ONTARIO PORK

PIGS, PORK AND PROGRESS

Ontario Pork Research in Action

VOLUME 1 SPRING 2004

INSIDE:

ANTIBIOTIC ALTERNATIVES TO REDUCE HARMFUL BACTERIA

LARGER, STRONGER LITTERS THROUGH BETTER MANAGEMENT

HOUSING AND MANAGEMENT STRATEGIES FOR HEALTHIER PIGS

PROMOTING HARMONY BETWEEN PRODUCERS AND NEIGHBOURS

University of Guelph researcher Cate Dewey is addressing important health and production issues that will impact producers' profit margins.
See page 9

CONTENTS

4 HEALTH
In the lab and on the farm, researchers are working to develop antibiotic alternatives to reduce harmful bacteria.

10 REPRODUCTION
New management, genetic and breeding techniques will help produce larger, stronger litters.

13 BEHAVIOUR
Identifying good housing and management strategies means happier, healthier pigs.

16 PRODUCTION
Research that focuses on genetics, nutrition and biotechnology works together to improve pork operations in Ontario.

26 ENVIRONMENT
Reducing odour, pathogens and harmful gas emissions from manure promotes harmony between producers and their neighbours.

Cover photo by **Martin Schwalbe**
Photo this page courtesy of **Agriculture and Agri-Food Canada**

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VOLUME I, SPRING 2004

A publication to promote dialogue, understanding and communication about research accomplishments and activity funded by Ontario Pork.

Pigs, Pork and Progress is a joint publication of Ontario Pork and the University of Guelph. It is written and produced by the agricultural communication students and SPARK (Students Promoting Awareness of Research Knowledge).

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www.uoguelph.ca/research/omaf/animals/pork.shtml

A strong commitment to research

Martin Schwalbe

Getting vital information into producers' hands

Research is one of the fundamental building blocks in the advancement of our industry and is a cornerstone of its success. Getting this scientific knowledge into the hands of producers is vital and is the reason for this publication. These articles highlight just some of the research funded by Ontario Pork, which dedicates 20 cents from the service fee of each hog marketed to research.

At Ontario Pork, we regularly evaluate projects and programs and try to fund those that present real value to this industry. Its strong relationship with the research community, both here in Guelph and across Canada, is a benefit to all of agriculture. This magazine is a showcase of the leading edge work that is being done and illustrates what can be achieved by building partnerships across the industry.

Our hope is that this publication will increase your awareness of the valuable research being done for your benefit.

I hope you enjoy reading this publication, and I encourage you to contact our office with your comments. We want to know what you think. Enjoy!

Larry Skinner,
Chair,
Ontario Pork

Paula Bialski

Research addresses key issues in pork production

The diversity of research reported in this publication reflects the broad scope and intensity of pork research in Ontario. Research addresses key issues in pork production with the ultimate aim of enabling the Ontario pork industry to grow in an environmentally sustainable manner, while ensuring product quality and safety for a global market.

Topics you'll read about here include practical means to improve sow reproductive performance, safe methods of dead-stock disposal, odour control, the impact of country-of-origin labelling of food products in the United States, the search for genes that enhance pork meat quality, and novel means to control pathogens that represent a risk to pigs and consumers.

This publication further illustrates the effective partnership among the pork research community, the Ontario Ministry of Agriculture and Food and industry groups, especially Ontario Pork. We welcome your feedback to this magazine and research activities at the University of Guelph.

Prof. Kees de Lange,
Co-ordinator, Pork Research Program,
University of Guelph

Martin Schwalbe

Producer support takes research to new level

The University of Guelph has a long tradition of working with the agri-food industry to address challenges and create opportunities. It's a tradition fuelled by the agreement for research and services with the Ontario Ministry of Agriculture and Food, and by direct support from the industry through grower organizations and commodity groups. They complement each other fully and make possible developments that would otherwise be elusive at best.

Support from the ministry has created a critical mass of research expertise in Ontario. From this foundation, researchers at Guelph and collaborating institutions can work together to pursue answers to the industry's biggest problems. Liaisons develop, coalitions form and partnerships advance in all sectors.

This publication is testimony to the partnership that has developed between the University of Guelph and Ontario Pork. The stories show how investment by Ontario Pork is helping scientists focus on industry needs and giving pork producers a voice in the laboratory, at Guelph and beyond.

When farmers direct their hard-earned dollars to research, they are placing value on new discoveries. I am pleased that our research communications group and student writers could help create this publication with Ontario Pork and bring to light the vital research activity under way.

Dr. Alan Wildeman,
Vice-President (Research),
University of Guelph

Food safety from farm to fork

BY CINDY TODD

PAULA BIALSKI

Keeping food safe from farm to fork is a high priority for University of Guelph researchers.

FOOD SAFETY HAS MOVED to the farm, with a University of Guelph research team screening pig herds for the presence of potential diseases that may contaminate meat.

Since 2001, Prof. Robert Friendship, Department of Population Medicine, has been collecting blood and fecal samples from Ontario hog farms for a province-wide disease surveillance study. He analyzes these samples to identify pathogens and their presence within a herd or between farms, and determines how good the diagnostic tests are for measuring the presence or absence of disease.

"Farmers are unaware that food safety pathogens are present on their farms because (the pathogens) generally don't cause clinical disease in pigs," says Friendship. "By identifying these organisms at the farm level, we can take steps to reduce the risk of contaminants entering the abattoir."

Researchers recognize that some pathogenic organisms are less prevalent than in previous years and that new diseases are always emerging. That's why the disease surveillance project was developed — to examine on-farm prevalence of important disease-causing agents that pose a threat to human health. These include *Salmonella*, *Escherichia coli*, *Toxoplasma gondii*, *Yersinia enterocolitica*, *Balantidium*, *Giardia* and *Cryptosporidia*.

Friendship says that by taking a proactive approach and monitoring Ontario pig farms for these disease-causing organisms, the industry will be better prepared to deal with future food safety concerns involving pork contamination. This study is also examining pigs for swine influenza, parvovirus and *Lawsonia intracellularis*, and other diseases that affect production but are not food safety issues.

The swine surveillance project has yielded significant preliminary results. For the first time in North America, fecal sample analysis has identified a small number of pigs harbouring *E. coli* 0157:H7, a human pathogen.

Other findings were also eye-opening. *Toxoplasma gondii*, an infectious parasite (associated with cats) that can cause human brain damage and harm developing fetuses, was isolated in four per cent of the sampled herds. Friendship has linked this to hog farms with barn cats or rodent control problems. Swine influenza was found in about 80 per cent of Ontario hog operations. Interestingly, almost all the farms found to be free of the influenza virus were located in eastern Ontario, which indicates certain provincial regions may be swine influenza-free.

The surveillance project will continue examining farms for disease-causing organisms and will also start focusing on ways to reduce or eliminate food safety pathogens from pig farms, to decrease the potential for pork contamination. Consumers want reassurance that the food chain is safe, says Friendship, and he hopes this study will serve as a stepping stone for future disease monitoring programs that will reward pork producers with low on-farm levels of food safety pathogens.

Other researchers involved in this project include Profs. Cate Dewey and Scott McEwen, Population Medicine; Carlton Gyles, Pathobiology; and Ming Fan, Animal and Poultry Science.

This project is supported by Ontario Pork, the Ontario Ministry of Agriculture and Food (OMAF)-University of Guelph animal research program and an OMAF food safety research grant. Ontario Pork also obtained funding from the Canada-Ontario Research and Development Program, which is funded by OMAF and Agriculture and Agri-Food Canada and administered by the Agriculture Adaptation Council on behalf of the Ontario Agricultural Commodity Council.

KEEPING BACTERIA OUT OF THE FOOD CYCLE

by Marianne Fallis

KNOWING HOW HUMAN PATHOGENS ENTER and spread in pig herds is critical for maintaining the safety of pork products. University of Guelph researchers are finding out where bacteria might slip into the production process.

Profs. Keith Warriner and Mansel Griffith, Department of Food Science, and Robert Friendship, Population Medicine, are using DNA fingerprints — patterns unique to individual bacteria strains — of *Salmonella* and *E. coli* to trace how these gut bacteria are transferred from the farm to products we buy in the supermarket.

"Knowing the points at which bacterial contaminations enter the pork production chain — from farm to fork — will allow more effective control strategies to be developed," Warriner says.

Current prevention methods don't appear to remove all threat of *Salmonella* in meat, he says. Research by Friendship indicates that *Salmonella* could be present in 10 per cent of pig herds, and Warriner has found this number can rise to 20 per cent during processing.

Salmonella infection from a variety of food products (including meat, eggs and produce) affects more than 39,000 people in Ontario each year, costing $152 million in health care and lost productivity.

"We need to take this risk away from the consumer," says Warriner.

Preliminary results indicate that on-farm *Salmonella* reduction alone will not protect the food chain. He believes a complete "biosecurity" system that encompasses each step from the farm to in-home meal preparation is necessary to control the bacterium.

To achieve this goal, the researchers will continue to identify where these pathogens are introduced in pork production over the next year.

This research is funded by the Ontario Ministry of Agriculture and Food.

Professor Janet MacInnes, centre, and her research team are looking at how certain bacteria in swine herds can affect a pig's health.

MARTIN SCHWALBE

Healthy one day, sick the next

Researchers probe bacterial infection path to control swine disease

BY ANITA HOOPER

COMBINING PIGLETS from different farms into a single farm is common practice on Ontario swine operations, but University of Guelph researchers warn that this may result in sudden onset of disease, even if each group appears healthy before joining the herd.

Prof. Janet MacInnes and graduate students Shivani Ojha and Durda Slavic of the Department of Pathobiology are looking at the bacterium *Actinobacillus suis*, which is found in many Ontario swine herds. It can keep a low profile until suddenly invading the animal. MacInnes is concentrating her efforts on discovering how *A. suis* shifts from harmless to aggressive.

"By understanding how this infection takes hold, we may better control disease in swine operations," she says. "We need to learn more about the systems that control these bacteria."

A. suis resides harmlessly on pigs' mucosal surfaces, such as their nasal tracts and tonsils, before infection becomes apparent. But once infection sets in (by travelling to the blood), the effects can be severe and quick.

A. suis infects the blood (a condition called septicemia) and also leads to arthritis, pneumonia and sudden death. A recent survey of swine operations across Ontario found more than 90 per cent had *A. suis* present.

An outbreak in naive herds that have never experienced the bacterium before can be devastating, resulting in many pig losses, says MacInnes. But not all *A. suis* -positive pigs become ill. In herds where the bacterium has been present for a long time, outbreaks are random. This is likely due to protective antibodies from the sow's colostrum that play an important role in immune defence, she says.

To further understand why *A. suis* will cause disease in some pigs and not others, MacInnes and her students are examining bacterium strains for their different pathogenic potentials. By analyzing sugars on the bacterium's surface, which is thought to be involved in bacteria attaching themselves to the pig tissue, they've found one type called *A. suis* O2 that may be more likely to cause disease. The researchers believe this strain may be more difficult for the pig's immune system to recognize and mount a proper defence against.

Others involved in this research include graduate students Abdul Lone, Catherine Hill and Devon Metcalf of the Department of Pathobiology; Prof. Mario Monteiro of the Department of Chemistry and Biochemistry; Marc Sirois of the University of Quebec at Trois Rivières; and Malcolm Perry of the National Research Council (NRC).

This research is sponsored in part by Ontario Pork through the Bacterial Pathogens Network, the Natural Sciences and Engineering Research Council, the NRC and the Ontario Ministry of Agriculture and Food.

That scent? Antibiotic substitutes

Plant extracts could be promising alternatives to conventional treatments

BY ROBERT FIELDHOUSE

DID YOU KNOW
PIGS DON'T SWEAT.

HERBAL EXTRACTS with medicinal properties may provide an alternative to conventional drug treatments, say researchers. They're looking for plant extracts with antibiotic-like properties to prevent disease and promote growth in livestock.

A group led by Joshua Gong, a research scientist with the Agriculture and Agri-Food Canada (AAFC) food research program, is evaluating herbal extracts and essential oils such as cinnamon, thyme and oregano to displace antibiotics added to livestock feed. Antibiotic feeding, thought to maintain animal health, is banned in Europe because overuse can cause antibiotic-resistant bacteria to develop and residues to form in pork products. Gong believes North America will soon follow suit, leading to high demand for alternative treatments.

"We need to develop strategies to replace dietary antibiotics that promote swine growth and maintain food safety," says Gong. "We hope plant-based essential oils will be one approach to help reduce dietary antibiotic use."

Antibiotics have long been used in feed to support livestock health by inhibiting bacterial pathogen growth in the gut. Low antibiotic doses in feed prevent gut bacterial diseases and promote animal growth, says Gong. But exactly how dietary antibiotics work is not yet clear.

