most green roofs currently exist on commercial buildings, there is potential for more residential applications.

Zheng emphasizes that designing and growing green roofs is a complex process for a host of reasons. For one, the artificial soil, called substrate, cannot be too thick or it may exceed the roof's maximum loading capacity. But at the same time, the substrate's thin layer must be able to hold water and provide nourishment to the plants.

And while similar green roof models can be adopted from Europe, many Canadian conditions are unique. For example, the plants used for Canadian green roofs must be able to withstand the freezing winter climate, as well as the hot and dry summers.

The researchers are currently evaluating different plants – from sedum to perennial flowers to juniper – to find the most stress-resistant species that can withstand little shelter and more extreme weather conditions than on the ground.

These plants must also be low-maintenance in order to save energy, labour and water and fertilizer costs, as well as to strike a balance between productivity and energy conservation.

Zheng wants Guelph to be the go-to place for green roof research for both companies and students.

"We want all green roof companies to come here, learn from one another and get advice. And architects can come here to learn different types of green roof designs," says Zheng. "This will also be an opportunity for students to do related research and collaborate across all disciplines."

Also part of the green roof team is lab technician Katie Vinson, graduate student Greg Yuristy, horticulturalists Mary Jane Clark and Linping Wang, plant pathologist Dr. Lynn Tian and undergraduate students Siobhan Dunets and Thannushan Nimalendra.

This research is funded by the OMAFRA-U of G Partnership. Additional funding is provided by Carrot Common, Live Roof Ontario, Sedum Master, Landscape Ontario and Flowers Canada. R

Prof. Youbin Zheng (left) is working with research assistant Mary Jane Clark and several others to adapt and develop green roofs for Canadian climates.

(Opposite page) Green roofs such as this one on the University of Guelph's Science Complex are slowly appearing in urban areas across Ontario.

PHOTO: BRUCE SARGENT

PHOTO: COURTESY OF YOUBIN ZHENG

Prof. Peter Pauls is working to bring dissolvable bean plastic bags to kitchen cupboards everywhere.

How to make bean plastic

Beans have two major components, starch and protein. The bean plastic developed by Prof. Peter Pauls (see article, right) is formed only from protein, so the starch is removed through an extractive process. To remove the starch, a batch of beans is ground to form an extract, and the pH is adjusted so the protein dissolves and the starch granules form pellets. Again, the pH is adjusted to separate and remove the protein from the solution. Finally, the protein is freeze-dried to eliminate the excess water.

The protein is then mixed with glycerol (an edible plant-derived product that is incorporated into a range of foods) and dissolved in water. Finally, it's cast on a glass plate where a film, or plastic, is formed when the water evaporates.

Like other plastics, bean plastic can be heat molded into different shapes. Various bean varieties have different proteins, which can be used to create plastics that differ in colour, strength and flexibility.

Culls no more

Dissolvable bean plastic is better all around

BY SAMANTHA BEATTIE

A dissolvable package – not a can – is what Prof. Peter Pauls wants to find in his cupboard when he craves a bowl of steaming hot soup.

Pauls, chair of the Plant Agriculture department at the University of Guelph, is working on a "bean plastic" package that will instantly dissolve in boiling water and leave no trace of the container.

Pauls is creating the bean plastic out of dry kidney or white bean "culls" – beans that are split or broken from combining and cleaning processes.

"Right now, culls are a low-value material," says Pauls. "We want to do something with the protein from culls that would increase its value, especially because all farmers are looking for ways to diversify the market for their products."

The bean plastic is completely biodegradable and water-soluble. Furthermore, it's made from a renewable resource, which – in light of rising petroleum prices – could make bean plastic cheaper to produce than conventional, petroleum-based plastic.

The product would also be an attractive alternative for manufacturers because it's UV protective. Grocery stores face the problem of clear-packaged foods degrading under store lighting, and Pauls thinks bean plastic could prolong shelf life.

Pauls is in the preliminary stages of discussing the commercial potential for bean plastic with a manufacturer.

He is collaborating on this research with post-doctoral fellow Loo-Sar Chia. Other collaborators include Profs. Loong-Tak Lim and Duane Falk and graduate student Alex Jenson, along with participation from University of Waterloo chemical engineering Profs. Leonardo Simon, Ray Legge and Christine Moresoli.

This research is funded by the OMAFRA-U of G Partnership. Additional funding is provided by the Ministry of Economic Development and Innovation, Ontario Wheat Producers (now part of the Grain Farmers of Ontario) and MITACS. Seed funding has been provided by the Ontario White Bean Marketing Board and the Ontario Coloured Bean Growers. R

PHOTO: BRUCE SARGENT

Making progress towards high-oil soybeans

This specialized crop is being developed for better biodiesel

BY JOEY SABLJIC

In the search for greener, alternative fuels, soybeans are becoming Ontario's most available, renewable and cheapest source of oil for biodiesel production. The main drawback to soybeans for this purpose is that the oil content of most domestically grown varieties is only about 20 per cent, compared to other oils such as canola (44 per cent) or sunflower (50 to 55 per cent).

Plant Agriculture Prof. Istvan Rajcan is leading a research team at the University of Guelph that's breeding new soybean varieties that will have 23 to 24 per cent oil in the seed. He and his team have tracked down several soybean varieties known to have higher-than-average oil content, and have crossed these lines to create new varieties aimed at the 25-per-cent oil mark.

Their first results have been promising, with some newly developed breeding lines coming from crosses between Chinese and Canadian soybeans having more than 24 per cent oil in the seed.

Rajcan is confident that these higher-oil – and higher-value – soybeans will lead to more cost-effective biodiesel and edible oil production.

"We want to create a product that brings value to all parts of the industry," says Rajcan. "Everyone from biodiesel producers, crushers and farmers will benefit from a higher-value product."

Molecular markers are being developed by Rajcan and his team for selecting high-oil seeds before they're even planted. The markers act as detailed DNA profiles that Rajcan and PhD candidate Milad Eskandari create by analyzing several soy breeding lines for gene combinations that generate higher oil content.

Using higher-oil soybeans for creating biodiesel will make for a more cost-effective biodiesel production process, as the oil will be easier to extract and put to use. These soybeans could potentially displace other oil imports and be used to reach most of Ontario's biodiesel production target.

Rajcan says these soybeans will open up specialized markets for producers growing high-oil soybeans exclusively for food or fuel purposes – all while easing growing food-versus-fuel concerns within the soybean industry.

Soybeans with high-oil traits are being specially bred by Prof. Istvan Rajcan for more cost-effective biodiesel and edible oil products.

"There's enough room for everyone among soybean producers," says Rajcan. "High-oil soybeans can create a specialization in the market and even lead to the creation of further value-added products."

He hopes to have these new varieties ready for registration within the next two to three years.

Master's student Golsa Samii Saket was also involved in this study.

This research is funded by the OMAFRA-U of G Partnership. Additional funding is provided by the Grain Farmers of Ontario.

Biodiesel facilities, such as the BIOX plant in Hamilton, Ont., could make use of higher-oil soybeans.

PHOTO: TOP – BRUCE SARGENT | PHOTO: BOTTOM – BIOX CORPORATION

Prof. Emma Allen-Vercoe is looking at the connection between gut bacteria and inflammatory bowel disease.

Bacteria can't beat Roboguts

BY CAROL MOORE

One in every 160 Canadians suffers from inflammatory bowel disease (IBD), a chronic, debilitating condition that affects the digestive system and causes symptoms including inflammation, abdominal pain, cramping and fatigue. Canada has among the highest incidence of IBD in the world, costing the economy approximately $1.8 billion annually.

Now, a device called Roboguts has been developed by University of Guelph researchers to simulate intestinal tract conditions in people who suffer from IBD. The researchers' goal is to profile gut bacterial communities and better understand the relationship between gut bacteria and IBD.

The research team, led by Prof. Emma Allen-Vercoe, Molecular and Cellular Biology, is comparing distal (lower gut) bacterial profiles from healthy donors to those from patients suffering from IBD. She's using Roboguts to grow the bacterial communities found in fecal samples in an anaerobic environment, and then profiling the stability of these bacterial communities.

Allen-Vercoe has found patients suffering from IBD have reduced diversity in their colon bacteria. She reasons that a decline in bacterial diversity impairs a patient's ability to combat different types of stress, whether physical or mental.

"Healthy guts have a very diverse colon microflora population and that can absorb a lot of stress," says Allen-Vercoe. "But IBD patients have reduced diversity and can't absorb the stress, which leads to all sorts of health problems."

The researchers are using the Roboguts to monitor what happens when stress is added to the system, and then comparing the stress response in IBD and healthy patients.

Canada has among the highest incidence of IBD in the world, costing the economy approximately $1.8 billion annually

The specific stress response currently being examined is to norepinephrine, an acute stress hormone that affects the attention and responding actions in the brain and the flight-or-fight response. Norepinephrine is known to cause changes in gene regulation in some pathogens, such as *E. coli 0157:H7*.