"We're integrating different approaches to reduce harmful bacteria, support swine productivity and enhance food safety."
– Joshua Gong

There's no question, however, that antibiotic-resistant bacteria are becoming more widespread. Swine researchers believe that combining prebiotics (beneficial non-living agents that regulate gut microflora) with probiotics (beneficial live micro-organisms that regulate gut microflora) in feed could be a safer strategy for supporting animal health.

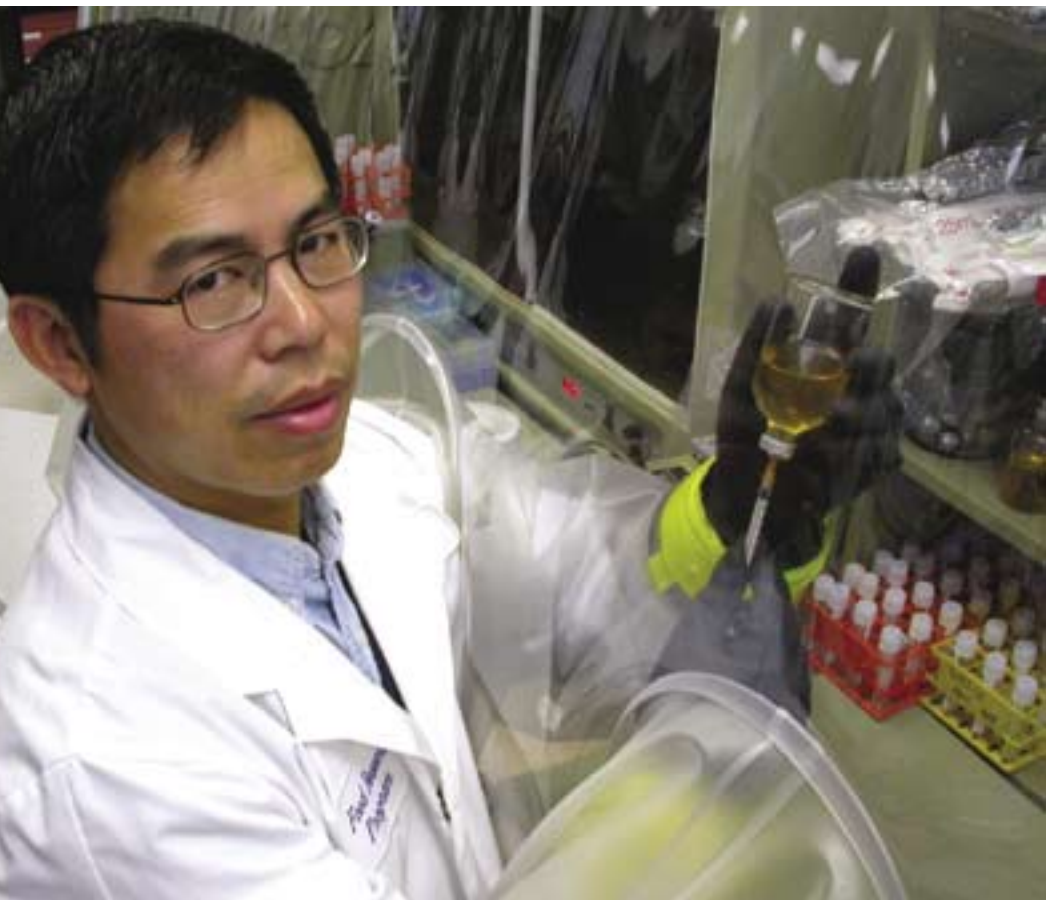
Gong thinks herbal extracts and essential oils are potential candidates for alternative treatments. Herbal medicine has been practised in China for hundreds of years, and essential oils have been used safely in perfumes, cosmetics and food. In fact, some herbal products are already marketed for swine, but most have not been tested scientifically. He is interested in the influence of herbal extracts on both gut micro-organisms and animal immune systems, and is using them as prebiotics to regulate gut micro-organisms — promoting beneficial bacteria that inhibit harmful bacteria such as *E. coli* and *Salmonella*.

"We're integrating different approaches to reduce harmful bacteria, support swine productivity and enhance food safety," says Gong. "A prebiotic-probiotic cocktail may one day be as potent as antibiotics at keeping animals healthy."

He hopes to complete essential oil trials in swine this year.

Other researchers involved in this work are Rong Cao, Ting Zhou and Weiduo (Sue) Si of AAFC; University of Guelph professors Robert Friendship and Kees de Lange; Wayne Du of the Ontario Ministry of Agriculture and Food (OMAF); and Case Poppe and Roger Johnson of Health Canada.

This research is funded by OMAF's food safety program, Ontario Pork and AAFC. Ontario Pork also obtained funding from the Canada-Ontario Research and Development Program, which is funded by OMAF and AAFC and administered by the Agriculture Adaptation Council on behalf of the Ontario Agricultural Commodity Council.



PAULA BIALSKI

Agriculture and Agri-Food Canada researcher Joshua Gong is studying herbal extracts that may have antibiotic properties for swine.

Good bugs versus bad bugs

Potential alternative treatments are emerging for promoting gut health

BY MICHELLE DANIEL

PIGLET DIARRHEA CAUSED by *E. coli* can jeopardize an animal's well-being and delay growth. So University of Guelph researchers are perfecting an alternative treatment that promotes gut health.

Profs. Robert Friendship, Department of Population Medicine, and Kees de Lange, Animal and Poultry Science, are examining the use of probiotics — beneficial live bacteria — to reduce *E. coli* infections in newly weaned piglets. They hope to find a substitute for antibiotic treatments, which may leave residual contaminants in meat and spread antibiotic-resistant bacteria from animals to humans.

"Probiotics are a promising alternative to antibiotics," says Friendship. "By finding how to best create and implement an effective probiotic treatment program, we hope to improve swine performance."

Probiotics are ingested live micro-organisms that survive acidic stomach and intestinal bile and colonize the intestine. It's estimated that more than 800 micro-organism species live in the pig's large intestine. Researchers say interactions among micro-organisms and with the surrounding environment are complicated and still poorly understood.

Graduate student Rocio Amezcua has identified several potential probiotics, isolated from a readily available source: pig feces. Researchers hope probiotic organisms originating from the pig will successfully survive again in its gut.

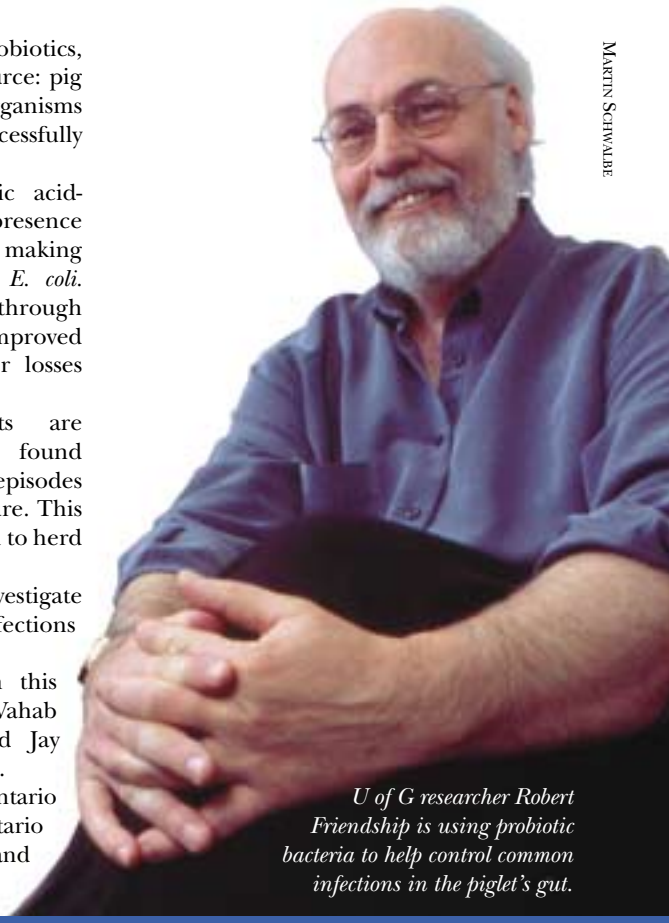
The bacteria chosen are lactic acid-producing organisms (LAB). Their presence lowers the gut pH by creating acid, making an unfavourable environment for *E. coli*. Increasing LAB levels in the gut through probiotic treatment could mean improved gut health, weight gain and fewer losses from scours.

"Preliminary research results are promising," says Amezcua. She found probiotics can shorten diarrhea episodes and reduce *E. coli* excreted in manure. This lowers the risk of spreading infection to herd mates.

Next, Friendship will investigate probiotics that treat *Salmonella* infections in swine.

Others researchers involved in this project include graduate students Vahab Farzan, Population Medicine, and Jay Squires, Animal and Poultry Science.

This research is funded by the Ontario Ministry of Agriculture and Food, Ontario Pork and the Ontario Research and Development Challenge Fund.



MARTIN SCHWALBE

U of G researcher Robert Friendship is using probiotic bacteria to help control common infections in the piglet's gut.

LIQUID FEED HELPS DELIVER PROBIOTICS

by Karen Brinke

PROBIOTIC ORGANISMS — BENEFICIAL LIVE micro-organisms — are a promising and safe substitute for antibiotics, say Guelph researchers. Now they're looking at new ways of delivering these beneficial bugs.

Profs. Robert Friendship, Population Medicine, and Kees de Lange, Animal and Poultry Science, are using liquid feed to dispense probiotic treatments to swine.

Commonly used pig feeds are dry and pelleted, a process that kills most probiotic bacteria. So the researchers are investigating liquid feeding — currently used to raise about one-fifth of Ontario's market hogs — to deliver probiotics to pigs.

Liquid feeding systems can use wet co-products from the dairy and brewing industries, such as whey, distillers' grain solubles and high-moisture corn.

"In liquid feeds, probiotics can be multiplied from a starter culture, saving time and money," says de Lange.

Certain ingredients, such as corn distillers' solubles, are fermented by specific microbes, boosting protein content and feed digestibility, he says. When probiotic organisms are added to the fermenting feed, its probiotic micro-organism content increases significantly, allowing liquid feed to directly deliver probiotics to pigs.

For effective fermentation, the liquid feed's acidity should be closely controlled, says de Lange. In addition, using a combination of different microbes in the starting culture results in better fermentation and faster probiotic growth.

Trials using new liquid feeding equipment — the first of its kind in North America — will begin in 2004 at the University of Guelph's Arkell Swine Research Station.

Other researchers involved in this project include graduate students Rocio Amezcua, Population Medicine, and Jay Squires, Animal and Poultry Science.

This research is funded by the Ontario Ministry of Agriculture and Food (OMAF), Ontario Pork and the Ontario Research and Development Challenge Fund. The research program on liquid feeding has been developed in collaboration with the Swine Liquid Feeding Association and with the support of industry partners DACO Laboratories, Grand Valley Fortifiers, Big Dutchman, Great Lakes Nutrition, BSC Nutrition, Stratford Agri-Analyses, Furst McNess, Chris Hanssen Laboratories and Kenpal. Ontario Pork also obtained funding from the Canada-Ontario Research and Development Program, which is funded by OMAF and Agriculture and Agri-Food Canada and administered by the Agriculture Adaptation Council on behalf of the Ontario Agricultural Commodity Council.

Understanding *E. coli* resistance

Research will improve treatment and prevention strategies

BY CINDY TODD

DISEASE SURVEILLANCE STUDIES have shown that bacterial resistance to commonly administered antibiotics is an emerging problem in the Ontario pork industry. And that has sparked University of Guelph researchers to examine the genetics behind the resistance phenomenon.

Prof. Patrick Boerlin of the Department of Pathobiology is leading a new research initiative that is looking at intestinal *Escherichia coli* from pigs and determining the genes responsible for antibiotic resistance. This will give researchers more information on how resistance to antibiotics is spread among bacteria and provide them with a better understanding of how to manage *E. coli*, which can cause conditions such as diarrhea.

"This research will have great return for pork producers," says Boerlin. "It will help them optimize treatment and preventive strategies for diarrhea in pigs."

Besides tracking antibiotic resistance in *E. coli* from pigs, Boerlin and his research team are identifying virulence genes — those that make some *E. coli* capable of causing diarrheal disease. Once the genes for *E. coli* resistance and virulence have been characterized, the researchers will examine gene distribution to identify potential links between resistance and virulence.

Boerlin says it's important to uncover possible associations between resistance and virulence. *E. coli*-infected pigs that are treated with an antibiotic unable to destroy the disease-causing bacteria may experience proliferation of the harmful bacteria. The "good" bacteria, which are susceptible to the antibiotic treatment, will be killed off. Preliminary findings strongly suggest that relationships exist between *E. coli* resistance and virulence.