So far, Allen-Vercoe has observed that the gut bacterial profiles from healthy people respond to norepinephrine, and she is currently testing whether the changes seen are greater in bacterial communities from patients with IBD compared to healthy people. She believes that the lack of diversity of gut bacteria in IBD patients would skew the gut microecology, and contribute to an imbalance within the gut that then predisposes an individual to a flare-up of their disease.

She wants to find out the mechanism behind the imbalance.

"We know that IBD is the smoking gun and stress is the trigger," says Allen-Vercoe. "Now, we need to figure out what the bullet is."

Once the mechanism is found behind the imbalance, Allen-Vercoe wants to be able to research how therapeutic treatment with a pre- or probiotic might help to restore the gut bacteria population to normal. She hopes this will prevent or reduce relapses in IBD patients, increasing their quality of life.

The research is applicable not only to IBD, but also to other diseases that are increasingly being connected to disturbances in the ecology of the gut microflora, including obesity, *Clostridium difficile*-associated disease, and regressive autism.

Collaborators on these research efforts include Dr. Sydney Finegold, University of California at Los Angeles; Dr. Derrick MacFabe, University of Western Ontario; Dr. Elaine Petrof, Queen's University; and Dr. Cezar Khursigara, University of Guelph.

This research is funded by the OMAFRA-U of G Partnership. Additional funding is provided by the Crohn's and Colitis Foundation of Canada, Canada Foundation for Innovation, the National Institutes of Health and the Ministry of Economic Development and Innovation.

PHOTO: MARTIN SCHWALBE

Identifying healthier herds

A reliable test to detect cattle with a superior immune response is on its way

BY JOEY SABLJIC

A University of Guelph research team has developed a safe, accurate way to help identify cows with the strongest, most disease-resistant immune systems — technology that could realize substantial herd health savings plus other benefits.

Prof. Bonnie Mallard, an immunogeneticist in the university's Department of Pathobiology, PhD candidate Lauraine Wagter-Lesperance and a team of researchers have developed and patented a test called High Immune Response (HIR).

"This is a sustainable, environmentally friendly technology," Mallard says. "Just as you would breed for milk production, you would breed for optimum immune response using the HIR technology."

The technology identifies cattle as high, average or low immune responders. High responders have more balanced immune responses capable of defending against the large number of diverse pathogens that infect dairy cattle.

Identifying these animals for a breeding program could lower disease occurrence, greatly reducing veterinary treatment costs (mastitis treatment, for example, can cost $100 per infection plus lost production). It could also increase a herd's response to vaccinations.

HIR testing and analysis need to be done only once at any stage of an animal's life from two months of age onward. The procedure is done during three short on-farm visits over a 15-day period.

Graduate students Shannon Cartwright (left) and Rebecca Opsteen (right) collect samples from a dairy herd for HIR testing.

First, the animal is immunized with a patented test antigen system, similar to a vaccine, to spur its immune system into action. Next, blood or milk samples are taken and analysed to determine the speed and strength of its immune responses to the test antigens.

Researchers then rank each animal according to its ability to pass along its valuable immune genes based on estimated breeding values for immune responsiveness.

The results will enable producers to cull cattle with low-immune response profiles, to select an appropriate bull for breeding, based on the immune profiles of both sire and dam, and to tailor each animal's vaccinations and management according to its indicated immune response status.

As well, colostrum enriched with higher amounts of protective antibodies from HIR cows could supplement calves during their vulnerable first few days after birth.

HIR's benefits could also translate to the supermarket. Consumers could enjoy milk products from healthier animals that require far fewer antibiotics and disease treatments over their lifetimes.

"HIR is about animal health," says Mallard. "But it also has a lot of benefit further on down the line, as it relates to milk and dairy products. It's a total farm-to-fork idea."

Mallard and her team are now looking to apply the HIR test system to sires in addition to cows, heifers and calves. Another crucial part of their work will involve forming partnerships to bring HIR into the wider dairy community.

Recent graduate students involved in this research are Shannon Cartwright, Kathleen Thompson Crispi, Jacqueline Gallienne, Brad Hine, Marlene Paibomesai, Claire Martin, Brendan Hussey, Rebecca Opsteen, Neda Emam, Mehdi Emam and Sophia Lim.

This research is funded by the OMAFRA-U of G Partnership. Additional funding is provided by the Natural Sciences and Engineering Research Council and the Canadian Dairy Network.

PHOTOS: BRUCE SARGENT

Cover your ears

Researchers are preparing for the arrival of the western bean cutworm

BY KATHARINE TUERKE

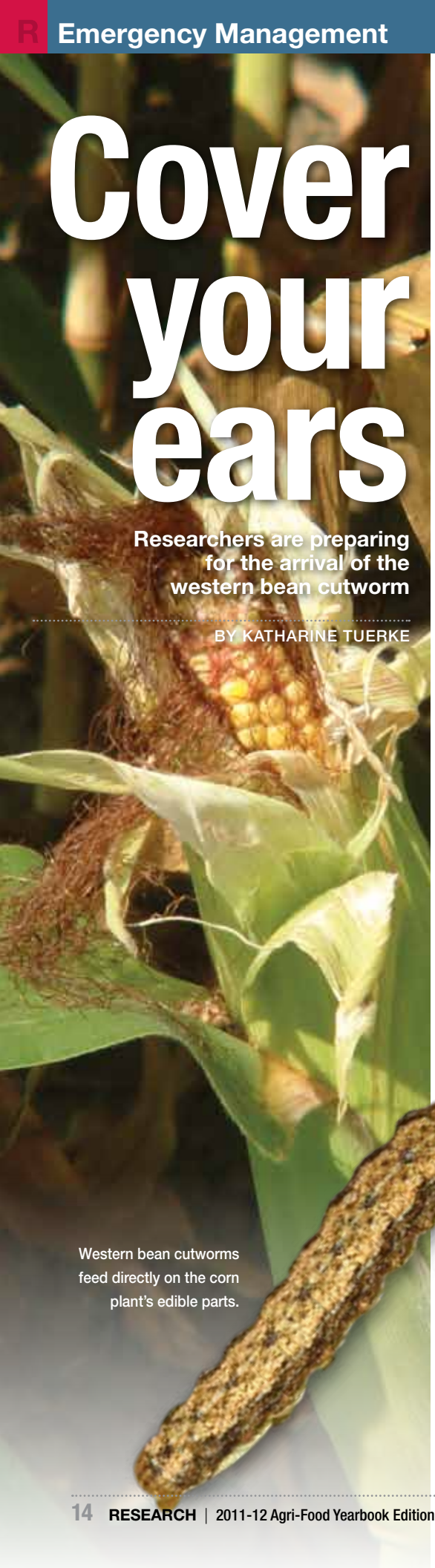
A new pest has arrived in Ontario. The destructive western bean cutworm (WBC) that has plagued the Great Plains and Corn Belt fields of the United States for decades is migrating into the Great Lakes region. Since making its Canadian debut in 2008, the pest has already appeared in Ontario and south-central Quebec and farmers are concerned.

Plant Agriculture Prof. Art Schaafsma, Director of the University of Guelph Ridgetown Campus, and his team are studying the biology of this invasive field crop pest to develop successful management practices for Ontario producers. Schaafsma's team includes Profs. Rebecca Hallett, Chris Gillard and Cheryl Trueman, research associate Jocelyn Smith (Grain Farmers of Ontario) and entomologist Tracey Baute of the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA).

The partnership between OMAFRA and the University of Guelph has helped to strengthen collaborations with other universities and institutions, bringing more crop pest specialists onto the project, such as Dr. Chris DiFonzo of Michigan State University and Dr. Jeremy McNeil of the University of Western Ontario.

"The team approach speeds up knowledge acquisition, interpretation, and transfer, allowing a quick reaction to an emerging problem," says Schaafsma.

Despite its name, WBC is also a corn pest. The cutworm's larvae feed directly on the fruit of the plant (corn ears and edible bean pods), reducing yield and quality as well as increasing crop exposure to secondary pests, such as molds. The WBC has one generation per year and overwinters as full-grown larvae (pupating in the spring).



Western bean cutworms feed directly on the corn plant's edible parts.

"WBC has the potential to be a significant pest for corn, dry beans, and possibly vegetable crops. This research will determine just how great the risk is under Ontario production conditions," says research associate Smith.

Before developing successful management strategies and practices, the researchers must investigate the biology and behavior of the newly arrived pest in a northern climate. They are now identifying the distribution and overwintering success of the WBC as well as determining its ideal growing conditions and preferred host plants. They're using weekly pheromone traps to determine the distribution of WBC across Ontario and southern Quebec. The traps are scented with the female pheromone and the number of male moths caught is counted. The traps are monitored from June to September and moth catches typically peak in mid-July.

Over the last few years the number of moths has significantly increased, suggesting that the pest has expanded further into the Great Lakes region. The most northern and eastern sites in North America to have captured WBC moths are Thornlea, Ont. and Montmagney, Que.

Field experiments were conducted to examine the overwintering success of the WBC larvae in different soil types. Larvae were collected from the field and inserted into silt loam, sandy clay loam and loam soils and the number of surviving larvae or moths were measured at different times throughout the winter and spring.

Researchers found that WBC successfully overwinters in some regions of Ontario. Upcoming studies will investigate the success of exposing overwintering larvae to different temperatures and amount of snow cover while they are in the soil.

Ontario's varied agricultural landscape often has vegetable and field crops growing in close proximity of each other. Schaafsma and his team are investigating the threat WBC will have on Ontario's vegetable crop production, in addition to its effect on corn, dry beans and common weeds.

The researchers' next step is to investigate the effectiveness of various foliar insecticides for corn and dry beans, as well as feeding damage of WBC on transgenic corn. After completing these studies, best management practices and grower recommendations can be developed to help Ontario's producers manage this new pest.

"Studying the biology of the WBC will help Ontario producers manage the pest in the short and long term as well as develop sustainable insect resistance management practices for transgenic corn," says Smith.

This research is funded by the OMAFRA-U of G Partnership. R

PHOTO OF CUTWORM: OMAFRA | PHOTO OF CORN: DAVE PELESCHAK

Better management practices control poultry pathogens

On-farm practices and biosecurity protocols affect infectious disease prevalence, says Prof. Michele Guerin.

BY JOHNNY ROBERTS

Researchers are looking into how to improve management practices on Ontario broiler farms.

Prof. Michele Guerin, Department of Population Medicine, is working with six poultry processing plants in Ontario (which together represent approximately 70 per cent of Ontario's broiler processing) and 240 chicken farmers to help them detect pathogens of poultry-health significance.

She believes that surveillance for viral and bacterial pathogens in commercial broiler chickens in Ontario is needed for the sector to gain a better understanding of baseline levels of pathogens in the province, what factors are associated with the presence of those pathogens, and how they impact chicken producers.

"I'm looking into how on-farm management practices and biosecurity protocols impact the prevalence of infectious diseases," she says. These are diseases that have an impact on illness, death, premature removal and processing plant rejections, which affect producers financially.

Guerin and her team are testing broiler flocks for nine viral pathogens: avian adeno-associated viruses, avian encephalomyelitis virus, chicken anemia virus, fowl adenovirus, infectious bursal disease virus, infectious bronchitis virus, infectious laryngotracheitis virus, Newcastle disease virus, and reovirus.

Flocks are also tested for bacterial pathogens, which include *Brachyspira* spp., *Clostridium spp*., and *Enterococcus cecorum*.

After samples are collected at the processing plant, Guerin goes to the farm where the flock was raised and interviews the farmer.

She asks questions regarding flock-specific management practices – for example, how the barn was cleaned and disinfected before the chicks arrived, how water lines were disinfected, what types of materials were used to construct the barn where the chickens were raised, and how pests were managed on the farm.

This is where Guerin investigates the association between management practices on the farm and organisms that were detected in that flock.

She and her research team are also looking at molecular aspects of several of the pathogens, to better understand if more than one strain is present in the population, and if some are more pathogenic than others. "If we find there are certain management practices that either increase or decrease the risk of a particular pathogen being present, we hope to be able to identify interventions that could have a highly beneficial outcome to individual farmers and the broiler chicken population in general," says Guerin.

Guerin is working with graduate students Michael Eregae, Hind Kasab-Bachi and Eric Nham.

This research is funded by the OMAFRA-U of G Partnership. Additional funding is provided by the Poultry Industry Council and the Animal Health Laboratory.

PHOTO OF CHICKENS: ISTOCK | PHOTO OF MICHELLE GUERIN: BRUCE SARGENT

Partners for Pro

Designer functional foods for a thriving agriculture and food sector

Anthocyanins are a type of polyphenol, antioxidants that give fruits such as blueberries, strawberries and sour cherries their vibrant colours. They're of great interest to researchers because they've been found to fight cancer.

But, no matter how much or how many of these antioxidant-rich foods people eat, less than one per cent of the active ingredient is absorbed into the blood plasma.

Plant Agriculture Prof. Gopi Paliyath, along with several other researchers, is looking to increase the body's uptake of these beneficial polyphenols.

He and his team are studying living colorectal cancer cells to see how they absorb and metabolize anthocyanins.

From several studies, they have found that absorbed polyphenols alter cancer cell structure and gene expression, destroying the cancer cell. Normal cells are not affected by such treatments.

Paliyath hopes that further understanding of the mode of absorption of polyphenols will lead to the creation of functionally enhanced foods that can help fight cancer.

Cherries are chock-full of cancer-fighting antioxidants called anthocyanins.

Bio-bins: renewable products from agricultural materials

Bio-composite storage bins – which can be used to hold anything from small parts in a garage workshop to stationery supplies on an office desk – arrived this year at Home Hardware stores across Ontario, and recently appeared in Canadian Tire outlets.

These devices, known as "bio-bins," have roots in the University of Guelph's Bioproducts Discovery and Development Centre, where Plant Agriculture Prof. Amar Mohanty and his research team have joined a novel partnership benefiting farmers, consumers and the environment, with support from the Ontario Ministry of Agriculture, Food and Rural Affairs and the Hannam Soybean Utilization Fund.

By making these products from post-consumer plastics and natural fibres such as switchgrass, miscanthus, soy hulls, oat hulls or wheat straw, Mohanty and his team hope to reduce the carbon footprint, lessen dependence on fossil fuels and open new markets for Ontario farmers and manufacturers.

Now, Mohanty and his partners at U of G and off campus, plan to explore other products and applications such as flowerpots, bird feeders and blue boxes for municipal recycling programs.

Prof. Amar Mohanty with a bio-bin made from post-consumer plastics and natural fibres.

PHOTO OF CHERRIES: MARTIN SCHWALBE | PHOTO: UNIVERSITY OF GUELPH COMMUNICATIONS AND PUBLIC AFFAIRS

An improved genetic test will help producers effectively breed for more tender beef.

Improving beef tenderness – it's in the genes

Improving beef tenderness to increase consumer satisfaction – an ongoing goal of Ontario's beef producers – is the focus of a University of Guelph study led by Animal and Poultry Science Prof. Steve Miller.

He and his research team have found a link between meat tenderness and an animal's genetic makeup.

Now, they want to improve genetic tests that help producers effectively breed for more tender beef by figuring out which specific single nucleotide polymorphisms (SNPs), or gene differences, influence quality traits such as tenderness.

By identifying all of the genetic components responsible for tenderness, Miller says a genetic test could be made more specialized and cost-effective.

He sees building herds strong in meat tenderness as an important step in ensuring a bright future for Canada's beef industry as well as in opening new export market opportunities for producers.

Miller hopes to continue researching genetic links to tenderness and aims to commercialize an improved test for producer use in the next few years.

Rural communities are embracing change

Ontario's rural communities are undergoing significant changes. Two forces – increasing energy prices and climate change – are fundamentally challenging traditional agricultural methods and the rural lifestyle.

To help communities deal with change, University of Guelph Prof. Wayne Caldwell has sent out 400 surveys across Ontario, asking rural communities what kind of adaptive innovations they have created. He will compile the innovative suggestions into a publicly available manual.

He's optimistic about the responses. Early results show that in many instances, innovations – such as farmers markets, the local food movement, community-supported agriculture and bicycle trails – are emerging.

Caldwell is now evaluating these innovations to make them applicable to as many rural areas, villages, towns and municipalities as possible.

Prof. Wayne Caldwell is documenting how rural communities have successfully responsed to change.

PHOTO OF BEEF: ISTOCK | PHOTO: BRUCE SARGENT

Ontario pork remains a market contender

Canadian meat packers re-evaluate business models

BY BRUCE SARGENT

Iowa has been a pork industry leader in North America for many years thanks to high production and low grain costs, but a Guelph researcher says its competitive edge may be declining and Ontario's pork industry could be close to competing and profiting on the same scale.

Ridgetown Campus Prof. Ken McEwan, Production Economics and Agribusiness, compared trends in the Ontario pork industry with those in Manitoba and Iowa, to determine which factors – such as feed costs, industry infrastructure (e.g., access to capital, research, etc.), and government policy – have the greatest effect on competitiveness and profitability. He found that while Iowa was traditionally a market leader, its hold has weakened recently in favour of Ontario and Manitoba.

"Iowa farmers are a very important benchmark because of their long history of raising pigs thanks to many advantages, but primarily low grain costs," says McEwan.

Iowa alone raises 25 per cent of all hogs in North America. With the advantage of having the lowest grain costs, close proximity to the five largest meat packers, and low building and other production costs, Iowa is a dominant market force.

But in the past five years, increasing land costs, caused by high prices for commodities such as corn, have made production in Iowa more expensive. Currently, the U.S. ethanol industry consumes close to 40 per cent of the U.S. corn crop and this has changed the local feed basis for many farmers.