Although this research project will focus on identifying antibiotic resistance and virulence genes in *E. coli* from Ontario pigs, findings will be compared with data from other regions to determine if resistance patterns are local or if there are links among different geographical areas. Once the researchers get a better understanding of the genetics behind *E. coli* resistance and virulence in pigs, they also want to compare the patterns with those of other species. Their ultimate goal is to determine if there's a link between *E. coli* resistance in pigs and humans.

"Resistance is a global problem," says Boerlin. "This project will allow us to examine *E. coli* resistance patterns and determine possible relationships between farm animals and humans."

Other researchers involved in this project are Prof. Carlton Gyles, Pathobiology; Profs. Scott McEwen and Robert Friendship, Population Medicine; Richard Reid-Smith of Health Canada; and Marie Archambault of the Animal Health Laboratory.

This research is funded by Ontario Pork and the Ontario Ministry of Agriculture and Food.

U of G pathobiology Professor Patrick Boerlin is studying the genes responsible for antibiotic resistance in intestinal E. coli.

MARTIN SCHWALBE

NEW FACULTY ON THE FOOD SAFETY FRONT LINES

A NEW FACULTY MEMBER AT THE UNIVERSITY OF Guelph is focusing his efforts on the battle against antibiotic-resistant bacteria.

Prof. Jeff Gray, Department of Pathobiology, is studying how microbes in the gut become resistant to antibiotics. This has implications for food safety because resistant bacteria may develop in production animals and could be passed on to humans through meat consumption.

"The University of Guelph takes a proactive approach to food safety and antimicrobial use in the pork industry," says Gray. "I hope to bring new ideas to the table on this important health and production issue."

This project is closely related to his previous work at the U.S. Department of Agriculture's Antimicrobial Resistance Research Unit, which links producers, veterinarians and government officials to share information on this topic. Gray hopes to integrate his research expertise with that of the strong research team currently working with antibiotic-resistant organisms at Guelph.

This winter, he will begin analyzing bacteria present in the pig's intestine to identify possible changes to its genetic structure as a result of antimicrobial use. Understanding these changes may help researchers better control the development of resistant bacteria.

by Clare Illingworth

PRRS vaccine may affect sperm health

Don't use it for breeding boars, say researchers

BY MICHELLE DANIEL

PHOTOBAR.COM

A vaccine intended to protect swine against the PRRS virus can negatively affect breeding boars, say Guelph epidemiologists.

A VACCINE USED TO PREVENT porcine reproductive and respiratory syndrome (PRRS) in pigs has University of Guelph researchers concerned about its negative effects on semen quality.

Prof. Cate Dewey, Department of Population Medicine, is evaluating the PRRS modified live virus vaccine in naive boars, those unaffected by the virus. The vaccine is not meant for use in breeding boars, she says, but some farms may not heed this warning. Now, research suggests that in the case of boars, producers should avoid it.

"The use of the PRRS vaccine in swine herds is an important industry question," says Dewey. "If producers use this vaccine on boar studs, there may be problems. They need to realize that the boar's semen may be severely affected."

Over the last decade, PRRS has become one of the most economically significant diseases in pig herds. It's caused by a virus that invades the host animal. The virus is able to survive and replicate in pigs, causing pre-weaning illness, respiratory disease and reproductive complications such as stillborn piglets. The PRRS virus is spread by pig-to-pig contact and semen.

The researchers studied boar semen over 13 weeks in PRRS-negative boars vaccinated six weeks after the study began. They found that vaccination reduced semen quality in 63 per cent of boars. Total motility and forward motility of spermatozoa were reduced, and increases in loose acrosomes — the caplike structures on the head of sperm that aid in egg penetration — were also observed after vaccination. For most boars, these changes began three weeks after vaccination.

No boars tested positive for the presence of PRRS vaccine virus in their semen or reproductive tissues. This was surprising, says Dewey, because an earlier PRRS vaccine showed vaccine virus shedding in the semen. But even with these findings, she recommends that the semen of vaccinated boars be tested for PRRS virus before it's sold and that additional research on the long-term effects be considered.

"I think producers and veterinarians need to use the vaccine with caution, with the understanding that it can have negative effects on animals vaccinated."

Other researchers involved in this project are graduate student Keven Vilaca and Profs. Robert Friendship and Claire Plante, Population Medicine; and Prof. Mary Buhr, Animal and Poultry Science.

This research is funded by Ontario Pork, the Ontario Ministry of Agriculture and Food and Boehringer Ingelheim.

MEET THE RESEARCHER: CATE DEWEY

RESEARCH THAT CAN BE APPLIED TO THE farm — that's what Prof. Cate Dewey, Department of Population Medicine, strives for in all her projects. That's why she focuses on keeping herds healthy and improving production, two issues that really hit home with producers.

Over the past eight years, Dewey has been conducting research at the University of Guelph and working closely with local producers' herds. Her latest studies have looked at the care of small piglets (see page 19) and testing the newest PRRS vaccine on breeding boars (see story at left).

"I feel very privileged to work with producers and veterinarians to try and answer research questions that are important to Ontario pork producers," she says. "Together, we can work towards improving the industry to ensure its sustainability in the future."

After graduating from the Ontario Veterinary College in 1979, Dewey spent six years working in a mixed-animal practice, then returned to Guelph as a graduate student and clinician in Swine Field Services. This gave her an opportunity to share her enthusiasm for swine medicine with veterinary students.

Now, she's acting chair of her department, performing research and service work at OVC and teaching swine health management. Her excellence in research and teaching won her a President's Distinguished Professor Award in 2000.

Look for new research by Dewey and her graduate students on improving production in farms with low farrowing rates, and on the effect of weaning age on sow productivity. These projects are funded by Ontario Pork, the Ontario Ministry of Agriculture and Food, and Agriculture and Agri-Food Canada.

by Clare Illingworth

Frozen semen: it's a delicate matter

Researchers look to new protective solutions when freezing boar semen

BY DANIEL VAUTOUR

RESEARCHERS ARE TARGETING delicate elements in frozen boar semen to try to improve the conception rate in sows that are inseminated artificially.

Currently, 70 per cent of all insemination is done using fresh semen, which must be used within three to five days of collection. After that, the product is fragile, resulting in a lower fertility rate and restricting its use to local markets. It's sometimes difficult to get semen from one end of the country to receptive sows at the other end within that narrow time frame, says Prof. Mary Buhr, Department of Animal and Poultry Science.

PAULA BIALSKI

"World markets will open up for us when we perfect frozen boar semen," she says.

Sometimes boar semen is frozen for species preservation or special breeding stock. This semen results in a 50- to 70-percent conception rate and a litter with two pigs fewer than fresh semen provides.

And although the semen of some species freezes well, swine semen doesn't, and the sperm that do survive freezing and thawing are fragile.

The first step in improving the situation is to identify where the damage occurs. Buhr and others have shown that freezing and thawing damage the sperm membranes, which are made of lipids and proteins. Researchers think the egg cannot recognize sperm with damaged membranes. Buhr's research is identifying exactly which lipids change during freezing. She's working to develop a protective solution to enhance lipid protective components in sperm membranes, to repair or protect those vital for conception.

"World markets will open up for us when we perfect frozen boar semen."
– Mary Buhr

Although freezing semen is now economically viable for only high-value livestock, in the future — when mass production reduces the price — frozen semen will be viable for commercial breeders, says Buhr.

"One recipe for a protective solution is working, but we are moving towards one that's more effective and economically feasible through mass production."

Initial funding for this research was provided by the Manitoba Pork Council. The work is now sponsored by the Ontario Ministry of Agriculture and Food, Ontario Pork and the Natural Sciences and Engineering Research Council.

U of G Professor, right, Mary Buhr and graduate student Deborah Sibblies are studying ways to protect boar semen while frozen for use in artificial insemination.

A step towards reducing lost pregnancies

BY BETH KENT

MARTIN SCHWALBE

U of G Professor Anne Croy, and researchers Gordon Black and Chandrakant Tayade are searching the pig genome for genes related to fetal survival.

UNIVERSITY OF GUELPH RESEARCHERS have identified the genes that help increase life-giving blood flow to a developing fetus in mice and humans — and now they're zeroing in on pigs. They've found that the same kinds of genes that support blood flow in mice and humans are active in pigs, too, and they're trying to determine the role the genes play in fetal piglet development. The goal is to reduce the abnormally high rate of fetal losses in pigs, which can be more than 20 per cent.

Prof. Anne Croy of the Department of Biomedical Sciences and her research trainees Gordon Black and Chandrakant Tayade found a set of genes comparable with those identified in mice or humans, expressed within the uterine vascular tissue of pigs.

When a new embryo attaches to the uterine wall, maternal blood flow must increase — and the mother's blood vessels must expand — to ensure the embryo becomes a viable fetus. Without more blood, the fetus fails to develop and eventually dies.

For some reason, this is a particular problem in pigs and costs producers dearly in lost piglets and pregnancies. A sow's pregnancy generally lasts 114 days. At days 12 to 15, the embryo attaches to the uterine wall, at which time blood vessels expand, surrounding the fetus. From then on, the embryo requires additional blood vessel support to develop.

Numerous cell types make up the uterine vascular tissue. But lymphocytes — white blood cells that provide immune protection — are the only mobile ones. The researchers discovered that the action of lymphocytes moving towards the vessels triggers mechanisms to allow blood vessel expansion around the fetus.

They're continuing to investigate this lymphocyte movement and how certain genes in the uterine tissue are expressed during embryo attachment. Early findings indicate a definite change in the functional levels of certain genes during early pregnancy.

Tayade says this research "may lead to genetic selection for high concentrations of uterine lymphocytes or substances that could artificially support the expansion of blood vessels, with the potential to increase litter size and profitability for producers."

This research is funded by Agriculture and Agri-Food Canada, the Natural Sciences and Engineering Research Council, Ontario Pork and the Ontario Ministry of Agriculture and Food.

CATTLE PATHOGEN MAY AFFECT PIGS, TOO

by Beth Kent

A PATHOGEN THAT AFFECTS FERTILITY IN CATTLE may cause similar difficulties in pigs, say researchers.

Prof. Heidi Engelhardt, formerly of the Department of Animal and Poultry Science at the University of Guelph, explored the parasite *Trichomonas foetus* (sexually transmitted in cattle) as a potential reproductive pathogen in swine. It infects digestive, respiratory and occasionally reproductive tracts. Some sows have healthy pregnancies with a *Trichomonas* infection; others don't.

"Trichomonads may cause early pregnancy losses in pigs, as they do in cattle, and pregnancy failures in late gestation sows," says Engelhardt. "Late gestation losses really affect a producer's pocketbook because these animals are often not discovered until expected farrowing time."

Previous studies with cattle show that Trichomonads can cause infertility and abortions, but some infected cows do carry out normal pregnancies. In her tests of swine, Engelhardt found trichomonads in "problem breeders" that had lost repeated pregnancies, as well as in healthy breeding sows.

But she believes the parasite is still a potential threat. Litters born to infected sows may be smaller, and piglets could have reduced viability. It may also be possible that infected pigs are more susceptible to other pathogens.

Engelhardt says further studies are needed to better understand the effects of trichomonads.

This research is funded by Ontario Pork, the Natural Sciences and Engineering Research Council, and the Ontario Ministry of Agriculture and Food.

Small efforts make big difference to newborn piglets

Heat, oxygen — and bovine colostrum — get them off to a great start

BY JOE SCOTT

PIGLET MORTALITY can be a frustrating problem, but even small changes in farrowing practices may help address the situation.

Prof. Roger Hacker, Department of Animal and Poultry Science, says the most critical time for piglets is shortly after farrowing. Offering heat, oxygen and bovine milk products (immunoglobulin) to the piglet can improve survival, especially for the smallest ones, and make a big difference to pig health and producers' bottom line.

"The majority of piglet deaths occur within the first seven days of life," says Hacker. "Certainly, it's the first hours after farrowing that the piglets are weakest."

Chilling can put small piglets at a disadvantage in competing with the rest of the litter for colostrum from the sow. Hacker says it's vital that underweight piglets receive adequate warmth and comfort to stabilize their body temperature.

"The most effective and easiest thing a pork producer can do is add some heat at the rear of the sow in the farrowing zone."
– Roger Hacker

"The most effective and easiest thing a pork producer can do is add some heat at the rear of the sow in the farrowing zone," he says. "Adding a heat lamp can result in significant improvement in smaller piglet viability."

Another problem is lack of oxygen. Because of a sow's U-shaped uterus and large litter sizes, piglets can be oxygen-deprived even before birth and will then be lethargic after birth. Hacker suggests they be placed in 40-per-cent oxygen immediately at birth — not later, because the benefits diminish as time goes on and labour costs often make it inefficient.

Another small but effective step producers can take in the first 12 hours after birth is to provide energy to piglets, he says. Regular table cream is a good energy source. Feeding as little as six millilitres of cream along with dried colostrum will quickly catalyze strength and immunity in a newborn pig because its intestinal lining is highly permeable, allowing for large molecules and proteins from colostrum to pass rapidly from the gut into the bloodstream.

"This measure helps immunity and gets growth started right away," says Hacker. "Small efforts may lead to large rewards when the piglets are shipped as market hogs."

This research is sponsored by Ontario Pork and the Ontario Ministry of Agriculture and Food (OMAF). Ontario Pork also obtained funding from the Canada-Ontario Research and Development Program, which is funded by OMAF and Agriculture and Agri-Food Canada and administered by the Agriculture Adaptation Council on behalf of the Ontario Agricultural Commodity Council.

Heat, oxygen and bovine milk products can improve a newborn piglet's chance of survival, says U of G Professor Roger Hacker.

MARTIN SCHWALBE

Adjusting the internal clock

Researchers use lighting intervals to stimulate resting in piglets

BY MARIANNE FALLIS

POST-WEANING STRESS can hinder piglet health and behaviour. Guelph researchers are easing this transition by using light to cue resting and feeding behaviour.

Prof. Suzanne Millman, Department of Population Medicine, says weaned piglets may require cues to replace the sow's grunts that indicate feeding time. If these cues aren't available to help them during this transition period, piglet stress may increase. She is replacing the missing cues with alternatives such as lighting intervals to determine the effect on feeding, drinking and resting patterns.

"We're trying to establish how the loss of the sow affects piglets behaviourally shortly after weaning," says Millman. "By decreasing piglet stress (using regular signals), we hope to improve their health and well-being."

She's interested in piglet resting behaviour. Preliminary results indicate that although sows feed piglets in hourly intervals followed by resting periods, post-weaned piglets tend to rest longer and eat larger, less frequent meals. This could be due to the absence of "wake-up" sounds from the sow. Rest is important for recuperation from stress, but shorter, more frequent resting and feeding bouts may benefit piglets.

Researchers are using an intermittent lighting program to regulate feeding and resting patterns. They're replacing the common 10 light-hour days with two light hours followed by four dark hours. Millman hopes to entice piglet feeding when lights are on and resting when lights are off.

She will monitor piglet response to these different lighting schedules, including frequency of eating, drinking and resting. Measurements such as weight gain and water intake will also help determine if synchronizing piglet resting behaviour will improve their well-being.

"If programs such as this are implemented into commercial operations, they could improve piglet health, thereby strengthening the swine herd," she says.

Also involved in this project are research associate Kimberly Sheppard and undergraduate research assistants Melissa Madden and Erin Reid. Madden received funding from the Summer Ontario Veterinary College Leadership Award and the James and Marjorie Pinkney Award.

This research is sponsored by the Natural Sciences and Engineering Research Council, Ontario Pork and the Ontario Ministry of Agriculture and Food's swine research program.

U of G researchers are using light to help keep newly weaned piglets' sleeping and eating schedules regular.

PHOTOBAR.COM

A mighty wind

Drafty barns aren't to blame for all piglet vices

BY CLARE ILLINGWORTH

DID YOU KNOW PIGS DIVIDE THEIR PEN INTO SLEEPING, FEEDING AND DEFECATING AREAS.

ENVIRONMENTAL FACTORS such as drafty barns have been suspected of promoting certain pig behavioural vices that reduce animal welfare. But Prof. Tina Widowski of the Department of Animal and Poultry Science says it's unlikely that one factor alone is to blame.

Widowski is looking at two common problems in swine herds — belly nosing in newly weaned piglets and tail biting in growing pigs — to determine what effect cool drafts have on these behaviours. She found that while the drafts didn't directly affect either behaviour, the pigs were more restless. And restless pigs may engage in more tail- and ear-biting activities.

"There's often no quick environmental fix to many behavioural problems," says Widowski, "and tail biting is the most poorly understood vice of all farm animals."

Belly nosing in newly weaned piglets is believed to mimic the udder-massaging behaviours piglets use to stimulate milk letdown in sows. But continual belly nosing may leave lesions on piglet bellies. Tail biting is more destructive, causing injury, spinal abscesses and, in severe cases, carcass condemnation at the abattoir.

When these vices manifest themselves in a herd, says Widowski, many housing aspects are blamed, from crowding to water source to air supply.

To determine if drafts alone promote these behavioural vices, she and her research team used ceiling fans and an air conditioner in specialized rooms called environmental chambers to control the housing temperature and airflow.

A curtain divided the room in half, leaving one side draft-free so the piglets' response to increased airflow could be compared with that of pigs in non-draft conditions. Video cameras monitored both sides of the curtain, allowing the researchers to record how the animals spent their time in both treatments.

Widowski and her team supervised 80 newly weaned piglets, housed in groups of four under the two conditions. Results showed that belly-nosing behaviour did not increase among the piglets in the cold-draft group, but they did find piglets were restless and spent more time chewing on their pen mates' ears and tails than did the non-draft piglets. Some researchers believe this could lead to tail-biting behaviours.

To study the tail-biting response, the researchers used ropes dipped in salt water that mimicked a tail. Although the rope tails may not be an exact model for tail biting, they are safer than monitoring actual tail biting, says Widowski. Individually housed pigs weighing 45 kilograms — the most common stage for this vice — spent time on both sides of the curtain. The researchers found that cool drafts increased the pigs' activity. They were observed standing, changing behaviour and biting at the rope tails more often, but this didn't increase time spent chewing the rope.

MARTIN SCHWALBE

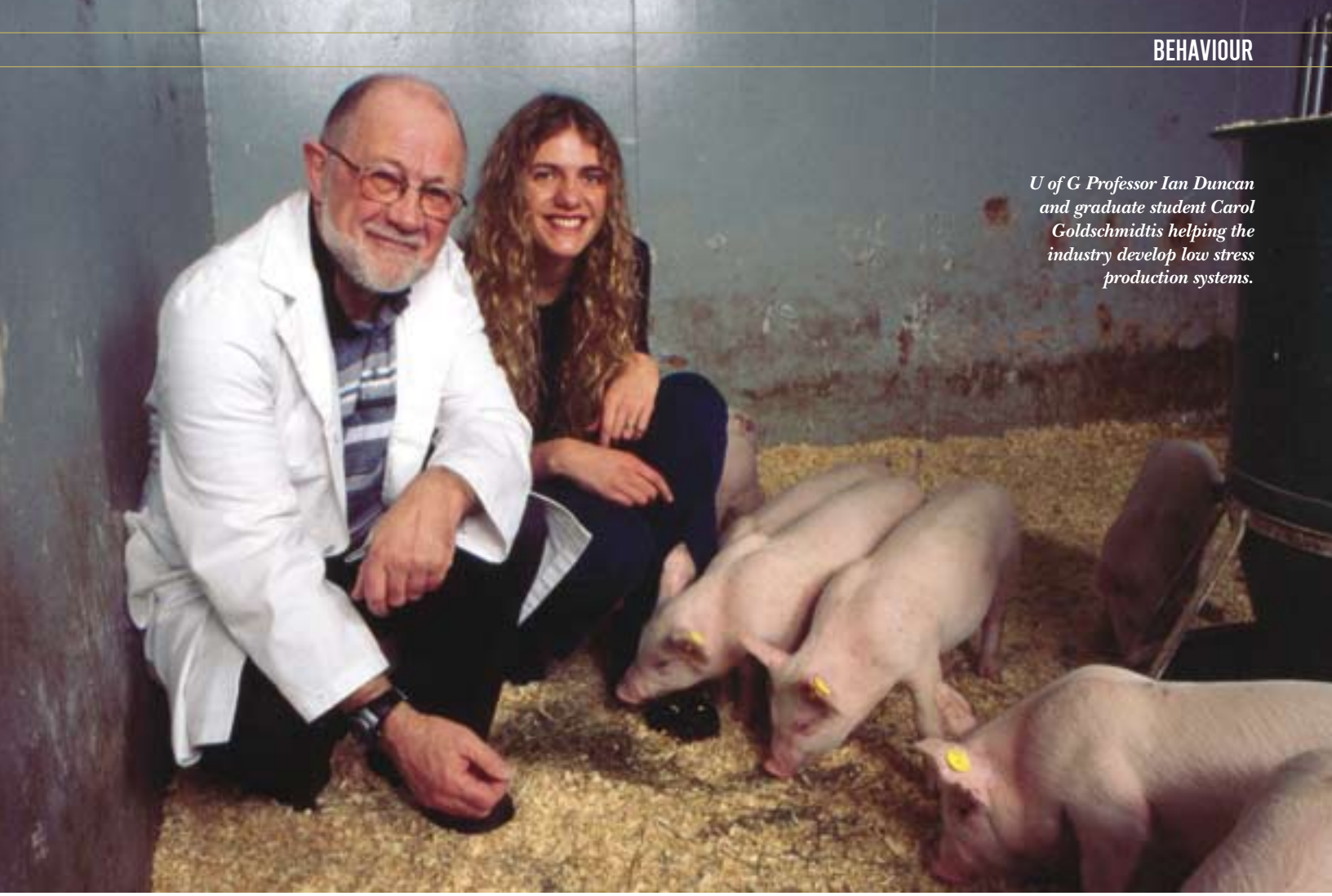
Poorly managed ventilation systems promote drafts and cause restlessness, which may be related to behviour problems in pigs, says Professor Tina Widowski.

"Behaviour problems in swine are often misunderstood, difficult to control in herds, and even more difficult to study in the laboratory," says Widowski. "We need to gain a deeper understanding of why these vices occur before they can be alleviated."

She and her team will continue to explore the role that environment and development play in pig behaviours.

Others involved in this work include graduate student Andrea Bruni and former graduate student Marilyn Jankevicius of the Department of Animal and Poultry Science, undergraduate student Laura Scott and technician Lindsay Tippin. The environmental chambers were designed by agricultural engineer Ron McDonald of Agviro Inc. in Guelph.

This project was funded by the Natural Sciences and Engineering Research Council, the Ontario Ministry of Agriculture and Food and Ontario Pork.



U of G Professor Ian Duncan and graduate student Carol Goldschmidtis helping the industry develop low stress production systems.

MARTIN SCHWALBE

Happy together

Production may be improved by understanding recognition

BY SARAH BROWN

PIGS' ABILITY TO RECOGNIZE each other could allow producers to develop more pig-friendly production systems.

Prof. Ian Duncan, Department of Animal and Poultry Science, believes pigs can recognize and remember one another. It's well-known that pigs in groups assume a social hierarchy and that introducing a strange pig will result in fighting. It follows, then, that understanding how pigs recognize each other will help the industry develop low-stress production systems where pigs are happy together, he says.

"There's a recent trend to keep gestation sows in groups rather than house them individually," says Duncan. "By understanding how pigs recognize each other, we can develop a basis for more harmonious, less stressful production systems" by grouping those who get along with each other.

Duncan, his colleague Prof. Tina Widowski and graduate student Carol Goldschmidt are trying to understand whether it's smell, sight or some other stimulus that promotes recognition. After obtaining encouraging results from previous studies, they're now embarking on a new project that will include exposing a test pig to two or more pigs in small pens. The pigs in the pens will be from the same social group as the test pig, so there will be some familiarity between them.

"By understanding how pigs recognize each other, we can develop a basis for more harmonious, less stressful production systems."
– Ian Duncan

Individual pig recognition and memory will be measured by the test pig's ability to continually choose the correct target pig, despite repetition and design changes. The researchers will watch as the test pig is exposed to more than two pigs and see if it can continually recognize and approach the same target pig, using smell and sight to differentiate.

Duncan says this research will generate a better understanding of how many pigs one pig can recognize and how many are too many to recognize, leading to production systems that use harmonious grouping strategies.

This research was funded by the Ontario Ministry of Agriculture and Food and the Natural Sciences and Engineering Research Council.

Taking 'stalk' in better feed

Researchers look to genetic strategies for resistance to corn fungus

BY JOE SCOTT

FEED THAT IS SAFE, economical and of high quality is essential in the livestock business. And this is driving new research at the University of Guelph that could lead to savings on the feed bill while delivering a top-notch product.

Prof. Peter Pauls, Department of Plant Agriculture, is looking at corn's resistance to *Fusarium*, a fungus that commonly plagues Ontario corn crops. The fungus usually attacks a crop during the flowering stage of growth and produces deoxynivalenol (DON) or vomitoxin, which can be harmful to both livestock and humans. Some infected crops can be used in animal feed, but the Canadian Food Inspection Agency recommends a limit of one part per million.

Besides the health issues with DON, handling contaminated crops can become expensive.

"*Fusarium*-infected corn should be handled separately from the rest," says Pauls. "This hurts pork producers who mix their own feed because more storage is required to keep things separate."