Prof. Ken McEwan

Coupled with the global recession and the thriving Canadian dollar, competition between regions remains intense and profitability is constantly shifting. Only a few years ago, the Canadian dollar was valued at US$0.62. Now, it's at par, or higher. This means Canadian farmers and processors have had to overcome the adversity posed by a strong Canadian dollar by lowering costs and improving productivity to compete.

Compared to American packers running double shifts, Canadian plants with single operating shifts have been forced to re-evaluate their business models to survive. Currently, there is much interest in branding and moving away from the traditional high-volume commodity pork model.

When profitability is analyzed for different hog growth stages, McEwan says that many profit margin deficits between Ontario and other areas can be overcome. Specifically, efficiency and productivity modifications to farm and packing operations would increase Ontario's competitive edge in the market and bolster long-run sustainability in the industry.

"Competitiveness is an elusive target, and it can change over time due to many factors which all impact greatly on the relative comparison of these areas," says McEwan. This means while Iowa may have the lead, Manitoba and Ontario are not out of the race, with conditions always changing.

Collaborators for this project include research associates Randy Duffy and Lynn Marchand from Ridgetown Campus.

This research is funded by the OMAFRA-U of G Partnership. Additional funding is provided by Ontario Pork.

PHOTO OF PIGLETS: ISTOCK | PHOTO: MARTIN SCHWALBE

Pinpointing profitability in marketing

BY JOEY SABLJIC

Deciding how and when to market corn and soybean crops isn't easy for producers because so many variables exist – such as crop prices, yields and demand.

However, some common marketing strategies can be more profitable than others, according to research by Prof. Richard Vyn, an agricultural economist from the University of Guelph's Ridgetown Campus.

Vyn created a simulation model to compare the financial returns and risks associated with the most common marketing strategies used by Ontario corn and soybean producers.

Vyn says timing can be everything when selling a corn or soy crop. Market conditions can change without much warning, and producers need to determine their marketing response.

"Commodity prices fluctuate quite a bit, so you have to be careful assuming that what happened in the past will continue into the future," says Vyn. "But it is worthwhile to see what strategies have allowed producers to do the best over time."

Some of the most common marketing methods Vyn studied included pre-harvest strategies such as futures contracts, forward contracts and options. He also looked at basis contracts and a variety of cash sale strategies in the post-harvest period.

Vyn's simulation model works by generating an average price per bushel of either soy or corn for each marketing strategy and year, using historical pricing data from 1992 to 2009. Then he compares the prices received over time from each marketing strategy, while accounting for any associated costs, such as interest or storage costs.

These prices are then compared to the prices producers received by selling their entire crop at harvest through a cash sale, rather than during a pre-harvest time period.

So far, Vyn has found that for corn sales, pre-harvest futures or forward contracts tended to net producers the highest profits. However, for soybeans, strategies involving cash sales in the post-harvest period tended to generate higher prices for producers.

"The relative performance of strategies can vary based on pre-harvest market conditions," says Vyn. "When pre-harvest prices are high, there is a good chance that prices will drop going into harvest. Pre-harvest strategies tend to work best in these situations."

As for next steps, Vyn says that he wants to run his simulation again over a different or perhaps longer time period, to see what results the specific marketing strategies would yield.

This research is funded by the OMAFRA-U of G Partnership. Additional funding is provided by the Grain Farmers of Ontario.

Producers use several different types of contracts to sell their grain. Some of the most common methods are:

Cash sale — the producer is paid the most current price for his or her grain upon delivery without any prior arrangements or agreements. This is the most common type of contract.

Forward contract — the producer agrees to a fixed price for his or her grain during a future delivery period, regardless of whether prices rise or fall during that time.

Futures contract — the producer agree to supply a specific quantity and quality of grain for an agreed upon price at a specified future delivery date, with the ability to offset the contract at any time before this date.

Basis contract — the producer locks in the basis component of the price at delivery, and delays setting the futures component of the price until a later date within a specified time frame.

Option — an option gives the producer the right to buy or sell a particular futures contract at a certain price within a specified time frame, regardless of whether futures prices rise or fall during that time.

PHOTO: BRUCE SARGENT

Beetlemania

Researchers seek to predict and manage populations of bean leaf beetles in warmer climates

BY JOEY SABLJIC

Climate change might be the culprit behind bean leaf beetle migration into Ontario.

Hungry bean leaf beetles destroy soybean yields by feeding on pods and introducing damaging diseases. They have cut yields in half in the U.S. and now they're spreading throughout southern Ontario. The reason for their spread is still unclear, but a team of Guelph researchers suspect climate change is the culprit – warmer winters and higher temperatures may be dramatically affecting the beetles' ability to grow, spread and produce multiple generations each growing season.

Prof. Rebecca Hallett, School of Environmental Sciences, is working with graduate students Emily Robinson and Cara McCreary to determine if and how climate change and warmer temperatures are helping the bean leaf beetle thrive, and ways farmers can respond.

"Climate change has already reached the point where it's having effects," says Hallett. "Now, we're looking for ways that producers can make adjustments and adapt to these emerging threats."

First, Hallett and Robinson are studying how warmer temperatures will affect the bean leaf beetle's ability to reproduce, as well as its over-wintering survival. They're designing experiments to simulate warmer winter temperatures, so they can predict when bean leaf beetles will emerge during the year, along with their likely ability to survive and thrive in simulated warmer environments.

Warmer climates will result from higher CO_2 levels, so Hallett is also looking at how bean leaf beetles fare in CO_2-rich environments, which alter the nutritional content of soybean plants and reduce the amount of protein available for beetles to feed on. In some cases, insects have thrived on plants grown in such conditions but currently it's difficult to predict how CO_2-related changes will affect bean leaf beetle populations, Hallett says.

In related work, Hallett and McCreary are trying to determine how many bean leaf beetle generations are present throughout a growing season in southern Ontario.

So far, they know the pest critically damages soybean crops during two periods. First, over-wintered adults emerge, feed on alfalfa and move onto young soybean plants. Then, their larvae feed on the plant's roots before moving onto the pods, causing the most devastation to yields.

Last year McCreary found through field trials that Ontario bean leaf beetles produce only one generation. This season she will be working with the insects in tightly controlled environment growth chambers to further study their growth and development over a simulated warmer growing season, to see how developmental times are affected.

Hallett also hopes to develop an action threshold that will give producers a much clearer indication of when to apply insecticides (based upon the number of bean leaf beetles present) to prevent yield losses.

"The timing and use of pesticides is one of the most crucial decisions that a farmer must make," says Hallett. "It's important for them to know precisely when they're needed."

Also involved are Profs. Art Schaafsma, Department of Plant Agriculture at Ridgetown Campus, and Jonathan Newman, School of Environmental Sciences.

This research is funded by the OMAFRA-U of G Partnership. Additional funding is provided by the Grain Farmers of Ontario.

PHOTO OF BEETLE: CARA MCCREARY | PHOTO OF BEETLE ON LEAF: COURTESY OF OMAFRA

A new approach to beef tenderness and feed efficiency

BY OWEN ROBERTS

Consumers want tender meat, and given the ever-rising costs of beef feedlot production, farmers need to produce it as efficiently as possible. That means assembling and managing herds that are the best at using feed throughout their lives, particularly at the later stages of the all-important finishing phase, when they are typically the least efficient at turning feed into muscle.

To that end, University of Guelph Animal and Poultry Science Prof. Ira Mandell is leading an effort to use new technology to find feed-efficient cattle. Crossbred cattle are being used extensively for feedlot production now, and thanks to research, the industry is acquiring the technology to identify which cattle are the most efficient. Mandell wants to put that technology to work.

"Identifying efficient cattle is critical for lowering costs of production, lowering feed intake and waste production, and for increasing saleable meat yield and returns to producers," he says. "The ultimate goal of the project is to provide more information for feedlot producers using state-of-the art technology to ensure profitability while ensuring quality beef."

Feed efficiency (also known as feed conversion) is a well-established, desirable trait for selecting the cattle that enter feedlots. But as profit margins continue to get squeezed by jumps in feed and fuel costs, more effective and accurate selection tools are needed to further identify the top candidates for feedlot cattle.

That's where something called residual feed intake (RFI) comes in. RFI is the difference between an individual animal's actual feed intake and its anticipated or expected feed intake for maintaining body weight and gain over the feeding period.

Cattle that use low amounts of feed for a given amount of gain are classified as low RFI, and will grow at similar or faster rates than high RFI cattle that require more feed to achieve the same weight results.

Genomics may be used in the future to identify efficient calves by examining the DNA of particularly efficient animals, then grouping them into an RFI classification. Mandell says the most desirable animals are exceptional at converting feed to gain.

To find the most efficient animals, three cattle-feeding trials are being conducted with feedlot performance, carcass and meat quality traits in mind.