Pauls's research team is introducing genes that provide resistance to *Fusarium* into corn lines adapted for Ontario (they're using resistance genes from rice and some corn varieties). The rice genes have been modified to be resistant to the mould and are being inserted into the corn plant. The corn genes they've isolated that show resistance are usually expressed in the young seedling.

The researchers hope that by expressing these genes when the plant is flowering, which is also when *Fusarium* develops, the crop will become resistant to the fungus.

OLIVIA BROWN

U of G Professor Peter Pauls is helping corn fight a toxic fungus by adding novel genes to the plant.

"*Fusarium*-infected corn should be handled separately from the rest. This hurts pork producers who mix their own feed because more storage is required to keep things separate."
– Peter Pauls

This research could especially benefit pork producers. Pigs are particularly sensitive to DON and will exhibit reduced feed intake, growth and feed efficiency when the toxin is ingested. There's also evidence that toxins can affect a sow's litter size. For that reason, it's critical that DON is limited in the feed of farrowing operations.

Researchers are working to develop a rapid test for detecting resistance genes. Currently, it takes a few years to be sure that genes will be expressed in the next generation. A rapid test would work to establish a genetic fingerprint of the plant. This would speed up the breeding process and help bring better varieties to the market.

"Plant breeding can take a great deal of time and resources," says Pauls. "A rapid test could cut down the time it takes to develop a new variety of corn, giving farmers a better corn crop sooner."

This research is sponsored by Agriculture and Agri-Food Canada, the Canada Foundation for Innovation, the Natural Sciences and Engineering Research Council, the Ontario Corn Producers' Association, the Ontario Innovation Trust, Ontario Pork, the Ontario Research and Development Challenge Fund, Pioneer Hi-Bred, Syngenta Canada Inc. and Fédération des Producteurs de Cultures Commerciales du Québec.

Micro-organisms could save producers millions

BY ROBERT FIELDHOUSE

TOXINS IN FEED CAN REDUCE pig growth, well-being and meat quality, so Guelph researchers are looking for ways to detoxify contaminated feed, using an unlikely source — microbes.

Ting Zhou and his team at Agriculture and Agri-Food Canada (AAFC) are investigating bacteria that can eliminate vomitoxin caused by *Fusarium* fungi in swine feed. It's estimated that vomitoxin costs the Canadian pork industry $39 million annually in reduced feed efficiency and weight gain. The researchers hope to prevent the toxin from reaching the pigs.

"Vomitoxin has created a long history of problems for the swine industry," says Zhou. "Just a small amount can have damaging effects on productivity."

Research has found that one gram per 100 kilograms of feed will reduce swine growth by 50 per cent.

The culprit is in the grain. *Fusarium* infection is common in corn, wheat and barley. Moisture and cool temperatures provide an optimum environment for this fungus to grow on grains. Contaminated grain not suitable for feed can sometimes be used for ethanol production, but often it's simply disposed of, at considerable financial loss to producers.

In the past, binding agents have been added to feeds to decrease vomitoxin absorption in the pig's digestive tract, says Zhou, but his team believes that inactivating this damaging toxin could provide better results.

So they're borrowing a page from another barnyard companion — chickens. Poultry are less sensitive to vomitoxin because microbes in their lower gut (used to aid digestion) produce neutralizing enzymes. Zhou's team has shown that certain gut microbes convert vomitoxin to de-epoxy vomitoxin, which is several hundred times less toxic than its parent compound.

It's estimated that vomitoxin costs the Canadian pork industry $39 million annually in reduced feed efficiency and weight gain.

The researchers are now screening the hundreds of gut microbes found in chickens to pinpoint which bacteria may be helpful. They hope to add these bacteria or their neutralizing enzyme to contaminated feed, reducing its toxin load before it reaches swine diets.

Once these micro-organism strains are identified, their detoxification efficiency and optimal growth conditions can be analyzed. Eventually, the researchers hope to uncover the underlying genes that make the enzyme, so it can be synthesized in the lab.

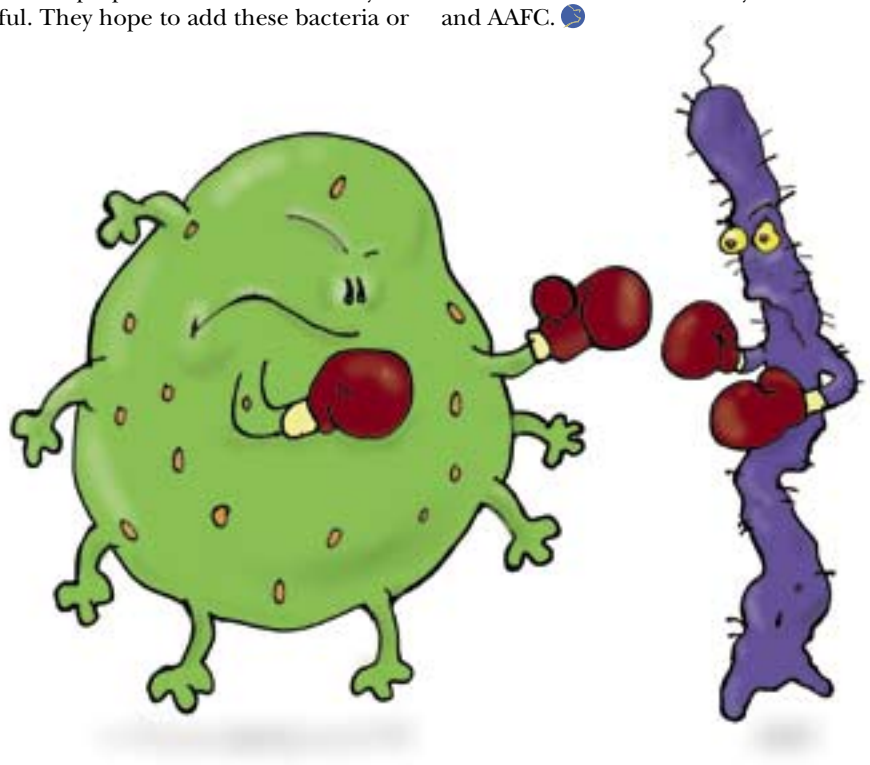
"Reducing vomitoxin in feed will increase animal productivity and welfare," says Zhou. "It will also help protect the safety of our food chain."

Toxins in animal feeds can pass residues on to the meat, so reducing vomitoxin in diets will also reduce toxic residues that may be present in animal-based foods. He hopes this research will help to further increase consumer confidence in food products.

Other researchers involved in this project are Joshua Gong, Chris Young, Rong Cao, Michael Cottrill, Hai Yu, Honghui Zhu and Xiuzhen Li of AAFC; Prof. Kees de Lange of the University of Guelph; and Wayne Du of the Ontario Ministry of Agriculture and Food.

This research is funded by Ontario Pork and AAFC.

DID YOU KNOW SCIENTISTS BELIEVE THE PIG ORIGINATED IN CHINA. EARLY EUROPEAN SETTLERS BROUGHT PIGS TO CANADA IN THE 1600s.



BRIAN FRAY

Selecting for survival

Larger litters are not always better

BY CLARE ILLINGWORTH

MARTIN SCHWALBE

Balancing litter size and piglet survivability could help producer profits, says U of G Professor Andy Robinson.

LARGER LITTER SIZE is a popular trait used for selecting breeding stock in the pork industry, but unfortunately, the industry is misinformed, because piglet survival drops in larger litters. That actually means less profit for producers. What's needed is a better balance between litter size and survivability.

That's what University of Guelph professors Andy Robinson and Margaret Quinton of the Centre for Genetic Improvement of Livestock have achieved. Analyzing production data collected over the last seven years from Ontario swine breeders, they have determined that a link exists between the heritability of litter size and piglet survival. If the two traits can be used together in breeding programs, both the number of piglets born per litter and the number that survive will be optimized.

"Having the ability to select for piglet survivability as well as litter size will greatly benefit the swine industry," says Robinson. "Increasing the number of piglets that survive and grow to market weight will be more profitable for producers."

Piglet mortality can have a number of causes, such as poor mothering ability of the sow, crushing and disease. But in large litters, the problem is often piglet size. These animals tend to have lower birth weights, which means they're less hardy and viable.

Using a technique known as Snell scoring — which estimates the heritability of a genetic trait and can determine whether or not a correlation exists between different traits — the researchers analyzed the number of piglets surviving the first 24 hours of life, litter size and number of pigs born alive in the popular Landrace and Yorkshire breeds. They found that, like litter size, piglet survivability is indeed a heritable trait in sows and that these two traits are correlated.

Piglet mortality can have a number of causes, such as poor mothering ability of the sow, crushing and disease.

They hope piglet survival will become part of the selection index for breeding sows in the near future.

"Selecting for piglet survivability while simultaneously selecting for total piglets born is a more effective method," says Robinson. "Having a greater number of piglets born is meaningless if they don't survive."

Data for this research were supplied by the Ontario Swine Improvement Program.

Small piglets need extra attention

Maximum care makes problems more rare

BY KENT FRASER

PAULA BIALSKI

Maximum-care management gets piglets off to a good start and could mean better returns for producers.

MAXIMUM CARE MANAGEMENT aimed at decreasing chilling, starvation and infectious diseases — basically, a commitment of an extra minute per day per litter — can improve small-pig survivability by almost 20 per cent, according to University of Guelph research.

"Maximum care is paying attention to detail, observing and responding to what you see," says Prof. Cate Dewey of the Department of Population Medicine. "It gives greater opportunity for small-piglet survival and higher weaning weights."

Dewey led a study comparing standard management practices in pork production with management techniques that gave all newborn piglets the best environment and care. Standard-care litters underwent normal teeth clipping, tail dockings, castration and iron injections and were provided with heat lamps. Processing instruments were not cleaned between pigs. Sows were fed twice daily.

The maximum-care management techniques used disinfected instruments for processing procedures. Each litter was provided with rubber mats and heat lamps. Chilled pigs were dried off after farrowing and fed colostrum. Severely affected pigs were given a hot water bottle to lie on. Large litters were split-suckled, separating the large and small piglets for one hour on the first day of life. Sows were given three meals daily, and manure from the crates was removed twice a day.

The pre-weaning mortality rate was 9.2 per cent for pigs in the maximum-care group and 10.1 per cent for pigs in the standard-care group. All piglets under 500 grams died before weaning, but among piglets weighing 600 grams to one kilogram, more were saved by maximum care. In standard-care litters, 30 per cent died; under maximum care, that number was reduced to 12 per cent.

Dewey says maximum care gave the smaller piglets a higher chance of survival from pre-weaning mortality. Indeed, by 16 days, there was an increase in total weight of 200 grams for small piglets (those under 1.1 kg at birth) and 150 grams for large piglets.

Giving smaller piglets a greater chance to succeed and lowering piglet mortality can have a great bearing on the efficiency of a hog operation, she says. It can also affect the industry by refocusing producers' attention on piglet care. If producers start the animals off well, an economic return will be achieved from lower piglet mortality and increased weight gain in the finishing barn.

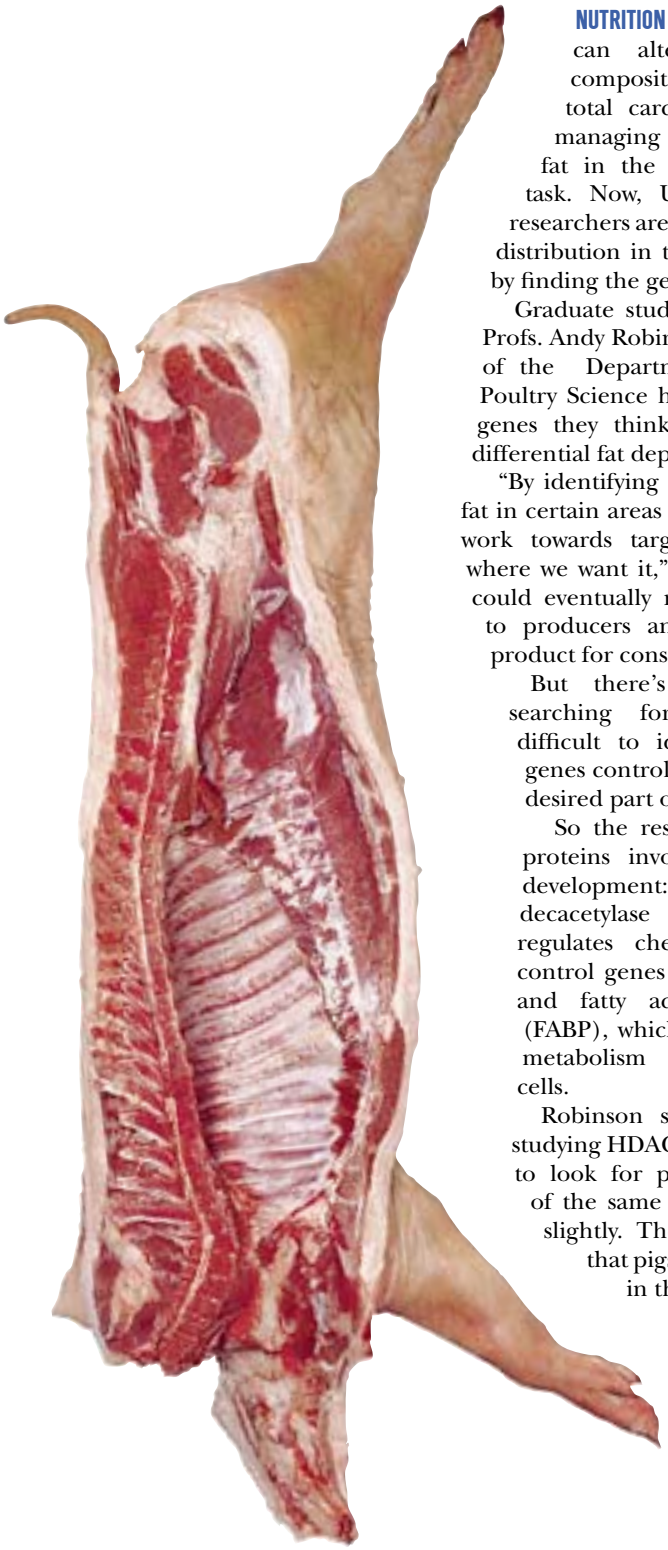
"Although maximum care incurs labour and supply costs, the resulting litter survival and weight gain will benefit producers in the long run," says Dewey. "This study gives producers some new ideas about what specifically they might implement in the barn to improve their existing operation."

This research was funded by Ontario Pork, the Ontario Ministry of Agriculture and Food, and Agriculture and Agri-Food Canada.

Searching for the elusive fat gene

Researchers uncover clues for understanding fat deposition

BY KRISTY NUDDS



ONTARIO PORK

NUTRITION AND SELECTIVE BREEDING can alter a pig's carcass composition, especially the total carcass fat content. But managing the distribution of fat in the carcass is a difficult task. Now, University of Guelph researchers are working to control fat distribution in the carcass deposition by finding the genes responsible for it.

Graduate student Xianghai Ye and Profs. Andy Robinson and Ann Gibbins of the Department of Animal and Poultry Science have identified several genes they think are associated with differential fat deposition.

"By identifying genes responsible for fat in certain areas of the carcass, we can work towards targeting fat deposition where we want it," says Robinson. "This could eventually mean greater returns to producers and a more desirable product for consumers."

But there's a challenge with searching for "fat" genes. It's difficult to identify which set of genes controls fat deposition in the desired part of the body.

So the researchers studied two proteins involved with fat tissue development: the enzyme histone decacetylase (HDAC), which regulates chemical changes that control genes for fat tissue growth; and fatty acid binding protein (FABP), which helps regulate lipid metabolism and transport into cells.

Robinson says while they were studying HDAC and FABP, it was vital to look for polymorphisms, forms of the same gene that differ only slightly. The researchers believe that pigs with a polymorphism in these genes controlling fat deposition may be more likely to show differences in the way fat is deposited in the body.

Tissue samples were taken from a population of 429 pigs developed from crosses of Hampshire, Duroc and Large White breeds. A total of 110 traits were measured on each pig, including body weight, backfat thickness, lean muscle weight and muscle fat content.

"By identifying genes responsible for fat in certain areas of the carcass, we can work towards targeting fat deposition where we want it."
– Andy Robinson

The researchers found four polymorphisms in this pig population, all affecting different body areas; one in particular at the HDAC enzyme may be involved with differential fat deposition.

How this polymorphism affects fat deposition isn't fully understood yet. In the future, producers may be able to select breeding pigs for this important characteristic based on a genetic test.

"If other polymorphisms responsible for differential fat tissue deposition can be identified, they can be used as genetic markers in the pigs," says Robinson. "This research demonstrates the potential for altering the carcass structure distribution of fat."

This research was sponsored by the Ontario Ministry of Agriculture and Food, the Ontario Swine Improvement Program and Shamrock Breeders Group. Animals involved in this research were raised at Ridgetown College.

A quality carcass is a balance between genetics and nutrition.

DID YOU KNOW THE BIGGEST PIG ON RECORD WAS BIG BILL, MEASURING 2.7 METRES LONG AND WEIGHING 1157KG.

DID YOU KNOW THAT THE SWINE GENOME HAS MORE THAN 100,000 GENES.

A chip off the ol' pig

Genetic technology is helping to link swine traits to genes

BY KIM WAALDERBOS

PHOTOBAR.COM

Researchers are using new technologies to identify economically important swine genes.

IMPORTANT SWINE TRAITS such as fast growth rate, disease resistance and high piglet survival may be all in the genes, but matching up traits with genes is a substantial task — one that's being sped up and cut down to size by Guelph researchers.

Prof. Jim Squires and graduate student Jennifer Stewart of the Department of Animal and Poultry Science are trying to link swine traits to the genes responsible for them. It's a tedious process, but they're being helped along with microarrays, small glass slides or "chips" that bind specific genes to reveal which ones are active in each pig. They hope to refine genetic tools for producers to improve their herds.

"By identifying and associating these genes with observed traits, we can help producers select for stronger, healthier animals," says Squires. "Microarrays simply speed this process along."

The traditional strategy for genetic research has been to concentrate on one or two genes at a time, to see their effects on a specific trait. Microarrays expand on this approach — and speed it up — by allowing researchers to screen thousands of genes at a time.

Here's how it works. Gene products from the pig's tissue bind to individual "docking stations" — each one tailored exclusively to attach to a particular gene — on the microarray chip. Once they're "docked," the gene products are illuminated by a chemical dye, so researchers can identify which genes are active in a particular pig. From there, they can relate these active genes back to possible traits or behaviours in the animal.

The researchers are also hoping to use sophisticated new swine microarrays to pinpoint specific gene activity more accurately. At present, says Stewart, not many swine-specific microarrays exist. In fact, she's using chips designed for human studies that she and Squires received from the Ontario Cancer Institute. Human chips are useful because many genes from humans and pigs are similar. With new microarrays designed especially for pigs, she hopes producers can select herd genetics related to certain behaviours and disease-fighting traits.

"By identifying and associating these genes with observed traits, we can help producers select for stronger, healthier animals."
– Jim Squires

Other researchers working with Squires on the microarray project include Profs. Kees de Lange, Julang Li and Tina Widowski, Department of Animal and Poultry Science; Prof. Cate Dewey, Department of Population Medicine; and Joshua Gong of Agriculture and Agri-Food Canada.

This research is funded by Ontario Pork and the Food Systems Biotechnology Centre at the University of Guelph.

It's very unCOOL

Country-of-origin labelling will add costs and cut margins, say researchers

BY SARAH BROWN

OLIVIA BROWN

Labelling U.S.-sold pork and other meat products with its country of origin could hit both producers and consumers in their pocketbooks, says a Ridgetown College researcher.

THE UNITED STATES WANTS A LABEL on most imported foods clearly stating the product's country of origin. University of Guelph researchers are warning the agri-food industry to brace itself because the cost of country-of-origin labelling (COOL) will be many millions of dollars.

Prof. John Cranfield and research associate Randy Duffy of the Department of Agricultural Economics and Business and Prof. Ken McEwan of Ridgetown College are forecasting a $55.3-million producer-compliance cost to the Canadian pork industry alone.

This represents a $7.50 processing fee for each hog to cover the extra sorting, segregation and tracing regulations COOL requires. With 44 per cent of Ontario's pork being exported to the United States, studies about the implications of COOL have the pork industry's attention.

"If COOL becomes reality, its impact on the pork industry could be damaging," says McEwan. "In the long term, producers could see profitability loss."

COOL is driven in part by a 2002 study by the Department of Agricultural and Resource Economics at Colorado State University, which reported that American consumers perceive home-grown products to be safer than imports. It helped prompt the U.S. Congress to develop COOL legislation, which is likely to be implemented this year. It will apply to all imported meat and seafood, as well as fresh or frozen fruits and vegetables.

"Ironically, COOL will not promote food safety or food quality," says McEwan. "The legislation doesn't affect providers or processing standards."

He has reviewed industry data on Ontario's production and export of live and processed hogs to determine the financial effect COOL could have on individual producers. The initial impact will be lower pig prices because the processing fee will be deducted from Canadian hogs exported to the States. This loss by Ontario producers, he adds, would have a multiplier effect on the provincial economy, resulting in a loss of more than $368 million in COOL's first year.

"If COOL becomes reality, its impact on the pork industry could be damaging. In the long term, producers could see profitability loss."
– Ken McEwan

Ontario producers need to prepare for COOL's impact, say researchers. One suggestion from McEwan is for Ontario producers to value-add with more local processing, giving their products a higher value when exported. Another solution may be to find U.S. processors willing to slaughter only Canadian animals, he says. This would minimize the segregation and record-keeping costs paid by producers.

U.S. legislators have extended COOL's compliance deadline from Sept. 30, 2004, to 2006 in order to help U.S. farmers and processors adjust to the additional costs associated with more labelling. Although an implementation extension will give producers more time to prepare, the resulting impact on the agriculture industry and its commodities will still be hard-felt, says McEwen.

This research was funded by Ontario Pork and the Ontario Ministry of Agriculture and Food research program at Ridgetown College.

Consumers want more information

They change their decisions when they have more product knowledge

BY SARAH BROWN

MEAT AND FISH PRODUCED from transgenic technology may one day reach markets, so University of Guelph researchers asked consumers how they'll accept these foods. The response: Canadian consumers want to know the facts about their food before they buy.

Prof. David Castle, Department of Philosophy, and Prof. Karen Finlay and graduate student Steve Clark of the Department of Marketing and Consumer Studies asked more than 1,300 Canadians what information would help them accept transgenic pork and salmon. They found that increasing consumer awareness about the benefits of transgenic animals changed consumers' purchasing decisions.

"Knowing the facts behind foods could help people understand new technologies, such as transgenic products, that are often introduced without properly informing consumers," Castle says.

Olivia Brown

U of G Professors David Castle, left, and Karen Finlay used hand-held devices to poll consumers in major Canadian cities about their thoughts on genetically modified food.

Last winter, 1,355 consumers from eight Canadian cities (Vancouver, Kelowna, Calgary, Guelph, Toronto, Montreal, Fredericton and St. John's) were asked about their understanding of transgenic technologies, their acceptance levels and what information they need to make an informed purchase. Consumers registered their response to the technologies digitally, on hand-held units and with written transcripts.

Researchers focused on two potential transgenic products, pork and salmon. Pork can be produced using Enviropigs™, which produce a specific digestive enzyme to reduce the phosphorus excreted in their manure by 60 per cent or more. The enzyme, called phytase, makes phosphorus in feed more accessible during digestion, allowing less phosphorus to end up in manure. Excess phosphorus applied to fields as fertilizer could reach waterways, harming aquatic life.

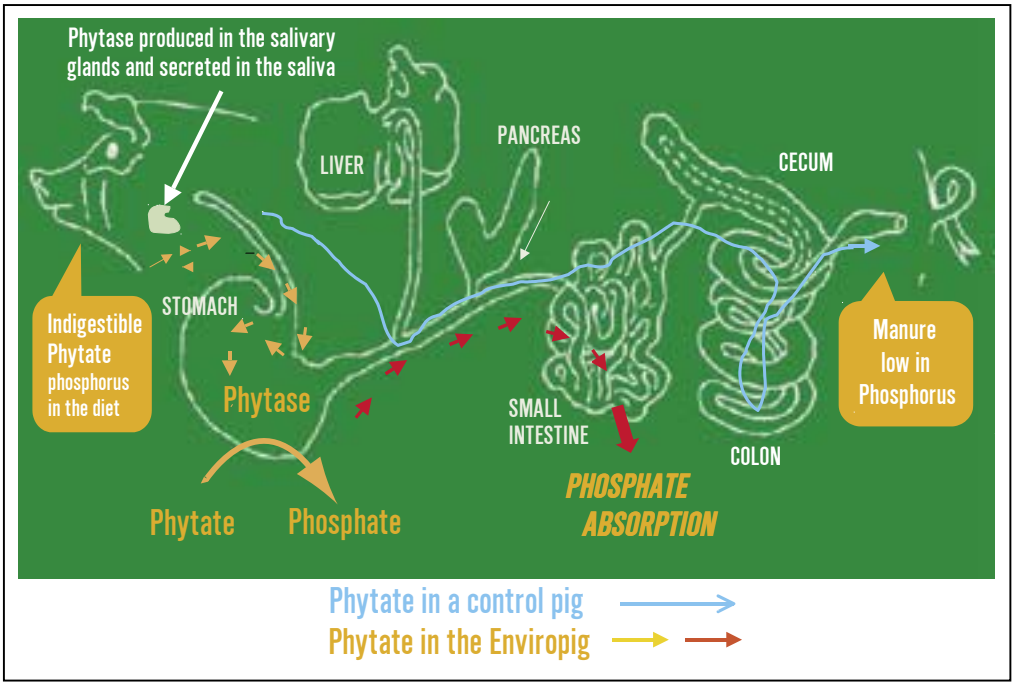
Transgenic salmon have an added growth gene taken from another fish that enables faster growth. These salmon would reach markets faster than conventionally raised salmon and could provide a positive economic spinoff for coastal towns and villages rearing fish throughout the year.