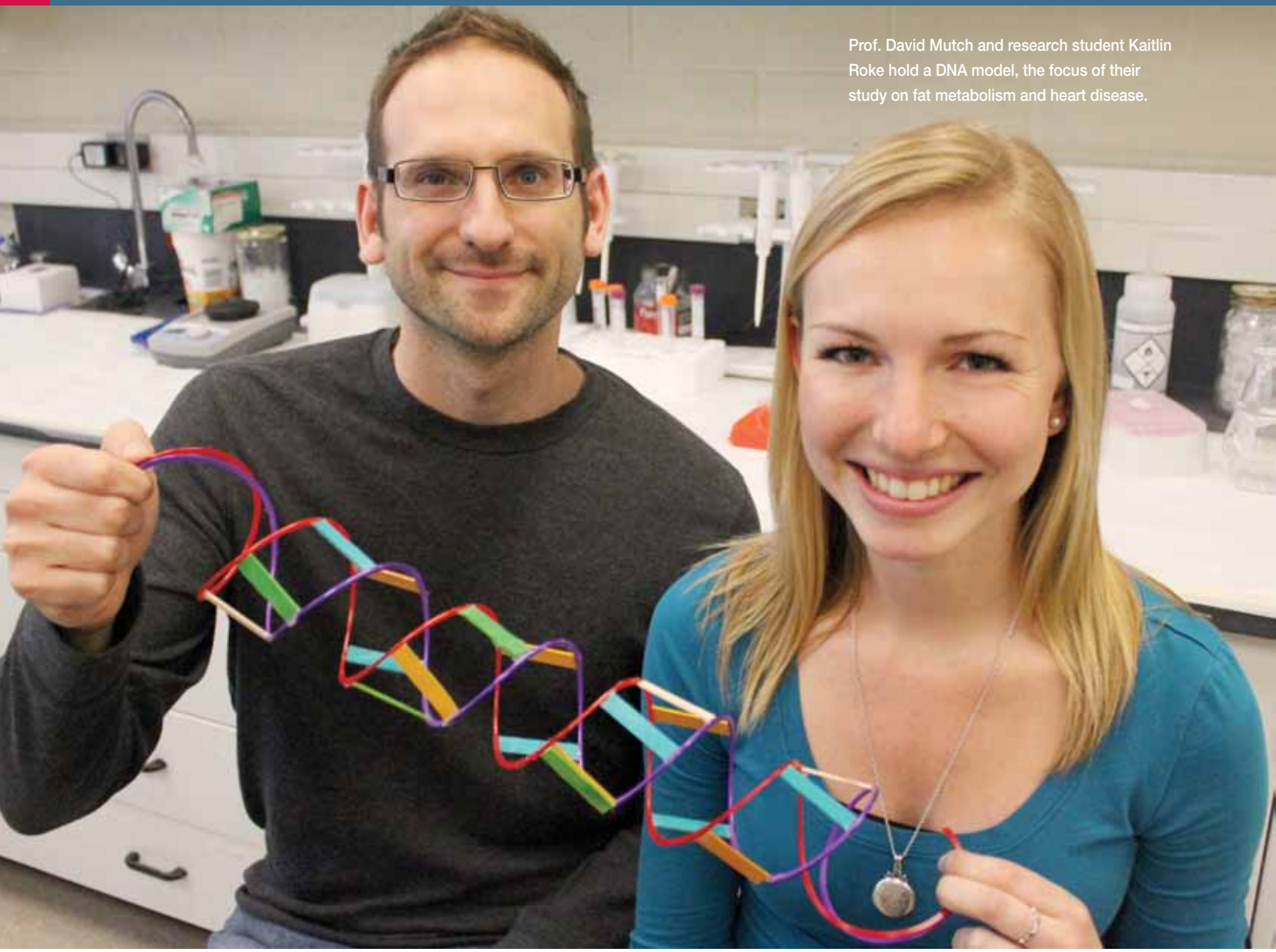
In the first trial, various management strategies using growth promoters are being examined to enhance growth, feed efficiency and muscling. Another trial will examine low-cost feed ingredients to replace corn, for lowering costs of production. Identifying more efficient cattle – that is, those requiring less feed per unit of gain – would improve profitability for feedlot producers. A final trial will incorporate results from the previous two.

Mandell hopes beef producers in Ontario and elsewhere, as well as consumers, will benefit from this research.

"These management strategies can have dramatic effects on gains, carcass and meat quality traits," he says. "As well, Canadian consumers will benefit because the study will help identify whether specific management practices contribute to beef tenderness. That could increase returns for producers and the Ontario beef industry, by increasing demand by domestic and export markets."

This research is funded by the OMAFRA-U of G Partnership. Additional funding is provided by the Ontario Cattlemen's Association.

PHOTO: ONTARIO AGRICULTURE PHOTO LIBRARY



Prof. David Mutch and research student Kaitlin Roke hold a DNA model, the focus of their study on fat metabolism and heart disease.

Food for your genes

Study examines connections between ethnicity and fat metabolism

BY JOSHUA GAUCI AND JOEY SABLJIC

Genetic differences between ethnic groups may influence how one's body is able to metabolize essential fatty acids, according to a new study published in *Molecular Genetics* and *Metabolism*.

These findings may help researchers better understand the differences in fat metabolism between ethnic groups that could have a role in altering an individual's risk for chronic health conditions such as cardiovascular disease.

Knowing that different ethnic groups process fats differently could eventually lead to a demand for farmers to grow and produce natural foods that are tailored to better suit specific ethnic groups based on their underlying genetic makeup.

Nutrigenomics Prof. David Mutch from the University of Guelph, working in collaboration with colleagues at the University of Toronto, collected DNA samples from young Asian and Caucasian adults to see whether there was a relationship between a gene that's involved in fat metabolism called fatty acid desaturase 1 (FADS1), and the amount of polyunsaturated fatty acids – such as omega-3 and omega-6 – within the blood plasma.

"We have found that genetic variation in FADS1 can affect lipid metabolism differently between ethnicities," says Mutch. "This begs the question: does the genetic control of lipid metabolism underlie some of the ethnic-specific risks for cardiovascular disease?"

But while genetics may play a role, Mutch says that diet could also be crucial in determining whether certain ethnic groups are more or less at risk for cardiovascular disease.

PHOTO: BRUCE SARGENT

Most typical Western diets have about a 10 to 1 ratio of omega-6 to omega-3 fatty acids. Omega-3 and omega-6 fatty acids are both metabolized by FADS1. But because of the higher levels of omega-6 fatty acids in the diet, more are metabolized in comparison to omega-3s. When omega-6s are metabolized, they form eicosanoids, a type of inflammatory molecule known to contribute to the development of cardiovascular disease.

Asian diets generally contain more heart-healthy omega-3 fatty acids from fish and soy products. While omega-3 fatty acids also form eicosanoids, they are far less inflammatory compared to eicosanoids formed from omega-6 fatty acids and may actually have anti-inflammatory effects.

Mutch says that this reinforces the importance of considering both genetics and dietary habits at the same time.

Understanding how genes like FADS1 and different diets interact is a crucial next step in understanding ethnic differences for the risk of developing cardiovascular disease.

"Typically, the impact of any one genetic variation on disease risk is small," says Mutch. "Anything that increases variability in risk factors above one per cent is huge, because heart disease risk is multi-factorial and is influenced by hundreds of genes, in addition to lifestyle and diet."

This research is funded by the OMAFRA-U of G Partnership. Additional funding is provided by the Advanced Foods and Materials Network, the Canada Foundation for Innovation and the Public Health Agency of Canada.

Osteoarthritis causes painful inflammation in joints such as the knee.

PHOTO: ISTOCK

Relief for osteoarthritis sufferers may be sips away

BY LAURA STRATTON

Tea, the world's most widely consumed prepared beverage, may gain a whole new set of fans if a new variety developed at the University of Guelph proves helpful in treating symptoms of osteoarthritis (OA) – a disease affecting one in 10 Canadians.

Although it looks, tastes and smells like conventional mint tea, this newly enhanced tea contains the leaves of spearmint plants specifically bred by Plant Agriculture Prof. Laima Kott to contain 15 to 20 times the amount of rosmarinic acid (RosA), an anti-inflammatory component beneficial to OA sufferers.

OA occurs when cartilage in the joints begins to break down, resulting in pain, stiffness, and inflammation. Prof. Amanda Wright, Department of Human Health and Nutritional Sciences (HHNS), says this enhanced tea could significantly improve quality of life, as well as decrease many direct and indirect economic burdens associated with OA, which range from surgical interventions to time off work.

Now, Wright and her research team are testing the tea's effectiveness in a series of human trials. Wright and HHNS researchers Prof. Alison Duncan and Hilary Tulk are measuring cartilage degradation, inflammation and physical function in participants with OA who will drink the tea two times a day for four months.

Wright, the Director of the university's Human Nutraceutical Research Unit, says the results could help open the door to an alternative, low-cost treatment option for OA sufferers.

"The tea provides hope in the area of complementary therapies, specifically for osteoarthritis," says Wright. "With no satisfactory treatment option available, the potential impact of a positive outcome is huge."

This research is funded by the OMAFRA-U of G Partnership.