Manufacturers are usually reluctant to tell consumers that products are transgenic for fear of reduced sales, says Finlay. So consumers surveyed were first asked to respond to the concept of buying meat from transgenic pigs and salmon. Initially, 53 per cent indicated they would purchase both transgenic products. Consumers were then provided with information pertaining to the animal's purpose and the resulting environmental or economic benefits. Based on that, an additional seven per cent said they would consider the purchase. These results suggest that providing product information leads to increased consumer willingness to buy transgenic products.

Castle and Finlay hope a proactive approach to informing consumers about their food will promote better communication about transgenic food development. By understanding consumers' motives for accepting or rejecting transgenic food products, producers and retailers will be better prepared for the reaction once the products reach grocery store shelves.

"Transgenic animals are real, they do work, and they may eventually reach the food market," says Castle. "Consumer acceptance and education should be of major concern to producers if the benefits of these technologies are to be realized. An uninformed — or misinformed — public won't be able to make informed choices about what they choose to eat."

This research was funded by the Canadian Program on Genomics and Global Health.



It's safety first for the Enviropig™

Researchers are testing meat from this novel technology to ensure its safety

BY JUDY MAUS

OVERCOMING THE BARRIERS that prevent the Enviropig™ from extending its benefits internationally has become a top priority for the University of Guelph research team that developed it.

Enviropig™ researchers know the animal's waste contains less phosphorus than that of conventional pigs, thanks to an introduced gene that makes the animals more efficient at digesting and using plant phosphorus, which contributes to nutrient loading in waterways.

But their work is far from finished.

The researchers, including Profs. John Phillips, Molecular Biology and Genetics, and Cecil Forsberg, Microbiology, have been doing extensive analyses designed to answer Health Canada's questions about whether Enviropigs™ are safe to enter the food chain. Right now, the animals are confined to research facilities. Before they can be raised by farmers and consumed by the public or exported, a variety of data must be assembled to satisfy federal regulatory requirements.

"The ultimate goal of the phase we're in right now is to produce the evidence that the regulatory agencies require to give us the go-ahead," says Phillips. "We're determined to do it because we believe these animals really will offer a unique tool in the environmental sustainability of animal agriculture."

The researchers hope the Enviropig™ will benefit pork producers domestically and internationally, particularly in countries where low-quality feed is all that's available. Typically, low-quality feed contains less phosphorus, which limits growth rate. But Enviropigs™ are more efficient at extracting phosphorus than conventional pigs are, making them better able to benefit from low-quality feed.

The Enviropig™ offers a unique tool in agriculture's environmental sustainability.

To comply with standard food safety regulations, researchers have analyzed the animal's fat, mineral and protein composition. They're also performing tests to show that Enviropig products are free from known allergens. Preliminary results look promising, Phillips says.

With food safety issues at the forefront of public concern, research methods are under much greater scrutiny than ever before, he says, so analyses must be extraordinarily thorough and accurate. Social sensitivities also accompany the idea of any transgenic organism, further increasing the level of scrutiny and research required.

Findings to this point show improved phosphorus digestion is the only difference between Enviropigs™ and conventional pigs. In addition, Enviropigs™ have been shown to be no more susceptible to disease and have proven to produce litters of the same size and at the same rate as their non-transgenic predecessors.

Once safety questions are addressed, Phillips hopes the Enviropig™ will stand on its own merits for the diverse benefits it has to offer.

This project is sponsored by Ontario Pork and MaRS LANDING (Medical and Related Sciences Links to Agricultural Network for Development and Innovation with Guelph).

Fibre-rich feed needs extra punch

Threonine supplements are vital if you're feeding high fibre

BY BLAIR CRESSMAN

DIETS CONTAINING HIGH LEVELS of fibrous ingredients can substantially reduce protein uptake by pigs and should be supplemented, says a University of Guelph researcher.

Prof. Kees de Lange, Department of Animal and Poultry Science, says fibre is often added to diets to reduce manure odour and feed costs, to improve gut health or to enhance the animal's well-being. But it turns out these fibrous ingredients can also reduce the animal's ability to extract nutrients from its food. One nutrient whose use can be substantially affected is the amino acid threonine, which is essential for tissue growth.

"Pigs fed fibrous diets should be supplemented with threonine to maintain lean tissue growth," says de Lange.

Dietary fibre can be either insoluble (cellulose fibre) or soluble in water. The negative effects of water-soluble fibre — such as pectins found in rye and soybeans — has been the focus of research by de Lange, Prof. Steve Leeson and graduate students Julia Zhu and Aileen Libao. They've found water-soluble fibre can reduce lean tissue growth in pigs fed threonine-limiting diets by as much as 15 per cent. These negative effects were not observed when pigs were fed lysine-limiting diets. If fibre-rich feeds are supplemented with specific amino acids, says de Lange, pigs will receive the benefits of fibre without losing lean tissue growth.

"Dietary pectins stimulate threonine losses from the large intestine by increasing intestinal cell turnover," he says. Intestinal bacteria may also be stimulated by water-soluble fibre to consume proteins that are high in threonine. This means that standard digestibility measurements taken in the small intestine won't capture the negative influence of soluble fibre.

"The take-home message is that in our current feed formulation systems, we're not accounting for the negative effects of soluble fibre," de Lange says.

PAULA BIALSKI

Adding fibre to swine diets reduces manure odour, but decreases nutrient uptake from feed, says U of G Professor Kees de Lange.

Standard digestibility measurements taken in the small intestine won't capture the negative influence of soluble fibre.

He is now exploring the influence of fibre on other essential amino acids, including methionine and tryptophan.

This research was sponsored by Ontario Pork, Degussa AG, Agribrands/Cargill, the Natural Sciences and Engineering Research Council, and the Ontario Ministry of Agriculture and Food (OMAF) research program at the University of Guelph. Ontario Pork also obtained funding from the Canada-Ontario Research and Development Program, which is funded by OMAF and Agriculture and Agri-Food Canada and administered by the Agriculture Adaptation Council on behalf of the Ontario Agricultural Commodity Council.

Don't forget the water factor

Humans produce 40 times more waste than pigs

BY KATIE MEYER

PEOPLE OPPOSED TO BUILDING new livestock barns routinely point to studies showing that livestock produces much more waste than humans do. But it turns out those studies omit a big factor — the huge amount of water used in handling human waste.

According to Prof. Ron Fleming of the University of Guelph's Ridgetown College, humans actually produce 40 times more waste than pigs, after allowing for the extra dilution water that's used by humans.

He says 2,000 feeder pigs produce the equivalent organic waste of 7,000 people. But human sewage handling uses so much water that the waste from just 50 people takes up the same volume as waste from 2,000 pigs.

"We're doing this study to educate people and help them put waste production into perspective," says Fleming.

This initiative is in response to a growing demand from the rural community for farms to use sewage treatment practices similar to those used for managing human waste. Fleming says some people attribute more environmental risks to current farm practices and believe human sewage treatment methods to be superior, but the gains and losses of the existing processes should be weighed first.

The waste from just 50 people takes up the same volume as waste from 2,000 pigs.

Typically, livestock manure systems are much different from municipal sewage systems, he says. These systems can be compared using an indicator called biochemical oxygen demand (BOD 5), a five-day digestion test reflecting the amount of organic material in waste water. It measures how much oxygen is required by micro-organisms to stabilize the organic matter in this water over five days.

Liquid pig manure has a BOD 5 of 28,000 parts per million (PPM or mg/L). Raw sewage entering a waste-water treatment plant has a BOD 5 of about 170 ppm because it's so heavily diluted with water. That makes animal manure 165 times more concentrated than human sewage. A human actually produces the same volume of diluted waste as about 40 pigs. Before dilution, the ratio is more like one pig to four humans.

Farm manure management systems introduce nutrients such as nitrogen and phosphorus back into cropland by spreading it as fertilizer. The manure represents a high organic load, which is recycled through this process. With human waste management, however, organic loading is very low because sewage is heavily diluted with water. In the treatment process, bacteria are killed off by chlorination.

Although some people have suggested that sewage treatment be considered on farms, they may not appreciate the environmental costs, particularly the amount of water that would be required, says Fleming.

"Farmers have a great deal of interest in manure treatment systems," he says, "but the most appropriate systems may be different from those used for human waste."

This research is sponsored by the Ontario Ministry of Agriculture and Food and Ontario Pork.

Ridgetown College researcher Ron Fleming says sewage treatment systems are not the solution for managing swine waste.

MARK STAFF

Supplementing swine diets with phosphorus may not be necessary as new research indicates it's more digestible than originally thought.

AGRICULTURE AND AGRI-FOOD CANADA

Time to fine-tune phosphorus

Conventional measurements significantly underestimate digestibility

BY FRANCINE MORLEY

EATING LIKE A PIG is taking on a whole new meaning at the University of Guelph as researchers take a closer look at how swine digest dietary phosphorus.

Conventional measurements for phosphorus — an essential mineral for bone development and growth — underestimate the true digestibility in swine feed ingredients by 25 to 35 per cent. This results in inaccurate diet formulation and can lead to increased feed costs and environmental pollution, says Prof. Ming Fan, Department of Animal and Poultry Science.

"Cost and pollution have made research on improving the efficiency of phosphorus use by pigs one of the most important issues in swine nutrition," Fan says.

Most of the phosphorus in swine diets comes from ingredients of plant origin and isn't thoroughly digested, so diets are often supplemented with inorganic phosphorus to make sure swine nutrient requirements are met. That's costly to producers and the environment, and according to research by Fan and his colleagues, it may be unnecessary as well.

"A scarcity of information exists on the true digestibility values and the endogenous phosphorus outputs associated with various feed ingredients for pigs," he says. "Our research shows that we have been underestimating digestive utilization of phosphorus in corn and soybean meal, major feed ingredients in commercial swine diets around the world."

Fan and his research team are the first to measure digestion of feed ingredients in terms of what's called true digestibility, which adjusts for phosphorus that is naturally secreted by pigs into their digestive tracts. Without adjusting for such endogenous outputs, phosphorus digestibility is underestimated for conventional corn and soybean meal by as much as 25 and 38 per cent, respectively.

Fan's research is good news for hog producers' bottom line, but it's also good news for the environment because phosphorus is a key contributor to eutrophication (oxygen depletion) in fresh surface water. Reducing phosphorus released in hog fecal excretion — along with improved manure management practices — would help ease the burden, he says. And pork producers would benefit through reduced phosphorus supplementation costs and more accurate diet formulations.

The next step in his research is to more accurately define true digestible phosphorus requirements for pigs.

This research is funded by the Natural Sciences and Engineering Research Council, the Ontario Ministry of Agriculture and Food and Ontario Pork.

One step closer to odourless manure

An electrifying approach allows researchers to breathe fresh air

BY CHERYL TRUEMAN

PROGRESS IS BEING MADE in the effort to eliminate unpleasant odours associated with hog manure.

Prof. Nigel Bunce of the Department of Chemistry and Biochemistry at the University of Guelph is finding that chemical reactions could help remove odours from manure. He hopes the reactions started by electricity will eliminate odours and help separate liquid manure into solid and liquid parts.

Bunce believes this research could help hog producers develop better relationships with their neighbours.

"We have a project that is turning out to be very successful," he says. "Success is being able to tell Ontario hog producers: 'Yes, we have an idea that we can pass on to engineers and economists for further development and application of pig farms.'"

Many hog-manure components, including chemical compounds called indoles, produce unpleasant smells. In earlier research, Bunce has been able to break down the odour-causing chemical compounds found in hog manure through electrolysis, the same technology used to produce aluminum. Electrolysis kick-starts chemical reactions through the presence of an electrical current in liquid solutions.

Passing a current between two electrodes starts a chemical reaction that changes hog manure's chemical structure. Compounds such as indoles become odourless.

"The chemistry is complicated and hog manure is very complex," says Bunce. "During electrolysis, there are many chemical reactions going on."

He has expanded his electrolysis research to encourage other chemical reactions that cause the solids in hog manure to join together and form a mass. This could eventually lead to a quick separation of solid and liquid parts of manure and allow the solid part to be composted like cattle manure. Solid manure is easier to handle and promotes easy composting because it can be composted in smaller units.

BETTER FARMING

Technology used to produce aluminum may also help sweeten unpleasant odours from swine manure.

Bunce hopes the completion of his research will lead to further studies focusing on economic and engineering solutions for on-farm electrolysis.

This research is sponsored by the Ontario Ministry of Agriculture and Food and Ontario Pork.

Swine slurry for better soil

It may be a viable alternative to chemical pesticides, researcher says

BY DAVE PETHERAM

GROWERS ARE WARNED not to add manure to potato fields for fear of increasing the incidence of scab disease, but researchers have found that adding swine manure can actually decrease the incidence of potato scab, ultimately delivering a better product to consumers.

George Lazarovits of Agriculture and Agri-Food Canada (AAFC) says swine manure applied to low pH soils helps kill the pathogens causing potato scab.

"Swine manure, if used correctly, may be an environmentally friendly alternative to chemical pesticide treatments," he says. "We hope to develop storage and handling techniques that allow more effective use."

Lazarovits and his research team discovered swine manure's beneficial properties after testing on three potato fields. Two fields showed disease reduction, something the researchers didn't expect. It was determined that volatile fatty acids (VFAs) in low pH soils contributed to this success.

"Swine manure, if used correctly, may be an environmentally friendly alternative to chemical pesticide treatments."
– George Lazarovits

VFAs in manure, such as vinegar (acetic acid) and other related compounds, are toxic to many plant pathogens in soil, under low pH conditions. Higher acid in the soil reduces pH and allows the VFAs to remain active. A higher pH soil (above 6.5) would effectively neutralize these acids.

VFAs also serve as a food source for beneficial soil organisms, which ingest unwanted pathogens. Because the acids are consumed, they offer a safe disease control method. Chemical pesticides and fumigants also reduce disease in potatoes, but these chemicals may leave residual contaminants in the soil that are picked up by potato plants, posing a health risk to farmers and consumers.

Lazarovits is now fine-tuning handling techniques that will make swine manure more effective at controlling diseases and will minimize food safety concerns in crops.

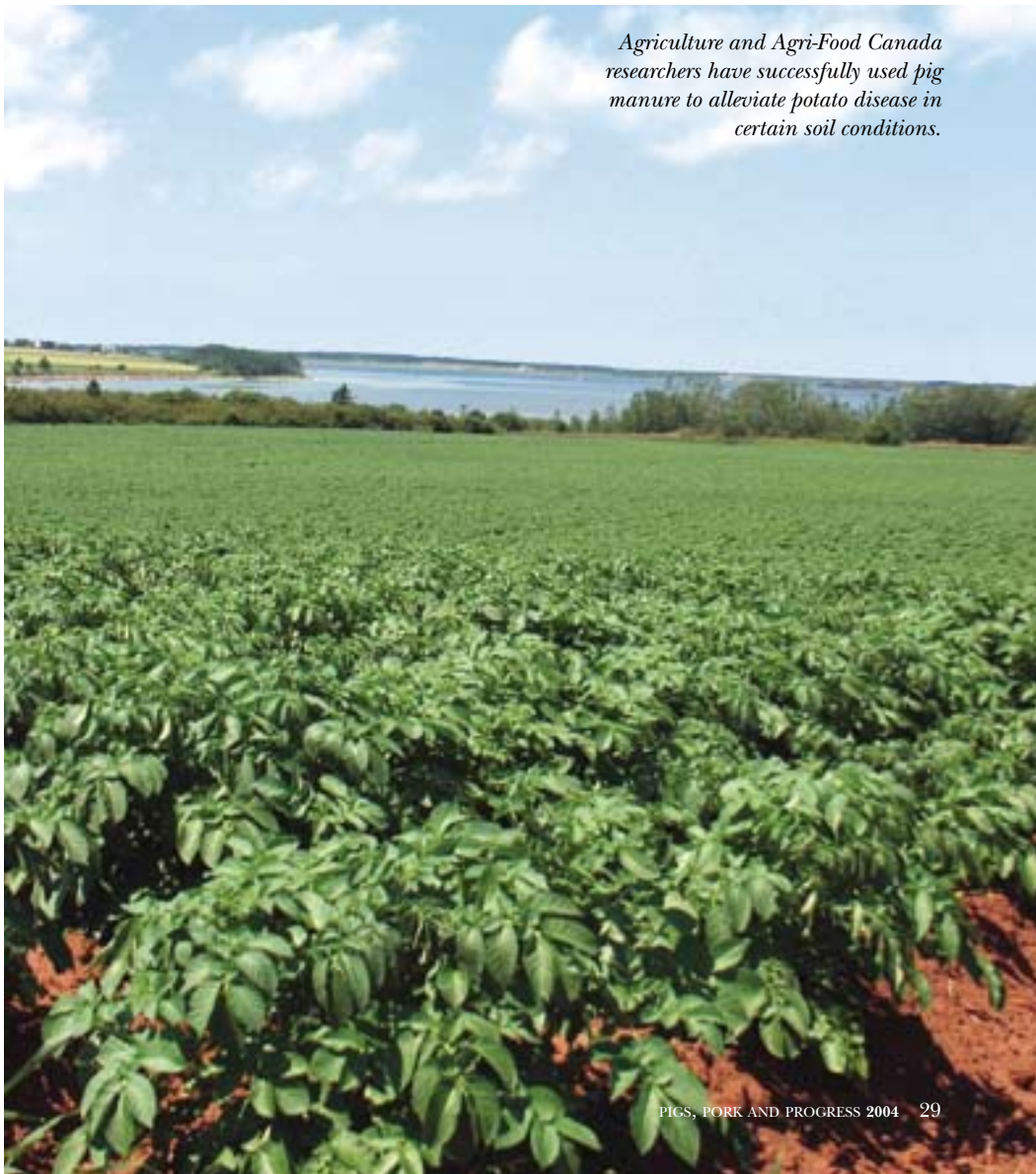
Researchers are also determining how herd management and manure storage conditions affect the type and number of VFAs in pig manure. With this information, they can better prescribe manure of various VFA levels for different soil types.

To eliminate the risk posed by human or animal pathogens such as *E. coli* and *Salmonella* in the handling of the manures, researchers are looking at various management techniques. An on-farm prototype of a thermophylolic composter, which pasteurizes manure by raising its temperature above 60 C, can eliminate potential pathogens. This pasteurized manure could also be combined with beneficial micro-organisms called probiotics that are helpful to soils. Lazarovits hopes this retrofit has the potential to make manure a source of value to producers.

"Our hope is to ultimately allow producers to turn manure into something that is value-added," he says. "Research is showing that pig manure isn't just simply a waste product anymore."

Other researchers involved in the discovery of swine manure's beneficial properties for potato crops are Ken Conn of AAFC and Mario Tenuta of the University of Manitoba.

This research is funded by Ontario Pork, the federal Canadapt Program administered by the Agriculture Adaptation Council and AAFC's matching investment initiative.



Agriculture and Agri-Food Canada researchers have successfully used pig manure to alleviate potato disease in certain soil conditions.

PRINCE EDWARD ISLAND POTATO BOARD

One-hour odour control

That's all it will take, if composting studies pan out

BY ALISON SCHNEIDER

Composting manure with straw can help alleviate odour and gas emissions.

RON FLEMING

COMPOSTING CAN ELIMINATE pig manure odours in as little as 60 minutes, according to U of G research.

Prof. Ron Fleming and research technician Malcolm MacAlpine of Ridgetown College found that mixing liquid manure with nutrients and organic materials such as straw can eliminate odours from swine manure in just one hour. Their findings are based on the proven principles behind composting, using oxygen and agitation to neutralize greenhouse gas emissions.

"No offensive odours can be detected after composted manure application or outside the composting building," says Fleming. "It leaves only an earthy smell that's much more pleasing."

In composting, organic materials such as manure and plants are broken down to produce a stabilized end product that's a good nutrient source and improves soil structure.

For his part, Fleming is using a technology called an in-vessel compost system designed by Tom Smith of Global Earth Producers. It mechanically turns and aerates liquid manure mixed with organic matter. The movement and aeration promote more rapid composting, producing heat and moisture rather than ammonia and odours.

Fleming also found that manure composting concentrates nutrients, reducing the volume that's spread on fields. This can save time and money when applying manure as a fertilizer, he says. Another benefit to composting manure may be the elimination of pathogens that could contaminate the water supply through runoff. His current research is determining storage conditions that help eliminate these harmful manure residents. This summer, Fleming will be demonstrating the manure composting system at Ridgetown College. The technology has been modified for handling turkey solid waste as well.

This research is funded through Agriculture and Agri-Food Canada's greenhouse gas mitigation program.

ABATING CLIMATE CHANGE

by Kris Robillard

GREENHOUSE GAS (GHG) EMISSIONS ARE KEY elements contributing to climate change. The release of GHG emissions into the atmosphere causes weather to change, resulting in pest infestations, droughts and health issues. University of Guelph researchers are joining forces to help reduce the production of GHG emissions, specifically methane.

Prof. Ron Fleming of Ridgetown College has developed an innovative composting technique that shows a 50-per-cent reduction in methane emissions during swine manure storage. This reduction has been quantified through research by Prof. Claudia Wagner-Riddle of the Department of Land Resource Science.

"It's my job as a scientist to contribute to the global effort of reducing GHGs," Wagner-Riddle says.

The composting initiative began almost 10 years ago in Ridgetown. Initially, Fleming began to experiment with ways of reducing odour produced by storing swine manure.

"The composting technique requires the use of a large mixer as well as fans that blow from below the pile of mixed straw and manure," says Wagner-Riddle.

Through composting, Fleming has successfully mitigated the odour (see story above), but a more recent initiative sponsored by the Climate Change Action Fund saw Wagner-Riddle join the team and measure the composting technique's ability to reduce methane production.

The composting technique could be adopted by environmentally concerned farmers. Currently, the costs associated with implementation are steep, but the benefits to the environment are impressive.

Other applications for the composting system have been recognized. Past research has concentrated primarily on managing swine manure storage, but new funds will enable testing of the composted manure as a fertilizer. Preliminary work on this has already begun.

Establishing a quality fertilizer would help farmers adopt the composting waste-management system, says Wagner-Riddle. And through large-scale adoption, the agriculture sector could notably reduce its production of GHG emissions (currently this stands at 10 per cent).

A 2000 study indicated that Canada's agriculture industry produced 8.3 per cent of the nation's GHG emissions. Of that, 15 per cent was due to manure.

This research was funded by the Climate Change Action Fund of Environment Canada and the Ontario Ministry of Agriculture and Food.

Adding science to on-farm cremation

Farmers' interest in disposal alternatives leads to field trials for commercial units

BY DAVE PETHERAM

WITH SHRINKING MARGINS and a decreased market for rendered animal byproducts, producers are looking for safe alternatives to dispose of dead-stock. Under Ontario's Dead Animal Disposal Act, dead-stock disposal options for swine producers are burial, on-farm composting and pickup by a licensed dead-stock collector. These limited options are forcing many farmers to consider on-farm cremation.

Researchers in the University of Guelph's School of Engineering conducted a series of field trials on commercially available on-farm cremation units. They analyzed the flue gas leaving the cremation unit for particulate matter, heavy metals, carbon monoxide, sulphur dioxide, oxides of nitrogen, acidic gases, and volatile and semi-volatile organic compounds.

"We want to develop a better understanding of the emissions from these cremation units," says Prof. Bill Van Heyst. "These data can contribute to the development of codes of practice and guidelines for using on-farm cremation units, if they are to be included in the new nutrient management legislation."

Ensuring environmental safety is vital for the cremation unit's acceptance on Ontario farms.

Samples of the remaining ash were analyzed for the presence of heavy metals and semi-volatile organic compounds, as well as their toxic leaching potential. The economics of using on-farm incinerators is also under review.

Ensuring that incinerators are environmentally safe is vital if these units are going to be allowed on Ontario farms, says Van Heyst. He believes this research may ultimately lead to a certification program for commercially available on-farm cremation units.

This level of testing is unprecedented in North America, he adds. Some studies were conducted in the United Kingdom, but they didn't explore variability in incineration units and incineration of different animal types.

Although cremating dead-stock may not be as economically feasible as composting, both systems provide alternatives for on-farm dead-stock disposal. Biosecurity is a constant concern for producers, says Van Heyst, and reducing outside traffic (such as dead-stock removal services) to the farm is paramount for addressing this concern.

On-farm incinerators, if legalized for use with on-farm mortalities, will be covered under the new Nutrient Management Act for farmers and the Food Quality and Safety Act for abattoirs.

This research was funded by the Ontario Ministry of the Environment, Environment Canada, the Ontario Ministry of Agriculture and Food and the University of Guelph's School of Engineering.



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