Prof. David Wolyn is breeding asparagus with more rutin – a powerful antioxidant believed to reduce the symptoms of inflammatory bowel disease. His team is also improving the crop's winter hardiness.

Towards better health and plant hardiness

BY JOHNNY ROBERTS

Foods high in antioxidants such as rutin have become a major component of consumers' diets, because they contribute to good health. Guelph Millennium, an asparagus breed high in rutin, was developed from an ongoing breeding program at U of G.

This program is now looking at not only increasing rutin concentration, but also improving winter hardiness and developing new asparagus hybrids that are hardy for re-planting.

"This project is designed to develop traits that will help enhance asparagus cultivars," says Plant Agriculture Prof. David Wolyn, who led the team that developed Guelph Millennium.

Studies have shown that Guelph Millennium contains higher rutin levels than any other asparagus breed.

First, Wolyn and his team compared rutin levels of asparagus from five different farms in Ontario. Across a two-year study, the asparagus at each of the farms showed relatively similar high concentration levels of rutin.

The implication is that rutin would be high in most asparagus farms across southern Ontario, making it easily available to consumers. If the concentration varied significantly among farms then it would be difficult to provide consumers with a reliable product high in rutin, says Wolyn. Now, he's looking for specific parents that are high in rutin so the research team can breed improved hybrids.

At the same time, Rong Cao of Agriculture and Agri-Food Canada is

PHOTO: BRUCE SARGENT

investigating the best cooking method for asparagus in order to optimize the amount of rutin consumed. The team is experimenting with baking, boiling, steaming, microwaving and pan-frying asparagus.

The next trait the team is trying to improve is winter hardiness. They're studying how asparagus physiology changes during dormancy and how it adapts to survive during Canadian winters. They're looking for ways to identify those that should be selected for winter hardiness.

Finally, Wolyn is trying to improve asparagus re-plant resistance. Since asparagus is a perennial, once the crop is planted it's cultivated for more than a decade. So if root-borne diseases exist, they can carry over from year to year. Asparagus' roots also have the tendency to release compounds into the soil that negatively affect the plant's growth.

"Farmers may get 60 per cent of their yield on replant soil compared to if they planted the same variety on soil never having grown asparagus. It's important to realize that farmers can have difficulty going back on old asparagus land and one has to buy new virgin land or accept a yield penalty when replanting," says Wolyn.

In response to this, Wolyn and his research team are trying to develop new asparagus hybrids that are hardy for re-planting to try and reduce potential low yield problems for growers.

Research students involved are Jenna Drinkwater, Jae Joon Kim, Jennifer Lu and Arash Panjtandoust.

This research is funded by the OMAFRA-U of G Partnership. Additional funding is provided by the Asparagus Growers' Marketing Board and the Agricultural Adaptation Council.

Whole food may be a whole lot better

BY EMILY PADHI

Whole foods such as asparagus contain healthy, bioactive compounds that could help improve gut health.

PHOTO: ISTOCK

Asparagus contains a compound that is believed to help with symptoms of inflammatory bowel disease (IBD). But researchers say eating the food whole, rather than merely isolating the active compound, may prove more beneficial.

Research scientist Dr. Krista Power at the Guelph Food Research Centre (GFRC), Agriculture and Agri-Food Canada, is working with colleagues at the University of Guelph to study the effect of whole foods such as asparagus on gut health.

Power and her collaborators want to understand if eating asparagus in its complete form is better than taking a supplement containing the concentrated bioactive substance of interest, rutin. Bioactives are the individual components in a food that are said to be responsible for the food's particular health benefit.

"While it helps to know what exactly in our foods is making it so healthy, there is a growing trend to extract these beneficial compounds and take them in a concentrated form, such as a pill," says Power. But she thinks the effects of individual components within a food do not compare to the broad, wide-reaching benefits attained through eating foods whole.

Their study is focused on IBD, a chronic condition that affects more than 200,000 Canadians, and is characterized by abdominal pain, diarrhea, rectal bleeding and weight loss. Power and her grad student Jenifer Lu are using models to study inflammatory bowel disease and understand how rutin's anti-inflammatory properties may lessen the disease's progression.

During digestion, an interplay occurs between all the components in the whole food (e.g., proteins, fibre, etc.) and the body, which the researchers say is likely to enhance the bioactive's benefit. As well, certain bacteria growing in the large intestine can also play a role.

"The degree to which a compound is transformed in the gut to its more active form may depend on the composition and activity of the gut microflora, which in turn can be affected by the types of food we eat," says Power.

Eat local, taste global

Guelph research could feed the demand for ethno-cultural foods

BY JOHNNY ROBERTS

University of Guelph researchers say Canadian farmers have a $60-million-a-month opportunity in the Greater Toronto Area (GTA) alone growing crops in high demand by various ethno-cultural groups.

To help fill that gap, Guelph researchers are launching a program called Ethno-Cultural Vegetables Ontario (ECVO) that will create awareness about the benefits of locally produced ethno-cultural vegetables and help farmers learn how to grow them.

"More and more people want to eat locally grown food," says Prof. Glen Filson, School of Environmental Design and Rural Development. "We found that people are willing to pay more for these vegetables if they're grown fresh and if they're in an accessible location."

Filson is working with ECVO project manager Bamidele Adekunle, a PhD graduate of the Department of Food, Agricultural and Resource Economics, and Sridharan Sethuratnam, a master's graduate of Rural Extension Studies, who manages start-up programs for the Guelph-based organization FarmStart. That incubator project helps new Ontario farmers – particularly immigrant and second-career farmers – gain access to affordable farmland.

To determine the market and demand for ethno-cultural vegetables, the U of G research team surveyed ethnic grocery stores and food markets in the GTA. The team conducted more than 750 interviews targeting the most dominant ethnic groups and discovered ethno-cultural foods were in high demand.

The researchers looked at reasons why particular ethnic groups consume a significant amount of vegetables. Respondents said the foods were healthy, nutritious, medicinal, part of their tradition or culture, offered a preferred taste, or were part of their vegetarian lifestyle.

The largest ethnic groups in the GTA were identified as the South Asian, Chinese and Afro-Caribbean communities.

Good food, better aging

Agri-food for Healthy Aging (A-HA) is spreading knowledge about research into agri-food, nutrition and health as they apply to aging.

Human Health and Nutritional Sciences Prof. Alison Duncan and A-HA researchers have partnered with the OMAFRA-U of G Knowledge Translation and Transfer (KTT) program to create a series of online and print resources that can be distributed to a rapidly growing network of health-care professionals and researchers.

They are also hosting a series of interactive knowledge transfer events aimed at helping food producers and the health sector realize new market opportunities and health benefits behind consuming functional foods grown in Ontario.

Through their outreach efforts, Duncan and the A-HA researchers will be able to more effectively distribute their information, expand their audiences, form new research partnerships and train several Highly Qualified Personnel students.

New smartphone app helps guard against soybean aphids

Warding off invasive crop pests such as the soybean aphid requires accurate and timely information about where the latest threats are coming from – and how they can be prevented.

A Guelph research team wants to put this crucial information into producers' hands through a novel, on-farm smartphone tool, supported by the Knowledge Translation and Transfer program.

Environmental Sciences Prof. Rebecca Hallett is working with OMAFRA field crop entomologist Tracy Baute on a new smartphone application, called Aphid Advisor, which they hope will help give producers the upper hand against this year's severe soybean aphid infestations.

Aphid Advisor features photos and information about the soybean aphid's natural enemies, such as the lady beetle. The app advises farmers if there is a need to apply insecticides based on the ratio of natural enemies to aphids. This way, farmers can ensure that they are only using insecticides when necessary and they can otherwise let nature take its course.

PHOTOS: ISTOCK

According to Adekunle and Filson, South Asian preferences included okra, eggplant and bitter melon. The vegetables in high demand by the Chinese group were bok choy, Chinese broccoli and eggplant. The Afro-Caribbean group preferred okra, African eggplant, garden eggs and smooth amaranth.

The researchers estimate the demand per month for these ethno-cultural vegetables is at least $21 million for the Chinese group, $7 million for the Afro-Caribbean group and $33 million for the South Asian group. Filson says these numbers point to a significant niche market and that Canadian farmers should consider trying to grow some of these commodities.

"Money put into this potential market could also provide support during Canada's economic recovery," he says.

FarmStart, U of G's Simcoe Research Station and the Vineland Research and Innovation Centre are growing these vegetables in trials. Their research will help to determine important information specific to Ontario such as crop spacing, the amount of fertilizer required and the kind of irrigation systems needed.

Ontario's growing season isn't as long as many of the native climates these vegetables are accustomed to, but some of these foods can be grown in greenhouses, or started there and finished in fields. And in many cases, local soil composition can be modified in the field to meet the demands that a particular crop requires, says Filson.

This research is funded by the Knowledge Translation and Transfer program through the OMAFRA-U of G Partnership. Additional funding is provided by the Ontario Market Investment Fund.

Prof. Glen Filson is working with Bamidele Adekunle (right) and Sridharan Sethuratnam (left) to raise awareness about growing ethno-cultural vegetables in Ontario.

PHOTO: BRUCE SARGENT

This student knows how to handle an emergency

BY NATALIE OSBORNE

The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) and University of Guelph Partnership's Highly Qualified Personnel (HQP) scholarship program is designed to help students achieve success in any field they enter, be it government, academia or industry.

Dr. Cathy Furness is one student making the most of the HQP program. A graduate of U of G's veterinary program with a master's degree in clinical medicine, she's now working as a veterinarian in the Ontario Veterinary College (OVC) clinic but wanted the opportunity to continue her graduate training in large animal internal medicine.

"My long-time mentor Prof. Laurent Viel mentioned the HQP opportunity to me," says Furness. "It's been an amazing experience and I highly encourage anyone to apply."

Furness's project focuses on emergency planning and preparedness related to large animals. In collaboration with OVC Prof. David Kelton, she's assessing the emergency preparedness level of livestock producers as well as the veterinarians who serve them throughout Ontario.

The project aims to learn what producers have in place for an emergency response to a variety of situations, such as a prolonged electrical power outage, a mandatory herd evacuation, extreme weather or disease outbreaks. Furness also wants to discover how producers expect different levels of government to respond in emergency situations. She found that often the producers' expectations and the government's mandate were quite different.

Furness spent her four-month work term in three different locations. First, she worked with the County of Wellington, where she created a database of all the large animal veterinarians in the county whom the municipality could contact if they needed assistance.

Next, Furness job-shadowed with OMAFRA's humane standards officer Penny Lawlis, travelling to abattoirs across the province. She designed a captive bolt euthanasia-training course and held a seminar and practical training session attended by veterinarians from Ontario and Quebec.

Furness also carried out background research on preparation of first responders dealing with large animals in emergencies for Defence Research and Development Canada.

"I had been working a little bit on emergency response in the background when I had time, but having the work term and the funding behind it to be able to just sit down and focus on it was great," says Furness. "I learned a lot, I made some great contacts in the industry. It was just an incredible experience."

Program leader and Animal and Poultry Science Prof. Steve Leeson believes this combination of research and practical job experience improves the HQP students' market readiness, and benefits OMAFRA's research interests.

"This program increases students' understanding of the role of research findings in entrepreneurial opportunities and, in some cases, shaping science-based public policy," he says.

The program aims to help put academic research into a broader business and entrepreneurial context through a specially-created course, UNIV 6050: Integration of Science and Business, which gives students essential communication, negotiation and leadership skills.

Students are introduced to a wide range of business and innovation concepts, asked to think about their projects from a marketing perspective, consider what value their work could have for consumers and how they might bring their research to market.

"Many of these students had come through science programs, and most of them had never taken a business course before," says course instructor Prof. Michael von Massow, School of Hospitality and Tourism Management. "It helps them to apply an economic perspective to the work they're doing, so that they can focus on providing maximum value where it's needed most – either to company shareholders or to society at large."

OVC veterinarian and HQP graduate student Cathy Furness poses with Cappuccino, an 11-year-old pony mare from OMAFRA's research herd. In addition to her veterinary work, Furness is also researching emergency preparedness for production and farm animals through the OMAFRA-U of G Partnership's HQP graduate program.

PHOTO: BRUCE SARGENT

New facility opens doors for future veterinarians

BY SAMANTHA BEATTIE

A new state-of-the-art facility at the Ontario Veterinary College (OVC) is helping student veterinarians gain hands-on experience treating farm animals.

Thanks to a $2.3-million investment from the Ontario Ministry of Food, Agriculture and Rural Affairs (OMAFRA), the Large Animal Clinical Skills Building helps Doctor of Veterinary Medicine (DVM) students at the University of Guelph prepare for careers in rural veterinary practice.

"This facility is a tremendous investment in protecting the health of our animal agriculture industry and Ontario's rural communities," says Prof. Kerry Lissemore, OVC's associate dean of academic affairs. "Student veterinarians will develop critical experience with farm animals in a safe learning environment. This support from OMAFRA is vital to our ability to provide high-quality veterinary clinical education, as well as to protect and advance the health of animals, people and the environment."

The 8,300-square-foot facility provides bright and flexible space for OVC's large animal learning labs, which allow students and faculty to use modern technology and animal-handling equipment.

Healthy animals will be separated from hospitalized patients, ensuring that OVC meets the requirements for accreditation by the Canadian Veterinary Medical Association, the American Veterinary Medical Association and the standards of the Canadian Council on Animal Care.

Lissemore says that the Large Animal Clinical Skills Building is just one of many ways that the Veterinary Clinical Education Program (VCEP) enhances learning. The program also funds student veterinarian externships, post-DVM training and graduate programs in the OVC Health Sciences Centre and the stipends for veterinarians enrolled in the Master of Public Health program. It also partially funds some faculty and staff salaries.

The Large Animal Clinical Skills Building is located next to Barn 37, University of Guelph's historic dairy barn. A separate renovation project funded by OVC and donations has improved the barnyard and added 19 box stalls for horses to Barn 37. OVC and the Ontario Agricultural College both use Barn 37, which is the last functioning barn on campus.

"OMAFRA is proud to support the next generation of veterinarians and animal health experts," says Jim Richardson, OMAFRA animal health and welfare director. "This new clinic will contribute to strong, growing livestock and agricultural industries and support rural communities, by providing a highly qualified cadre of professionals skilled in maintaining the health and welfare of the province's animal populations."

VCEP is jointly managed by OMAFRA and OVC. R

The new Large Animal Clinical Skills Building features the most modern animal handling equipment to provide a safe learning environment for animals and students.

PHOTO: ONTARIO VETERINARY COLLEGE

Improved lab methods streamline multi-residue testing

BY JOEY SABLJIC

Safeguarding Ontario's food supply involves staying on top of potential contaminants that could make their way into the products that we eat.

Using advances in technology, researchers at the University of Guelph's Agriculture and Food Laboratory (AFL) have developed techniques that can quickly and efficiently screen consumer products such as meat and produce for potentially harmful levels of drug residues or pesticides. In the process, the results allow OMAFRA to respond and help keep Ontario foods among the safest in the world.

"You need to be able to make a statement about food quality, so you want a testing method that is reliable and that can detect a number of compounds at the same time," says Dr. Perry Martos, Method Development Manager at the AFL.

For decades now, methods to detect pesticide residue in produce samples have been evolving from numerous smaller scope multiple residue approaches to fewer residue methods with the capability of detecting hundreds of compounds in fruit and vegetable samples at one time. Recently, the AFL has expanded the number of detectable pesticides, in a single produce sample, to nearly 500 using just two multiple residue methods. The development of similar methods for meat samples lagged behind due to the differences in sample types, produce versus meat, and the target compounds, pesticides versus veterinary drugs. Martos has been leading the research team responsible for developing more efficient and effective multi-residue tests in meat and food products.

Through their multi-year research and development efforts, Martos and his team work closely with our partners at OMAFRA to determine the scope of methods that will meet the province's mandate for food safety. As a result, this comprehensive analysis detects 39 different veterinary drug compounds in beef, pork, sheep and goat products through merging upwards of 15 different testing methods into a single one. They're using a combination of liquid chromatography and mass spectrometry as a means of separating out and detecting residues within the edible portions of an animal, such as the muscle, liver or kidneys.

Martos says one of the main keys to their multi-residue testing method involves a better approach to sample preparation. This allows them to get an accurate reading of a compound's presence in the animal carcass without it being exaggerated or suppressed by surrounding material, such as fat.

Veterinarians and farmers use veterinary drugs as accepted animal health management practices. The Agriculture and Food Laboratory generates results from provincial monitoring samples using this new multi-residue method that allows OMAFRA to provide information used in the direction of their programs as well as to producers about the presence of veterinary drug residues.

"Instead of having to manage several different testing methods, we're managing only one method (in meat)," says Martos. "What's great about our method is that it's expandable, so we've been able to add new compounds" in response to OMAFRA's testing requirements.

In the coming years, Martos and his team will continue honing and expanding their multiple residue testing efforts for foods, with an eye towards using their new approach to combine methods for the detection of pesticides, mycotoxins and veterinary drugs into an even larger-scoped single analysis.

The Agriculture and Food Laboratory's multiple residue testing research and development is supported by the OMAFRA – University of Guelph Partnership.

AFL method development manager Dr. Perry Martos (right) works with Fiona Jayasundara, a chemistry method development scientist, on more effective and efficient multi-residue tests that help them screen meat and produce products.

PHOTO: JOEY SABLJIC

Entering a new era in dairy monitoring

New system draws on data from established dairy industry organizations

BY NATALIE OSBORNE

Accurate disease surveillance systems are important for health and safety as well as international trade, but monitoring every dairy farm in Ontario is a daunting task. Now, University of Guelph researchers have designed an efficient and low-cost surveillance system that could make disease monitoring more effective.

The system uses an innovative combination of information gathered by three pre-existing entities: the University of Guelph's Animal Health Laboratory (AHL), CanWest Dairy Herd Improvement (DHI) and Dairy Farmers of Ontario (DFO). Population Medicine Prof. David Kelton and his team believe that together these resources can give a complete picture of dairy herd health in Ontario.

"This is the first time information from these three groups has been combined in this way," says Kelton. "We're trying to make the best use of these existing data sources to meet the surveillance objectives of the Ontario Animal Health Surveillance Network."

The key to the system's cost effectiveness is passive surveillance, meaning that researchers use data that are already being gathered for purposes other than disease monitoring. Utilizing these readily available information sources means researchers don't have to spend time and money actively gathering data themselves.

Veterinarians in Ontario routinely submit tissue and blood samples from dairy herds to the AHL for testing. Kelton and his team can use the test results from these samples as a reliable source of disease status information in Ontario herds.

However, the samples are not always accompanied by detailed farm location information, making it difficult to map out exactly where disease is occurring. What's more, not every farm uses veterinarians, so researchers can't tell how much of the province the AHL samples cover.

In contrast, more than 3,200 dairy producers (more than 75 per cent of Ontario dairy herds) use the surveillance system's second source, CanWest DHI. Traditionally a milk recording service, DHI receives monthly milk samples from herds and maintains a current inventory of the dairy animals on each farm. DHI also offers disease-testing services for common problems, such as Johnes disease.

This last feature allows Kelton's team to get data from farms that may not use traditional veterinary services or the AHL. Combined, the two sources offer a steady supply of reliable and relevant disease status information for Ontario's dairy herds.

But a big question researchers want answered is: where exactly is disease occurring? A functioning surveillance system must be able to describe how cases are dispersed throughout the province, which areas have the highest prevalence and whether a disease is spreading to new areas.

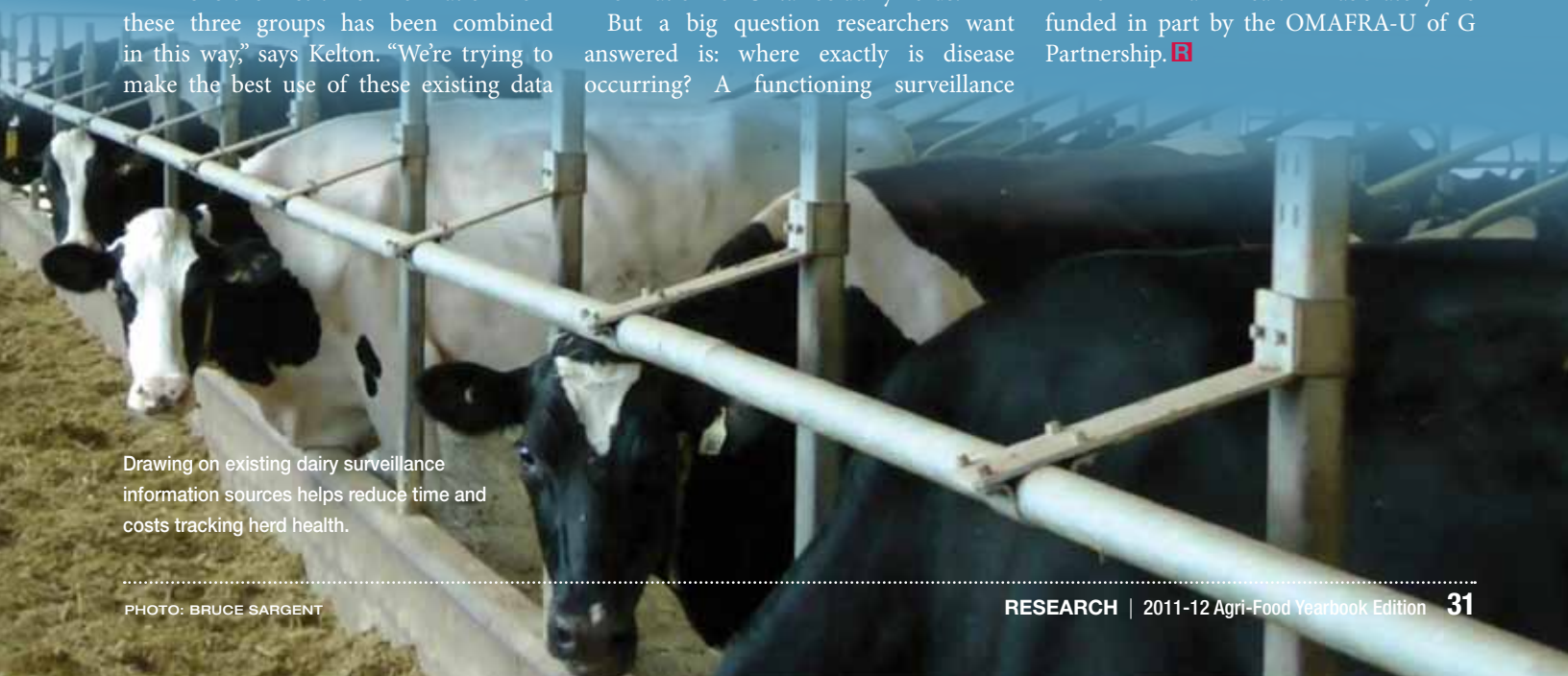
That's where the third source, DFO, comes in. The DFO has the geographic information system co-ordinates for the primary barns of each of Ontario's 4,350 dairy farms, which it uses to guide their milk trucks in shipment routes. After signing confidentiality agreements with producers, Kelton and his team manually matched test results to specific farm locations.

Researchers then compared the AHL's and DHI's sample dispersal throughout the province. They found that some areas were better represented by one agency than the other, but combining the two gave them the most complete coverage.

However, manually matching each test result to a specific farm was a time consuming and labour intensive process. Researchers believe the system could be streamlined if the AHL, DFO and DHI used a common herd identifier for their samples. For example, if each test result was accompanied by the DFO licence number or the premises ID, plotting the data on a map would be much easier.

"Incorporating the DHI disease test results and herd inventories into a combined data base with AHL and DFO enhances our surveillance coverage and capacity," says Kelton. "What's more, because we get constant milk samples, we could also use this system to actively take a random sample of herds and determine their health status."

The Animal Health Laboratory is funded in part by the OMAFRA-U of G Partnership. R



Drawing on existing dairy surveillance information sources helps reduce time and costs tracking herd health.

PHOTO: BRUCE SARGENT

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Prosperous agri-food industry

Strong rural communities

Sustainability

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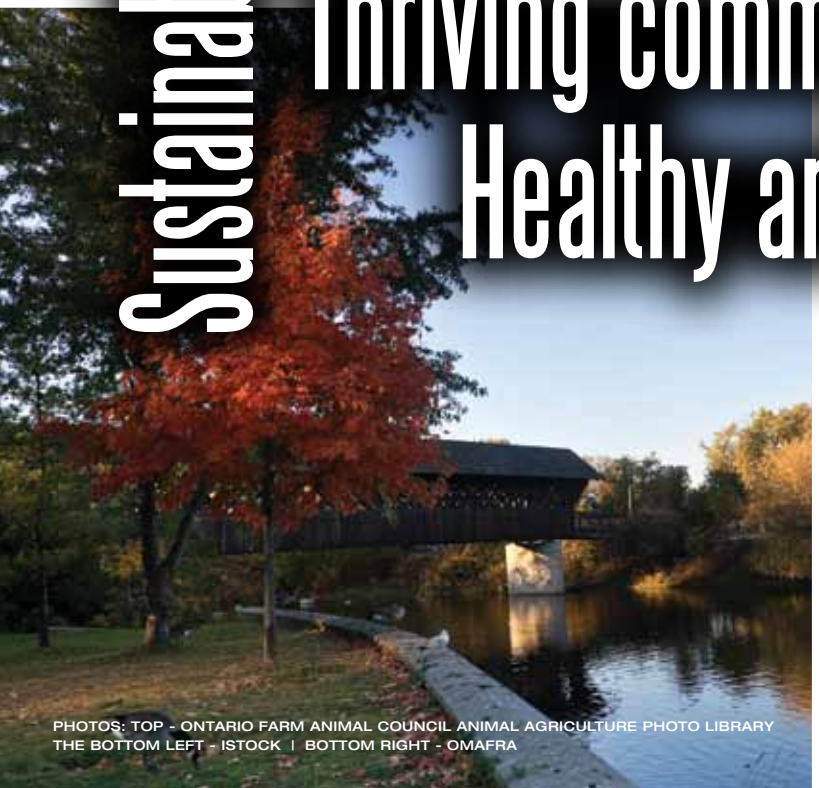
Healthy animals



Ontario

PHOTOS: TOP - ONTARIO FARM ANIMAL COUNCIL ANIMAL AGRICULTURE PHOTO LIBRARY
THE BOTTOM LEFT - ISTOCK | BOTTOM RIGHT - OMAFRA